Enter your transmittal number → X280136
Transmittal Number

Your unique Transmittal Number can be accessed online:
http://www.mass.gov/eea/agencies/massdep/service/approvals/transmittal-form-for-payment.html

Massachusetts Department of Environmental Protection

Transmittal Form for Permit Application and Payment

1. Please type or print. A separate Transmittal Form must be completed for each permit application.

2. Make your check payable to the Commonwealth of Massachusetts and mail it with a copy of this form to: MassDEP, P.O. Box 4062, Boston, MA 02211.

3. Three copies of this form will be needed.

Copy 1 - the original must accompany your permit application. **Copy 2** must accompany your fee payment. **Copy 3** should be retained for your records

4. Both fee-paying and exempt applicants must mail a copy of this transmittal form to:

MassDEP
P.O. Box 4062
Boston, MA
02211

*** Note:**
For BWSC Permits, enter the LSP.

A. Permit Information

BRP WS 17
1. Permit Code: 4 to 7 character code from permit instructions

New Source Approval > or = 70 gpm
2. Name of Permit Category

Request for Site Exam and Prolonged Pumping Test Proposal
3. Type of Project or Activity

B. Applicant Information – Firm or Individual

Ipswich Utilities Department
1. Name of Firm - Or, if party needing this approval is an individual enter name below:

2. **Last Name** of Individual
3. **First Name** of Individual
4. MI

272 High Street, PO Box 151
5. Street Address

Ipswich	MA	01938	978-356-6635	
6. City/Town	7. State	8. Zip Code	9. Telephone #	10. Ext. #

Ms. Vicki Halmen, Water & Wastewater Director
11. Contact Person

vhalmen@ipswichutilities.org
12. e-mail address

C. Facility, Site or Individual Requiring Approval

Proposed Well Sources, Lynch Site
1. Name of Facility, Site Or Individual

Linebrook Road
2. Street Address

Ipswich	MA			
3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #

NA		
8. DEP Facility Number (if Known)	9. Federal I.D. Number (if Known)	10. BWSC Tracking # (if Known)

D. Application Prepared by (if different from Section B)*

AECOM
1. Name of Firm Or Individual

250 Apollo Drive
2. Address

Chelmsford	MA	01824	978-905-2180	
3. City/Town	4. State	5. Zip Code	6. Telephone #	7. Ext. #

Douglas DeNatale
8. Contact Person

9. LSP Number (BWSC Permits only)

E. Permit - Project Coordination

1. Is this project subject to MEPA review? ☒ yes ☐ no
If yes, enter the project's EOEA file number - assigned when an Environmental Notification Form is submitted to the MEPA unit: not yet assigned
EOEA File Number

F. Amount Due

DEP Use Only

Permit No:

Rec'd Date:

Reviewer:

Special Provisions:

1. ☒ **Fee** Exempt (city, town or municipal housing authority)(state agency if fee is $100 or less).
There are no fee exemptions for BWSC permits, regardless of applicant status.
2. ☐ Hardship Request - payment extensions according to 310 CMR 4.04(3)(c).
3. ☐ Alternative Schedule Project (according to 310 CMR 4.05 and 4.10).
4. ☐ Homeowner (according to 310 CMR 4.02).

Check Number	Dollar Amount	Date

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

BRP WS Application

For Drinking Water Program (Water Supply) Permits or Approvals

X280136
Transmittal Number

NA
Facility ID# (if known)

A. Application

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

1. Is this application for ☒ an Original or ☐ a Resubmittal?

2. Applicant:

Name	Address			
Ipswich Utilities Department	272 High Street, PO Box 151			
City	**State**	**Zip**	**Contact**	**Telephone**
Ipswich	MA	01938	Ms. Vicki Halmen	978-356-6635

3. Consultant:

Name	Address			
AECOM	250 Apollo Drive			
City	**State**	**Zip**	**Contact**	**Telephone**
Chelmsford	MA	01824	Douglas DeNatale	978-905-2180

B. Permit

Please check the permit or approval for which you are applying:

Zone II Determination for Existing Sources
- ☐ BRP WS 07 Approval to Conduct Pump Test for Zone II Delineation
- ☐ BRP WS 08 Approval of Zone II Delineation

New Technology
- ☐ BRP WS 11 Minor New Technology Approval; where no field test required
  - ☐ Drinking Water Additive
  - ☐ Cross Connection Device
  - ☐ Water Vending Machine
  - ☐ Other (specify):
- ☐ BRP WS 12 Major New Technology Approval: where field testing is required
- ☐ BRP WS 27 New Technology with Third-party Approval
- ☐ BRP WS 28 Vending Site/Source Prototype
- ☐ BRP WS 31 Vending and POU/POE Devices with Third-party Approval

New Source Approvals <70 gpm
- ☐ BRP WS 13 Exploratory Phase, Site Examination, Land Use Survey and Approval to Conduct Pumping Test
- ☐ BRP WS 15 Pumping Test Report Approval and Approval to Construct Source
- ☐ BRP WS 37 Approval of Transient Non-Community Source Less than 7 Gallons per Minute (combines BRP WS 13 and BRP WS 15 submittals)

New Source Approvals = or > 70 gpm
- ☒ BRP WS 17 Exploratory Phase, Site Examination, Land Use Survey, and Conduct Pumping Test
- ☐ BRP WS 19 Pumping Test Report Approval
- ☐ BRP WS 20 To Construct Source

Water Treatment Approvals
- ☐ BRP WS 21A To Conduct Pilot Study < 40,000 gpd
- ☐ BRP WS 21B To Conduct Pilot Study = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 21C To Conduct Pilot Study = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 21D To Conduct Pilot Study = or > 1 mgd
- ☐ BRP WS 22A Pilot Study Report < 40,000 gpd
- ☐ BRP WS 22B Pilot Study Report = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 22C Pilot Study Report = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 22D Pilot Study Report = or > 1 mgd
- ☐ BRP WS 23A To Construct Facility <40,000 gpd
- ☐ BRP WS 23B To Construct Facility = or > 40,000 gpd and < 200,000 gpd
- ☐ BRP WS 23C To Construct Facility = or > 200,000 gpd and < 1 mgd
- ☐ BRP WS 24 To Construct Facility = or > 1 mgd
- ☐ BRP WS 25 Treatment Facility Modification
- ☐ BRP WS 29 Water Treatment: Chemical Addition Retrofits of Water Systems > 3,300 people
- ☐ BRP WS 30A Vending Installation Approval
- ☐ BRP WS 30B POU/POE Installation Approval
- ☐ BRP WS 34 Water Treatment: Chemical Addition Retrofits of Water Systems = or < 3,300 people
- ☐ BRP WS 35A Multiple Vending Installation Approval
- ☐ BRP WS 35B Multiple POU/POE Installation Approval

Water Quality Assurance
- ☐ BRP WS 26 Sale or Acquisition of Land for Water Source
- ☐ BRP WS 36 Abandonment of Water Source

Distribution System Modifications
- ☐ BRP WS 32 Systems > 3,300 people
- ☐ BRP WS 33 Systems = or < 3,300 people

Massachusetts Department of Environmental Protection
Bureau of Resource Protection – Drinking Water Program

BRP WS Application

For Drinking Water Program (Water Supply) Permits or Approvals

X280136
Transmittal Number

NA
Facility ID# (if known)

C. Certification

"I certify, under penalty of law, that this application and all attachments were prepared under my supervision, in accordance with a system designed to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted in this application, the information submitted is, to the best of my knowledge and belief, true, accurate and complete."

	April 20, 2018
Authorized Signature	Date
Douglas DeNatale	Project Manager/Senior Hydrogeologist
Print Name	Position/Title

AECOM
250 Apollo Drive
Chelmsford, MA 01824
www.aecom.com

978 905 2100 tel
978 905 2101 fax

April 20, 2018

Mr. James Persky
Department of Environmental Protection
Drinking Water Program
Northeast Regional Office
205B Lowell Street
Wilmington, MA 01887

Subject: **Request For Site Exam and Proposed Pumping Test Design Lynch Site Ipswich, Massachusetts**

Dear Mr. Persky:

On behalf of the Ipswich Water Department, AECOM hereby submits two copies of a Request For Site Exam and Prolonged Pumping Test Proposal for a proposed well field at the Lynch Site in Ipswich. Provided the results of the pumping test are favorable, Ipswich plans to install four new wells as a public water supply.

The Town is eager to schedule a Site Exam with DEP at the earliest possible convenience, so that the pumping test can be conducted during the late spring or early summer months. AECOM will contact DEP in the near future to schedule the Site Exam.

Please call if you have any questions regarding the contents of this submittal.

Very truly yours,

AECOM

Douglas DeNatale,
Senior Hydrogeologist

cc: Ms. Vicki Halmen, Director, Water & Wastewater, Ipswich Utilities Department (5 copies)

AECOM

REQUEST FOR SITE EXAM
Lynch Site
Ipswich, Massachusetts

Site Location and Background

The Town of Ipswich is in the process of evaluating its existing municipal water supply and planning for the future. Since 2015, and as a part of the planning process, the Town has been investigating potential new sources of groundwater supply to either supplement or replace existing sources. In all, the Town has undertaken test-well drilling at six locations. The most promising of these locations, in terms of both water quality and capacity, is the Lynch Site on Linebrook Road.

Figure 1, the Locus Map, shows the Lynch Site and the surrounding topography, drainage and roadways. Figure 1 also shows the boundary of town-owned land (approximately 390 acres in size), which includes the Town's existing surface water supplies, Dow Brook and Bull Brook Reservoirs. A set of test wells was drilled at the Lynch Site in August 2016, identified as TW 13-16, TW 14-16, TW 15-16, TW 16-16 and TW 17-16, shown on the Site Plan, Figure 2. After manifolding these wells together, an eight-hour pumping test was conducted on August 31, 2016 at a constant rate of 171 gallons per minute (gpm). Based on this pumping test, AECOM concluded that four permanent wells at the Lynch Site could yield in the range of 300 to 400 gpm, subject to confirmation through a long-term pumping test. It is important to note that the pumping test took place during a historic drought.

The Lynch Site rests on Town-owned land directly north of Linebrook Road. The Town currently leases the Lynch Site for agricultural use. Bull Brook lies directly north of the test wells. The surrounding land uses consist largely of undeveloped (including State Forest) and agricultural land. Minor residential development exists along Linebrook Road and Mile Lane. The Doyon Elementary School lies directly across the street to the south of the Lynch Site. The area is unsewered. Wetlands are present bordering Bull Brook and its tributaries. All of the test well sites are in upland. These features and their locations are discussed below in more detail.

Bedrock and Surficial Geology

According to the Bedrock Geology of Massachusetts (Hatch, 1991), the bedrock in Ipswich consists largely of northeast-trending bands of intrusive igneous rocks (granite, granodiorite, diorite and gabbro), with lesser amounts of low-grade metamorphic volcanic rocks (see Figure 3). The rocks range in age from Silurian to Proterozoic, meaning that they are 400 to more than 600 million years old. The bedrock is cut by northeast-trending faults, the most prominent of which may be related to the Bloody Bluff Fault, a regional fault-system that extends continuously southwest into Connecticut. The Bloody Bluff Fault has not been active for tens of millions of years. Faulting plays a role in controlling local drainage patterns, most notably, along certain reaches of the Ipswich River. Despite their age, ancient fault and fracture systems can transmit water readily and, in some cases, are capable of producing a considerable amount of water to wells. For example, moderately high-capacity well supplies have been found at Turner Hill in Ipswich. The bedrock is covered almost entirely by soils, and is exposed only in isolated outcrops, for example, along the Ipswich River in the downtown area. The degree to which groundwater in the bedrock interacts with the overlying soils is largely unknown.

By contrast, the soils overlying the bedrock are much younger – 13,000 to 24,000 years old (Hein, C. J., et al., 2013). The soils consist largely of three types: glacial till; glaciofluvial deposits; and glaciomarine deposits. Figure 4 depicts local surficial geologic conditions, based on US Geological Survey mapping.

- Glacial Till is the oldest of the glacial soils, and consists of a heterogeneous mixture of sand, gravel, clay, silt and sometimes cobbles. Till was deposited directly on top of the bedrock, either beneath the continental ice sheet as it advanced south ("lodgement till"), or later as the glacial ice melted away ("ablation till" or "ground moraine"). Till generally does not transmit groundwater rapidly, and is not considered suitable for municipal water supply. In the test wells AECOM has drilled in Ipswich, only a thin layer of till, no more than about eight-feet thick, has been encountered. Till was not encountered in borings at the Lynch Site. AECOM's drilling has been limited to the lowlands and in pre-glacial valleys, where the till may have been partially or completely washed off the bedrock surface by glacial

meltwater streams. Thicker till is undoubtedly present in the hills of Ipswich, e.g., at Turner Hill, Turkey Hill, Scott Hill and Bush Hill, among other places.

- Glaciofluvial Deposits were laid down on top of till or bedrock by streams flowing from the ice sheet as it melted away. As the streams flowed, they carried a mixture of "dirty" soils, some originating as till and some from the base of or within the ice sheet. The action of flowing water washed the "dirt" (clay and silt) from the soils, leaving behind only the coarse-grained soils, i.e., sand, gravel and cobbles. These soils commonly have interconnected pore spaces and transmit groundwater rapidly. Where these soils are widespread, they constitute aquifers that are suitable for municipal water supply. All of the Town's existing groundwater supplies are built in aquifers consisting of glaciofluvial deposits. The aquifer soils identified at the Lynch Site are extremely coarse-grained, though thin, consisting largely of gravel and cobbles. The coarseness of the soils implies deposition by very rapidly flowing meltwater.

- Glaciomarine Deposits were deposited by ocean water that flooded the land in Ipswich in late glacial times. These soils consist of soft, un-layered clay, often overlain by 5 to 30 feet of uniform fine-medium sand and silty sand. For the most part, the glaciomarine deposits were laid down directly on top of the glacial till, or on top of the glaciofluvial deposits. Clay is widespread in Ipswich and has been exploited for brick-making at several locales, including the former clay pit directly north of the Browns Well. At the Browns Well, approximately 40 feet of glaciomarine clay overlies a 15-foot thick glaciofluvial aquifer consisting of sand, gravel and cobbles. At the Lynch Site, approximately 50 feet of glaciomarine soils (uniform sand and silty sand layers, above the clay layer), overlie the glaciofluvial aquifer.

Swamp deposits, developed after the glacial era and presumed to be relatively thin, directly overlie the glaciofluvial and glaciomarine soils. Swamp deposits are widespread in the watershed of the Lynch Site.

AECOM has developed two geologic cross sections for the Lynch Site and its surroundings (Figure 5 and 6), one extending from the Mile Lane Well southwest to the Lynch Site, and the second, from areas north of Bull Brook Reservoir southwest to the Doyon Elementary School. The cross sections are based largely on recent drilling. Geologic logs of borings are in Appendix A. The Town is planning to install an additional eight borings and observation wells near the Lynch Site, which will further define local stratigraphic conditions.

Groundwater Flow, Boundary Conditions and Aquifer Recharge

Regionally, the groundwater in Ipswich flows toward the marshlands along the coast, which in this case, is almost directly east of the Lynch Site. Locally, groundwater flow is undoubtedly more complex. To our knowledge, no detailed maps of groundwater flow in the glaciofluvial aquifers of this part of Ipswich exist. For now, we can assume that groundwater in these aquifers also flows generally easterly, though on a more local scale, groundwater probably flows more or less downhill and parallel to Bull Brook and tributary streams. Elevations of existing and proposed test and observation wells in the area will be determined under the New Source Approval process. Once this is completed, static water levels will be measured to develop maps showing groundwater flow patterns.

Resolving the aquifer boundaries for the Lynch Site presents a challenge. For one thing, the coarse-grained glaciofluvial aquifer soils are buried beneath glaciomarine deposits, and the presence of the buried aquifer can only be known through drilling. For example, test wells completed north of Bull Brook indicate that the soils consist entirely of glaciomarine deposits, and aquifer soils are absent. In addition, it may be that the aquifer soils lie in a pre-glacial valley, whose presence is also unknown without drilling. Finally, the glaciomarine clay undoubtedly "pinches out" inland, but the whereabouts of the limits of glaciomarine clay cannot be known without drilling. With this in mind, our comments below about aquifer boundaries must be considered preliminary.

The existing surficial geologic mapping (Figure 4) indicates that glaciofluvial and glaciomarine soils are widespread, and dominate over till soils. The lateral aquifer boundaries are represented by the contact between the till and the glaciofluvial/glaciomarine deposits. Where the glaciofluvial/glaciomarine soils

extend to the watershed divide, the watershed divide represents the aquifer boundary. The bedrock surface, which underlies the soils everywhere, represents the base of the aquifer. The top of the aquifer is represented by the contact between the glaciofluvial aquifer and overlying clay, except where the clay is absent, in which case the water table is the top of the aquifer.

In her study of the Assabet River basin, Leslie DeSimone of the U.S. Geological Survey (USGS), in Scientific Investigations Report 2004-5119 (2004), discusses rainfall-recharge estimates for glacial aquifers of southern New England. These recharge estimates, ranging from 17.5 to 25.5 inches per year, were developed by a number of USGS authors over the years. We have selected 20 inches-per-year of rainfall recharge for Ipswich (see Preliminary Zone II discussion below). Olimpio and de Lima (1984), in their study of the Mattapoisett River valley, estimate that groundwater runoff from till provides an additional 6.9 inches of recharge (equivalent to 0.34 mgd per square mile) to aquifer soils. We have assumed that this till recharge-rate applies to Ipswich (see Preliminary Zone II discussion below).

Test-Well Drilling Summary

As stated above, a set of test wells was drilled at the Lynch Site in August 2016, including TW 13-16, TW 14-16, TW 15-16 and TW 16-16. The soils were found to consist in general of the following:

- Glaciomarine: Brown fine-to-medium sands and fine gravel, ground surface to a depth of 4 feet;
- Glaciomarine: Brown, clean, fine sands from 4 to 13 feet;
- Glaciomarine: Stiff olive-grey to brown silts with fine sands from 13 to 28 feet;
- Glaciomarine: Grey, sticky, soft, clay of high plasticity from 28 to between 39 and 50 feet;
- Glaciofluvial: Very dense, brown fine-to-coarse gravel with a trace of fine-to-coarse sand to a depth of between 50 to 59 feet.
- Refusal, presumed to be a heavily cobbled layer, or top of bedrock, encountered at a depth of between 50 to 59 feet.

A fifth test well, TW 17-16, was placed two feet from TW 13-16 for pumping-test observation purposes. Well screens of 0.100- to .250-inch slot were installed in the test wells, the wells were developed and then rated, in gallons per minute (gpm). Individual pumping rates ranged from 55 to 89 gpm. The static water level was measured to be about 10 feet below ground surface. All of the test wells were left-in-place. Table 1 summarizes the test-well construction, development and pumping details. Geologic logs are in Appendix A.

Summary of 8-Hour Pumping Test

On August 31, 2016, TW 13-16, TW 14-16, TW 15-16, and TW 16-16 were manifolded together and pumped for eight hours at a constant rate of 171 gpm. A vacuum of 20 inches was recorded in TW 13-16. The static water level in observation well TW 17-16, two feet from TW 13-16, was approximately 10.06 feet below ground surface. At the end of eight hours of pumping, the drawdown observed in TW 17-16 was 3.43 feet. Water-level recovery was satisfactory. The water level in TW 17-16 recovered to within 0.47 foot of the static level (86%) after two hours of recovery, and 0.04 foot (99%) in eight hours. TW 13-16, TW 14-16, TW 15-16, TW 16-16, and TW 17-16 were left in place. The pumping test record and drawdown-recovery graph are in Appendix B.

TABLE 1
SUMMARY OF TEST WELLS
LYNCH SITE
IPSWICH, MASSACHUSETTS

Well ID	TW 13-16	TW 14-16	TW 15-16	TW 16-16	TW 17-16
Location	0.53 mi SW Mile Ln Well	75 ft W of TW 13-16	75 ft E of TW 13-16	75 ft S of TW 13-16	2 ft NE of TW 13-16
Total Depth, ft bgs	55.5	51	50	55	59
Apparent top of gravel, ft bgs	50	45	46	49	50
Gravel thickness, ft	5.5	6	4	6	9
Screen Interval, ft bgs	50 - 55	46 - 51	45 - 50	50 - 55	52 - 57
Screen Slot Size, inch	100	250	250	250	200
Riser Pipe	2” diam. PVC	2” diam. PVC	2” diam. PVC	2” diam. PVC	2” diam. PVC
Well Screen	2” diam. stainless steel	2” diam. stainless steel	2” diam. stainless steel	2” diam. stainless steel	2” diam. stainless steel
Bentonite Seal Interval, ft	5 - 49	5 - 44	5 - 43	5 - 48	5 - 50
Static Water Level Depth, ft below ground surface	9.6	10.3	7.8	9.4	9.9
PVC Riser Above Ground, ft	0.3	4.3	0.3	0.6	3.4
Development Time, hours	2.5	1.5	1.5	2	2
Development Pumping Rate, gpm	67	84	84	89	55
Development vacuum, inches	23	25	20	22	29
Pumping Test Rate, gpm	67	84	84	89	55
Pumping Test vacuum, inches	23	25	20	22	29
Specific Capacity, 8 hr, gpm/ft	49.8	NA	NA	NA	NA
Status	Left-in-place	Left-in-place	Left-in-place	Left-in-place	Left-in-place

Potential Well Yield

The eight-hour pumping tests conducted on August 31, 2016 indicates that four permanent wells at the Lynch Site could yield in the range of 300 to 400 gallons per minute (gpm) combined. The long-term sustainable yield is subject to confirmation through a prolonged pumping test.

Water Quality

Water samples, collected at the conclusion of the pumping test on August 31, 2016, were subjected to both field and laboratory water-quality testing. Samples were collected from a tap fitted to the discharge end of the suction pump manifolded to the four test wells. Therefore, the samples represented a composite of the four wells. Samples were tested for those parameters specified for DEP New Source Approval, as the Town was considering using the Lynch wells as an emergency supply due to extreme drought conditions during the summer of 2016. Laboratory testing was performed by Alpha Analytical, Inc. of Westborough, Massachusetts, or its subcontractor laboratories. AECOM field-tested water samples for pH, specific conductance, temperature, dissolved oxygen, and oxidation-reduction potential using a YSI 556 water-quality testing apparatus equipped with a flow-through cell.

At the end of the pumping test, total iron and manganese levels were found to meet the secondary drinking water limits of 0.30 and 0.05 mg/L, respectively. Iron was detected at 0.030 mg/L; manganese at 0.001 mg/L. Nitrate levels were found to be 3.0 mg/L, below the Maximum Contaminant Level (MCL) of 10 mg/L. Of the volatile organic compounds (VOCs), only a trace (less than 0.5 ug/L) of chloroform was detected. Synthetic Organic Compounds (SOCs) were not detected. Total Coliform Bacteria was detected in the sample, though e-coli was not detected. It is likely that the Total Coliform is an artifact of sampling, and perhaps related to sampling under hot, dry, dusty conditions in an agricultural field. Field pH was found to range from 7.90 to 7.96. Tables 2 and 3 below summarize the results of the field and laboratory water-quality testing. Laboratory reports are in Appendix C.

TABLE 2
FIELD WATER-QUALITY SUMMARY
LYNCH SITE
IPSWICH, MASSACHUSETTS

Parameter	Units	Reporting Limit	Drinking Water Standard	TW 13-16
Field Tests – Sampled:				*August 31, 2016*
Temperature	^{o}C	N/A	NE	11.1
Specific conductivity	umho/cm	N/A	NE	573
Dissolved oxygen	mg/L	N/A	NE	5.31
Dissolved oxygen	% saturation	N/A	NE	48.7
Oxidation-reduction potential	mV	N/A	NE	37.5
pH	Std units	N/A	6.5-8.5*	7.9
Carbon dioxide gas	mg/L	2	NE	16

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TABLE 3
LABORATORY WATER-QUALITY SUMMARY
LYNCH SITE
IPSWICH, MASSACHUSETTS

Parameter	Units	Reporting Limit	Drinking Water Standard	TWs 13-16, 14-16, 15-16, 16-16
Laboratory Tests – Sampled				*August 31, 2016*
pH	Std. Unit	NA	6.5-8.5[2]	7.7
Turbidity	NTU	0.20	1	1.1
Color	APCU	5.0	15[2]	ND
Odor	TON	1	3[2]	No Odor
Alkalinity, as $CaCO_3$	mg/L	2.00	NE	137
Specific Conductance	umhos/cm	10	NE	690
Hardness, Total	mg/L	0.660	NE	134
Total Dissolved Solids	mg/L	10	500[2]	370
Fluoride	mg/L	0.20	4.0	0.03
Chloride	mg/L	12.5	250[2]	122
Total Cyanide	mg/L	0.005	0.2	ND
Sulfate	mg/L	1.00	250[2]	15.8
Ammonia-Nitrogen	mg/L	0.075	NE	ND
Nitrite-Nitrogen	mg/L	0.050	1	ND
Nitrate-Nitrogen	mg/L	0.10	10	3.0
Phosphorus	mg/L	0.010	NE	ND
Aluminum	mg/L	0.100	0.05-0.2[2]	0.021
Antimony	mg/L	0.00200	0.006	ND
Arsenic	mg/L	0.00100	0.010	ND
Arsenic, dissolved	mg/L	0.0010	0.010	ND
Barium	mg/L	0.00100	2	0.01739
Beryllium	mg/L	0.00100	0.004	ND
Cadmium	mg/L	0.00100	0.005	ND
Calcium	mg/L	0.100	NE	45.6
Chromium	mg/L	0.00100	0.1	0.00050
Copper	mg/L	0.00100	1.0[2]	0.00158
Iron	mg/L	0.050	0.3[2]	0.030
Iron, dissolved	mg/L	0.05	0.3[2]	ND
Lead	mg/L	0.00100	0.015	ND
Magnesium	mg/L	0.100	NE	4.77
Manganese	mg/L	0.00100	0.05[2]	0.00103
Manganese, dissolved	mg/L	0.0010	0.05[2]	0.0011
Mercury	mg/L	0.0002	0.002	ND
Nickel	mg/L	0.0010	0.1[3]	0.00010
Potassium	mg/L	2.50	NE	3.76
Selenium	mg/L	0.00500	0.05	ND
Silicon	mg/L	0.500	NE	6.35
Silver	mg/L	0.00100	0.10[2]	ND
Sodium	mg/L	2.00	20[3]	104
Thallium	mg/L	0.00100	0.002	ND

TABLE 3 (Continued)
LABORATORY WATER-QUALITY SUMMARY
LYNCH SITE
IPSWICH, MASSACHUSETTS

Parameter	Units	Reporting Limit	Drinking Water Standard	TWs 13-16, 14-16, 15-16, 16-16
Laboratory Tests – Sampled				*August 31, 2016*
Zinc	mg/L	0.00500	5[2]	0.00397
Gross Alpha	pCi/L	1.8	15	0.8(+-2.0)
Gross Beta	pCi/L	2.2	4 millirem/yr	0.6(+-2.2)
Radium 226	pCi/L	0.1	5 (Ra226+228)	0.1(+-0.2)
Radium 228	pCi/L	0.5	5 (Ra226+228)	0.2(+-0.6)
Radon	pCi/L	NA	10,000[3]	520
Total Coliform	Col/100ml	NA	Positive	Positive
E-Coli	Col/100ml	NA	Positive	Negative
Total Organic Carbon	mg/L	0.500	NE	0.760
Perchlorate	μg/L	0.050	2	0.524
SOCs	μg/L	Various	Various	ND
VOCs - Chloroform	μg/L	0.5	70[3]	0.27
VOCs – All others	μg/L	0.5	Various	ND

Abbreviations:

[1]Mass. Max. Contaminant Level
[2]Mass. Secondary Max. Contaminant Level
[3]Mass. Drinking Water Guideline
μmho/cm = micromho per centimeter
NTU = Nephelometric Turbidity Units
SOC = Synthetic Organic Compounds
NT = not tested
ND = not detected
NE = not established
N/A = Not applicable
o C = degrees Celsius
Col/100 ml = colonies per 100 milliliter
ug/L = microgram per liter
mg/L = milligram per liter
pCi/L = picoCurie per liter
mV = millivolts
TON = Threshold Odor Number

Zone I
The Town of Ipswich owns approximately 5.87 of the 6.49 acres of land (about 90%) required for Zone I water-supply protection (see Site Plan, Figure 2). Ipswich would therefore need to purchase or gain control of 0.62 acres of land, largely wetland.

Preliminary Zone II and Zone III
AECOM delineated the Preliminary Zones II and III for the proposed wells at the Lynch Site using the following criteria:

- Stagnation-point analysis to determine the down-gradient Zone II boundary;
- the till and watershed boundaries for the lateral Zone II boundaries; and
- Watershed boundaries for the Zone III boundaries.

The stagnation point analysis (boundary flow line equation, Bear, 1979) can be stated as follows:

$$L = Q/2\pi Ti,$$

Where:
L = down-gradient stagnation point, in feet
Q = well yield, in cubic feet per day (ft^3/day)
K = hydraulic conductivity, (ft/day)

b = aquifer thickness, (ft)
T = K x b = Transmissivity, in feet squared per day (ft^2/day)
i = hydraulic gradient, ft/ft

Given:
Q = 400 gpm (77,000 ft^3/day),
K = 200 ft/day
b = 10 ft
T = K x b = 2,000 ft^2/day
i = 0.0011 ft/ft

The down-gradient stagnation point is computed to be:

L = 5,500 feet.

Note that the hydraulic gradient is based on the estimated hydraulic gradient in Bull Brook (from LIDAR, 2011), wherein the brook elevation drops from 37.5 feet at Linebrook Road to 35.3 feet, a distance of 2,000 feet downstream. The downgradient Preliminary Zone II boundary was extended to the Bull Brook Reservoir dam, a distance of 4,000 feet downgradient of the Lynch Site, not 5,500 feet, as computed. Field investigations planned (see Pumping Test Proposal, below) should help to clarify groundwater flow patterns, hydraulic gradient and stratigraphic conditions necessary to improve the final Zone II delineation.

The Preliminary Zones II and III are shown on Figure 7. The watershed divide shown on Figure 7 was created from the USGS' Streamstats application. The total watershed area (Zones II and III) that could contribute water to the Lynch Site is 2.59 square miles. The total area of the Preliminary Zone II, which consists of glaciomarine, glaciofluvial and swamp deposits, is 1.69 square miles. Assuming a direct recharge to the aquifer of 0.95 million gallons per day (mgd) per square-mile (equivalent to 20 inches of rainfall recharge per year), Zone II receives 1.61-mgd of recharge. The total area of the Preliminary Zone III is 0.90 square mile. Zone III could theoretically contribute an additional 0.31-mgd of recharge, assuming 0.34-mgd per square-mile of groundwater runoff from the till terrain (see aquifer recharge discussion on page 3). The total recharge from the Preliminary Zones II and III would then, theoretically, be 1.92-mgd, more than enough to support a withdrawal of 0.58-mgd (400 gpm) from the Lynch Site.

Wellhead Protection Compliance
A September 12, 2005 letter from DEP (see Appendix D) states that the Town of Ipswich is in compliance with the Massachusetts Wellhead Protection Regulations, 310 CMR 22.21(2). Ipswich has both a compliant Water Supply Protection District Bylaw and Floor Drain Regulation.

Land Use, Zoning, Potential Contamination Sources, Ecological Features and Water Withdrawals
Land use, zoning, potential contamination sources, ecological features and water withdrawals within one-half mile of the proposed wells were determined from MassGIS databases, the Ipswich Water Department, AECOM's knowledge of the area and Google Earth. Land use within one-half mile of the Lynch Site (see Figure 8) consists of open space (largely wooded, but also including Town recreation fields), utility (undeveloped, wooded land controlled by the Town for water-supply protection), mixed use (largely undeveloped and wooded, with lesser amounts of commercial and agricultural uses), residential, commercial (in agricultural use) and institutional (school). The Lynch Site itself is currently used for agriculture. All land within one-half mile is zoned residential (RRA). Potential contamination source (PCS) locations are shown on Figure 8, and PCS characteristics are summarized on Table 4. Wetlands associated with Bull Brook and its tributaries are common within one-half mile of the site (see Figure 9). One Certified Vernal Pool has been identified approximately one-half mile southwest of the Lynch Site. Massachusetts Natural Heritage and Endangered Species Program (NHESP) Habitats for Rare Species and Rare Wildlife are absent from within one-half mile of the site.

TABLE 4
POTENTIAL CONTAMINATION SOURCES
LYNCH SITE
IPSWICH, MASSACHUSETTS

Site Number[1]	Location	Description	DEP Risk Category[2]
1	Lynch Site	Agricultural	M
2	Linebrook Road	Agricultural	M
3	Doyon School	School with septic system discharge	M
4	Acushnet Road	Mixed commercial/agricultural	M

Notes:
1 Locations shown on Figure 8
2 High (H), Medium (M), or Low (L) threat to groundwater based on table of Potential Sources of Groundwater Contamination, page 23 of DEP's "Making Wellhead Protection Work in Massachusetts", December 1997.

The nearest existing, public community and non-community water withdrawals (see Figure 10) are Ipswich's Mile Lane Well, Bull Brook Reservoir and Dow Brook Reservoir. Only Bull Brook Reservoir is within one-half mile of the Lynch Site. Minor withdrawals are made from small ponds north of Bull Brook and tributaries of Bull Brook to support local agriculture.

Site Screening Worksheet
The Site Screening Worksheet is included in Appendix E, along with the Alternatives Analysis, and Early Notice in the Environmental Monitor. We also include the output from the Streamstats application.

The Town of Ipswich is preparing a Water Conservation Questionnaire, and will submit it under separate cover. Over the last 15 years, the Town has made diligent efforts to achieve the water-conservation goals of the Massachusetts Water Resources Commission, including unaccounted for water (UAW), residential gallon per capita per day (rgpcd) and those involving leak detection, metering, pricing, and public education. These efforts are described in more detail in the attached Alternatives Analysis.

PUMPING TEST PROPOSAL
LYNCH SITE
IPSWICH, MASSACHUSETTS

Project Background

Since 2015, the Town of Ipswich has been investigating potential new sources of groundwater supply to either supplement or replace existing sources. In all, the Town has undertaken test-well drilling at six locations. The most promising of these locations, in terms of both water quality and capacity, is the Lynch Site on Linebrook Road. The Town is proposing to develop the Lynch Site as a well field with four gravel-packed wells, in which case a 250-foot Zone I radius would apply. The Town currently owns more than 90% of Zone I (see Figure 2). Should the Lynch Site become an approved public water supply, the Town will acquire or obtain control of the remainder of Zone I. The Lynch Site is in Zone A and/or Zone B for Bull Brook Reservoir (Figure 11).

Pumping Test - General

Four 8-inch diameter test wells will be installed at each of sites TW 13-16, TW 14-16, TW 15-16, and TW 16-16 for pumping-test purposes. AECOM proposes to conduct a 48-hour pumping test on one of the 8-inch diameter test wells, followed directly thereafter by a second test of all four wells, lasting for a period of five days or more. The overall goals of the pumping tests are: 1) to evaluate the long-term combined yield of the four well sites, 2) to evaluate the water quality, 3) to understand conceptually how the aquifer functions under pumping and non-pumping conditions, 4) to collect technical data necessary to support a Zone II delineation, and 5) to evaluate potential impacts on Bull Brook and bordering wetlands due to pumping. The single-well pumping test is aimed at obtaining drawdown data sufficient to compute aquifer hydraulic characteristics. The multiple-well pumping test will be used to test water quality, to establish drawdown stabilization, to estimate long-term yield, to learn how the aquifer functions and to observe impacts to the brook and associated wetlands, if any.

The proposed observation-well network is intended to define local groundwater-flow patterns, hydraulic gradient, and stratigraphic conditions. Individual observation wells will be used to obtain water-level drawdown data necessary to compute aquifer hydraulic characteristics. The observation wells may be useful in the future for water-level and water-quality monitoring. AECOM will install up to four shallow hand-driven well points in nearby wetlands and/or Bull Brook to evaluate to what extent the wetlands and brook are hydraulically connected to the pumped aquifer. One seepage meter each will be paired with two drive points to evaluate hydraulic conductivity of the stream bottom.

Zones II and III will be delineated using conceptual Zone-II modeling methods.

Prolonged Pumping Test

8-inch Diameter Pumping Wells

An 8-inch diameter test well will be installed one to two feet from each of existing test wells TW 13-16, TW 14-16, TW 15-16, and TW 16-16 for pumping test purposes (locations shown on Figure 2). The wells will be driven to a depth of 50 to 60 feet. A 3- to 5-foot length of telescoping well screen will be installed at these depths. The screen slot-sizes will be determined from grain-size analysis of soil samples obtained during drilling.

Duration of Tests

Water levels will be measured for a period of at least one week prior to the first pumping test, sufficient to observe water-level trends. The first pumping test will last a period of 48 hours. During this test, only one 8-inch diameter well will be pumped. The second test will commence directly after the first pumping test has been completed, with no intervening recovery phase. During the second pumping test, all four 8-inch diameter test wells will be pumped simultaneously. We anticipate that the second pumping test will last five days or more. However, this will be extended if necessary to achieve required stabilization. After the second test, recovery measurements will be taken for a period of time equal to the period of pumping.

Pumping Rates
During the first pumping test, we expect to pump the 8-inch diameter well at a rate of about 125 to 150 gpm. For the second test, we expect to pump each well at a rate of between 75 to 100 gpm. The actual rates will be established once the 8-inch diameter test wells are constructed and developed.

Observation Wells
AECOM is proposing to observe water-levels in 16 conventional test/observation wells and four drive points. Five test wells already exist at the Lynch Site (TW13-16, TW14-16, TW15-16, TW16-16, TW17-16), plus two test wells near the Mile Lane Well (TW7-16 and TW11-16) and one well near the High School (TW21-17). AECOM intends to install five new observation wells on Water Department land (TW13A, TW13B, TW13C, TW13D and TW13E), three new observation wells at the Doyon School (TW13F, TW13G and TW13H) and four new drive points (DP-1, DP-2, DP-3 and DP-4) in Bull Brook. TW21-17, which is nearly 7,000 feet east of the Lynch Site, will be used as an ambient well. Provided field conditions permit, a seepage meter will be installed at each of two drive-point locations. All wells and drive points will be surveyed for location and elevation relative to sea level.

The proposed observation-well/drive-point locations (shown on Figure 2) are approximate and are subject to change depending on field conditions. For example, observation well locations may be adjusted if the glaciofluvial aquifer is not encountered during drilling. Observation well distances and construction features are summarized on Table 5.

Antecedent Readings
Prior to the first test, water levels will be measured in the drive points, selected observation wells, and the ambient well at least three times before the pumping test to establish an ambient water-level trend. All observation wells and drive points will be read immediately before the start of the first test to establish static water-level conditions and static groundwater flow patterns.

Precipitation Measurements
AECOM will establish a temporary rain gauge in an open area on-site for the pumping tests. Rainfall will be recorded daily on site. Rainfall data will also be obtained from the nearest National Weather Service Station for comparison.

Drawdown Readings
Upon startup of the first test, water levels will be measured manually in the 8-inch pumping well and four selected observation wells (selected among TW13-16, TW14-16, TW15-16, TW 16-16, TW13A and TW13B), according to the following schedule: 30 seconds into the test; one minute to ten minutes - every minute; ten minutes to 100 minutes - every ten minutes; two hours to 12 hours - every hour; 12 hours to the end of the test - every two hours. Electronic data logging equipment will be installed in five selected observation wells to facilitate aquifer analysis. Water levels in the ambient well and the drive points will be measured at least twice per day during the pumping period. The remaining observation wells will be measured at intervals of two, four, or six hours throughout the pumping test. The exact observation wells selected for intensive observation will be subject to review in the field and may change from what is proposed above.

For the second test, the 8-inch diameter pumping wells and test wells TW13-16, TW14-16, TW15-16, TW 16-16, will be measured every two hours. The remaining wells will be measured every two, four, or six hours, depending on actual drawdown conditions. The drive points and ambient well will be measured twice daily.

TABLE 5
EXISTING AND PROPOSED OBSERVATION WELLS
LYNCH SITE
IPSWICH, MASSACHUSETTS

Observation Well	Distance, feet, from Proposed 8-inch Diameter Well, TW 13-16	Well Construction (Casing/Screen)	Well Screen Depth, feet Below Ground
Existing Well			
TW 7-16	1,950 NE	2" PVC/2" St.St.	20.5-23.5
TW 11-16	2,850 E	2" PVC/2" St.St.	44-49
TW 13-16	0	2" PVC/2" St.St.	50-55
TW 14-16	75 W	2" PVC/2" St.St.	46-51
TW 15-16	75 E	2" PVC/2" St.St.	45-50
TW 16-16	75 S	2" PVC/2" St.St.	50-55
TW 17-16	2	2" PVC/2" St.St.	52-57
TW 21-17 (ambient)	6,900 E	2" PVC/2" St.St.	40-45
Proposed Obs. Well			
OW 13A	300 SE	2"PVC/2"PVC	<60
OW 13B	370 W	2"PVC/2"PVC	<60
OW 13C	600 E	2"PVC/2"PVC	<60
OW 13D	800 ENE	2"PVC/2"PVC	<60
OW 13E	800 WSW	2"PVC/2"PVC	<60
OW 13F	550 S	2"PVC/2"PVC	<60
OW 13G	1200 SW	2"PVC/2"PVC	<60
OW 13H	1650 S	2"PVC/2"PVC	<60
Proposed Drive Point			
DP-1 (Bull Brook)	450 NE	1.25"galv/1.25"St.St.	7-9 (+/-)
DP-2 (Bull Brook)	200 N	1.25"galv/1.25"St.St.	7-9 (+/-)
DP-3 (Bull Brook)	550 W	1.25"galv/1.25"St.St.	7-9 (+/-)
DP-4 (Bull Brook)	800 SW	1.25"galv/1.25"St.St.	7-9 (+/-)

E = East, W = West, N = North, S = South, galv = galvanized, St.St. – stainless steel

Recovery Readings

Upon shutdown of the second test, recovery readings will be measured manually in selected wells, as follows: 30 seconds into recovery; one to ten minutes - every minute; ten minutes to 100 minutes - every ten minutes; two hours to 12 hours - every hour; 12 hours to 24 hours - every two hours; and every two days thereafter until full recovery is evident. Selected wells will be monitored for recovery with electronic data logging equipment. Water levels in the ambient well will be measured at least once every two days during recovery. Drive points will be read once in the first 24 hours of recovery and once more, if necessary. All other observation wells will be read once every two, four or six hours for the first 24 hours of recovery and every two days thereafter until full recovery is achieved. As with the drawdown readings, the exact observation wells selected for intensive observation will be subject to review in the field and may change from what is proposed above.

Discharge Conveyance and Flow Measurements

Water will be conveyed to Bull Brook about 600 feet northeast of TW 13-16 (see Figure 2 for proposed location) through four separate discharge lines. The rate of flow from the 8-inch diameter wells will be measured using individual circular orifice weirs fitted to the end of each discharge pipeline or a 50-gallon drum, whichever is more accurate and practical.

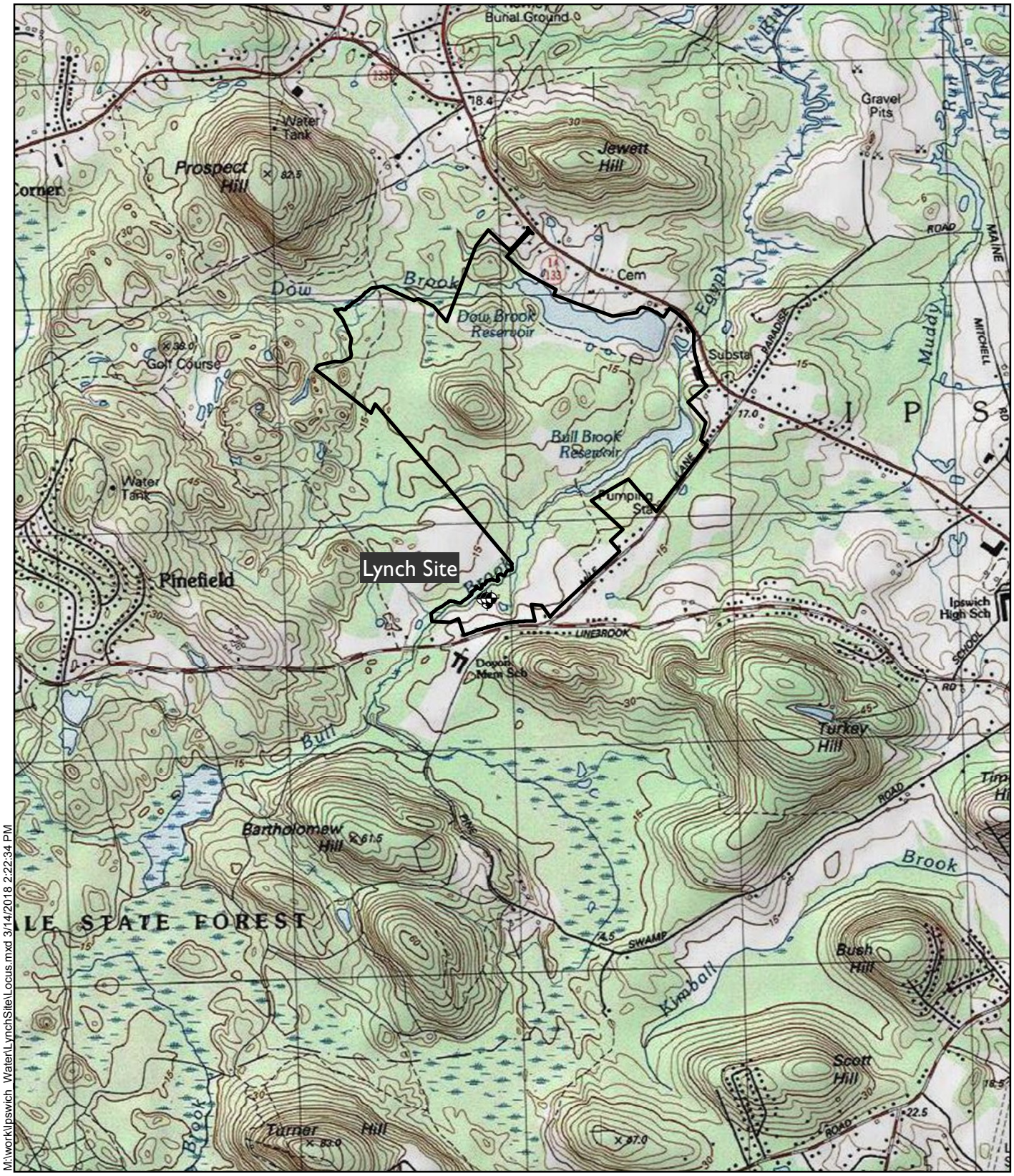
Water Quality Testing

Water samples will be collected from the four 8-inch diameter pumping wells during the second pumping test only. A composite set of samples will be obtained and analyzed for the four wells. Samples will be collected from sample taps fitted to the discharge pipelines at each wellhead and composited in the field. Samples will be tested for the parameters listed on Table 6 one-hour after pumping begins, at the midpoint of the pumping test and on the final day of pumping. All laboratory analytical testing will be performed by a DEP certified laboratory. Additional samples will be collected and tested in the field for pH, specific conductance, carbon dioxide, dissolved oxygen, oxidation-reduction potential and temperature.

TABLE 6
PROPOSED WATER QUALITY TESTING SCHEDULE
LYNCH SITE
IPSWICH, MASSACHUSETTS

First Day of Pumping	**Midpoint**	**Final Day of Pumping**	
Field-Testing			
Dissolved Oxygen	Dissolved Oxygen	Dissolved Oxygen	
Carbon Dioxide	Carbon Dioxide	Carbon Dioxide	
Oxidation-reduction potential	Oxidation-reduction potential	Oxidation-reduction potential	
pH	pH	pH	
Specific Cond.	Specific Cond.	Specific Cond.	
Temperature	Temperature	Temperature	
Laboratory Testing			
Alkalinity	Alkalinity	Alkalinity	Radium 226
Ammonia	Ammonia	Ammonia	Radium 228
Chloride	Chloride	Chloride	VOCs by 524.2
Color	Color	Color	Antimony
Hardness	Hardness	Hardness	Arsenic
Nitrate	Nitrate	Nitrate	Barium
Nitrite	Nitrite	Nitrite	Beryllium
Odor	Odor	Odor	Cadmium
pH	pH	pH	Chromium
Specific Cond.	Specific Cond.	Specific Cond.	Cyanide
Sulfate	Sulfate	Sulfate	Fluoride
TDS	TDS	TDS	Lead
Turbidity	Turbidity	Turbidity	Mercury
Aluminum	Aluminum	Aluminum	Nickel
Calcium	Calcium	Calcium	Selenium
Copper	Copper	Copper	Thallium
Iron	Iron	Iron	Phosphorus
Magnesium	Magnesium	Magnesium	SOCs
Manganese	Manganese	Manganese	Gross Alpha
Potassium	Potassium	Potassium	Gross Beta
Silver	Silver	Silver	Radon Gas
Sodium	Sodium	Sodium	Perchlorate
Zinc	Zinc	Zinc	TOC
	Total/Fecal Coliform	Total/Fecal Coliform	Oxidation-reduction potential

FIGURES



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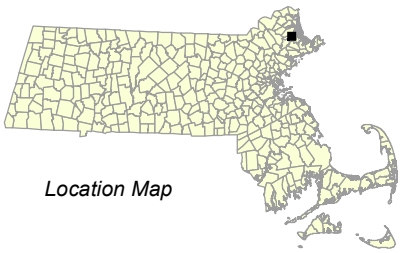
Sources: MassGIS and Esri

Well Locations - Lynch Site

Property Boundary
Town of Ipswich Land

0 1,000 2,000 4,000 Feet

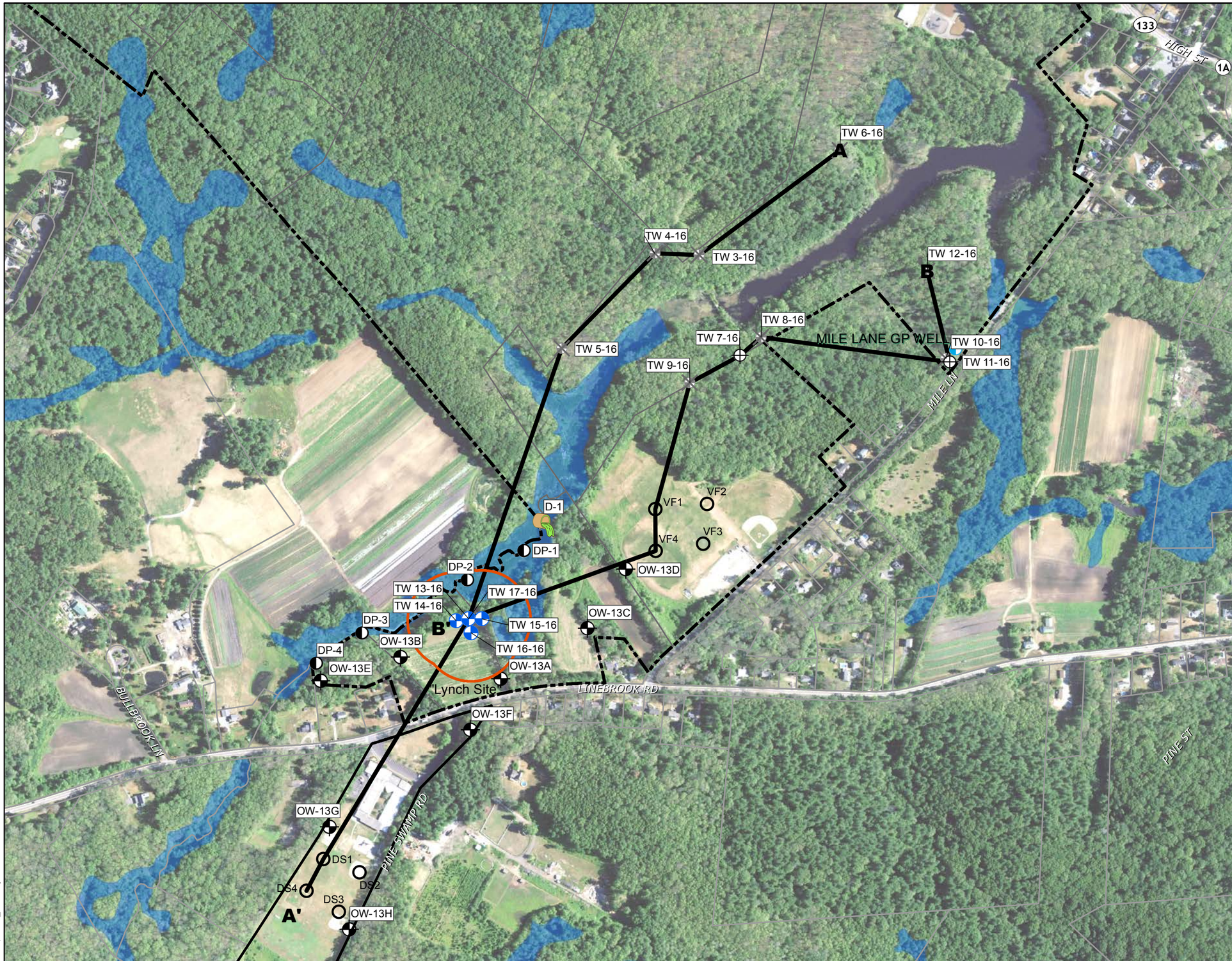


Location Map

Figure 1
Locus Map
Lynch Site
Ipswich, MA

March 2018

AECOM



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Property Boundary
Town of Ipswich Land

DEP Wetland

Public Water Supply
Groundwater

Proposed
Observation Well

Proposed Drive Point

Proposed Discharge

Proposed 8-Inch Diameter
Test Well

Removed
Test Well

Existing Test Well

Soil Boring by Others

Proposed 250-Ft
Zone I Boundary
(Four Well Sites)

A A' Line of Geologic
Cross-section
(See Figs 5 & 6)

Base map data provided by MassGIS and USDA.
Date of photo: 2016

March 20, 2018

Figure 2

Site Plan

Lynch Site
Ipswich, MA

0 250 500 1,000 Feet

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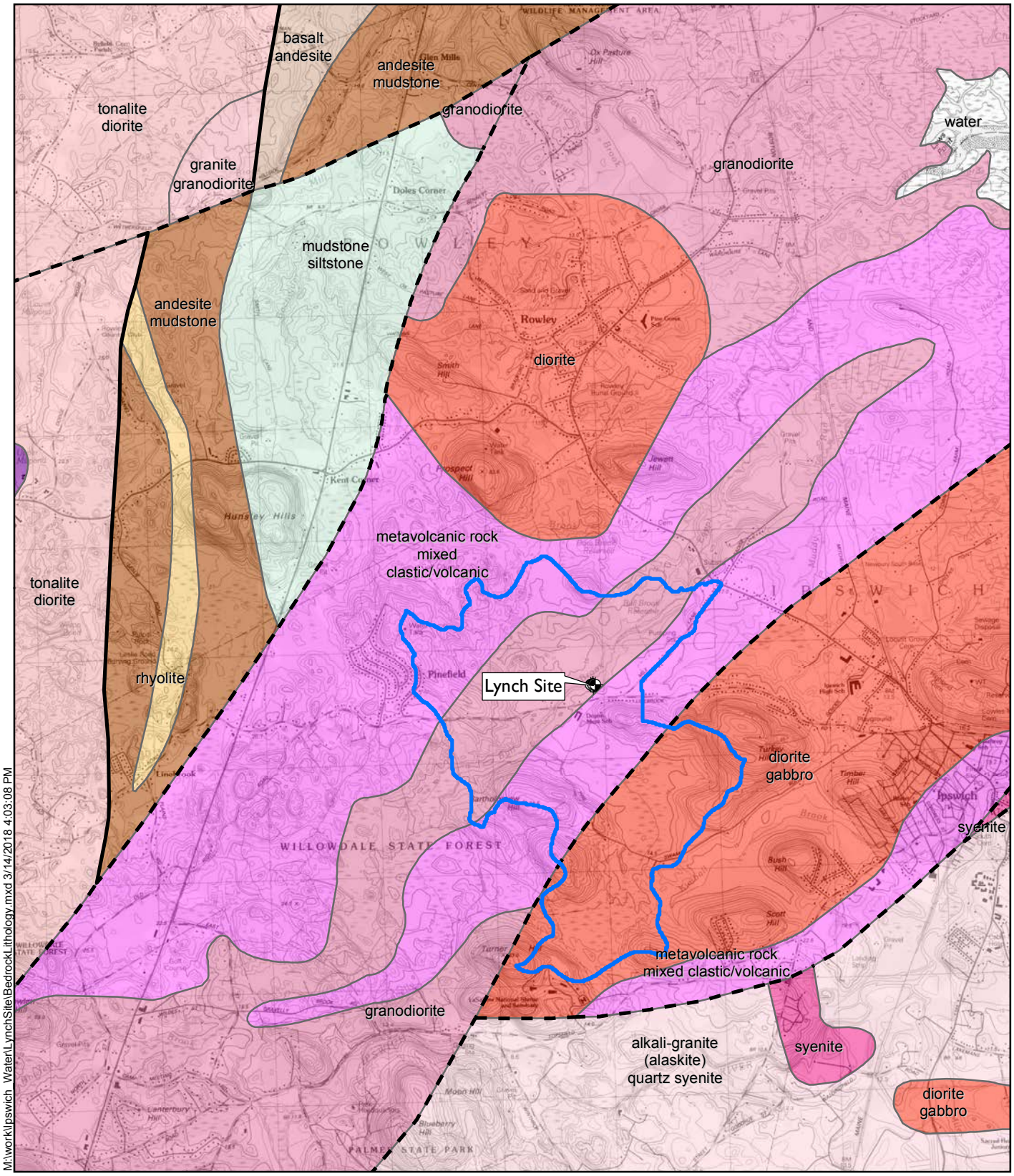


Proposed Wells - Lynch Site
Watershed Divide
Fault
Fault Inferred

alkali-granite (alaskite)
amphibolite
andesite
basalt

diorite
granite
granodiorite
metavolcanic rock

mudstone
rhyolite
syenite
tonalite

Sources: MassGIS and USGS.

0 2,000 4,000 8,000 Feet

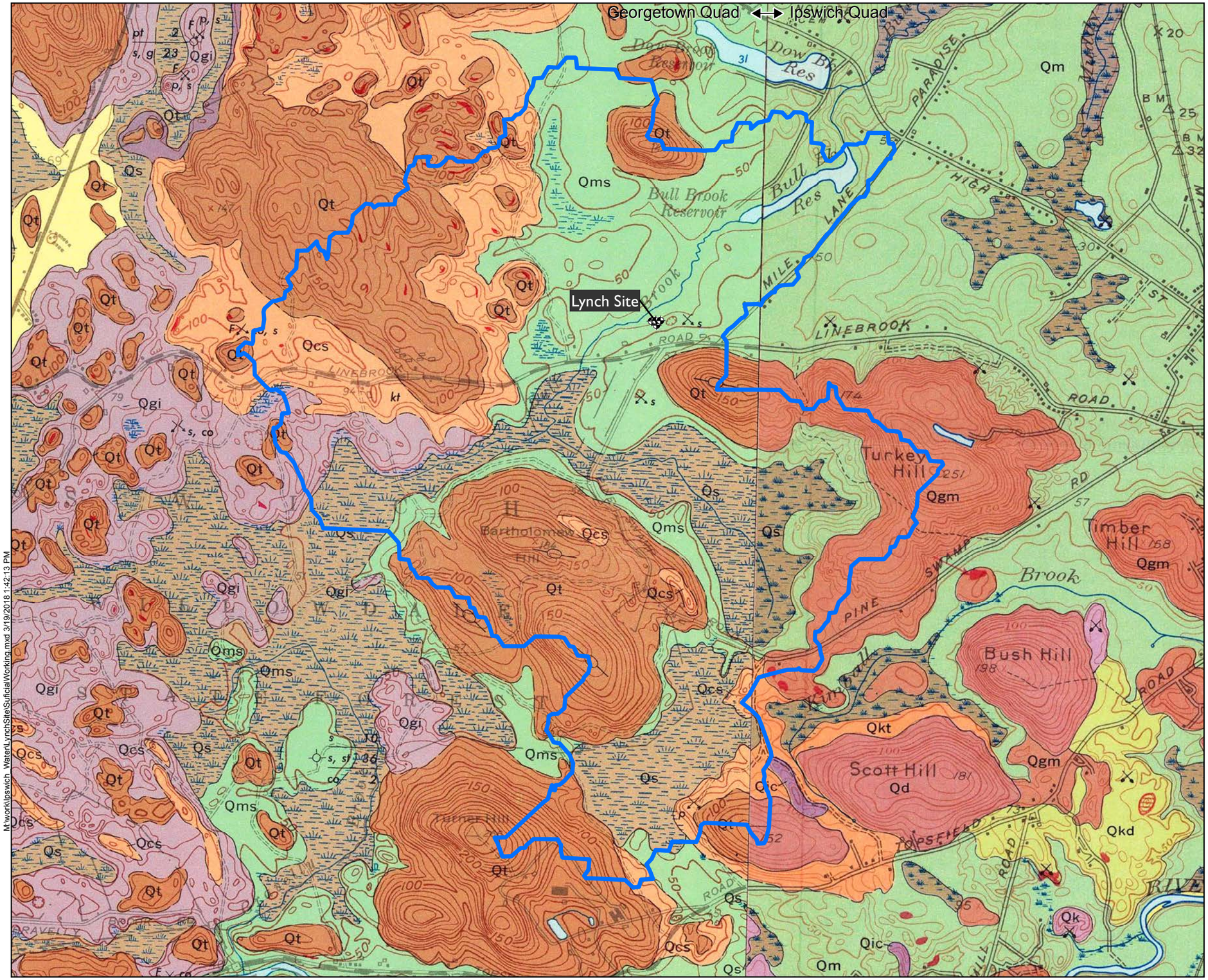
Figure 3

Bedrock Geology

Lynch Site
Ipswich, MA

March 2018

AECOM



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Well Locations - Lynch Site

Watershed Divide

Surficial Geology

Recent	Qs	Swamp Deposit
Glaciomarine Deposits	Qm	Marine and Estuarine Deposits
	Qms	Marine and Estuarine Clay
Glaciofluvial Deposits	Qgi	Deposits in the Ipswich River Area
	Qcs	Collapsed Stratified Drift Deposits
	Qkt	Kame Terraces
	Qk	Kames
	Qkd	Kame Delta
Till (Ice-Laid Deposits)	Qgm	Ground Moraine
	Qd	Drumlins
	Qt	Till

Bedrock Outcrop

Sources:

Cuppels, N.P., *Surficial geologic map of the Georgetown quadrangle, Essex County, Massachusetts*, U.S. Geological Survey, 1969.

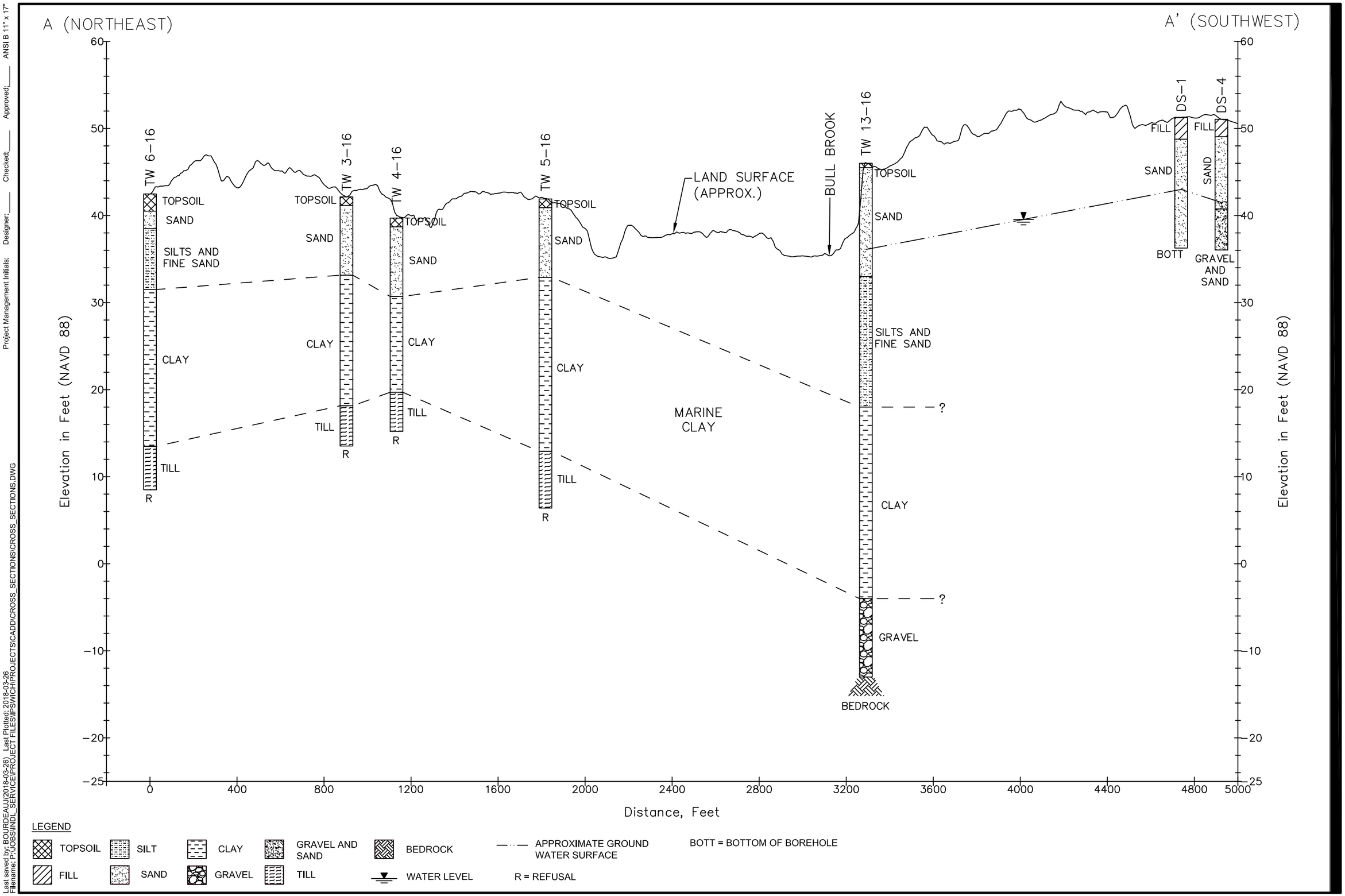
Sammel, E.A., *Surficial geology of the Ipswich quadrangle, Massachusetts*, U.S. Geological Survey, 1963.

Figure 4

Surficial Geology

Lynch Site
Ipswich, MA

0 750 1,500 3,000 Feet



AECOM

Figure: 5

GEOLOGIC CROSS SECTION A-A'
LYNCH SITE
IPSWICH, MA
Project No.: 60567459 Date: 2018-03-26

Project Management Initials: Designer:____ Checked:____ Approved:____ ANSI B 11" x 17"

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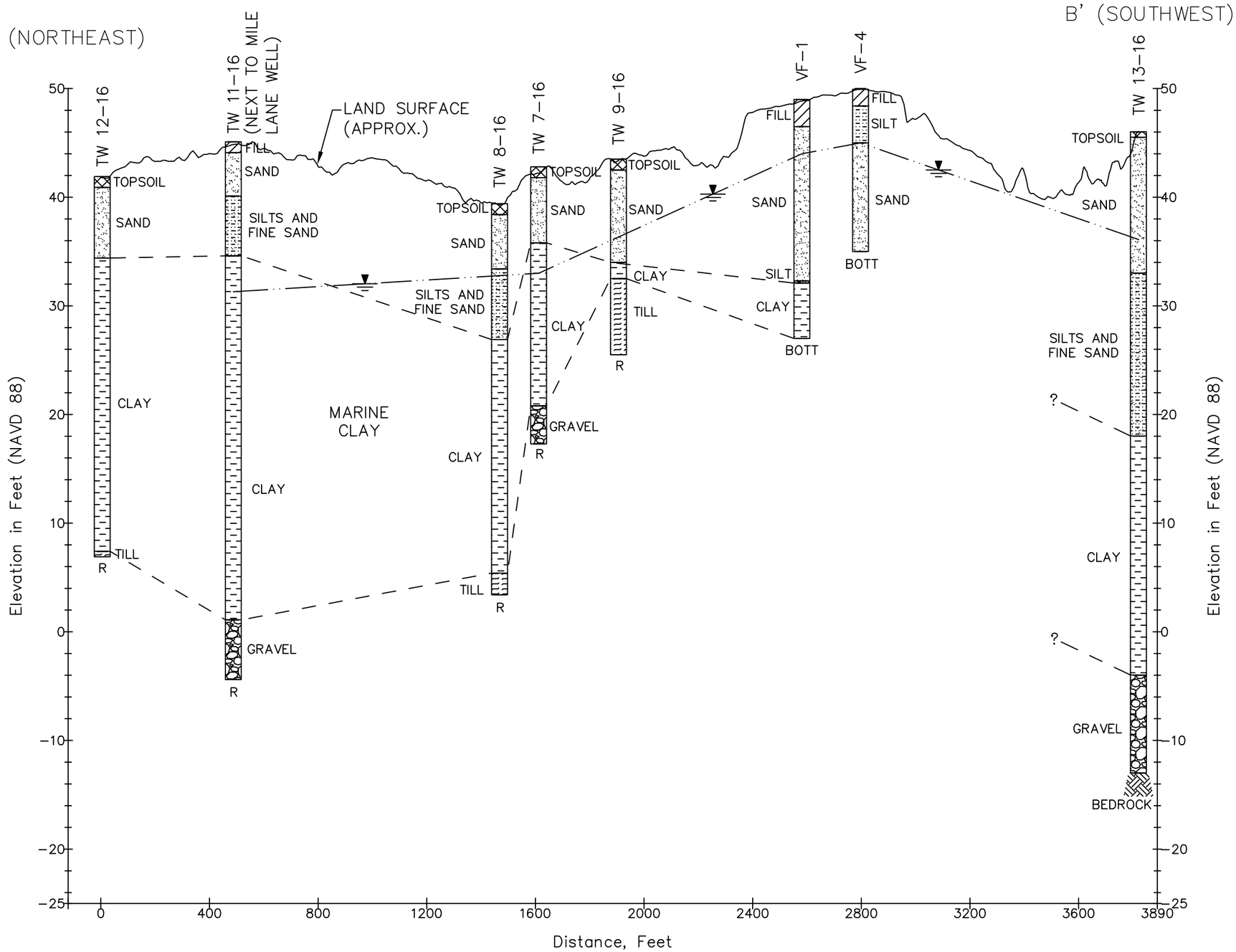

LEGEND

TOPSOIL, FILL, SILT, SAND, CLAY, GRAVEL, GRAVEL AND SAND, TILL, BEDROCK, WATER LEVEL, APPROXIMATE GROUND WATER SURFACE

BOTT = BOTTOM OF BOREHOLE

R = REFUSAL

GEOLOGIC CROSS SECTION B-B'
LYNCH SITE
IPSWICH, MA
Project No.: 60567459 Date: 2018-03-26

AECOM
Figure: 6

Project Management Initials: Designer:____ Checked:____ Approved:____ ANSI B 11" x 17"

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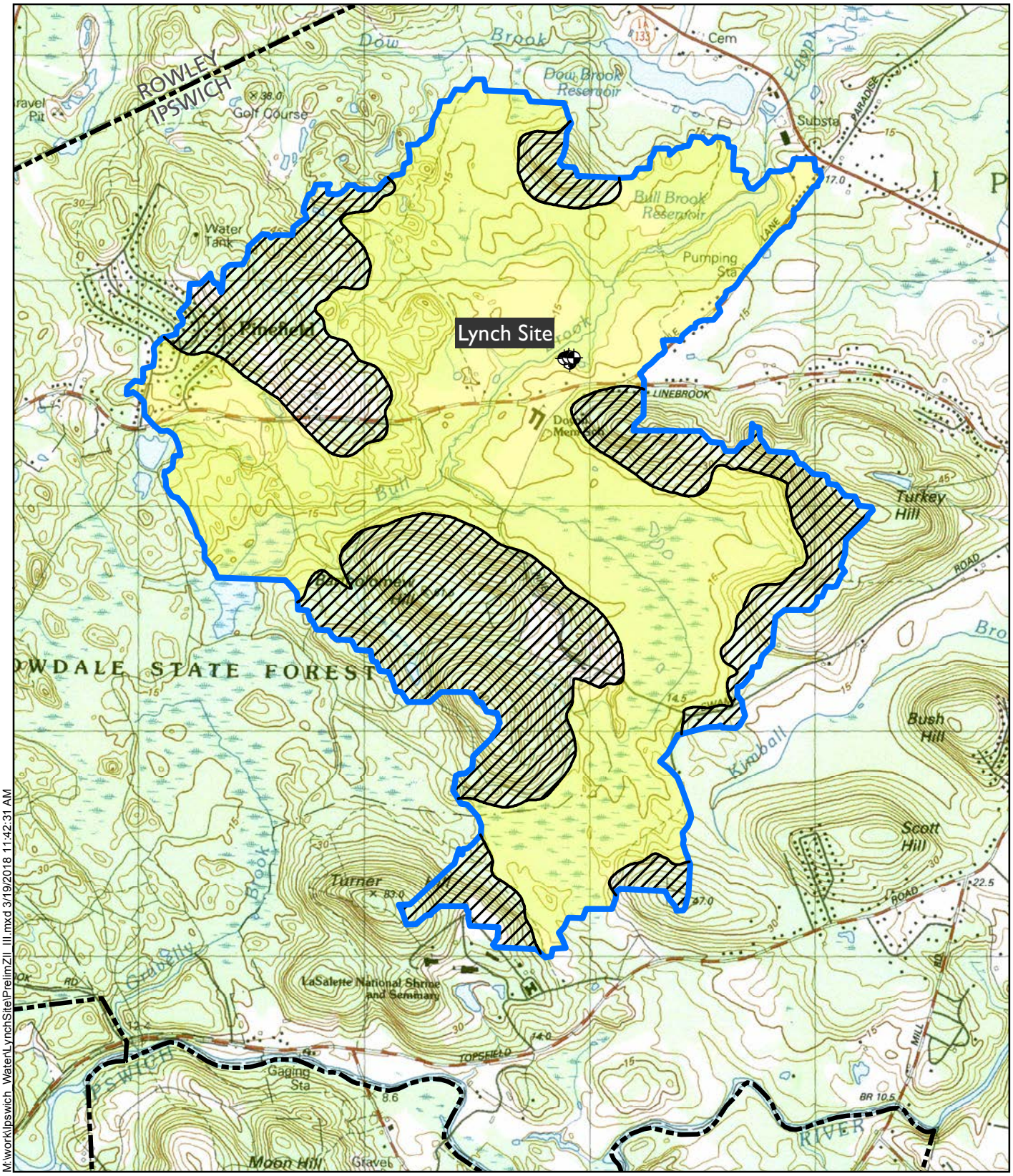

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Proposed Wells - Lynch Site

Watershed Divide

Zone II

Zone III

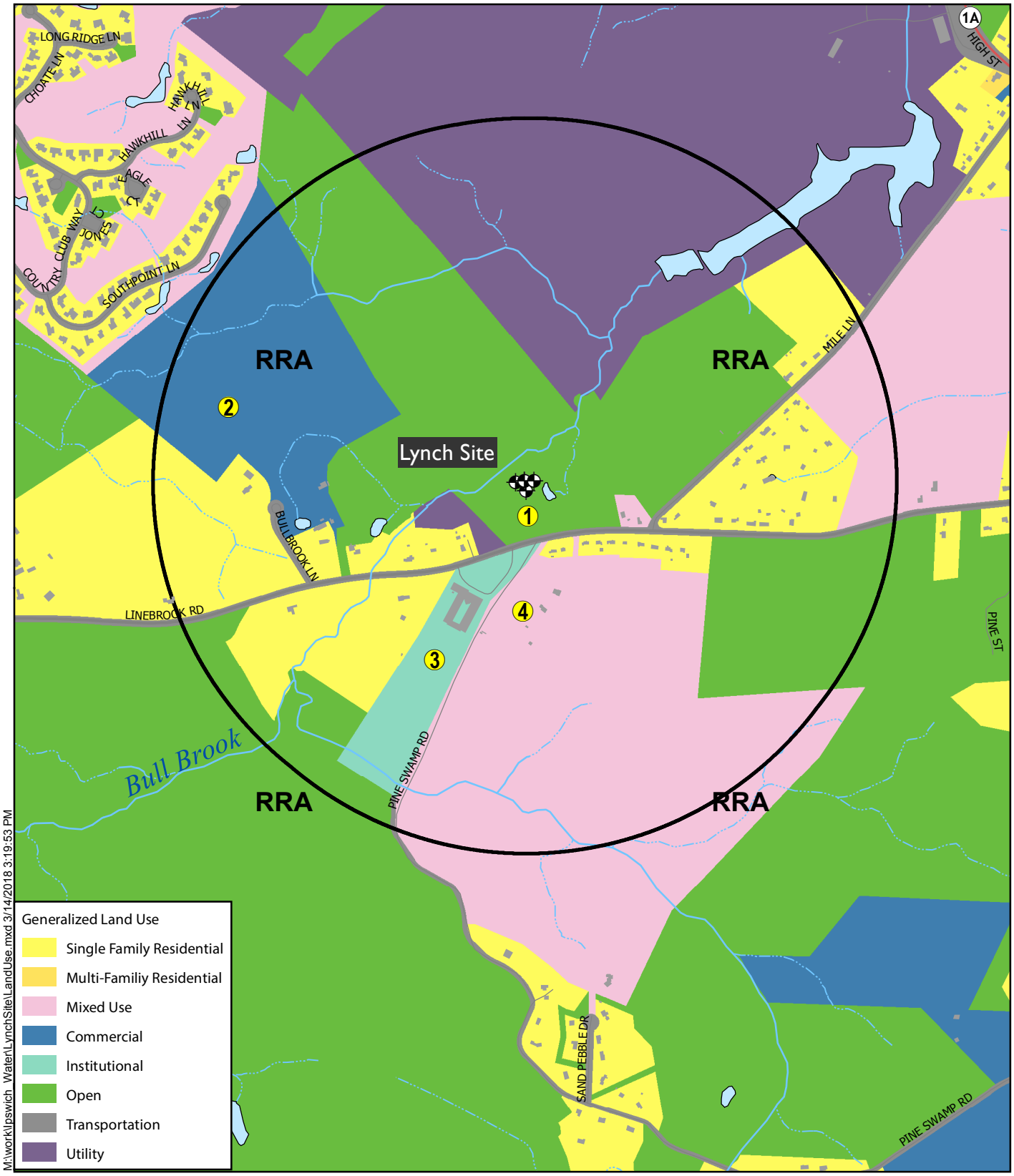
0 1,000 2,000 4,000 Feet

Figure 7

Preliminary Zones II & III

Lynch Site
Ipswich, MA

AECOM Imagine it. Delivered.



Sources: MassGIS. Land use derived from statewide Level 3 parcel data.

Proposed Wells - Lynch Site
MassDEP Site With Activity and Use Limtations
MassDEP Underground Storage Tanks
Mass DEP Large Quantity Generator/User
Zoning District RRA (Rural Residence A)
Half-Mile Radius
Potential Contamination Source (See Table 4)

0 500 1,000 2,000 Feet

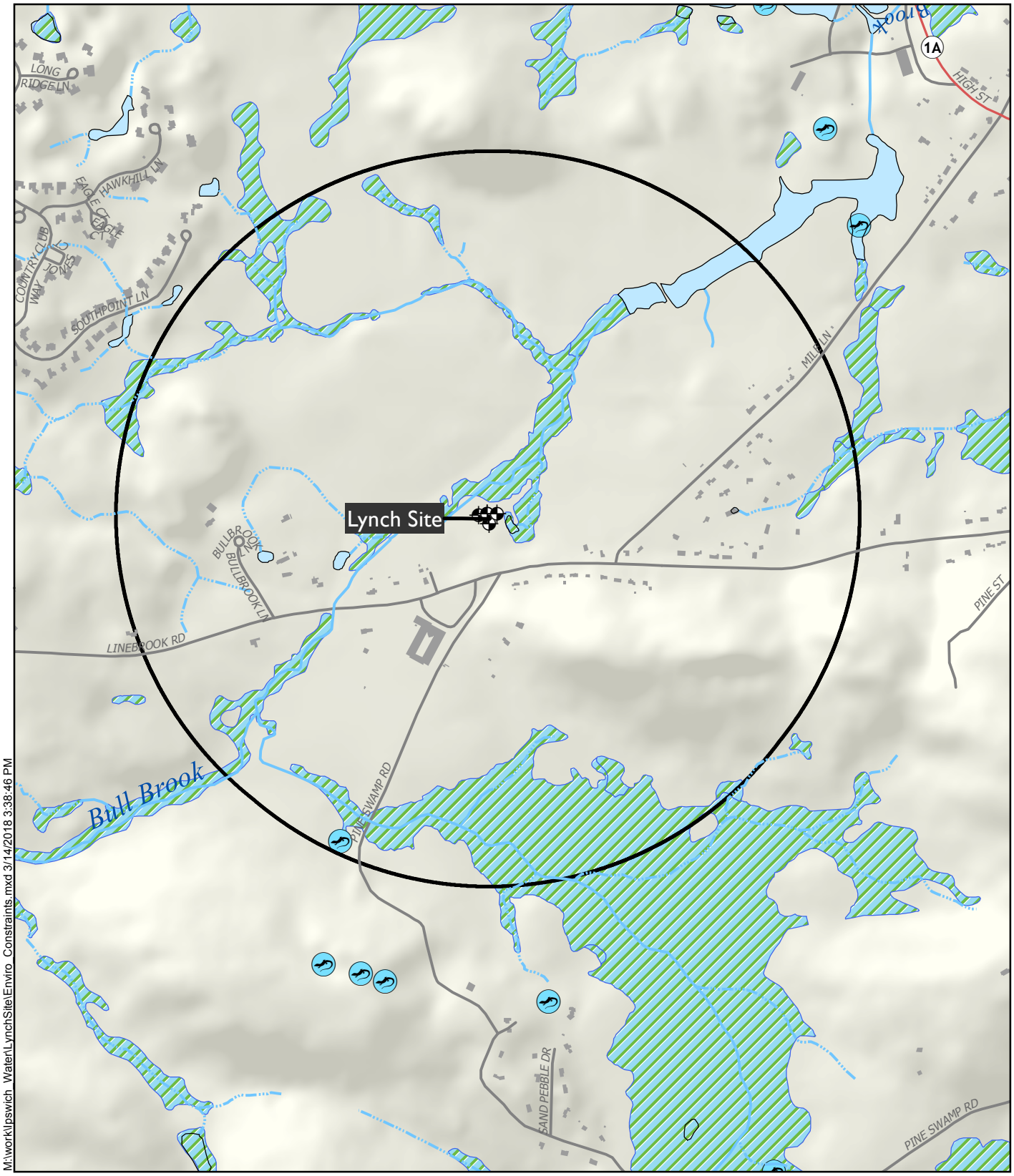
Figure 8

Land Use and Potential Contamination Sources

Lynch Site
Ipswich, MA

March 2018

AECOM



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Sources: MassGIS.

Proposed Wells - Lynch Site

Half-Mile Radius

NHESP Certified Vernal Pools

NHESP Estimated Habitats for Rare Wildlife

NHESP Priority Habitats for Rare Species

DEP Wetland

0 500 1,000 2,000 Feet

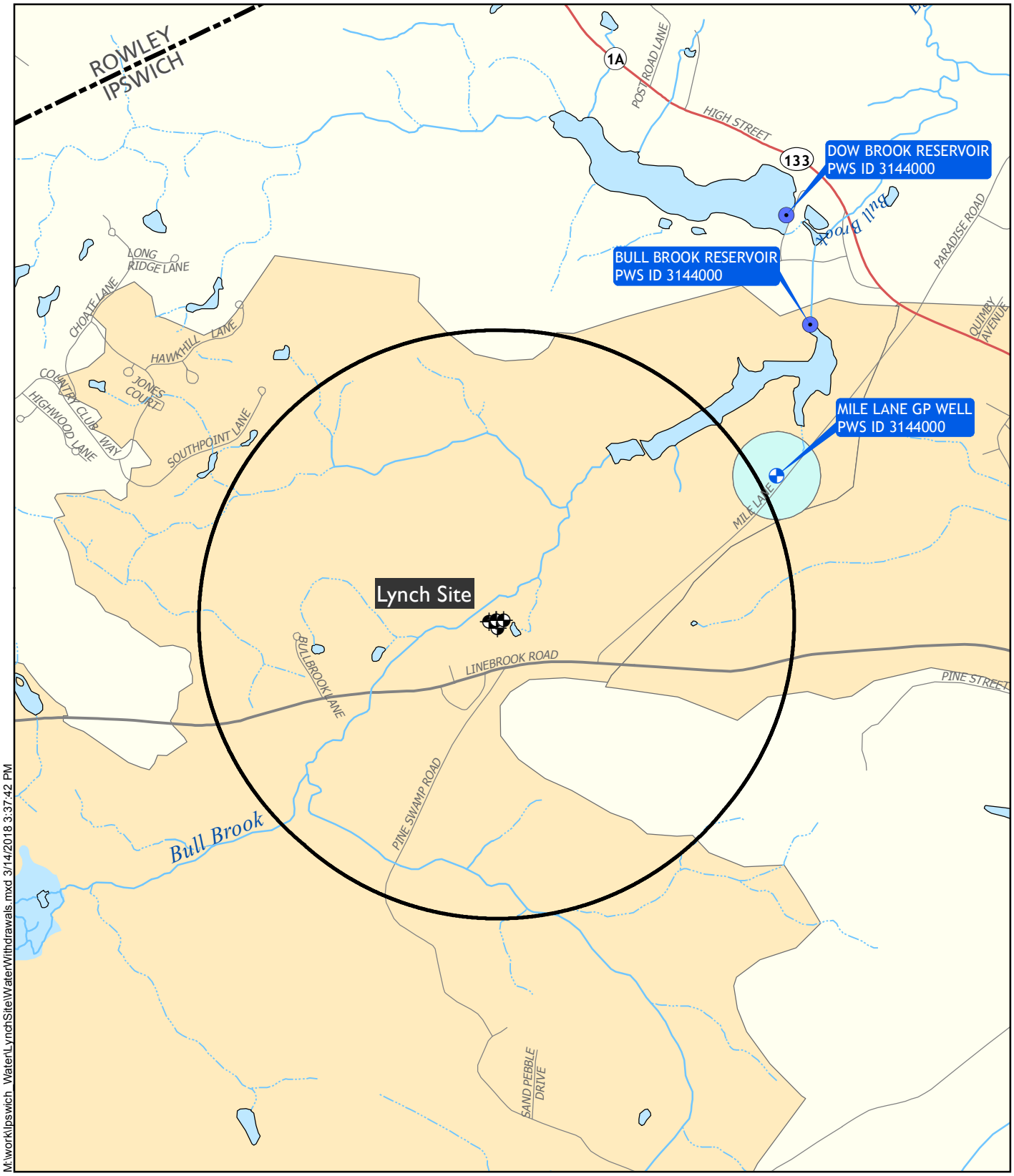
Figure 9

Wetlands and Habitat

Lynch Site
Ipswich, MA

March 2018

AECOM



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Proposed Wells - Lynch Site

Half-Mile Radius

Groundwater Supply

Surface Water Supply

Zone I Protection Area

Zone 2 Protection Area

0 500 1,000 2,000 Feet

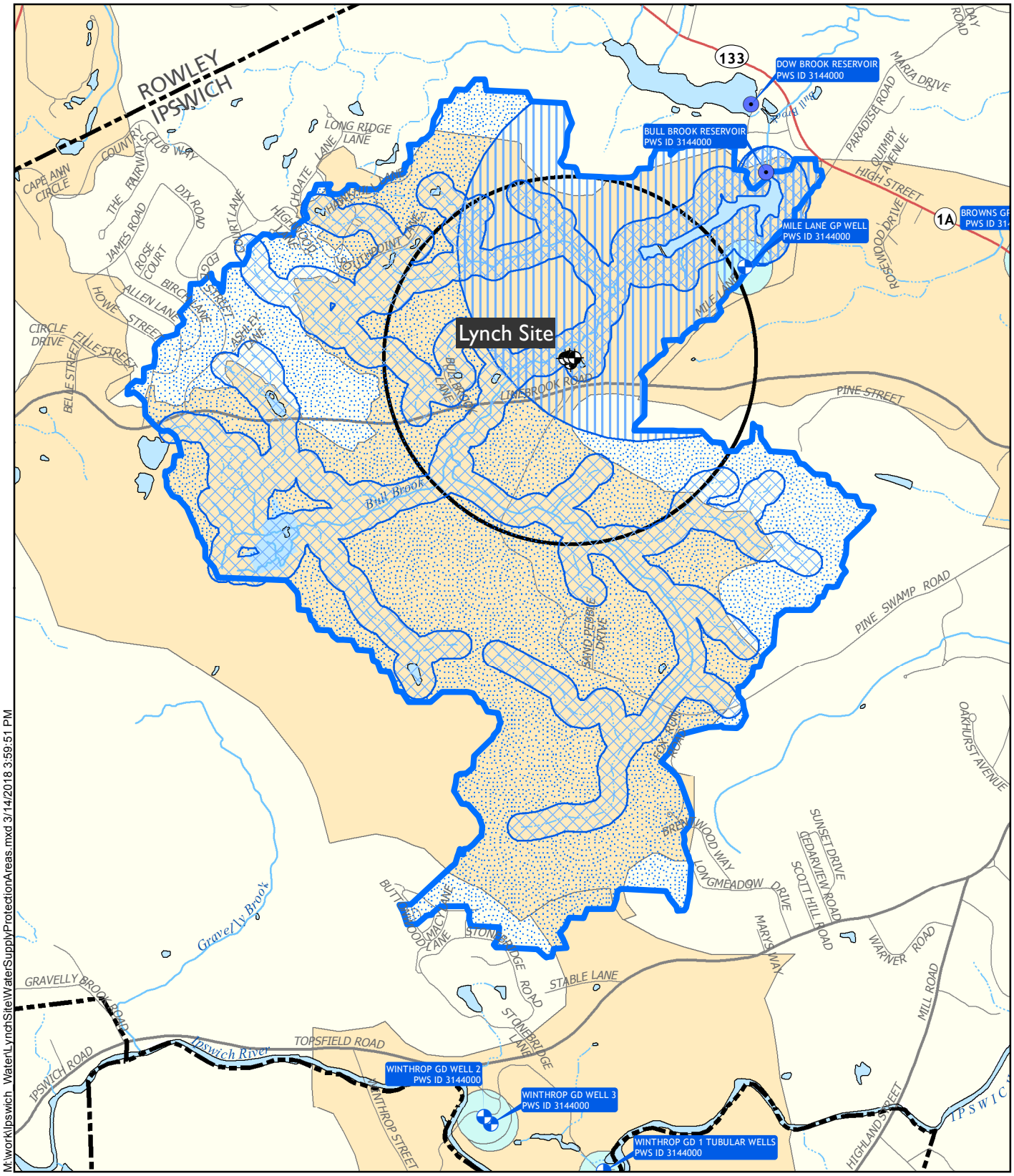
Figure 10

Water Withdrawals

Lynch Site

Ipswich, MA

AECOM Imagine it. Delivered.



Proposed Wells - Lynch Site

Half-Mile Radius

Groundwater Supply

Surface Water Supply

Zone I Protection Area

Zone 2 Protection Area

SWP Zone Bull Brook Reservoir

A

B

C

0 1,000 2,000 4,000 Feet

Figure 11

Water-Supply Protection Areas

Lynch Site

Ipswich, MA

AECOM Imagine it. Delivered.

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APPENDIX A – GEOLOGIC/WELL LOGS

DRILLING LOG

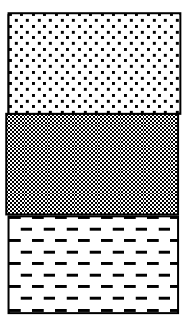
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW3-16
Bull Brook Reservoir, north side

DATES	Drilling Method:	Driller:	Borehole Diameter:
13-Jul-16 to 13-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	2" Sandy loam, rootletts.	Dark Brown			Topsoil
		6" F SAND, trace silt and rootletts. Topsoil.	Dark Brown			Sand
		3' F SAND, trace M sand	Orange/tan	m. dense		
		1' SILT, trace F sand.	Tan/orange-brown mottled	dense		
		Recovery = 56"				
5		1' F SAND, little M sand, 1" brown silt layer at 5'8".	Tan	mod. dense		
		2.8' M SAND, trace F + C sand, moist.	Brown			
		1' CLAY, trace silt.	Olive grey	stiff		
		Recovery = 58"				
10		CLAY, trace silt, sticky, wet, high plasticity.	Grey	soft		Marine Clay
		Recovery = 60"				
15		CLAY, sticky, wet, high plasticity.	Grey	soft		
		Recovery = 60"				
20		4.5' CLAY, wet, high plasticity.	Grey	soft		
		6" Till, Silty clay matrix, little M-C sand, little angular F-C gravel, up to 3".	Brown	very dense		
25		Recovery = 60"				Till

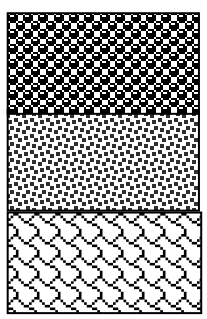
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW3-16
Bull Brook Reservoir, north side

DATES	Drilling Method:	Driller:	Borehole Diameter:
13-Jul-16 to 13-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
		Brown stony till, silty-clay matrix, little M-C sand, some F-C angular gravel up to 4".	Brown	Very Dense		Till
		Refusal at 28 feet				
30						
35						
40						
45	Sampled Continuously					
50						
55						
60						
65						

DRILLING LOG

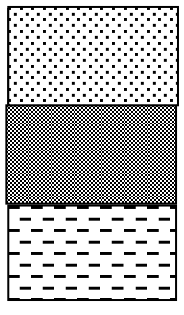
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW4-16
Bull Brook Reservoir, north side

DATES	Drilling Method:	Driller:	Borehole Diameter:
13-Jul-16 to 14-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	4" F SAND, little silt, rootletts.	Dark Brown			Topsoil
		1' F to VF SILTY SAND/SANDY SILT.	Tan	V. Dense		Sand
		3'8" F SAND, trace silt.	Tan	Dense		
		Recovery = 60"				
5		3'10" CLAYEY SILT, trace VF sand.	Tan	m. dense		
		14" CLAY, sticky, wet, high plasticity.	Grey	soft		
		Recovery = 60"				
10		CLAY, trace silt, sticky, wet, high plasticity.	Grey	soft		Marine Clay
		Recovery = 60"				
15		CLAY, sticky, wet, high plasticity.	Grey	soft		
		Recovery = 60"				
20		6" Till, Silty clay matrix, little M-C sand, little angular F-C gravel, up to 3".	Brown	Very dense		Till
25		**Refusal at 24.5 feet**				

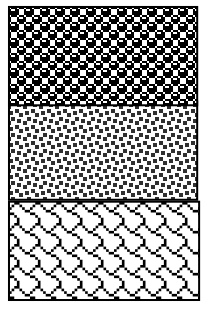
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

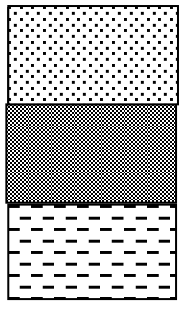
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW5-16
Bull Brook Reservoir, north side

DATES	Drilling Method:	Driller:	Borehole Diameter:
14-Jul-16 to 14-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	2" Sandy loam, rootletts.	Dark Brown			Topsoil
		6" F SAND, trace silt and rootletts. Topsoil.	Dark Brown			
		3' F SAND, trace M sand	Orange/tan	m. dense		Sand
		1' SILT, trace F sand.	Tan/orange-brown mottled	dense		
		Recovery = 56"				
5		1' F SAND, little M sand, 1" brown silt layer at 5'8".	Tan	mod. dense		
		2.8' M SAND, trace F + C sand, moist.	Brown			
		1' CLAY, trace silt.	Olive grey	stiff		
		Recovery = 58"				
10		CLAY, trace silt, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		Marine Clay
15		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
20		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
25						

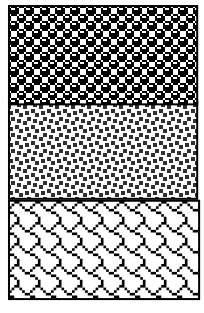
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW5-16
Bull Brook Reservoir, north side

DATES	Drilling Method:	Driller:	Borehole Diameter:
14-Jul-16 to 14-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	4.5' CLAY, wet, high plasticity. 6" Till, Silty clay matrix, little M-C sand, little angular F-C gravel, up to 3". Recovery = 60"	Grey Brown	soft very dense		Marine Clay
30		TILL, clayey/sandy matrix, fine to coarse sand, fine to coarse angular gravel clasts. Recovery = 24"	Grey	very dense		Till
35		**Refusal at 35.5 feet**				
40						
45						
50						
55						
60						
65						

DRILLING LOG

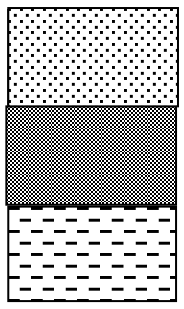
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW6-16
Bull Brook Reservoir, north side

DATES	Drilling Method:	Driller:	Borehole Diameter:
15-Jul-16 to 15-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	3" Loam, twigs, rootletts.	Brown	loose		Topsoil
		3" SAND, fine, organics.	Dark brown	loose		
		2' SAND, fine, trace M-C sand.	Orange to tan	m. dense		Sand
		6" SAND, medium, little F, trace C sand.	Brown	m. dense		
		1' SILT, little fine sand.	Grey/brown mottled	stiff		Silts with Fine Sands
5		1' SANDY SILT, F sand, moist.	Grey/brown mottled	Stiff		
		4' SILTY SAND, F sand, wet at 7 feet.	Grey/brown mottled	Stiff		
		Recovery = 60"				
10		1' SILT, trace F sand, trace clay.	Brown/tan mottled	stiff		
		4' CLAY, trace silt, sticky, wet, high plasticity.	Grey	soft		Marine Clay
		Recovery = 60"				
15		CLAY, sticky, wet, high plasticity.	Grey	soft		
		Recovery = 60"				
20		CLAY, sticky, wet, high plasticity.	Grey	soft		
		Recovery = 60"				
25						

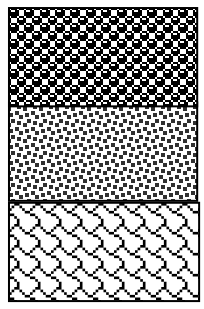
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW6-16
Bull Brook Reservoir, north side

DATES	Drilling Method:	Driller:	Borehole Diameter:
15-Jul-16 to 15-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	4' CLAY, some gravel, sticky, wet. 1' Stony till, clay/silt matrix, M-C sand, F-C angular gravel up to 3". Recovery = 60"	Grey	Soft		Clay
30		Stony till, clay/silt matrix, M-C sand, F-C angular gravel up to 3". No recovery.	Grey-Brown	Very Dense		Till
35		**Refusal at 34 feet**				
40						
45						
50						
55						
60						
65						

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

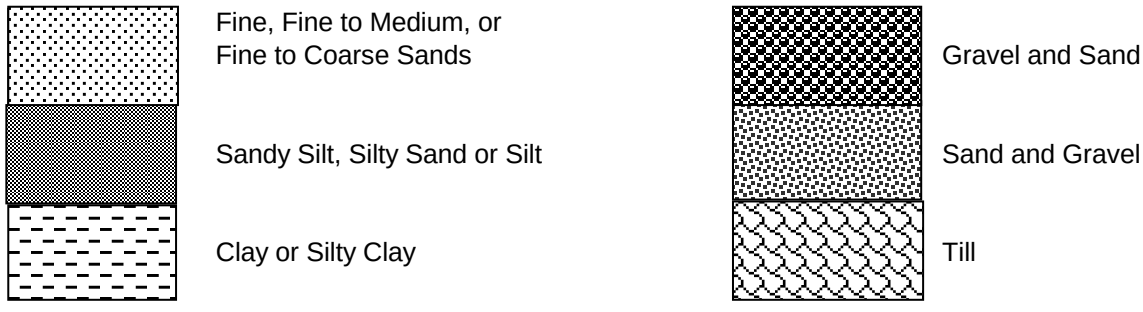
SITE: TW7-16
Bull Brook Reservoir, south side

DATES	Drilling Method:	Driller:	Borehole Diameter:
18-Jul-16 to 18-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	4" Loam	Dark brown	loose		Topsoil
		6" SAND, F sand, little silt	Brown	m. dense		Sand
		10" SANDY SILT, F sand	Tan	stiff		
		5" SAND, F sand, little M sand, trace silt	Tan	m. dense		
		20" SAND, M sand, some F sand	Tan/orange	m. dense		
5		2' SAND, M sand, little F sand	Brown	m. dense		
		3' CLAY, moist, becoming wet and soft at bottom of sampler Recovery = 60"	Olive-brown	stiff		Marine Clay
10		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
15		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
20		1.5' CLAY, sticky, wet, high plasticity. 6" GRAVEL, F-C angular gravel, little M-C sand, 3" broken rock in shoe.	Grey Brown	soft dense		Gravel
25						

Refusal at 25.5 feet

Key to symbols used in graphic log



Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

TW7-16:
2" x 100-slot st/st w/w screen, 23.5-18.5' bgs
2" diam. PVC riser, 18.5' to ground surface
bentonite seal from 9'-2' below ground
develop with diaphragm
80 gpm at 23" vacuum

DRILLING LOG

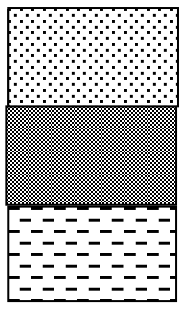
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW8-16
Bull Brook Reservoir, south side

DATES	Drilling Method:	Driller:	Borehole Diameter:
19-Jul-16 to 19-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	1" SANDY LOAM, F sand, rootletts	Dark brown	loose		Topsoil
		5" SAND, M sand with F sand	Tan	m. dense		Sand
		15" SAND, F sand with M sand	Light tan	m. dense		
		1' SAND, M sand, little C sand, trace F angular gravel, trace silt	Light brown	dense		
5		14" SAND, M sand, little F sand, little C sand, trace F subangular gravel	Reddish Brown	m. dense		
		4'10" SILTY SAND, F sand, clayey/silty lenses Recovery = 60"	Brown	dense		Silts and Fine Sands
10		2'7" CLAYEY SILT, lenses of F sand	Brown	stiff		
		2'5" CLAY, sticky, trace of F sand Recovery = 60"	Grey	soft		
15		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		Marine Clay
20		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
25						

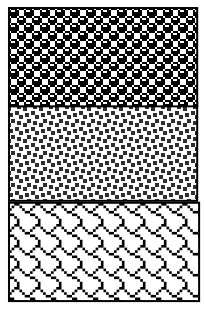
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW8-16
Bull Brook Reservoir, south side

DATES	Drilling Method:	Driller:	Borehole Diameter:
19-Jul-16 to 19-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		Marine Clay
30		4' CLAY, sticky, wet, high plasticity.	Grey	soft		
		6" TILL, clay-silt matrix, M-C sand, F-C angular gravel	Grey	v. dense		
35		No recovery				Till
		Refusal at 36 feet				
40						
45						
50						
55						
60						
65						

DRILLING LOG

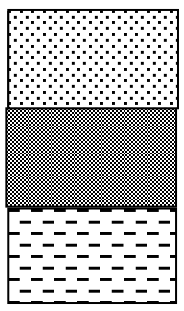
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW9-16
Bull Brook Reservoir, south side

DATES	Drilling Method:	Driller:	Borehole Diameter:
20-Jul-16 to 20-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	6" SANDY LOAM, F sand, twigs and rootletts	Dark brown	loose		Topsoil
		4' SAND, F sand Recovery = 54"	Grades brown to tan	m. dense		Sand
5		1.5' SAND, F sand	Tan	m. dense		
		2.5' SAND, M sand, little F sand, trace C sand	Brown	m. dense		
		6" CLAY, low plasticity Recovery = 54"	Olive-tan	stiff		
10		1' CLAY, low plasticity	Olive	stiff		Clay
		3' TILL, clayey matrix, F-C sand, F angular gravel Recovery = 48"	Brown	v. dense		Till
15		2' TILL, silty-clayey matrix, M-C sand, F angular gravel Recovery = 24"	Brown	v. dense		
20		**Refusal at 18 feet**				
25						

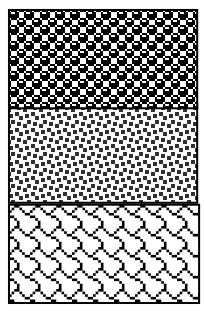
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

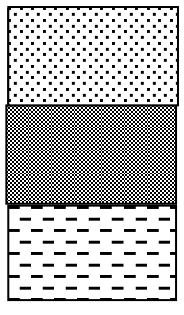
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW10-16
Mile Lane Well

DATES	Drilling Method:	Driller:	Borehole Diameter:
20-Jul-16 to 21-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	8" FILL, F sand, little M sand, trace C sand, little F subangular-subround gravel	Dark brown	dense		Sand
		5" SAND, F sand	Dark brown	m. dense		
		2'9" SAND, F sand	Tan to orange	m. dense		
		2" SILT	Grey	stiff		
5		11" SILT	Brown	stiff		Silts with Fine Sands
		1'3" SAND WITH SILT, F sand	Brown	dense		
		2'10" SILT	Brown	stiff		
		Recovery = 60"				
10		19" SILT	Brown	stiff		
		5" CLAY, low plasticity	Olive	m. stiff		
		8" SILT	Brown	stiff		
		2'4" SILTY CLAY, medium plasticity	Grey	soft		
		Recovery = 60"				
15		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		Marine Clay
20		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
25						

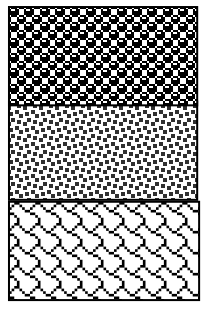
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW10-16
Mile Lane Well

DATES	Drilling Method:	Driller:	Borehole Diameter:
20-Jul-16 to 21-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		Clay
30		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
35		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
40		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
45		1' CLAY, sticky, high plasticity 2' GRAVEL, clean, F-C gravel, trace C sand, angular. Recovery = 36"	Grey Brown	soft v. dense		Gravel
50		**Refusal at 49.5 feet**				
55						
60						
65						

DRILLING LOG

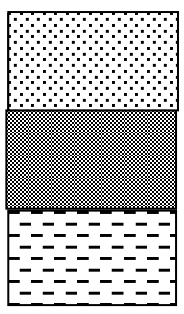
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW11-16
Mile Lane Well

DATES	Drilling Method:	Driller:	Borehole Diameter:
21-Jul-16 to 22-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	9" FILL, F sand, little M sand, little C sand, trace F-C subrounded gravel	Dark brown	dense		Sand
		7" SAND, F sand, organics, rootletts	Dark brown	m. dense		
		7" SAND, F sand, trace M-C sand	Orange	m. dense		
5		20" SAND, F sand	Tan to orange	m. dense		
		SAND with SILT, F sand, 4" olive clay lens at ~9'.	Light brown to orange	m. dense		Silts with Fine Sands
		Recovery = 60"				
10		6" SILT	Tan/orange mottled	stiff		
		3'1" SILTY CLAY, low plasticity	Olive grey	m. stiff		
		1'5" CLAY, sticky, high plasticity	Grey	soft		
		Recovery = 60"				
15		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		Clay
20		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
25						

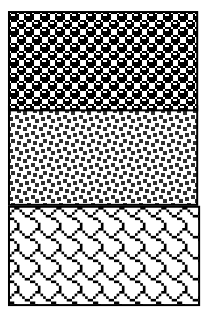
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW11-16
Mile Lane Well

DATES	Drilling Method:	Driller:	Borehole Diameter:
21-Jul-16 to 22-Jul-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		Clay
30		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
35		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
40		CLAY, sticky, wet, high plasticity. Change in drilling speed at 44' Recovery = 60"	Grey	soft		
45		6" GRAVELY CLAY, F angular gravel 6" GRAVEL, F-C angular gravel 6" TILL, brown, F-C sand, F-C gravel Recovery = 18"	Grey Brown Brown	stiff dense v. dense		Gravel
50		**Refusal at 49.5 feet**				
55						
60		TW11-16: 2" x 200-slot st/st w/w screen, 49-44' bgs 2" diam. PVC riser, 44' to ground surface bentonite seal from 43' to 5' below ground develop with diaphragm 73 gpm at 26" vacuum				
65						

DRILLING LOG

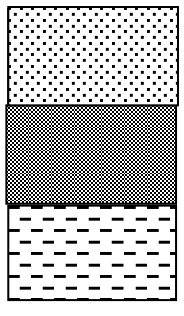
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW12-16
Bull Brook Reservoir, south side

DATES	Drilling Method:	Driller:	Borehole Diameter:
5-Aug-16 to 5-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	5" LOAMY SAND, F sand, organics	Dark brown	loose		Topsoil
		14" SAND, F sand	Dark brown to tan	m. dense		Sand
		2' SAND, M sand, some F, trace C sand	Tan	m. dense		
		7" SAND, F sand, trace C sand	Tan	m. dense		
		5" SAND, M sand, little F, trace F gravel	Light brown	m. dense		
5		9" SAND, M sand, little F sand, trace C	Brown	m. dense		
		7" SAND, F sand, little M sand	Brown	m. dense		
		15" SAND, M sand, little F sand, occasional lenses of F sand	Brown	m. dense		
10		18" SAND, M sand, little F, trace C, damp	Brown	m. dense		Clay
		22" SAND, M sand, little F sand, trace C sand, moist to wet	Reddish brown	m. dense		
		8" CLAY, low plasticity	Olive	stiff		
		2'6" CLAY, sticky, wet, high plasticity	Grey	soft		
		Recovery = 60"				
15		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
20		CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		
25						

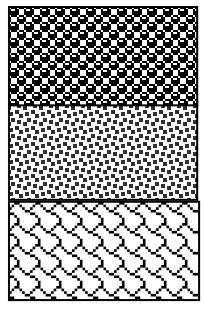
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW12-16
Bull Brook Reservoir, south side

DATES	Drilling Method:	Driller:	Borehole Diameter:
5-Aug-16 to 5-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	CLAY, sticky, wet, high plasticity. Recovery = 60"	Grey	soft		Clay
30		15" CLAY, high plasticity. 3" TILL, clayey matrix, M-C sand, F angular gravel Recovery = 18"	Grey Gray	m. stiff v. dense		Till
35		**Refusal at 35.5 feet**				
40						
45						
50						
55						
60						
65						

DRILLING LOG

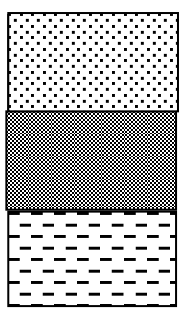
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW13-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
8-Aug-16 to 8-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	2" TILLED TOPSOIL, F sand, rootletts	Dark Brown	loose		Topsoil
		1'10" SAND, F sand, little M, trace C	Brown	m. dense		Sand
		8" GRAVEL, F subangular gravel, F-M sand. Dry.	Brown	dense		
		1' SAND, F sand, clean, moist.	Brown	m. dense		
5		SAND, F sand, clean, moist. Recovery = 51"	Brown	dense		
10		3'4" SAND, M sand, moist to wet.	Brown	dense		
		1'8" SILT, trace F sand, wet. Recovery = 60"	Olive brown	stiff		
15		15" SILT.	Olive brown	stiff		Silts and Fine Sands
		7" SAND, F sand	Reddish brown	m. dense		
		13" SILT and CLAY, interlayered	Olive brown	stiff		
		20" SAND, F sand, lenses of silt Recovery = 60"	Reddish brown	m. dense		
20		19" SAND, F sand, trace silt	Brown	dense		
		8" SILTY CLAY, low plasticity	Olive grey	stiff		
		20" SILTY SAND, F sand	Brown	dense		
		6" CLAY, soft, sticky, high plasticity Recovery = 60"	Grey	soft		Clay
25						

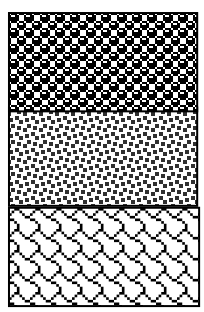
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW13-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
8-Aug-16 to 8-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	3' SANDY SILT, F sand 2' CLAY, sticky, wet, high plasticity Recovery = 60"	Grey Grey	stiff soft		Silt
30		SILTY CLAY, trace F sand, soft, high plasticity Recovery = 60"	Grey	soft		Clay
35		CLAY, trace silt, soft, high plasticity Recovery = 60"	Grey	soft		
40		CLAY, trace silt, soft, high plasticity Recovery = 60"	Grey	soft		
45		4'6" CLAY, soft, high plasticity 6" CLAY, low plasticity Recovery = 60"	Grey Brown/grey mottled	soft stiff		
50		GRAVEL, angular F-C gravel, broken rock pieces, trace silt/clay Recovery = 6"	Brown	Very Dense		Gravel
55		**Refusal at 55.5 feet**				
60		TW13-16: 2" x 100-slot st/st w/w screen, 50-55' bgs 2" diam. PVC riser, 50' to ground surface bentonite seal from 49' to 5' below ground develop with diaphragm 67 gpm at 23" vacuum				
65						

DRILLING LOG

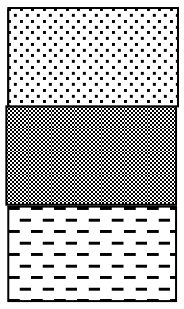
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW14-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
11-Aug-16 to 11-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				Sands and Silts (assumed)
5		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
10		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
15		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
20		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
25						

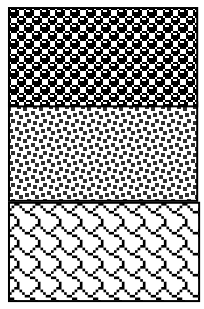
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW14-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
11-Aug-16 to 11-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				Clay (assumed)
30		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
35		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
40		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
45		GRAVEL, F-C angular gravel, F cobbles, shattered rock, little F-C sand, trace silt. Recovery = 24"	Brown	Very Dense		Gravel
50		**Refusal at 51 feet**				
55						
60		TW14-16: 2" x 250-slot st/st w/w screen, 46-51' bgs 2" diam. PVC riser, 46' to ground surface bentonite seal from 44' to 5' below ground develop with diaphragm 84 gpm at 25" vacuum				
65						

DRILLING LOG

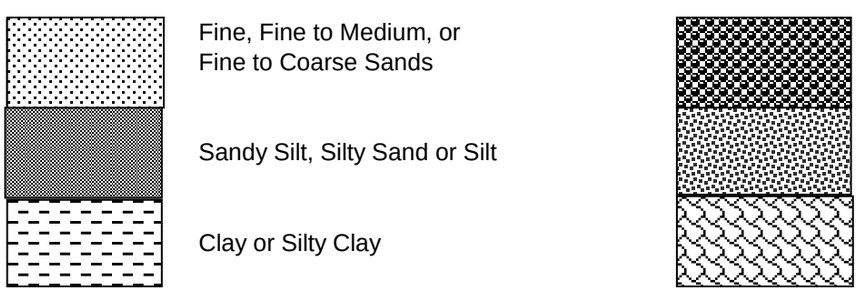
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW15-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
12-Aug-16 to 15-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				Sand and Silts (assumed)
5		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
10		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
15		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
20		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
25						

Key to symbols used in graphic log



Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW15-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
12-Aug-16 to 15-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
30		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				Clay (assumed)
35		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
40		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
45		GRAVEL, F-C angular gravel, F cobbles, broken rock pieces, trace F-C sand. Recovery = 12"	Brown	Very Dense		Gravel
50		**Refusal at 50 feet**				
55						
60		TW15-16: 2" x 250-slot st/st w/w screen, 50-45' bgs 2" diam. PVC riser, 45' to ground surface bentonite seal from 43' to 5' below ground develop with diaphragm 84 gpm at 20" vacuum				
65						

DRILLING LOG

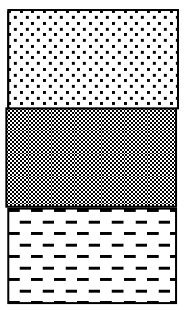
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW16-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
16-Aug-16 to 16-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				Sands and Silts (assumed)
5		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
10		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
15		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
20		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
25						

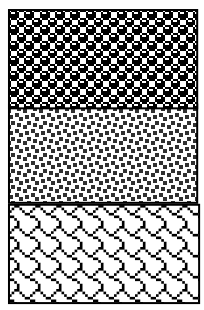
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW16-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
16-Aug-16 to 16-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3" diam. soil core

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				Clay (assumed)
30		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
35		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
40		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
45		No sample taken - 2.25" rods pushed, followed by 4" casing/3.5" rods.				
50		GRAVEL, F-C angular to subangular gravel, little F-M sand, little silt,one 3.5' cobble. Recovery = 24"	Brown	Very dense		Gravel
55		**Refusal at 55 feet**				
60		TW16-16: 2" x 250-slot st/st w/w screen, 55-50' bgs 2" diam. PVC riser, 50' to ground surface bentonite seal from 48' to 5' below ground develop with diaphragm 89 gpm at 22" vacuum				
65						

DRILLING LOG

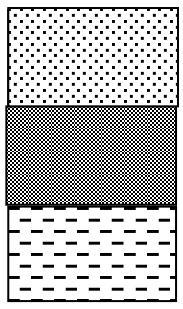
Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW17-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
17-Aug-16 to 18-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3.5" rotary bit

Depth, feet	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	No core taken - drive and wash.	Dark Brown			Sands and Silts
5		No core taken - drive and wash.	Brown			
10		No core taken - drive and wash.	Brown			
15		No core taken - drive and wash.	Light Brown			
20		No core taken - drive and wash.	Brown			
25						

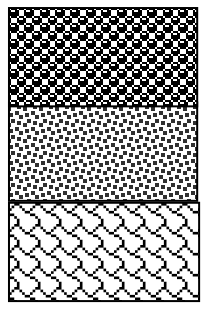
Key to symbols used in graphic log



Fine, Fine to Medium, or Fine to Coarse Sands

Sandy Silt, Silty Sand or Silt

Clay or Silty Clay



Gravel and Sand

Sand and Gravel

Till

Grain-Size Proportions

And: 35 to 50%
Some: 20 to 35%
Little: 10 to 20%
Trace: 1 to 10%

DRILLING LOG

Prepared by: E. Amir
AECOM
Chelmsford, MA

SITE: TW17-16
Lynch Property

DATES	Drilling Method:	Driller:	Borehole Diameter:
17-Aug-16 to 18-Aug-16	Geoprobe 7822 Direct Push	Maher Services	4.5" diam. Borehole; 3.5" rotary bit

Depth	Sample	Sample Description	Color	Density	Graphic Log	Interpretation
	Sampled Continuously	No core taken - drive and wash.	Dark Brown			Sand
30		No core taken - drive and wash.	Grey			Clay
35		No core taken - drive and wash.	Grey			
40		No core taken - drive and wash.	Grey			
45		No core taken - drive and wash.	Grey			
50		At 50', drilling speed slows down. Cuttings: rock chips, minimal silt and sand	Blue-gray with pink and white			Gravel and Cobbles
55		At 56' rock chips change color. At 59' drilling becomes choppy; possible top of bedrock.	Grey with orange and white			
60		**Washed to 59 feet, casing refusal at 57 feet**				
65		TW17-16: 2" x 200-slot st/st w/w screen, 57-52' bgs 2" diam. PVC riser, 52' to ground surface bentonite seal from 50' to 5' below ground develop with diaphragm 55 gpm at 29" vacuum				

Geotechnical Partnership, Inc.
Swampscott, Massachusetts
Sanford, Maine

PROJECT: Proposed New School Capacity
Multiple Site Review
Ipswich, Massachusetts

CLIENT: Perkins & Eastman Boston, MA

File No. 1538

Date Drilled	: 29 Feb to 4 March 2016
Boring Location	: Refer to Report Figure
Drilling Contractor	: Soil Exploration Corp.
	: Leominster, MA
Driller	: P. Goodhart
Rock Core	: ---
GPI Field Engineer	: LR Casselli, PE, MASCE CSI
Elevation and Datum	: NA
Drilling Mud Utilized	: Not necessary
Constant Water Head	: Not necessary

Test Boring No. DS1

Drill Rig Type	: ATV-mounted
Hammer Type	: Auto
Cat-Head or Winch	: NA
Soil Casing Type	: 8 in. OD HSA
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0		Topsoil (t = 8 in.)									Groundwater=7' Well Set: no
1–2.5		Tan, medium to fine SAND, few to little silt, trace coarse sand and fine grave (loose; moist) --Fill--	AR			1	3 4 4 5				SS-1: 1' - 3' R=9 N=8
3–5		Tan, medium to fine SAND, few silt and fine gravel, trace coarse sand (medium dense; moist)	SW			2	10 12 12 13				SS-2: 3' - 5' R=14 N=24
5–7		Tan, medium to fine SAND, few to little coarse to fine gravel, trace silt and coarse sand (medium dense; moist)	SW			3	5 8 8 7				SS-3: 5' - 7' R=16 N=16
7–9		Tan, medium to fine SAND, little coarse to fine gravel, few silt and coarse sand (medium dense; wet)	SW		▼	4	10 10 11 15				SS-4: 7' - 9' R=21 N=21
9–12		Tan, medium to fine SAND, few silt, none to trace coarse to fine gravel (medium dense; wet)	SW			5	5 6 6 7				SS-5: 10' - 12' R=17 N=12
12–14.0		Tan, medium to fine SAND, few silt, trace fine gravel (medium dense; wet) --Glacial Fluvial--	SW			6	5 6 8 7				SS-6: 13' - 15' R=22 N=14
14.0–15		Tan, medium to fine SAND, few silt (medium dense; wet) --Glacial Fluvial--	SP								Depth limited by local code.
15		Bottom of Exploration at 15 feet Depth									

Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%

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

Test Boring No. DS1

(1 of 1)

Geotechnical Partnership, Inc.
Swampscott, Massachusetts
Sanford, Maine

PROJECT: Proposed New School Capacity
Multiple Site Review
Ipswich, Massachusetts

CLIENT: Perkins & Eastman Boston, MA

File No. 1538

Date Drilled	: 29 Feb to 4 March 2016
Boring Location	: Refer to Report Figure
Drilling Contractor	: Soil Exploration Corp.
	: Leominster, MA
Driller	: P. Goodhart
Rock Core	: ---
GPI Field Engineer	: LR Casselli, PE, MASCE CSI
Elevation and Datum	: NA
Drilling Mud Utilized	: Not necessary
Constant Water Head	: Not necessary

Test Boring No. DS4

Drill Rig Type	: ATV-mounted
Hammer Type	: Auto
Cat-Head or Winch	: NA
Soil Casing Type	: 8 in. OD HSA
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph (10 – 50)	Average qu-Field	Average qu-Field (TSF) (0 – 4)	REMARKS
0		Topsoil (t = 8 in.)									Groundwater=7.5'
1		Tan-yellow, fine SAND, little medium sand, few to little silt (very loose; moist)	AR								Well Set: no
2		2.0 ft. --Fill/Reworked--				1	2 2 6 6				SS-1: 1' - 3' R=16 N=8
3		Tan, medium to fine SAND, little silt, few to little coarse to fine gravel, few coarse sand (medium dense; moist)	SW			2	12 25 28 34				SS-2: 3' - 5' R=15 N=53
4											
5		Tan, medium to fine SAND, little coarse to fine gravel, few to little silt, few coarse sand (dense; moist)				3	21 18 17 18				SS-3: 5' - 7' R=15 N=35
6											
7		Tan, medium to fine SAND, little to some coarse to fine gravel, few to little coarse sand, trace to few silt (dense; moist)			▼	4	13 15 12 12				SS-4: 7' - 9' R=20 N=27
8											
9		Tan, medium to fine SAND, little coarse to fine gravel, few to little coarse sand, few silt (medium dense; wet) --Glacial Fluvial--									
10			GW			5	6 7 11 9				SS-5: 10' - 12' R=12 N=18
11		Tan, coarse to fine GRAVEL (sub-rounded), some to mostly coarse to fine sand (medium dense; wet)									
12											
13		Tan, coarse to fine GRAVEL (sub-rounded) and medium to fine SAND, few silt and coarse sand (loose; wet)				6	5 6 6 7				SS-6: 13' - 15' R=20 N=12
14											
15		--Glacial Fluvial--									Depth limited by local code
		Bottom of Exploration at 15 feet Depth									
16											
17											
18											
19											
20											
21											
22											
23		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%									
24											

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

Test Boring No. DS4

03-05-2016 C:\Documents and Settings\Owner\My Documents\M-Tech\samples\1538 DS4-22.bor

Geotechnical Partnership, Inc.
Swampscott, Massachusetts
Sanford, Maine

PROJECT: Proposed New School Capacity
Multiple Site Review
Ipswich, Massachusetts

CLIENT: Perkins & Eastman Boston, MA

File No. 1538

Date Drilled	: 29 Feb to 4 March 2016
Boring Location	: Refer to Report Figure
Drilling Contractor	: Soil Exploration Corp.
	: Leominster, MA
Driller	: P. Goodhart
Rock Core	: ---
GPI Field Engineer	: LR Casselli, PE, MASCE CSI
Elevation and Datum	: NA
Drilling Mud Utilized	: Not necessary
Constant Water Head	: Water added to augers

Test Boring No. VF1

(1 of 1)

Drill Rig Type	: ATV-mounted
Hammer Type	: Auto
Cat-Head or Winch	: NA
Soil Casing Type	: 8 in. OD HSA
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Elev. in Feet

Depth in Feet	DESCRIPTIONS	USCS	Sample No.	Blow Count	Average qu-Field	REMARKS
0	Topsoil (t =7 in.)					Groundwater=5'
1	Tan, medium to fine SAND, trace to few coarse to fine gravel, trace silt and coarse sand (loose; dry) --Fill--	AR	1	4 4 5 12		Well Set: no
2	2.5 ft.					SS-1: 1' - 3' R=14 N=9
3	Tan, medium to fine SAND, trace silt and coarse sand, none to trace fine gravel (medium dense; moist)		2	9 8 7 11		SS-2: 3' - 5' R=18 N=15
4	Tan, medium to fine SAND, trace silt, none to trace fine gravel (medium dense; moist)					
5			3	5 4 5 4		SS-3: 5' - 7' R=17 N=9
6	Tan, medium to fine SAND, few silt (loose; wet)					
7			4	5 7 7 8		SS-4: 7' - 9' R=24 N=14
8	Tan, medium to fine SAND, few silt (medium dense; wet)					
9		SW				
10			5	5 8 11 12		SS-5: 10' - 12' R=19 N=19
11	Tan and orange, medium to fine SAND, few silt (medium dense; wet)					
12						
13						
14	Tan and orange, medium to fine SAND, few silt (medium dense; wet) --Glacial Fluvial--					
15	15.2 ft.		6	5 7 9 9		SS-6: 15' - 17' R=24 N=16
16	Orange-brown to tan-orange, fine SAND, little silt (medium dense; wet) --Glacial Fluvial--	SM				
17	16.7 ft.	ML				
18	Gray, SILT (non-plastic), little fine sand (medium dense; moist) --Glacial Fluvial--					
19	16.9 ft.					
20	Gray, silty CLAY (stiff; moist)	CL				
21	Gray, silty CLAY (stiff; moist) with frequent partings gray, fine sandy SILT (non-plastic; very moist) --Stiff Marine Sediment--		7	2 1 2 2	1.25	SS-7: 20' - 22' R=24 N=3 **P=1.4 TSF@20.5** **P=1.3 TSF@21.2** **P=1.1 TSF@21.9** P=Penetrometer
22	Bottom of Exploration at 22 feet Depth					
23	Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%					
24						

Blow Count Graph: 10 50

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

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

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

Test Boring No. VF1

(1 of 1)

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Geotechnical Partnership, Inc.
Swampscott, Massachusetts
Sanford, Maine

PROJECT: Proposed New School Capacity
Multiple Site Review
Ipswich, Massachusetts

CLIENT: Perkins & Eastman Boston, MA

File No. 1538

Date Drilled	: 29 Feb to 4 March 2016
Boring Location	: Refer to Report Figure
Drilling Contractor	: Soil Exploration Corp.
	: Leominster, MA
Driller	: P. Goodhart
Rock Core	: ---
GPI Field Engineer	: LR Casselli, PE, MASCE CSI
Elevation and Datum	: NA
Drilling Mud Utilized	: Not necessary
Constant Water Head	: Water added to augers

Test Boring No. VF4

Drill Rig Type	: ATV-mounted
Hammer Type	: Auto
Cat-Head or Winch	: NA
Soil Casing Type	: 8 in. OD HSA
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet | Elev. in Feet | DESCRIPTIONS | USCS | GRAPHIC | Water Level | Sample No. | Blow Count | Blow Count Graph (10 50) | Average qu-Field | Average qu-Field (TSF) (0 1 2 3 4) | REMARKS

Depth in Feet	DESCRIPTIONS	USCS
0	Topsoil (t =8 in.)	
1	Brown, medium to fine SAND, little to some coarse to fine gravel, few silt and coarse sand (medium dense; moist) --Fill--	AR
2	1.6 ft.	SM
3	Gray, fine sandy SILT (non-plastic), trace silty fine sand (medium dense; moist)	
4	3.0 ft. --Glacial Fluvial--	SM
5	Tan, fine sandy SILT (non-plastic) to silty fine SAND (medium dense; moist)	
5	5.0 ft. --Glacial Fluvial--	
6	Tan-brown, medium to fine SAND, few silt (medium dense; wet)	
7		
8	Tan-brown, medium to fine SAND, few silt (medium dense; wet)	
9		
10		SP
11	Tan-brown to orange-brown, medium to fine SAND, few silt (loose; wet)	
12		
13	Tan-brown to orange-brown, medium to fine SAND, few silt (loose; wet) with lenses gray, fine sandy SILT (non-plastic to low plastic) --Glacial Fluvial--	
14		
15	Bottom of Exploration at 15 feet Depth	
16		
17		
18		
19		
20		
21		
22		
23		
24		

Sample No.	Blow Count	REMARKS
		Groundwater=5'
		Well Set: no
1	5 8 8 18	SS-1: 1' - 3' R=20 N=16
2	13 12 7 5	SS-2: 3' - 5' R=17 N=19
3	4 4 6 7	SS-3: 5' - 7' R=21 N=10
4	7 7 7 8	SS-4: 7' - 9' R=22 N=14
5	4 4 5 5	SS-5: 10' - 12' R=20 N=9
6	3 5 7 9	SS-6: 13' - 15' R=17 N=12
		Likely transition to marine sediment at depth
		Depth limited by local code

Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%

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

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

Test Boring No. VF4

03-02-2016 C:\Documents and Settings\Owner\My Documents\M-Tech\samples\1538 VF4-22.bor

APPENDIX B - PUMPING TEST RECORDS

TW 13-16, TW 14-16, TW 15-16, and TW 16-16 Pumping Test Record August 31, 2016
Lynch Property Ipswich, MA Pump TW 13, 14, 15, and 16-16 Begin 08:30 am

DRAWDOWN Clear, hot, sunny, humid, ~90F

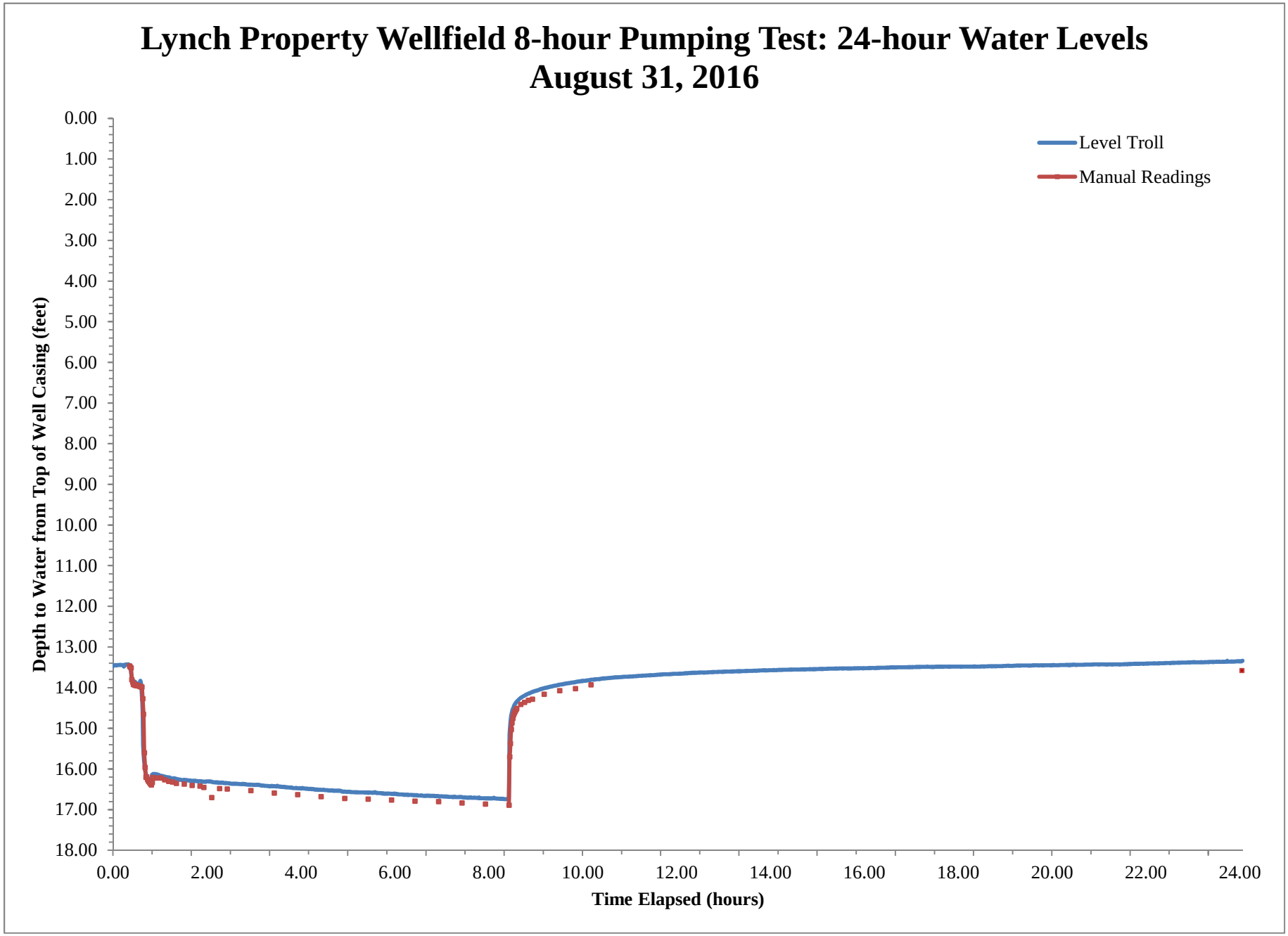
Elapsed	Water Level, depth in feet below top of PVC, unless indicated			Flow in	Vacuum	
Time (min.)	TW 17-16	TW 7-16	TW 11-16	GPM	inches	Note
Distance	2 ft	0.55 mi	0.4 mi			
0	13.46	14.06	18.75			Static WL
1	13.49					
2	13.51					
3	13.80					
4	13.86					
5	13.92					
6	13.91					
7	13.94					
8	13.94					
9	13.95					
10	13.94				10.0	
20	15.96				21.0	
30	16.21				21.0	
40	16.22			174	21.0	clear, no odor
50	16.30				20.0	
60	16.35					
70	16.37					
80	16.40			174	20.0	clear, no odor
90	16.42					
110	16.46					
120	16.49			171	20.0	clear, no odor
150	16.53					
180	16.59	14.04	18.69			
210	16.63			171	20.0	clear, no odor
240	16.68			171	20.0	clear, no odor
270	16.72					
300	16.74					
330	16.76	14.03	18.63	171	21.0	clear, no odor
360	16.79					
390	16.80					
420	16.83					
450	16.86			171	20.0	clear, no odor
480	16.89					
	END OF PUMPING					
Drawdown	3.43					

Additional Notes:
1) Flow measured at orifice weir; 3" plate in 6" pipe.

RECOVERY

Elapsed Time (min.) Distance	Water Level, depth in feet below Top of Casing TW 6-15 2 ft	235 ft	Begin recovery at 16:36	Note
0	16.89			Static WL
1	16.70			
2	15.37			
3	15.03			
4	14.86			
5	14.75			
6	14.67			
7	14.62			
8	14.58			
9	14.54			
10	14.51			
15	14.41			
20	14.41			
30	14.36			
40	14.28			
50	14.16			
60	14.07			
80	14.02			
100	13.96			
120	13.93			

Percent Recovery:
86 %



AECOM

\Transportation\Data1\work\60477124 - Ipswich Test Wells - Brown\PROJ\500 Deliverables\TestWell Report\Mile Lane Report\Appendix B\LevelTrollrecord.xlsx

APPENDIX C – LABORATORY REPORTS

ANALYTICAL REPORT

Lab Number:	L1627352
Client:	AECOM 250 Apollo Dr. Chelmsford, MA 01824
ATTN:	Doug DeNatale
Phone:	(978) 905-2180
Project Name:	IPSWICH, MA
Project Number:	60477124
Report Date:	09/08/16

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NY (11148), CT (PH-0574), NH (2003), NJ NELAP (MA935), RI (LAO00065), ME (MA00086), PA (68-03671), VA (460195), MD (348), IL (200077), NC (666), TX (T104704476), DOD (L2217), USDA (Permit #P-330-11-00240).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1627352-01	LYNCH	DW	IPSWICH, MA	08/31/16 15:00	08/31/16
L1627352-02	TRIP BLANK	DW	IPSWICH, MA	08/24/16 00:00	08/31/16

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY
For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

Project Name:	IPSWICH, MA	**Lab Number:**	L1627352
Project Number:	60477124	**Report Date:**	09/08/16

Case Narrative (continued)

Report Submission

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

Metals

The WG928045-4 MS recovery for silicon (187%), performed on L1627352-01, does not apply because the sample concentration is greater than four times the spike amount added.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Michelle M. Morris

Title: Technical Director/Representative

Date: 09/08/16

ORGANICS

VOLATILES

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

SAMPLE RESULTS

Lab ID: L1627352-01
Client ID: LYNCH
Sample Location: IPSWICH, MA
Matrix: Dw
Analytical Method: 16,524.2
Analytical Date: 09/01/16 15:10
Analyst: MM

Date Collected: 08/31/16 15:00
Date Received: 08/31/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by GC/MS - Westborough Lab						
Dichlorodifluoromethane	ND		ug/l	0.50	0.10	1
Chloromethane	ND		ug/l	0.50	0.15	1
Vinyl chloride	ND		ug/l	0.50	0.08	1
Bromomethane	ND		ug/l	0.50	0.13	1
Chloroethane	ND		ug/l	0.50	0.12	1
Trichlorofluoromethane	ND		ug/l	0.50	0.11	1
1,1-Dichloroethene	ND		ug/l	0.50	0.06	1
Methylene chloride	ND		ug/l	0.50	0.15	1
Methyl tert butyl ether	ND		ug/l	0.50	0.06	1
trans-1,2-Dichloroethene	ND		ug/l	0.50	0.09	1
1,1-Dichloroethane	ND		ug/l	0.50	0.09	1
2,2-Dichloropropane	ND		ug/l	0.50	0.11	1
cis-1,2-Dichloroethene	ND		ug/l	0.50	0.11	1
Chloroform	0.27	J	ug/l	0.50	0.05	1
Bromochloromethane	ND		ug/l	0.50	0.10	1
1,1,1-Trichloroethane	ND		ug/l	0.50	0.08	1
1,1-Dichloropropene	ND		ug/l	0.50	0.11	1
Carbon tetrachloride	ND		ug/l	0.50	0.10	1
1,2-Dichloroethane	ND		ug/l	0.50	0.08	1
Benzene	ND		ug/l	0.50	0.09	1
Trichloroethene	ND		ug/l	0.50	0.09	1
1,2-Dichloropropane	ND		ug/l	0.50	0.09	1
Bromodichloromethane	ND		ug/l	0.50	0.05	1
Dibromomethane	ND		ug/l	0.50	0.09	1
cis-1,3-Dichloropropene	ND		ug/l	0.50	0.10	1
Toluene	ND		ug/l	0.50	0.12	1
trans-1,3-Dichloropropene	ND		ug/l	0.50	0.09	1
1,1,2-Trichloroethane	ND		ug/l	0.50	0.12	1
1,3-Dichloropropane	ND		ug/l	0.50	0.11	1
Tetrachloroethene	ND		ug/l	0.50	0.09	1

Project Name: IPSWICH, MA
Project Number: 60477124
Lab Number: L1627352
Report Date: 09/08/16

SAMPLE RESULTS

Lab ID: L1627352-01
Client ID: LYNCH
Sample Location: IPSWICH, MA
Date Collected: 08/31/16 15:00
Date Received: 08/31/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by GC/MS - Westborough Lab						
Dibromochloromethane	ND		ug/l	0.50	0.08	1
1,2-Dibromoethane	ND		ug/l	0.50	0.06	1
Chlorobenzene	ND		ug/l	0.50	0.08	1
1,1,1,2-Tetrachloroethane	ND		ug/l	0.50	0.09	1
Ethylbenzene	ND		ug/l	0.50	0.06	1
p/m-Xylene	ND		ug/l	0.50	0.12	1
o-Xylene	ND		ug/l	0.50	0.09	1
Styrene	ND		ug/l	0.50	0.06	1
Isopropylbenzene	ND		ug/l	0.50	0.08	1
Bromoform	ND		ug/l	0.50	0.09	1
1,1,2,2-Tetrachloroethane	ND		ug/l	0.50	0.09	1
1,2,3-Trichloropropane	ND		ug/l	0.50	0.11	1
n-Propylbenzene	ND		ug/l	0.50	0.08	1
Bromobenzene	ND		ug/l	0.50	0.09	1
Xylenes, Total[1]	ND		ug/l	0.50	0.09	1
1,3,5-Trimethylbenzene	ND		ug/l	0.50	0.10	1
o-Chlorotoluene	ND		ug/l	0.50	0.10	1
p-Chlorotoluene	ND		ug/l	0.50	0.08	1
tert-Butylbenzene	ND		ug/l	0.50	0.09	1
1,2,4-Trimethylbenzene	ND		ug/l	0.50	0.08	1
sec-Butylbenzene	ND		ug/l	0.50	0.06	1
p-Isopropyltoluene	ND		ug/l	0.50	0.07	1
1,3-Dichlorobenzene	ND		ug/l	0.50	0.05	1
1,4-Dichlorobenzene	ND		ug/l	0.50	0.05	1
n-Butylbenzene	ND		ug/l	0.50	0.06	1
1,2-Dichlorobenzene	ND		ug/l	0.50	0.07	1
1,2-Dibromo-3-chloropropane	ND		ug/l	0.50	0.16	1
1,2,4-Trichlorobenzene	ND		ug/l	0.50	0.07	1
Hexachlorobutadiene	ND		ug/l	0.50	0.11	1
Naphthalene	ND		ug/l	0.50	0.06	1
1,2,3-Trichlorobenzene	ND		ug/l	0.50	0.06	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	104		80-120
4-Bromofluorobenzene	96		80-120

Project Name: IPSWICH, MA
Project Number: 60477124
Lab Number: L1627352
Report Date: 09/08/16

SAMPLE RESULTS

Lab ID: L1627352-02
Client ID: TRIP BLANK
Sample Location: IPSWICH, MA
Matrix: Dw
Analytical Method: 16,524.2
Analytical Date: 09/01/16 13:16
Analyst: GT

Date Collected: 08/24/16 00:00
Date Received: 08/31/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by GC/MS - Westborough Lab						
Dichlorodifluoromethane	ND		ug/l	0.50	0.10	1
Chloromethane	ND		ug/l	0.50	0.15	1
Vinyl chloride	ND		ug/l	0.50	0.08	1
Bromomethane	0.34	J	ug/l	0.50	0.13	1
Chloroethane	ND		ug/l	0.50	0.12	1
Trichlorofluoromethane	ND		ug/l	0.50	0.11	1
1,1-Dichloroethene	ND		ug/l	0.50	0.06	1
Methylene chloride	ND		ug/l	0.50	0.15	1
Methyl tert butyl ether	ND		ug/l	0.50	0.06	1
trans-1,2-Dichloroethene	ND		ug/l	0.50	0.09	1
1,1-Dichloroethane	ND		ug/l	0.50	0.09	1
2,2-Dichloropropane	ND		ug/l	0.50	0.11	1
cis-1,2-Dichloroethene	ND		ug/l	0.50	0.11	1
Chloroform	ND		ug/l	0.50	0.05	1
Bromochloromethane	ND		ug/l	0.50	0.10	1
1,1,1-Trichloroethane	ND		ug/l	0.50	0.08	1
1,1-Dichloropropene	ND		ug/l	0.50	0.11	1
Carbon tetrachloride	ND		ug/l	0.50	0.10	1
1,2-Dichloroethane	ND		ug/l	0.50	0.08	1
Benzene	ND		ug/l	0.50	0.09	1
Trichloroethene	ND		ug/l	0.50	0.09	1
1,2-Dichloropropane	ND		ug/l	0.50	0.09	1
Bromodichloromethane	ND		ug/l	0.50	0.05	1
Dibromomethane	ND		ug/l	0.50	0.09	1
cis-1,3-Dichloropropene	ND		ug/l	0.50	0.10	1
Toluene	ND		ug/l	0.50	0.12	1
trans-1,3-Dichloropropene	ND		ug/l	0.50	0.09	1
1,1,2-Trichloroethane	ND		ug/l	0.50	0.12	1
1,3-Dichloropropane	ND		ug/l	0.50	0.11	1
Tetrachloroethene	ND		ug/l	0.50	0.09	1

Project Name: IPSWICH, MA
Project Number: 60477124
Lab Number: L1627352
Report Date: 09/08/16

SAMPLE RESULTS

Lab ID: L1627352-02
Client ID: TRIP BLANK
Sample Location: IPSWICH, MA
Date Collected: 08/24/16 00:00
Date Received: 08/31/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Organics by GC/MS - Westborough Lab						
Dibromochloromethane	ND		ug/l	0.50	0.08	1
1,2-Dibromoethane	ND		ug/l	0.50	0.06	1
Chlorobenzene	ND		ug/l	0.50	0.08	1
1,1,1,2-Tetrachloroethane	ND		ug/l	0.50	0.09	1
Ethylbenzene	ND		ug/l	0.50	0.06	1
p/m-Xylene	ND		ug/l	0.50	0.12	1
o-Xylene	ND		ug/l	0.50	0.09	1
Styrene	ND		ug/l	0.50	0.06	1
Isopropylbenzene	ND		ug/l	0.50	0.08	1
Bromoform	ND		ug/l	0.50	0.09	1
1,1,2,2-Tetrachloroethane	ND		ug/l	0.50	0.09	1
1,2,3-Trichloropropane	ND		ug/l	0.50	0.11	1
n-Propylbenzene	ND		ug/l	0.50	0.08	1
Bromobenzene	ND		ug/l	0.50	0.09	1
Xylenes, Total[1]	ND		ug/l	0.50	0.09	1
1,3,5-Trimethylbenzene	ND		ug/l	0.50	0.10	1
o-Chlorotoluene	ND		ug/l	0.50	0.10	1
p-Chlorotoluene	ND		ug/l	0.50	0.08	1
tert-Butylbenzene	ND		ug/l	0.50	0.09	1
1,2,4-Trimethylbenzene	ND		ug/l	0.50	0.08	1
sec-Butylbenzene	ND		ug/l	0.50	0.06	1
p-Isopropyltoluene	ND		ug/l	0.50	0.07	1
1,3-Dichlorobenzene	ND		ug/l	0.50	0.05	1
1,4-Dichlorobenzene	ND		ug/l	0.50	0.05	1
n-Butylbenzene	ND		ug/l	0.50	0.06	1
1,2-Dichlorobenzene	ND		ug/l	0.50	0.07	1
1,2-Dibromo-3-chloropropane	ND		ug/l	0.50	0.16	1
1,2,4-Trichlorobenzene	ND		ug/l	0.50	0.07	1
Hexachlorobutadiene	ND		ug/l	0.50	0.11	1
Naphthalene	ND		ug/l	0.50	0.06	1
1,2,3-Trichlorobenzene	ND		ug/l	0.50	0.06	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	99		80-120
4-Bromofluorobenzene	95		80-120

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Method Blank Analysis
Batch Quality Control

Analytical Method: 16,524.2
Analytical Date: 09/01/16 12:03
Analyst: GT

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Organics by GC/MS - Westborough Lab for sample(s): 01-02 Batch: WG928423-4					
Dichlorodifluoromethane	ND		ug/l	0.50	0.10
Chloromethane	ND		ug/l	0.50	0.15
Vinyl chloride	ND		ug/l	0.50	0.08
Bromomethane	0.46	J	ug/l	0.50	0.13
Chloroethane	ND		ug/l	0.50	0.12
Trichlorofluoromethane	ND		ug/l	0.50	0.11
1,1-Dichloroethene	ND		ug/l	0.50	0.06
Methylene chloride	0.20	J	ug/l	0.50	0.15
Methyl tert butyl ether	ND		ug/l	0.50	0.06
trans-1,2-Dichloroethene	ND		ug/l	0.50	0.09
1,1-Dichloroethane	ND		ug/l	0.50	0.09
2,2-Dichloropropane	ND		ug/l	0.50	0.11
cis-1,2-Dichloroethene	ND		ug/l	0.50	0.11
Chloroform	ND		ug/l	0.50	0.05
Bromochloromethane	ND		ug/l	0.50	0.10
1,1,1-Trichloroethane	ND		ug/l	0.50	0.08
1,1-Dichloropropene	ND		ug/l	0.50	0.11
Carbon tetrachloride	ND		ug/l	0.50	0.10
1,2-Dichloroethane	ND		ug/l	0.50	0.08
Benzene	ND		ug/l	0.50	0.09
Trichloroethene	ND		ug/l	0.50	0.09
1,2-Dichloropropane	ND		ug/l	0.50	0.09
Bromodichloromethane	ND		ug/l	0.50	0.05
Dibromomethane	ND		ug/l	0.50	0.09
cis-1,3-Dichloropropene	ND		ug/l	0.50	0.10
Toluene	ND		ug/l	0.50	0.12
trans-1,3-Dichloropropene	ND		ug/l	0.50	0.09
1,1,2-Trichloroethane	ND		ug/l	0.50	0.12
1,3-Dichloropropane	ND		ug/l	0.50	0.11

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Method Blank Analysis
Batch Quality Control

Analytical Method: 16,524.2
Analytical Date: 09/01/16 12:03
Analyst: GT

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Organics by GC/MS - Westborough Lab for sample(s): 01-02 Batch: WG928423-4					
Tetrachloroethene	ND		ug/l	0.50	0.09
Dibromochloromethane	ND		ug/l	0.50	0.08
1,2-Dibromoethane	ND		ug/l	0.50	0.06
Chlorobenzene	ND		ug/l	0.50	0.08
1,1,1,2-Tetrachloroethane	ND		ug/l	0.50	0.09
Ethylbenzene	ND		ug/l	0.50	0.06
p/m-Xylene	ND		ug/l	0.50	0.12
o-Xylene	ND		ug/l	0.50	0.09
Styrene	ND		ug/l	0.50	0.06
Isopropylbenzene	ND		ug/l	0.50	0.08
Bromoform	ND		ug/l	0.50	0.09
1,1,2,2-Tetrachloroethane	ND		ug/l	0.50	0.09
1,2,3-Trichloropropane	ND		ug/l	0.50	0.11
n-Propylbenzene	ND		ug/l	0.50	0.08
Xylenes, Total[1]	ND		ug/l	0.50	0.09
Bromobenzene	ND		ug/l	0.50	0.09
1,3,5-Trimethylbenzene	ND		ug/l	0.50	0.10
o-Chlorotoluene	ND		ug/l	0.50	0.10
p-Chlorotoluene	ND		ug/l	0.50	0.08
tert-Butylbenzene	ND		ug/l	0.50	0.09
1,2,4-Trimethylbenzene	ND		ug/l	0.50	0.08
sec-Butylbenzene	ND		ug/l	0.50	0.06
p-Isopropyltoluene	ND		ug/l	0.50	0.07
1,3-Dichlorobenzene	ND		ug/l	0.50	0.05
1,4-Dichlorobenzene	ND		ug/l	0.50	0.05
n-Butylbenzene	ND		ug/l	0.50	0.06
1,2-Dichlorobenzene	ND		ug/l	0.50	0.07
1,2-Dibromo-3-chloropropane	ND		ug/l	0.50	0.16
1,2,4-Trichlorobenzene	ND		ug/l	0.50	0.07

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Method Blank Analysis
Batch Quality Control

Analytical Method: 16,524.2
Analytical Date: 09/01/16 12:03
Analyst: GT

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Organics by GC/MS - Westborough Lab for sample(s): 01-02 Batch: WG928423-4					
Hexachlorobutadiene	ND		ug/l	0.50	0.11
Naphthalene	ND		ug/l	0.50	0.06
1,2,3-Trichlorobenzene	ND		ug/l	0.50	0.06

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	102		80-120
4-Bromofluorobenzene	95		80-120

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 Batch: WG928423-3								
Dichlorodifluoromethane	92		-		70-130	-		20
Chloromethane	105		-		70-130	-		20
Vinyl chloride	105		-		70-130	-		20
Bromomethane	118		-		70-130	-		20
Chloroethane	105		-		70-130	-		20
Trichlorofluoromethane	100		-		70-130	-		20
1,1-Dichloroethene	108		-		70-130	-		20
Methylene chloride	102		-		70-130	-		20
Methyl tert butyl ether	98		-		70-130	-		20
trans-1,2-Dichloroethene	108		-		70-130	-		20
1,1-Dichloroethane	102		-		70-130	-		20
2,2-Dichloropropane	102		-		70-130	-		20
cis-1,2-Dichloroethene	105		-		70-130	-		20
Chloroform	102		-		70-130	-		20
Bromochloromethane	102		-		70-130	-		20
1,1,1-Trichloroethane	102		-		70-130	-		20
1,1-Dichloropropene	108		-		70-130	-		20
Carbon tetrachloride	100		-		70-130	-		20
1,2-Dichloroethane	100		-		70-130	-		20
Benzene	102		-		70-130	-		20
Trichloroethene	105		-		70-130	-		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 Batch: WG928423-3								
1,2-Dichloropropane	102		-		70-130	-		20
Bromodichloromethane	95		-		70-130	-		20
Dibromomethane	98		-		70-130	-		20
cis-1,3-Dichloropropene	98		-		70-130	-		20
Toluene	100		-		70-130	-		20
trans-1,3-Dichloropropene	108		-		70-130	-		20
1,1,2-Trichloroethane	100		-		70-130	-		20
1,3-Dichloropropane	95		-		70-130	-		20
Tetrachloroethene	100		-		70-130	-		20
Dibromochloromethane	92		-		70-130	-		20
1,2-Dibromoethane	95		-		70-130	-		20
Chlorobenzene	102		-		70-130	-		20
1,1,1,2-Tetrachloroethane	95		-		70-130	-		20
Ethylbenzene	102		-		70-130	-		20
p/m-Xylene	100		-		70-130	-		20
o-Xylene	98		-		70-130	-		20
Styrene	98		-		70-130	-		20
Isopropylbenzene	100		-		70-130	-		20
Bromoform	80		-		70-130	-		20
1,1,2,2-Tetrachloroethane	90		-		70-130	-		20
1,2,3-Trichloropropane	92		-		70-130	-		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 Batch: WG928423-3								
n-Propylbenzene	100		-		70-130	-		20
Bromobenzene	100		-		70-130	-		20
1,3,5-Trimethylbenzene	98		-		70-130	-		20
o-Chlorotoluene	100		-		70-130	-		20
p-Chlorotoluene	100		-		70-130	-		20
tert-Butylbenzene	98		-		70-130	-		20
1,2,4-Trimethylbenzene	98		-		70-130	-		20
sec-Butylbenzene	100		-		70-130	-		20
p-Isopropyltoluene	100		-		70-130	-		20
1,3-Dichlorobenzene	100		-		70-130	-		20
1,4-Dichlorobenzene	102		-		70-130	-		20
n-Butylbenzene	100		-		70-130	-		20
1,2-Dichlorobenzene	100		-		70-130	-		20
1,2-Dibromo-3-chloropropane	75		-		70-130	-		20
1,2,4-Trichlorobenzene	102		-		70-130	-		20
Hexachlorobutadiene	100		-		70-130	-		20
Naphthalene	98		-		70-130	-		20
1,2,3-Trichlorobenzene	100		-		70-130	-		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 Batch: WG928423-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichlorobenzene-d4	98				80-120
4-Bromofluorobenzene	96				80-120

Matrix Spike Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 QC Batch ID: WG928423-6 QC Sample: L1627059-01 Client ID: MS Sample												
Dichlorodifluoromethane	ND	4	3.8	95		-	-		70-130	-		20
Chloromethane	ND	4	4.1	103		-	-		70-130	-		20
Vinyl chloride	ND	4	4.3	108		-	-		70-130	-		20
Bromomethane	ND	4	4.4	110		-	-		70-130	-		20
Chloroethane	ND	4	4.4	110		-	-		70-130	-		20
Trichlorofluoromethane	ND	4	4.6	115		-	-		70-130	-		20
1,1-Dichloroethene	ND	4	4.5	113		-	-		70-130	-		20
Methylene chloride	ND	4	4.1	103		-	-		70-130	-		20
Methyl tert butyl ether	ND	4	4.3	108		-	-		70-130	-		20
trans-1,2-Dichloroethene	ND	4	4.3	108		-	-		70-130	-		20
1,1-Dichloroethane	ND	4	4.4	110		-	-		70-130	-		20
2,2-Dichloropropane	ND	4	3.9	98		-	-		70-130	-		20
cis-1,2-Dichloroethene	ND	4	4.4	110		-	-		70-130	-		20
Chloroform	ND	4	4.5	113		-	-		70-130	-		20
Bromochloromethane	ND	4	4.4	110		-	-		70-130	-		20
1,1,1-Trichloroethane	ND	4	4.4	110		-	-		70-130	-		20
1,1-Dichloropropene	ND	4	4.5	113		-	-		70-130	-		20
Carbon tetrachloride	ND	4	4.4	110		-	-		70-130	-		20
1,2-Dichloroethane	ND	4	4.4	110		-	-		70-130	-		20
Benzene	ND	4	4.5	113		-	-		70-130	-		20
Trichloroethene	ND	4	4.3	108		-	-		70-130	-		20

Matrix Spike Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 QC Batch ID: WG928423-6 QC Sample: L1627059-01 Client ID: MS Sample												
1,2-Dichloropropane	ND	4	4.4	110		-	-		70-130	-		20
Bromodichloromethane	ND	4	4.1	103		-	-		70-130	-		20
Dibromomethane	ND	4	4.4	110		-	-		70-130	-		20
cis-1,3-Dichloropropene	ND	4	3.8	95		-	-		70-130	-		20
Toluene	ND	4	4.4	110		-	-		70-130	-		20
trans-1,3-Dichloropropene	ND	4	4.3	108		-	-		70-130	-		20
1,1,2-Trichloroethane	ND	4	4.3	108		-	-		70-130	-		20
1,3-Dichloropropane	ND	4	4.2	105		-	-		70-130	-		20
Tetrachloroethene	ND	4	4.6	115		-	-		70-130	-		20
Dibromochloromethane	ND	4	4.0	100		-	-		70-130	-		20
1,2-Dibromoethane	ND	4	4.2	105		-	-		70-130	-		20
Chlorobenzene	ND	4	4.7	118		-	-		70-130	-		20
1,1,1,2-Tetrachloroethane	ND	4	4.4	110		-	-		70-130	-		20
Ethylbenzene	ND	4	4.6	115		-	-		70-130	-		20
p/m-Xylene	ND	8	8.9	111		-	-		70-130	-		20
o-Xylene	ND	4	4.4	110		-	-		70-130	-		20
Styrene	ND	4	3.9	98		-	-		70-130	-		20
Isopropylbenzene	ND	4	4.6	115		-	-		70-130	-		20
Bromoform	ND	4	3.9	98		-	-		70-130	-		20
1,1,2,2-Tetrachloroethane	ND	4	4.3	108		-	-		70-130	-		20
1,2,3-Trichloropropane	ND	4	4.4	110		-	-		70-130	-		20

Matrix Spike Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 QC Batch ID: WG928423-6 QC Sample: L1627059-01 Client ID: MS Sample												
n-Propylbenzene	ND	4	4.6	115		-	-		70-130	-		20
Bromobenzene	ND	4	4.3	108		-	-		70-130	-		20
1,3,5-Trimethylbenzene	ND	4	4.2	105		-	-		70-130	-		20
o-Chlorotoluene	ND	4	4.4	110		-	-		70-130	-		20
p-Chlorotoluene	ND	4	4.6	115		-	-		70-130	-		20
tert-Butylbenzene	ND	4	4.5	113		-	-		70-130	-		20
1,2,4-Trimethylbenzene	ND	4	4.0	100		-	-		70-130	-		20
sec-Butylbenzene	ND	4	4.5	113		-	-		70-130	-		20
p-Isopropyltoluene	ND	4	4.4	110		-	-		70-130	-		20
1,3-Dichlorobenzene	ND	4	4.4	110		-	-		70-130	-		20
1,4-Dichlorobenzene	ND	4	4.5	113		-	-		70-130	-		20
n-Butylbenzene	ND	4	4.4	110		-	-		70-130	-		20
1,2-Dichlorobenzene	ND	4	4.6	115		-	-		70-130	-		20
1,2-Dibromo-3-chloropropane	ND	4	3.7	92		-	-		70-130	-		20
1,2,4-Trichlorobenzene	ND	4	4.4	110		-	-		70-130	-		20
Hexachlorobutadiene	ND	4	4.4	110		-	-		70-130	-		20
Naphthalene	ND	4	4.0	100		-	-		70-130	-		20
1,2,3-Trichlorobenzene	ND	4	4.4	110		-	-		70-130	-		20

Matrix Spike Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 QC Batch ID: WG928423-6 QC Sample: L1627059-01 Client ID: MS Sample												

Surrogate	MS % Recovery	MS Qualifier	MSD % Recovery	MSD Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	102				80-120
4-Bromofluorobenzene	98				80-120

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 QC Batch ID: WG928423-5 QC Sample: L1627352-01 Client ID: LYNCH						
Dichlorodifluoromethane	ND	ND	ug/l	NC		20
Chloromethane	ND	ND	ug/l	NC		20
Vinyl chloride	ND	ND	ug/l	NC		20
Bromomethane	ND	ND	ug/l	NC		20
Chloroethane	ND	ND	ug/l	NC		20
Trichlorofluoromethane	ND	ND	ug/l	NC		20
1,1-Dichloroethene	ND	ND	ug/l	NC		20
Methylene chloride	ND	ND	ug/l	NC		20
Methyl tert butyl ether	ND	ND	ug/l	NC		20
trans-1,2-Dichloroethene	ND	ND	ug/l	NC		20
1,1-Dichloroethane	ND	ND	ug/l	NC		20
2,2-Dichloropropane	ND	ND	ug/l	NC		20
cis-1,2-Dichloroethene	ND	ND	ug/l	NC		20
Chloroform	0.27J	0.28J	ug/l	NC		20
Bromochloromethane	ND	ND	ug/l	NC		20
1,1,1-Trichloroethane	ND	ND	ug/l	NC		20
1,1-Dichloropropene	ND	ND	ug/l	NC		20
Carbon tetrachloride	ND	ND	ug/l	NC		20
1,2-Dichloroethane	ND	ND	ug/l	NC		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 QC Batch ID: WG928423-5 QC Sample: L1627352-01 Client ID: LYNCH					
Benzene	ND	ND	ug/l	NC	20
Trichloroethene	ND	ND	ug/l	NC	20
1,2-Dichloropropane	ND	ND	ug/l	NC	20
Bromodichloromethane	ND	ND	ug/l	NC	20
Dibromomethane	ND	ND	ug/l	NC	20
cis-1,3-Dichloropropene	ND	ND	ug/l	NC	20
Toluene	ND	ND	ug/l	NC	20
trans-1,3-Dichloropropene	ND	ND	ug/l	NC	20
1,1,2-Trichloroethane	ND	ND	ug/l	NC	20
1,3-Dichloropropane	ND	ND	ug/l	NC	20
Tetrachloroethene	ND	ND	ug/l	NC	20
Dibromochloromethane	ND	ND	ug/l	NC	20
1,2-Dibromoethane	ND	ND	ug/l	NC	20
Chlorobenzene	ND	ND	ug/l	NC	20
1,1,1,2-Tetrachloroethane	ND	ND	ug/l	NC	20
Ethylbenzene	ND	ND	ug/l	NC	20
p/m-Xylene	ND	ND	ug/l	NC	20
o-Xylene	ND	ND	ug/l	NC	20
Styrene	ND	ND	ug/l	NC	20

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 QC Batch ID: WG928423-5 QC Sample: L1627352-01 Client ID: LYNCH					
Isopropylbenzene	ND	ND	ug/l	NC	20
Bromoform	ND	ND	ug/l	NC	20
1,1,2,2-Tetrachloroethane	ND	ND	ug/l	NC	20
1,2,3-Trichloropropane	ND	ND	ug/l	NC	20
n-Propylbenzene	ND	ND	ug/l	NC	20
Bromobenzene	ND	ND	ug/l	NC	20
Xylenes, Total[1]	ND	ND	ug/l	NC	20
1,3,5-Trimethylbenzene	ND	ND	ug/l	NC	20
o-Chlorotoluene	ND	ND	ug/l	NC	20
p-Chlorotoluene	ND	ND	ug/l	NC	20
tert-Butylbenzene	ND	ND	ug/l	NC	20
1,2,4-Trimethylbenzene	ND	ND	ug/l	NC	20
sec-Butylbenzene	ND	ND	ug/l	NC	20
p-Isopropyltoluene	ND	ND	ug/l	NC	20
1,3-Dichlorobenzene	ND	ND	ug/l	NC	20
1,4-Dichlorobenzene	ND	ND	ug/l	NC	20
n-Butylbenzene	ND	ND	ug/l	NC	20
1,2-Dichlorobenzene	ND	ND	ug/l	NC	20
1,2-Dibromo-3-chloropropane	ND	ND	ug/l	NC	20

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
Volatile Organics by GC/MS - Westborough Lab Associated sample(s): 01-02 QC Batch ID: WG928423-5 QC Sample: L1627352-01 Client ID: LYNCH					
1,2,4-Trichlorobenzene	ND	ND	ug/l	NC	20
Hexachlorobutadiene	ND	ND	ug/l	NC	20
Naphthalene	ND	ND	ug/l	NC	20
1,2,3-Trichlorobenzene	ND	ND	ug/l	NC	20

Surrogate	%Recovery	Qualifier	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichlorobenzene-d4	104		103		80-120
4-Bromofluorobenzene	96		98		80-120

METALS

Project Name: IPSWICH, MA
Project Number: 60477124
Lab Number: L1627352
Report Date: 09/08/16

SAMPLE RESULTS

Lab ID: L1627352-01
Client ID: LYNCH
Sample Location: IPSWICH, MA
Matrix: Dw

Date Collected: 08/31/16 15:00
Date Received: 08/31/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Aluminum, Total	0.021	J	mg/l	0.100	0.020	1	09/01/16 09:00	09/07/16 10:08	EPA 3005A	19,200.7	JH
Arsenic, Total	ND		mg/l	0.00100	0.00030	1	09/01/16 09:00	09/02/16 15:52	EPA 3005A	3,200.8	BV
Calcium, Total	45.6		mg/l	0.100	0.030	1	09/01/16 09:00	09/07/16 10:08	EPA 3005A	19,200.7	JH
Copper, Total	0.00158		mg/l	0.00100	0.00010	1	09/01/16 09:00	09/02/16 15:52	EPA 3005A	3,200.8	BV
Iron, Total	0.030	J	mg/l	0.050	0.020	1	09/01/16 09:00	09/07/16 10:08	EPA 3005A	19,200.7	JH
Magnesium, Total	4.77		mg/l	0.100	0.010	1	09/01/16 09:00	09/07/16 10:08	EPA 3005A	19,200.7	JH
Manganese, Total	0.00103		mg/l	0.00100	0.00010	1	09/01/16 09:00	09/02/16 15:52	EPA 3005A	3,200.8	BV
Potassium, Total	3.76		mg/l	2.50	0.400	1	09/01/16 09:00	09/07/16 10:08	EPA 3005A	19,200.7	JH
Silicon, Total	6.35		mg/l	0.500	0.140	1	09/01/16 09:00	09/07/16 10:08	EPA 3005A	19,200.7	JH
Silver, Total	ND		mg/l	0.00100	0.00010	1	09/01/16 09:00	09/02/16 15:52	EPA 3005A	3,200.8	BV
Sodium, Total	104		mg/l	2.00	0.300	1	09/01/16 09:00	09/07/16 10:08	EPA 3005A	19,200.7	JH
Zinc, Total	0.00397	J	mg/l	0.00500	0.00120	1	09/01/16 09:00	09/02/16 15:52	EPA 3005A	3,200.8	BV
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	134		mg/l	0.660	NA	1	09/01/16 09:00	09/07/16 10:08	EPA 3005A	19,200.7	JH
Dissolved Metals - Mansfield Lab											
Arsenic, Dissolved	ND		mg/l	0.0010	0.0003	1	09/06/16 09:30	09/06/16 11:55	EPA 3005A	3,200.8	AM
Iron, Dissolved	ND		mg/l	0.05	0.02	1	09/06/16 09:30	09/06/16 23:35	EPA 3005A	19,200.7	AB
Manganese, Dissolved	0.0011		mg/l	0.0010	0.0003	1	09/06/16 09:30	09/06/16 11:55	EPA 3005A	3,200.8	AM

Project Name: IPSWICH, MA **Lab Number:** L1627352

Project Number: 60477124 **Report Date:** 09/08/16

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG928044-1										
Arsenic, Total	ND		mg/l	0.00100	0.00030	1	09/01/16 09:00	09/02/16 15:43	3,200.8	BV
Copper, Total	ND		mg/l	0.00100	0.00010	1	09/01/16 09:00	09/02/16 15:43	3,200.8	BV
Manganese, Total	ND		mg/l	0.00100	0.00010	1	09/01/16 09:00	09/02/16 15:43	3,200.8	BV
Silver, Total	ND		mg/l	0.00100	0.00010	1	09/01/16 09:00	09/02/16 15:43	3,200.8	BV
Zinc, Total	ND		mg/l	0.00500	0.00120	1	09/01/16 09:00	09/02/16 15:43	3,200.8	BV

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG928045-1										
Aluminum, Total	ND		mg/l	0.100	0.020	1	09/01/16 09:00	09/07/16 09:55	19,200.7	JH
Calcium, Total	ND		mg/l	0.100	0.030	1	09/01/16 09:00	09/07/16 09:55	19,200.7	JH
Iron, Total	ND		mg/l	0.050	0.020	1	09/01/16 09:00	09/07/16 09:55	19,200.7	JH
Magnesium, Total	ND		mg/l	0.100	0.010	1	09/01/16 09:00	09/07/16 09:55	19,200.7	JH
Potassium, Total	ND		mg/l	2.50	0.400	1	09/01/16 09:00	09/07/16 09:55	19,200.7	JH
Silicon, Total	ND		mg/l	0.500	0.140	1	09/01/16 09:00	09/07/16 09:55	19,200.7	JH
Sodium, Total	ND		mg/l	2.00	0.300	1	09/01/16 09:00	09/07/16 09:55	19,200.7	JH

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab for sample(s): 01 Batch: WG928045-1										
Hardness	ND		mg/l	0.660	NA	1	09/01/16 09:00	09/07/16 09:55	19,200.7	JH

Prep Information

Digestion Method: EPA 3005A

Project Name: IPSWICH, MA
Project Number: 60477124
Lab Number: L1627352
Report Date: 09/08/16

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Dissolved Metals - Mansfield Lab for sample(s): 01 Batch: WG929068-1										
Iron, Dissolved	ND		mg/l	0.05	0.02	1	09/06/16 09:30	09/06/16 23:02	19,200.7	AB

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Dissolved Metals - Mansfield Lab for sample(s): 01 Batch: WG929069-1										
Arsenic, Dissolved	ND		mg/l	0.0010	0.0003	1	09/06/16 09:30	09/06/16 11:28	3,200.8	AM
Manganese, Dissolved	ND		mg/l	0.0010	0.0003	1	09/06/16 09:30	09/06/16 11:28	3,200.8	AM

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG928044-2								
Arsenic, Total	103		-		85-115	-		
Copper, Total	99		-		85-115	-		
Manganese, Total	99		-		85-115	-		
Silver, Total	102		-		85-115	-		
Zinc, Total	97		-		85-115	-		
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG928045-2								
Aluminum, Total	102		-		85-115	-		
Calcium, Total	101		-		85-115	-		
Iron, Total	96		-		85-115	-		
Magnesium, Total	106		-		85-115	-		
Potassium, Total	102		-		85-115	-		
Silicon, Total	113		-		85-115	-		
Sodium, Total	104		-		85-115	-		
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01 Batch: WG928045-2								
Hardness	104		-		85-115	-		
Dissolved Metals - Mansfield Lab Associated sample(s): 01 Batch: WG929068-2								
Iron, Dissolved	91		-		85-115	-		

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
Dissolved Metals - Mansfield Lab Associated sample(s): 01 Batch: WG929069-2					
Arsenic, Dissolved	107	-	85-115	-	
Manganese, Dissolved	96	-	85-115	-	

Matrix Spike Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928044-4 QC Sample: L1627352-01 Client ID: LYNCH												
Arsenic, Total	ND	0.12	0.1316	110		-	-		70-130	-		20
Copper, Total	0.00158	0.25	0.2646	105		-	-		70-130	-		20
Manganese, Total	0.00103	0.5	0.5130	102		-	-		70-130	-		20
Silver, Total	ND	0.05	0.05337	107		-	-		70-130	-		20
Zinc, Total	0.00397J	0.5	0.5185	104		-	-		70-130	-		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928045-4 QC Sample: L1627352-01 Client ID: LYNCH												
Aluminum, Total	0.021J	2	2.21	110		-	-		75-125	-		20
Calcium, Total	45.6	10	54.9	93		-	-		75-125	-		20
Iron, Total	0.030J	1	1.03	103		-	-		75-125	-		20
Magnesium, Total	4.77	10	15.1	103		-	-		75-125	-		20
Potassium, Total	3.76	10	14.4	106		-	-		75-125	-		20
Silicon, Total	6.35	1	8.22	**187**	Q	-	-		75-125	-		20
Sodium, Total	104.	10	114	100		-	-		75-125	-		20
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928045-4 QC Sample: L1627352-01 Client ID: LYNCH												
Hardness	134.	66.2	199	98		-	-		75-125	-		20
Dissolved Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG929068-4 QC Sample: L1600009-19 Client ID: MS Sample												
Iron, Dissolved	ND	1	0.91	91		-	-		75-125	-		20
Dissolved Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG929069-4 QC Sample: L1600009-20 Client ID: MS Sample												
Arsenic, Dissolved	0.0021	0.12	0.1371	112		-	-		70-130	-		20
Manganese, Dissolved	10.84	0.5	11.17	**66**	Q	-	-		70-130	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928044-3 QC Sample: L1627352-01 Client ID: LYNCH						
Arsenic, Total	ND	ND	mg/l	NC		20
Copper, Total	0.00158	0.00131	mg/l	19		20
Manganese, Total	0.00103	0.00082J	mg/l	NC		20
Silver, Total	ND	ND	mg/l	NC		20
Zinc, Total	0.00397J	0.00140J	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928045-3 QC Sample: L1627352-01 Client ID: LYNCH						
Aluminum, Total	0.021J	ND	mg/l	NC		20
Calcium, Total	45.6	45.9	mg/l	1		20
Iron, Total	0.030J	0.026J	mg/l	NC		20
Magnesium, Total	4.77	4.82	mg/l	1		20
Potassium, Total	3.76	3.78	mg/l	1		20
Silicon, Total	6.35	6.41	mg/l	1		20
Sodium, Total	104.	106	mg/l	2		20
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928045-3 QC Sample: L1627352-01 Client ID: LYNCH						
Hardness	134.	134	mg/l	0		20
Dissolved Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG929068-3 QC Sample: L1600009-19 Client ID: DUP Sample						
Iron, Dissolved	ND	ND	mg/l	NC		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
Dissolved Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG929069-3 QC Sample: L1600009-20 Client ID: DUP Sample					
Arsenic, Dissolved	0.0021	0.0024	mg/l	9	20
Dissolved Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG929069-3 QC Sample: L1600009-20 Client ID: DUP Sample					
Manganese, Dissolved	10.84	11.01	mg/l	2	20

INORGANICS
&
MISCELLANEOUS

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

SAMPLE RESULTS

Lab ID: L1627352-01
Client ID: LYNCH
Sample Location: IPSWICH, MA
Matrix: Dw

Date Collected: 08/31/16 15:00
Date Received: 08/31/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	1.1		NTU	0.20	0.06	1	-	08/31/16 23:44	121,2130B	AS
Odor @ 60 C	NO ODOR		TON	1	1.0	1	-	08/31/16 20:00	30,2150B	AS
Color, Apparent	ND		A.P.C.U.	5.0	5.0	1	-	08/31/16 20:20	121,2120B	AS
Alkalinity, Total	137.		mg CaCO3/L	2.00	NA	1	-	09/01/16 10:11	121,2320B	AW
Specific Conductance @ 25 C	690		umhos/cm	10	10.	1	-	08/31/16 21:12	121,2510B	AS
Solids, Total Dissolved	370		mg/l	10	3.1	1	-	09/01/16 12:05	121,2540C	DW
pH (H)	7.7		SU	-	NA	1	-	08/31/16 19:37	121,4500H+-B	AS
Nitrogen, Ammonia	ND		mg/l	0.075	0.028	1	09/01/16 10:20	09/01/16 15:20	121,4500NH3-BH	JO
Nitrogen, Nitrite	ND		mg/l	0.050	0.010	1	-	09/01/16 00:41	44,353.2	MR
Nitrogen, Nitrate	3.0		mg/l	0.10	0.019	1	-	09/01/16 00:41	44,353.2	MR
Total Organic Carbon	0.760		mg/l	0.500	0.114	1	-	09/01/16 07:37	121,5310C	DW
Bacteria in Water - Westborough Lab										
Coliform, Total	Positive		col/100ml	-	NA	1	-	08/31/16 18:40	121,9223B	WR
Escherichia Coli	Negative		col/100ml	-	NA	1	-	08/31/16 18:40	121,9223B	WR
Anions by Ion Chromatography - Westborough Lab										
Chloride	122.		mg/l	12.5	1.35	25	-	09/01/16 23:05	44,300.0	AU
Sulfate	15.8		mg/l	1.00	0.150	1	-	09/01/16 19:17	44,300.0	AU

Project Name: IPSWICH, MA **Lab Number:** L1627352

Project Number: 60477124 **Report Date:** 09/08/16

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Bacteria in Water - Westborough Lab for sample(s): 01 Batch: WG927847-1										
Coliform, Total	Negative		col/100ml	-	NA	1	-	08/31/16 18:40	121,9223B	WR
Escherichia Coli	Negative		col/100ml	-	NA	1	-	08/31/16 18:40	121,9223B	WR
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG927868-1										
Nitrogen, Nitrate	ND		mg/l	0.10	0.019	1	-	09/01/16 00:05	44,353.2	MR
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG927869-1										
Nitrogen, Nitrite	ND		mg/l	0.050	0.010	1	-	09/01/16 00:11	44,353.2	MR
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG927876-1										
Odor	NO ODOR		TON	1	1.0	1	-	08/31/16 20:00	30,2150B	AS
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG927917-1										
Turbidity	0.13	J	NTU	0.20	0.06	1	-	08/31/16 23:44	121,2130B	AS
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG927982-1										
Solids, Total Dissolved	ND		mg/l	10	3.1	1	-	09/01/16 12:05	121,2540C	DW
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG927986-1										
Total Organic Carbon	ND		mg/l	0.500	0.114	1	-	09/01/16 07:37	121,5310C	DW
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG928064-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	09/01/16 10:11	121,2320B	AW
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG928098-1										
Nitrogen, Ammonia	ND		mg/l	0.075	0.028	1	09/01/16 10:20	09/01/16 13:31	121,4500NH3-BH	JO
Anions by Ion Chromatography - Westborough Lab for sample(s): 01 Batch: WG928342-1										
Sulfate	ND		mg/l	1.00	0.150	1	-	09/01/16 18:29	44,300.0	AU
Anions by Ion Chromatography - Westborough Lab for sample(s): 01 Batch: WG928342-1										
Chloride	ND		mg/l	0.500	0.054	1	-	09/01/16 18:29	44,300.0	AU

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG927850-1								
pH	100		-		99-101	-		5
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG927868-2								
Nitrogen, Nitrate	96		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG927869-2								
Nitrogen, Nitrite	106		-		90-110	-		20
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG927885-1								
Specific Conductance	100		-		99-101	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG927917-2								
Turbidity	100		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG927982-2								
Solids, Total Dissolved	86		-		80-120	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG927986-2								
Total Organic Carbon	96		-		90-110	-		

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG928064-2					
Alkalinity, Total	102	-	90-110	-	10
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG928098-2					
Nitrogen, Ammonia	92	-	80-120	-	20
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01 Batch: WG928342-2					
Chloride	108	-	90-110	-	
Sulfate	106	-	90-110	-	

Matrix Spike Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927868-4 QC Sample: L1627255-01 Client ID: MS Sample												
Nitrogen, Nitrate	1.8	4	5.5	92		-	-		83-113	-		6
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927869-4 QC Sample: L1627255-01 Client ID: MS Sample												
Nitrogen, Nitrite	0.054	4	4.2	104		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927986-6 QC Sample: L1627245-01 Client ID: MS Sample												
Total Organic Carbon	1.42	4	5.49	102		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG928064-4 QC Sample: L1627431-03 Client ID: MS Sample												
Alkalinity, Total	258.	100	364	106		-	-		86-116	-		10
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG928098-4 QC Sample: L1627352-01 Client ID: LYNCH												
Nitrogen, Ammonia	ND	4	3.68	92		-	-		80-120	-		20
Anions by Ion Chromatography - Westborough Lab Associated sample(s): 01 QC Batch ID: WG928342-3 WG928342-4 QC Sample: L1627245-01 Client ID: MS Sample												
Chloride	2.19	4	6.28	102		6.27	102		40-151	0		18
Sulfate	45.9	8	52.3	80		52.1	78		60-140	0		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927850-2 QC Sample: L1627274-01 Client ID: DUP Sample						
pH	8.6	8.6	SU	0		5
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927868-3 QC Sample: L1627255-01 Client ID: DUP Sample						
Nitrogen, Nitrate	1.8	1.8	mg/l	0		6
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927869-3 QC Sample: L1627255-01 Client ID: DUP Sample						
Nitrogen, Nitrite	0.054	0.055	mg/l	2		20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927876-2 QC Sample: L1627352-01 Client ID: LYNCH						
Odor	NO ODOR	NO ODOR	TON	NC		
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927879-1 QC Sample: L1627352-01 Client ID: LYNCH						
Color, Apparent	ND	ND	A.P.C.U.	NC		
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927885-2 QC Sample: L1627352-01 Client ID: LYNCH						
Specific Conductance @ 25 C	690	700	umhos/cm	1		20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927917-3 QC Sample: L1627352-01 Client ID: LYNCH						
Turbidity	1.1	1.0	NTU	10		13
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927982-3 QC Sample: L1627351-01 Client ID: DUP Sample						
Solids, Total Dissolved	5000	5100	mg/l	2		17
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG927986-5 QC Sample: L1627245-01 Client ID: DUP Sample						
Total Organic Carbon	1.42	1.49	mg/l	5		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG928064-3 QC Sample: L1627431-03 Client ID: DUP Sample					
Alkalinity, Total	258.	261	mg CaCO3/L	1	10
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG928098-3 QC Sample: L1627352-01 Client ID: LYNCH					
Nitrogen, Ammonia	ND	0.029J	mg/l	NC	20

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627352
Report Date: 09/08/16

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information Custody Seal

Cooler	
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1627352-01A	Vial Ascorbic Acid/HCl preserved	A	N/A	2.6	Y	Absent	524.2(14)
L1627352-01B	Vial Ascorbic Acid/HCl preserved	A	N/A	2.6	Y	Absent	524.2(14)
L1627352-01D	Vial H2SO4 preserved	A	N/A	2.6	Y	Absent	TOC-5310(28)
L1627352-01E	Vial H2SO4 preserved	A	N/A	2.6	Y	Absent	TOC-5310(28)
L1627352-01F	Vial H2SO4 preserved	A	N/A	2.6	Y	Absent	TOC-5310(28)
L1627352-01G	Plastic 120ml unpreserved w/No H	A	N/A	2.6	Y	Absent	ALK-T-2320(14)
L1627352-01H	Plastic 120ml unpreserved	A	7	2.6	Y	Absent	-
L1627352-01I	Amber 1000ml unpreserved	A	7	2.6	Y	Absent	COLOR-A-2120(2),ODOR-2150(1)
L1627352-01J	Bacteria Cup Na2S2O3 preserved	A	N/A	2.6	Y	Absent	T-COLI-C(1.25)
L1627352-01K	Bacteria Cup Na2S2O3 preserved	A	N/A	2.6	Y	Absent	T-COLI-C(1.25)
L1627352-01L	Plastic 950ml unpreserved	A	7	2.6	Y	Absent	SO4-300(28),TURB-2130(2),CL-300(28),NO2-353(2),COND-2510(1),NO3-353(2),PH-4500(.01),TDS-2540(7)
L1627352-01M	Plastic 500ml H2SO4 preserved	A	<2	2.6	Y	Absent	NH3-4500(28)
L1627352-01N	Plastic 250ml HNO3 preserved	A	<2	2.6	Y	Absent	CA-UI(180),MN-2008T(180),SI-UI(180),K-UI(180),ZN-2008T(180),CU-2008T(180),FE-UI(180),HARDU(180),MG-UI(180),AG-2008T(180),AS-2008T(180),AL-UI(180),NA-UI(180)
L1627352-01X	Plastic 120ml HNO3 preserved Fil	A	<2	2.6	Y	Absent	FE-RI(180),MN-2008S(180),AS-2008S(180)
L1627352-02A	Vial Ascorbic Acid/HCl preserved	A	N/A	2.6	Y	Absent	524.2(14)
L1627352-02B	Vial Ascorbic Acid/HCl preserved	A	N/A	2.6	Y	Absent	524.2(14)

*Values in parentheses indicate holding time in days

Project Name:	IPSWICH, MA	**Lab Number:**	L1627352
Project Number:	60477124	**Report Date:**	09/08/16

GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1	- The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Data Qualifiers

A	- Spectra identified as "Aldol Condensation Product".
B	- The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the

Report Format: DU Report with 'J' Qualifiers

Project Name: IPSWICH, MA **Lab Number:** L1627352

Project Number: 60477124 **Report Date:** 09/08/16

Data Qualifiers

reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

Report Format: DU Report with 'J' Qualifiers

REFERENCES

3 Methods for the Determination of Metals in Environmental Samples, Supplement I. EPA/600/R-94/111. May 1994.

16 Methods for the Determination of Organic Compounds in Drinking Water - Supplement II. EPA/600/R-92/129, August 1992.

19 Inductively Coupled Plasma Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes. Appendix C, Part 136, 40 CFR (Code of Federal Regulations). July 1, 1999 edition.

30 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WPCF. 18th Edition. 1992.

44 Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: ***EPA 3050B***

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.**
EPA 624: Volatile Halocarbons & Aromatics,
EPA 608: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9222D-MF**.

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 8/31/16

ALPHA Job #: L1627352

ALPHA ANALYTICAL
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220
320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Client Information

Client: AECOM
Address: 250 Apollo Drive
Chelmsford, MA 01824
Phone: 978-905-2100
Email: doug.denatale@aecom.com

Project Information

Project Name: Ipswich, MA
Project Location: Ipswich, MA
Project #: 60477124
Project Manager: Doug DeNatale
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Additional Project Information:

Fe = 0.02
MN = 0.01

ANALYSIS: VOC: ☐ 8260 ☐ 624 ☒ 524.2; SVOC: ☐ ABN ☐ PAH; METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15; METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13; EPH: ☐ Ranges & Targets ☐ Ranges Only; VPH: ☐ Ranges & Targets ☐ Ranges Only; ~~[illegible]~~ Alkalinity; ~~TPH~~ Dissolved metals: As, Fe, Mn; Color + odor; Coliform Bacteria; TDS, cond, pH, SO_4, TURB, CL, NO_3, NO_2; NH_3; TOC; Total Metals: Al, As, Ca, Cu, Fe, Mg, Mn, K, Si, Ag, Na, Zn, Hardness

SAMPLE INFO: Filtration ☐ Field ☒ Lab to do; Preservation ☐ Lab to do

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC	SVOC	METALS	METALS	EPH	VPH	Alkalinity	Dissolved metals	Color + odor	Coliform Bacteria	TDS, cond, pH, SO_4, TURB, CL, NO_3, NO_2	NH_3	TOC	Total Metals	Sample Comments	TOTAL # BOTTLES
27352-01	Lynch	08/31/16	1500	DW	EA	X						X	X	X	X	X	X	X	X		
	Trip Blank	08/31/16	—	—	—	X															

Container Type	V						P	P	A	B	P	P	V	P	
Preservative	1,B						A	A	A	H	A	D	D	C	

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	8/31/16 - 1553	[signature] AAL	8/31/16 1553
[signature] AAL	8/31/16 17:45	[signature]	8/31/16 1745

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO: 01-01 (rev. 12-Mar-2012)

ANALYTICAL REPORT

Lab Number:	L1627359
Client:	AECOM 250 Apollo Dr. Chelmsford, MA 01824
ATTN:	Doug DeNatale
Phone:	(978) 905-2180
Project Name:	IPSWICH, MA
Project Number:	60477124
Report Date:	09/19/16

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NY (11148), CT (PH-0574), NH (2003), NJ NELAP (MA935), RI (LAO00065), ME (MA00086), PA (68-03671), VA (460195), MD (348), IL (200077), NC (666), TX (T104704476), DOD (L2217), USDA (Permit #P-330-11-00240).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L1627359-01	LYNCH	DW	LYNCH	08/31/16 15:00	08/31/16

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively. When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. All specific QC information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications. Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances the specific failure is not narrated but noted in the associated QC table. The information is also incorporated in the Data Usability format of our Data Merger tool where it can be reviewed along with any associated usability implications.

Please see the associated ADEx data file for a comparison of laboratory reporting limits that were achieved with the regulatory Numerical Standards requested on the Chain of Custody.

HOLD POLICY
For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Client Service Representative and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Client Services at 800-624-9220 with any questions.

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Case Narrative (continued)

Report Submission

This final report replaces the partial reports issued September 8 and 14, 2016, and includes the results of all requested analyses.

The radiological and SOC analyses were subcontracted. Copies of the laboratory reports are included as an addendum. Please note: This data is only available in PDF format and is not available on Data Merger.

All non-detect (ND) or estimated concentrations (J-qualified) have been quantitated to the limit noted in the MDL column.

Fluoride

WG929438: A laboratory duplicate and matrix spike could not be performed due to insufficient sample volume available for analysis.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Kelly Stenstrom

Title: Technical Director/Representative

Date: 09/19/16

METALS

Project Name:	IPSWICH, MA	**Lab Number:**	L1627359
Project Number:	60477124	**Report Date:**	09/19/16

SAMPLE RESULTS

Lab ID:	L1627359-01	Date Collected:	08/31/16 15:00
Client ID:	LYNCH	Date Received:	08/31/16
Sample Location:	LYNCH	Field Prep:	Not Specified
Matrix:	Dw		

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Metals - Mansfield Lab											
Antimony, Total	ND		mg/l	0.00200	0.00020	1	09/02/16 07:50	09/02/16 11:54	EPA 3005A	3,200.8	BV
Barium, Total	0.01739		mg/l	0.00100	0.00010	1	09/02/16 07:50	09/02/16 11:54	EPA 3005A	3,200.8	BV
Beryllium, Total	ND		mg/l	0.00100	0.00010	1	09/02/16 07:50	09/02/16 21:42	EPA 3005A	3,200.8	BV
Cadmium, Total	ND		mg/l	0.00100	0.00005	1	09/02/16 07:50	09/02/16 11:54	EPA 3005A	3,200.8	BV
Chromium, Total	0.00050	J	mg/l	0.00100	0.00020	1	09/02/16 07:50	09/02/16 11:54	EPA 3005A	3,200.8	BV
Lead, Total	ND		mg/l	0.00100	0.00020	1	09/02/16 07:50	09/02/16 11:54	EPA 3005A	3,200.8	BV
Mercury, Total	ND		mg/l	0.0002	0.0001	1	09/02/16 12:00	09/02/16 22:59	EPA 245.1	3,245.1	EA
Nickel, Total	0.00010	J	mg/l	0.00100	0.00010	1	09/02/16 07:50	09/02/16 11:54	EPA 3005A	3,200.8	BV
Selenium, Total	ND		mg/l	0.00500	0.00030	1	09/02/16 07:50	09/02/16 11:54	EPA 3005A	3,200.8	BV
Thallium, Total	ND		mg/l	0.00100	0.00003	1	09/02/16 07:50	09/02/16 11:54	EPA 3005A	3,200.8	BV

Project Name: IPSWICH, MA
Project Number: 60477124
Lab Number: L1627359
Report Date: 09/19/16

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG928416-1										
Antimony, Total	ND		mg/l	0.00100	0.00020	1	09/02/16 07:50	09/02/16 11:24	3,200.8	BV
Barium, Total	ND		mg/l	0.00100	0.00010	1	09/02/16 07:50	09/02/16 11:24	3,200.8	BV
Beryllium, Total	ND		mg/l	0.00100	0.00010	1	09/02/16 07:50	09/02/16 11:24	3,200.8	BV
Cadmium, Total	ND		mg/l	0.00100	0.00005	1	09/02/16 07:50	09/02/16 11:24	3,200.8	BV
Chromium, Total	0.00040	J	mg/l	0.00100	0.00020	1	09/02/16 07:50	09/02/16 11:24	3,200.8	BV
Lead, Total	ND		mg/l	0.00100	0.00020	1	09/02/16 07:50	09/02/16 11:24	3,200.8	BV
Nickel, Total	ND		mg/l	0.00100	0.00010	1	09/02/16 07:50	09/02/16 11:24	3,200.8	BV
Selenium, Total	ND		mg/l	0.00500	0.00030	1	09/02/16 07:50	09/02/16 11:24	3,200.8	BV
Thallium, Total	ND		mg/l	0.00100	0.00003	1	09/02/16 07:50	09/02/16 11:24	3,200.8	BV

Prep Information

Digestion Method: EPA 3005A

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Metals - Mansfield Lab for sample(s): 01 Batch: WG928535-1										
Mercury, Total	ND		mg/l	0.00020	0.00006	1	09/02/16 12:00	09/02/16 22:32	3,245.1	EA

Prep Information

Digestion Method: EPA 245.1

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG928416-2								
Antimony, Total	93		-		85-115	-		
Barium, Total	101		-		85-115	-		
Beryllium, Total	103		-		85-115	-		
Cadmium, Total	112		-		85-115	-		
Chromium, Total	104		-		85-115	-		
Lead, Total	106		-		85-115	-		
Nickel, Total	105		-		85-115	-		
Selenium, Total	98		-		85-115	-		
Thallium, Total	102		-		85-115	-		
Total Metals - Mansfield Lab Associated sample(s): 01 Batch: WG928535-2								
Mercury, Total	94		-		85-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928416-4 QC Sample: L1627471-01 Client ID: MS Sample												
Antimony, Total	0.0006J	0.5	0.5321	106		-	-		70-130	-		20
Barium, Total	0.0003J	2	2.057	103		-	-		70-130	-		20
Beryllium, Total	ND	0.05	0.05204	104		-	-		70-130	-		20
Cadmium, Total	ND	0.051	0.05878	115		-	-		70-130	-		20
Chromium, Total	0.0002J	0.2	0.2044	102		-	-		70-130	-		20
Lead, Total	ND	0.51	0.5455	107		-	-		70-130	-		20
Nickel, Total	ND	0.5	0.5230	105		-	-		70-130	-		20
Selenium, Total	ND	0.12	0.1283	107		-	-		70-130	-		20
Thallium, Total	ND	0.12	0.1233	103		-	-		70-130	-		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928535-4 QC Sample: L1627473-01 Client ID: MS Sample												
Mercury, Total	0.01171	0.005	0.0153	71		-	-		70-130	-		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928535-6 QC Sample: L1627559-01 Client ID: MS Sample												
Mercury, Total	0.00007J	0.005	0.0043	86		-	-		70-130	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928416-3 QC Sample: L1627471-01 Client ID: DUP Sample						
Lead, Total	ND	ND	mg/l	NC		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928535-3 QC Sample: L1627473-01 Client ID: DUP Sample						
Mercury, Total	0.01171	0.0106	mg/l	10		20
Total Metals - Mansfield Lab Associated sample(s): 01 QC Batch ID: WG928535-5 QC Sample: L1627559-01 Client ID: DUP Sample						
Mercury, Total	0.00007J	0.0001J	mg/l	NC		20

INORGANICS
&
MISCELLANEOUS

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

SAMPLE RESULTS

Lab ID: L1627359-01
Client ID: LYNCH
Sample Location: LYNCH
Matrix: Dw

Date Collected: 08/31/16 15:00
Date Received: 08/31/16
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Perchlorate by IC-MS-MS - Westborough Lab										
Perchlorate	0.524		ug/l	0.050	0.010	1	-	09/07/16 00:38	71,332.0	SS
General Chemistry - Westborough Lab										
Cyanide, Total	ND		mg/l	0.005	0.001	1	09/02/16 09:30	09/06/16 11:10	121,4500CN-CE	JO
Fluoride	0.03	J	mg/l	0.20	0.02	1	-	09/07/16 14:05	121,4500F-C	MP
Phosphorus, Total	ND		mg/l	0.010	0.003	1	09/02/16 06:45	09/06/16 11:27	121,4500P-E	SD

Project Name: IPSWICH, MA **Lab Number:** L1627359

Project Number: 60477124 **Report Date:** 09/19/16

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG928444-1										
Phosphorus, Total	ND		mg/l	0.010	0.003	1	09/02/16 06:45	09/06/16 10:59	121,4500P-E	SD
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG928468-1										
Cyanide, Total	ND		mg/l	0.005	0.001	1	09/02/16 09:30	09/06/16 11:26	121,4500CN-CE	JO
Perchlorate by IC-MS-MS - Westborough Lab for sample(s): 01 Batch: WG929204-1										
Perchlorate	ND		ug/l	0.050	0.010	1	-	09/06/16 22:46	71,332.0	SS
General Chemistry - Westborough Lab for sample(s): 01 Batch: WG929438-1										
Fluoride	ND		mg/l	0.20	0.02	1	-	09/07/16 14:05	121,4500F-C	MP

Lab Control Sample Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG928444-2								
Phosphorus, Total	96		-		80-120	-		
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG928468-2								
Cyanide, Total	97		-		90-110	-		
Perchlorate by IC-MS-MS - Westborough Lab Associated sample(s): 01 Batch: WG929204-2								
Perchlorate	101		-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01 Batch: WG929438-2								
Fluoride	100		-		78-115	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG928444-3 QC Sample: L1626994-01 Client ID: MS Sample												
Phosphorus, Total	0.111	0.5	0.599	98		-	-		75-125	-		20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG928468-4 QC Sample: L1627533-02 Client ID: MS Sample												
Cyanide, Total	0.020	0.2	0.213	96		-	-		90-110	-		30
Perchlorate by IC-MS-MS - Westborough Lab Associated sample(s): 01 QC Batch ID: WG929204-3 QC Sample: L1627359-01 Client ID: LYNCH												
Perchlorate	0.524	1	1.40	88		-	-		80-120	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG928444-4 QC Sample: L1626994-01 Client ID: DUP Sample						
Phosphorus, Total	0.111	0.104	mg/l	7		20
General Chemistry - Westborough Lab Associated sample(s): 01 QC Batch ID: WG928468-3 QC Sample: L1627533-01 Client ID: DUP Sample						
Cyanide, Total	ND	ND	mg/l	NC		30
Perchlorate by IC-MS-MS - Westborough Lab Associated sample(s): 01 QC Batch ID: WG929204-4 QC Sample: L1627359-01 Client ID: LYNCH						
Perchlorate	0.524	0.516	ug/l	2		20

Project Name: IPSWICH, MA
Project Number: 60477124

Lab Number: L1627359
Report Date: 09/19/16

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information Custody Seal

Cooler	
A	Absent

Container Information

Container ID	Container Type	Cooler	pH	Temp deg C	Pres	Seal	Analysis(*)
L1627359-01A	Plastic 950ml HNO3 preserved	A	<2	2.0	Y	Absent	SUB-ALPHA/BETA(180)
L1627359-01B	Plastic 950ml HNO3 preserved	A	<2	2.0	Y	Absent	SUB-ALPHA/BETA(180)
L1627359-01C	Plastic 950ml HNO3 preserved	A	<2	2.0	Y	Absent	SUB-ALPHA/BETA(180)
L1627359-01D	Plastic 950ml HNO3 preserved	A	<2	2.0	Y	Absent	SUB-RA226(180)
L1627359-01E	Plastic 950ml HNO3 preserved	A	<2	2.0	Y	Absent	SUB-RA226(180)
L1627359-01F	Plastic 950ml HNO3 preserved	A	<2	2.0	Y	Absent	SUB-RA226(180)
L1627359-01G	Plastic 950ml HNO3 preserved	A	<2	2.0	Y	Absent	SUB-RA228(180)
L1627359-01H	Plastic 950ml HNO3 preserved	A	<2	2.0	Y	Absent	SUB-RA228(180)
L1627359-01I	Plastic 500ml HNO3 preserved	A	<2	2.0	Y	Absent	CD-2008T(180),NI-2008T(180),BE-2008T(180),HG-U(28),SE-2008T(180),BA-2008T(180),CR-2008T(180),PB-2008T(180),SB-2008T(180),TL-2008T(180)
L1627359-01J	Bacteria Cup unpreserved	A	N/A	2.0	Y	Absent	PERC-332(28)
L1627359-01K	Plastic 60ml unpreserved	A	7	2.0	Y	Absent	F-4500(28)
L1627359-01L	Plastic 250ml H2SO4 preserved	A	<2	2.0	Y	Absent	TPHOS-4500(28)
L1627359-01M	Plastic 250ml NaOH preserved	A	>12	2.0	Y	Absent	TCN-4500(14)
L1627359-01N	Amber 1000ml Na Sulfite/HCL pres	A	7	2.0	Y	Absent	SUB-525.2(14)
L1627359-01O	Amber 1000ml Na Sulfite/HCL pres	A	7	2.0	Y	Absent	SUB-525.2(14)
L1627359-01P	Vial unpreserved	A	N/A	2.0	Y	Absent	SUB-RADON(4)
L1627359-01Q	Vial unpreserved	A	N/A	2.0	Y	Absent	SUB-RADON(4)
L1627359-01R	Vial Na2S2O3 preserved	A	N/A	2.0	Y	Absent	SUB-515.3(14)
L1627359-01S	Vial Na2S2O3 preserved	A	N/A	2.0	Y	Absent	SUB-515.3(14)
L1627359-01T	Vial Na2S2O3 preserved	A	N/A	2.0	Y	Absent	SUB-515.3(14)
L1627359-01U	Vial MCAA/Na2S2O3 preserved	A	N/A	2.0	Y	Absent	SUB-531.1(28)
L1627359-01W	Vial Na2S2O3 preserved	A	N/A	2.0	Y	Absent	SUB-505(14),SUB-504.1(14)
L1627359-01X	Vial Na2S2O3 preserved	A	N/A	2.0	Y	Absent	SUB-505(14),SUB-504.1(14)
L1627359-01Y	Vial Na2S2O3 preserved	A	N/A	2.0	Y	Absent	SUB-505(14),SUB-504.1(14)

*Values in parentheses indicate holding time in days

Project Name:	IPSWICH, MA	**Lab Number:**	L1627359
Project Number:	60477124	**Report Date:**	09/19/16

GLOSSARY

Acronyms

EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Footnotes

1	- The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Data Qualifiers

A	- Spectra identified as "Aldol Condensation Product".
B	- The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the

Project Name: IPSWICH, MA **Lab Number:** L1627359

Project Number: 60477124 **Report Date:** 09/19/16

Data Qualifiers

reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

J - Estimated value. The Target analyte concentration is below the quantitation limit (RL), but above the Method Detection Limit (MDL) or Estimated Detection Limit (EDL) for SPME-related analyses. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

ND - Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for SPME-related analyses.

Report Format: DU Report with 'J' Qualifiers

Project Name: IPSWICH, MA
Project Number: 60477124
Lab Number: L1627359
Report Date: 09/19/16

REFERENCES

3 Methods for the Determination of Metals in Environmental Samples, Supplement I. EPA/600/R-94/111. May 1994.

71 Determination of Perchlorate in Drinking Water by Ion Chromatography with Suppressed Conductivity and Electrospray Ionization Mass Spectrometry. EPA Method 332.0, EPA/600/R-05/049. Revision 1.0, March 2005.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624: m/p-xylene, o-xylene
EPA 8260C: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), Methyl methacrylate, 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
EPA 300: DW: Bromide
EPA 6860: NPW and SCM: Perchlorate
EPA 9010: NPW and SCM: Amenable Cyanide Distillation
EPA 9012B: NPW: Total Cyanide
EPA 9050A: NPW: Specific Conductance
SM3500: NPW: Ferrous Iron
SM4500: NPW: Amenable Cyanide, Dissolved Oxygen; SCM: Total Phosphorus, TKN, NO2, NO3.
SM5310C: DW: Dissolved Organic Carbon

Mansfield Facility
SM 2540D: TSS
EPA 3005A NPW
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: ***EPA 3050B***

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **SM4500NO3-F, EPA 353.2**: Nitrate-N**, EPA 351.1, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D.**
EPA 624: Volatile Halocarbons & Aromatics,
EPA 608: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9222D-MF**.

Mansfield Facility:

Drinking Water
EPA 200.7: Ba, Be, Cd, Cr, Cu, Ni, Na, Ca. **EPA 200.8:** Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Ni, Se, TL. **EPA 245.1** Hg.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 8/31/16

ALPHA Job #: L1627359

ALPHA ANALYTICAL
8 Walkup Drive
Westboro, MA 01581
Tel: 508-898-9220

320 Forbes Blvd
Mansfield, MA 02048
Tel: 508-822-9300

Project Information

Project Name: Ipswich MA
Project Location: Lynch
Project #: 60477124
Project Manager: DeNatale
ALPHA Quote #: Bottle Order 227999

Turn-Around Time

☑ Standard ☐ RUSH (only confirmed if pre-approved!)

Date Due:

Report Information - Data Deliverables

☐ ADEx ☐ EMAIL

Billing Information

☐ Same as Client info PO #:

Client Information

Client: AECOM
Address: 250 Apollo Drive
Chelmsford
Phone: 978-905-2180
Email: doug.denatale@aecom.com

Regulatory Requirements & Project Information Requirements

☐ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

Additional Project Information:

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	~~VOC: ☐ 8260 ☐ 624 ☐ 524.2~~	~~SVOC: ☐ ABN ☐ PAH~~	METALS: ☐ MCP 13 ☐ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☐ Ranges Only	VPH: ☐ Ranges & Targets ☐ Ranges Only	~~☐ PCB ☐ PEST~~	TPH: ☐ Quant Only ☐ Fingerprint	Perchlorate	SOC	Total Plus.	Fluoride	TCN	Sb, Ba, Be, Cd, Cr, Pb, Hg, Ni, Se, Tl	Radon Gas	Gross Alpha, Beta, Ra 226/228	Sample Comments	TOTAL # BOTTLES
2735901	Lynch	8/31/16	1500	DW	DRD	✓	✓					✓		✓	✓	✓	✓	✓	✓				
						1	2					7		1	1	1	1	2	8				
						Container Type	B	A					V		P	P	P	P	V	P			
						Preservative	A	B					H		D	A	E	C	A	C			

Container Type
P= Plastic
A= Amber glass
V= Vial
G= Glass
B= Bacteria cup
C= Cube
O= Other
E= Encore
D= BOD Bottle

Preservative
A= None
B= HCl
C= HNO_3
D= H_2SO_4
E= NaOH
F= MeOH
G= $NaHSO_4$
H = $Na_2S_2O_3$
I= Ascorbic Acid
J = NH_4Cl
K= Zn Acetate
O= Other

Relinquished By:	Date/Time	Received By:	Date/Time
Douglas DeNatale	1600/8/31/16	[signature]	8/31/16 1600
Charles Hayes AAC	8/31/16 17:45	[signature]	8/31/16 1745

All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

FORM NO. 01-01 (rev. 12-Mar-2012)

AccuStar
Professional Radon Laboratory Services Since 1984

Radon in Water

NELAC NY 11769
NRPP 101193 AL
NRSB ARL0017

EPA 913.0 SM 20 7500 Rn
Liquid Scintillation

Laboratory Report for:

Alpha Analytical Laboratories
8 Walkup Drive
Westboro MA 01581

Property Tested:

LYNCH

Log Number	Device Number	Area Tested	Result (pCi/L)
1981259	1207778	LYNCH	520
1981260	1207779	LYNCH	460

Contact your State Radon Office for information about your radon in water test result. Links to State Radon Offices are available online at https://geopub.epa.gov/Radon/.

Comment: Alpha Analytical Laboratories was emailed a copy of this report. A copy of this report was emailed to subreports@alphalab.com.

Distributed by: Alpha Woods Hole Labs

Sample Collected:	08/31/2016	3:00 pm	Date Received:	09/02/2016	Date Analyzed:	09/02/2016
			Date Logged:	09/02/2016	Date Reported:	09/06/2016

Report Reviewed By: _____ Report Approved By: _____

Carolyn D. Koke, President, AccuStar Labs

Disclaimer:

The uncertainty of this radon measurement is ~+/- 10 %. Factors contributing to uncertainty include statistical variations, daily and seasonal variations in radon concentrations, sample collection techniques and operation of the dwelling. Interference with test conditions may influence the test results.

This report may only be transferred to a third party in its entirety. Analytical results relate to the samples AS RECEIVED BY THE LABORATORY. Results shown on this report represent levels of radon gas measured between the dates shown in the room or area of the site identified above as "Property Tested". Incorrect information will affect results. The results may not be construed as either predictive or supportive of measurements conducted in any area of this structure at any other time. AccuStar Labs, its employees and agents are not responsible for the consequences of any action taken or not taken based upon the results reported or any verbal or written interpretation of the results.

GRANITE STATE ANALYTICAL SERVICES, LLC
22 Manchester Road, Unit 2, Derry, NH 03038
Phone (800) 699-9920 (603) 432-3044 Fax (603) 434-4837
http://www.granitestateanalytical.com/

CERTIFICATE OF ANALYSIS FOR DRINKING WATER

DATE PRINTED: 09/13/2016
CLIENT NAME: Alpha Analytical
CLIENT ADDRESS: 8 Walkup Dr.
Westborough, MA 01581

Legend
- Passes ✓
- Fails EPA Primary ⊗
- Fails EPA Secondary ▼
- Fails EPA Proposed Limit ✕

SAMPLE ID#: 1609-00281-001
SAMPLED BY: Alpha Analytical
SAMPLE ADDRESS: L1627359
LYNCH
LOCATION:

DATE AND TIME COLLECTED: 08/31/2016 3:00 PM
DATE AND TIME RECEIVED: 09/02/2016 1:00 PM
ANALYSIS PACKAGE: SOC GSA MA
RECEIPT TEMPERATURE: ON ICE 4.3 CELSIUS
CLIENT JOB #

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	EPA Limit	Method	Analyst	Date-Time Analyzed
1,2-Dibromo-3-chloropropane (DBCP)*	<0.02	ug/L	✓		0.02	0.2 ug/L	EPA 504.1	DD-NH	09/08/16 9:39 PM
Date Extracted	-					No Limit	EPA 504.1	KV-NH	09/07/16 11:40 AM
Ethylene Dibromide (EDB)*	<0.02	ug/L	✓		0.02	0.05 ug/L	EPA 504.1	DD-NH	09/08/16 9:39 PM
Aroclor 1016	<0.2	ug/L			0.2	No Limit	EPA 505	DD-NH	09/08/16 4:45 AM
Aroclor 1221	<0.2	ug/L			0.2	No Limit	EPA 505	DD-NH	09/08/16 4:45 AM
Aroclor 1232	<0.2	ug/L			0.2	No Limit	EPA 505	DD-NH	09/08/16 4:45 AM
Aroclor 1242	<0.2	ug/L			0.2	No Limit	EPA 505	DD-NH	09/08/16 4:45 AM
Aroclor 1248	<0.2	ug/L			0.2	No Limit	EPA 505	DD-NH	09/08/16 4:45 AM
Aroclor 1254	<0.2	ug/L			0.2	No Limit	EPA 505	DD-NH	09/08/16 4:45 AM
Aroclor 1260	<0.2	ug/L			0.2	No Limit	EPA 505	DD-NH	09/08/16 4:45 AM
Chlordane*	<0.2	ug/L	✓		0.2	2 ug/L	EPA 505	DD-NH	09/08/16 4:45 AM
Date Extracted	-					No Limit	EPA 505	KV-NH	09/07/16 11:40 AM
Toxaphene*	<1.0	ug/L	✓		1.0	3 ug/L	EPA 505	DD-NH	09/08/16 4:45 AM
2,4,5-TP (Silvex)*	<0.25	ug/L	✓		0.25	50 ug/L	EPA 515.3	DD-NH	09/09/16 8:51 AM
2,4-D*	<1	ug/L	✓		1	70 ug/L	EPA 515.3	DD-NH	09/09/16 8:51 AM
Dalapon*	<1	ug/L	✓		1	200 ug/L	EPA 515.3	DD-NH	09/09/16 8:51 AM
Date Extracted	-					No Limit	EPA 515.3	ND-NH	09/08/16 9:15 AM
Dicamba*	<0.18	ug/L			0.18	No Limit	EPA 515.3	DD-NH	09/09/16 8:51 AM
Dinoseb*	<0.5	ug/L	✓		0.5	7 ug/L	EPA 515.3	DD-NH	09/09/16 8:51 AM
Pentachlorophenol*	<0.1	ug/L	✓		0.1	1 ug/L	EPA 515.3	DD-NH	09/09/16 8:51 AM
Picloram*	<1.3	ug/L	✓		1.3	500 ug/L	EPA 515.3	DD-NH	09/09/16 8:51 AM
2,4-Dichlorophenylacetic acid	112	%				No Limit	EPA 515.3 - SS	DD-NH	09/09/16 8:51 AM
Alachlor*	<0.1	ug/L	✓		0.1	2 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Aldrin*	<0.1	ug/L			0.1	No Limit	EPA 525.2	DD-NH	09/06/16 6:13 PM
Atrazine*	<0.1	ug/L	✓		0.1	3 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Benzo(a)pyrene*	<0.1	ug/L	✓		0.1	0.2 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Butachlor*	<0.1	ug/L			0.1	No Limit	EPA 525.2	DD-NH	09/06/16 6:13 PM
Date Extracted	-					No Limit	EPA 525.2	BM-NH	09/06/16 10:26 AM
Di(2-ethylhexyl)adipate*	<0.6	ug/L	✓		0.6	400 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Di(2-ethylhexyl)phthalate*	<3	ug/L	✓		3	6 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Dieldrin*	<0.04	ug/L			0.04	No Limit	EPA 525.2	DD-NH	09/06/16 6:13 PM

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CLIENT ADDRESS: 8 Walkup Dr.
Westborough, MA 01581

Legend
- Passes ✓
- Fails EPA Primary ⊗
- Fails EPA Secondary ▼
- Fails EPA Proposed Limit ✕

SAMPLE ID#: 1609-00281-001
SAMPLED BY: Alpha Analytical
SAMPLE ADDRESS: L1627359
LYNCH
LOCATION:

DATE AND TIME COLLECTED: 08/31/2016 3:00 PM
DATE AND TIME RECEIVED: 09/02/2016 1:00 PM
ANALYSIS PACKAGE: SOC GSA MA
RECEIPT TEMPERATURE: ON ICE 4.3 CELSIUS
CLIENT JOB #

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	EPA Limit	Method	Analyst	Date-Time Analyzed
Endrin*	<0.1	ug/L	✓		0.1	2 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Heptachlor Epoxide*	<0.06	ug/L	✓		0.06	0.2 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Heptachlor*	<0.04	ug/L	✓		0.04	0.4 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Hexachlorobenzene*	<0.1	ug/L	✓		0.1	1 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Hexachlorocyclopentadiene*	<0.1	ug/L	✓		0.1	50 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Lindane*	<0.07	ug/L	✓		0.07	0.2 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Methoxychlor*	<0.1	ug/L	✓		0.1	40 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
Metolachlor*	<0.1	ug/L			0.1	No Limit	EPA 525.2	DD-NH	09/06/16 6:13 PM
Metribuzin*	<0.1	ug/L			0.1	No Limit	EPA 525.2	DD-NH	09/06/16 6:13 PM
Propachlor*	<0.1	ug/L			0.1	No Limit	EPA 525.2	DD-NH	09/06/16 6:13 PM
Simazine*	<0.1	ug/L	✓		0.1	4 ug/L	EPA 525.2	DD-NH	09/06/16 6:13 PM
1,3-Dimethyl-2-nitrobenzene	99	%				No Limit	EPA 525.2 - SS	DD-NH	09/06/16 6:13 PM
Perylene-d12	84	%				No Limit	EPA 525.2 - SS	DD-NH	09/06/16 6:13 PM
Pyrene-d10	95	%				No Limit	EPA 525.2 - SS	DD-NH	09/06/16 6:13 PM
Triphenylphosphate	105	%				No Limit	EPA 525.2 - SS	DD-NH	09/06/16 6:13 PM
3-Hydroxycarbofuran*	<1	ug/L			1	No Limit	EPA 531.1	BM-NH	09/07/16 12:59 PM
Aldicarb Sulfone*	<1	ug/L			1	No Limit	EPA 531.1	BM-NH	09/07/16 12:59 PM
Aldicarb Sulfoxide*	<1	ug/L			1	No Limit	EPA 531.1	BM-NH	09/07/16 12:59 PM
Aldicarb*	<1	ug/L			1	No Limit	EPA 531.1	BM-NH	09/07/16 12:59 PM
Carbaryl*	<1	ug/L			1	No Limit	EPA 531.1	BM-NH	09/07/16 12:59 PM
Carbofuran*	<0.9	ug/L	✓		0.9	40 ug/L	EPA 531.1	BM-NH	09/07/16 12:59 PM
Methiocarb*	<1	ug/L			1	No Limit	EPA 531.1	BM-NH	09/07/16 12:59 PM
Methomyl*	<1	ug/L			1	No Limit	EPA 531.1	BM-NH	09/07/16 12:59 PM
Oxamyl (Vydate)*	<1	ug/L	✓		1	200 ug/L	EPA 531.1	BM-NH	09/07/16 12:59 PM
Propoxur (Baygon)*	<1	ug/L			1	No Limit	EPA 531.1	BM-NH	09/07/16 12:59 PM

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SAMPLE ID#: 1609-00281-001
SAMPLED BY: Alpha Analytical
SAMPLE ADDRESS: L1627359
LYNCH
LOCATION:

DATE AND TIME COLLECTED: 08/31/2016 3:00 PM
DATE AND TIME RECEIVED: 09/02/2016 1:00 PM
ANALYSIS PACKAGE: SOC GSA MA
RECEIPT TEMPERATURE: ON ICE 4.3 CELSIUS
CLIENT JOB #

Test Description	Results	Test Units	Pass /Fail	DQ Flag	RL	EPA Limit	Method	Analyst	Date-Time Analyzed

The results presented in this report relate to the samples listed above in the condition in which they were received.
RL: "Reporting limit" means the lowest level of an analyte that can be accurately recovered from the matrix of interest.

Data Qualifier (DQ) Flags: None

*** MA Certified Analysis**

Donald J. D'Anjou, Ph. D.
Laboratory Director

This analysis meets Commonwealth of Massachusetts requirements except as noted.
State Certifications: | NH 1015 | MA M-NH003 | ME NH00003 | RI 101513 | VT VT-101507 |
This certificate shall not be reproduced, except in full, without the written approval of Granite State Analytical Services, LLC

Hazen Research, Inc.
4601 Indiana Street
Golden, CO 80403 USA
Tel: (303) 279-4501
Fax: (303) 278-1528

DATE	September 19, 2016
HRI PROJECT	009-458
HRI SERIES NO	I109/16
DATE REC'D.	9/8/2016
CUST. P.O.#	L1627359

Alpha Analytical, Inc.
Karyn Raymond
Eight Walkup Drive
Westborough, MA 01581-1019

REPORT OF ANALYSIS

SAMPLE NO. I109/16-1

SAMPLE IDENTIFICATION: L1627359-01 - Lynch - sampled on 08/31/2016 @ 1500

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Gross Alpha (+-Precision*), pCi/l (T)	0.8(+-2.0)	1.8	SM 7110 B	9/12/2016 @ 0730	LD
Gross Beta (+-Precision*), pCi/l (T)	0.6(+-2.2)	2.2	SM 7110 B	9/12/2016 @ 0730	LD
Radium-226 (+-Precision*), pCi/l (T)	0.1(+-0.2)	0.1	SM 7500-Ra B	9/9/2016 @ 1005	LD
Radium-228 (+-Precision*), pCi/l (T)	0.2(+-0.6)	0.5	EPA Ra-05	9/13/2016 @ 1247	JR

Certification ID's: CO/EPA CO00008; CT PH-0152; KS E-10265; NJ CO008; NYSELAP (NELAC Certified) 11417; RI LAO00284; WI 998376610, TX T104704256-15-6

*Variability of the radioactive decay process (counting error) at the 95% confidence level, 1.96 sigma.

By: Jessica Axen
Jessica Axen
Analytical Laboratories Manager

Report may only be copied in its entirety.
Results reported herein relate only to discrete samples submitted by the client. Hazen Research, Inc. does not warrant that the results are representative of anything other than the samples that were received in the laboratory.

CODES: (T) = Total (D) = Dissolved (S) = Suspended (R) = Total Recoverable
(PD) = Potentially Dissolved < = Less Than

Page 1 of 1

An Employee-Owned Company

HAZEN RESEARCH, INC.
RADIOCHEMISTRY LABORATORY

Date: 09/12/2016

Batch QC Evaluation Form-Gross Alpha

Analyte: Gross Alpha

Control Standard/LFB: ID: C11 pCi/ml: 57.4 (use 1.0 ml diluted)

Spike Solution: ID: C11 pCi/ml: 57.4 (use 1.0 ml)

Spike Recovery Calculation: Sample: TAP

Calculation: $\frac{(51.5)(1.0) - (0.5)(0.2)}{57.4} \times 100 = 90$ %

Batch QC Evaluation:

Parameter	Criteria	Pass	Fail	N/A
Control Std./LFB	+/-- 30 %	✓		
Spike Recovery	70 - 130 %	✓		
Blank	< or = 2 x MDL	✓		
Duplicate 1	95% confidence interval overlap	✓		
Duplicate 2 *	95% confidence interval overlap			✓

* Required for batch size greater than 10 samples.

Conclusions:

✓ Batch Passes
____ Batch Fails
____ Batch Passes, with exceptions:

Reruns Required: _____

Narrative: _____

Batch Listing by Lab Control Number:

I109/16	H197/16
I75/16	H198/16
H287/16	H209/16
I84/16	
I64/16	
H196/16	

Evaluator: Lynnea Rockwell

9/13/16
Date

HAZEN RESEARCH, INC.
RADIOCHEMISTRY LABORATORY

Date: 09/12/2016

Batch QC Evaluation Form-Gross Beta

Analyte: Gross Beta

Control Standard/LFB: ID: C11 pCi/ml: 44.0 (use 1.0 ml diluted)

Spike Solution: ID: C11 pCi/ml: 44.0 (use 1.0 ml)

Spike Recovery Calculation: Sample: TAP

Calculation: $\frac{(39.3)(1.0)-(0.0)(0.2)}{44.0}$ X 100 = 90 %

Batch QC Evaluation:

Parameter	Criteria	Pass	Fail	N/A
Control Std./LFB	+/-- 20 %	✓		
Spike Recovery	80 - 120 %	✓		
Blank	< or = 2 x MDL	✓		
Duplicate 1	95% confidence interval overlap	✓		
Duplicate 2 *	95% confidence interval overlap			✓

* Required for batch size greater than 10 samples.

Conclusions:

✓ Batch Passes
____ Batch Fails
____ Batch Passes, with exceptions:

Reruns Required: _____

Narrative: _____

Batch Listing by Lab Control Number:

I109/16
I75/16
H287/16
I84/16
I64/16
H196/16

H197/16
H198/16
H209/16

Evaluator: Lynnea Rockwell
9/13/16
Date

HAZEN RESEARCH, INC.
RADIOCHEMISTRY LABORATORY

Date: 09/09/2016

Batch QC Evaluation Form

Analyte: Ra-226

Control Standard/LFB: ID: NBL 6A pCi/ml: 23.0 (use 2 ml diluted)

Spike Solution: ID: NBL 6A pCi/ml: 23.0 (use 2 ml)

Spike Recovery Calculation: Sample: H204-1c

Calculation: $\frac{(50.0)\overset{47.5}{(0.950)} - (4.6)\overset{4.37}{(0.950)}}{46.0} \times 100 =$ 94 %

Batch QC Evaluation:

Parameter	Criteria	Pass	Fail	N/A
Control Std./LFB	+/-- 20 %	/		
Spike Recovery	80 - 120 %	/		
Blank	< or = 2 x MDL	/		
Duplicate 1	95% confidence interval overlap	/		
Duplicate 2 *	95% confidence interval overlap	/		

* Required for batch size greater than 10 samples.

Conclusions:

/ Batch Passes
____ Batch Fails
____ Batch Passes, with exceptions:

Reruns Required: _____

Narrative: _____

Batch Listing by Lab Control Number:

I64/16	H198/16
I109/16	H200/16
H195/16	H204/16
H287/16	H206/16
H196/16	H207/16
H197/16	

Evaluator: Lynnea Rockwell

9/14/16
Date

HAZEN RESEARCH, INC.
RADIOCHEMISTRY LABORATORY

Date: 09/13/2016

Batch QC Evaluation Form

Analyte: Ra-228

Control Standard/LFB: ID: NBL 7A pCi/ml: 13.2 (use 2 ml diluted)

Spike Solution: ID: NBL 7A pCi/ml: 13.2 (use 2 ml)

Spike Recovery Calculation: Sample: I109-1g

Calculation: $\frac{(26.2)(1.0)-(0.2)(1.0)}{26.4} \times 100 =$ 98 %

Batch QC Evaluation:

Parameter	Criteria	Pass	Fail	N/A
Control Std./LFB	+/-- 20 %	/		
Spike Recovery	80 - 120 %	/		
Blank	< or = 2 x MDL	/		
Duplicate 1	95% confidence interval overlap	/		
Duplicate 2 *	95% confidence interval overlap			/

* Required for batch size greater than 10 samples.

Conclusions:

/ Batch Passes
___ Batch Fails
___ Batch Passes, with exceptions:

Reruns Required: _____

Narrative: _____

Batch Listing by Lab Control Number:

I109/16
H288/16
I61/16

Evaluator: Lynnea Rockwell
9/16/16
Date

SUB UPS: Hazen, CO

CHAIN OF CUSTODY

PAGE OF

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193

Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #: L1627359

Client Information

Client: Alpha Analytical Lab

Address: 8 Walkup Drive

Westborough, Ma 01581

Phone: 508-898-9220

Fax:

Email: subreports@alphalab.com

☐ These samples have been Previously analyzed by Alpha

Project Information

Project Name:

Project Location: MA

Project #:

Project Manager: Karyn Raymond

ALPHA Quote #:

Turn-Around Time

☒ Standard ☒ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Report Information Data Deliverables

☐ FAX ☐ EMAIL

☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program Criteria

MCP PRESUMPTIVE CERTAINTY-CT REASONABLE CONFIDENCE PROTOCOLS

☐ Yes ☐ No Are MCP Analytical Methods Required?

☐ Yes ☐ No Are CT RCP (Reasonable Confidence Protocols) Required?

Other Project Specific Requirements/Comments/Detection Limits:

Please reference Alpha Job # L1627359 on this report.

ANALYSIS

RUSH PER KARYN RAYMOND. 9/8/16

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	RA226	RA228	ALPHA/BETA										Sample Specific Comments	TOTAL # BOTTLES
L1627359-01	LYNCH	8/31/16	15:00	DW		X	X	X											8
Container Type						P	P	P	-	-	-	-	-	-	-	-	-		
Preservative						C	C	C	-	-	-	-	-	-	-	-	-		

PLEASE ANSWER QUESTIONS ABOVE!

IS YOUR PROJECT MA MCP *or* CT RCP?

FORM NO: 01-01 (I) (rev. 30-JUL-07)

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	09/01/16		

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Payment Terms.

APPENDIX D – DEP CORRESPONDENCE, STATUS OF WELLHEAD PROTECTION COMPLIANCE

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

MITT ROMNEY
Governor

KERRY HEALEY
Lieutenant Governor

STEPHEN R. PRITCHARD
Secretary

ROBERT W. GOLLEDGE, Jr.
Commissioner

September 12, 2005

Timothy Henry
Ipswich Water Department
274 High Street
Ipswich, Massachusetts 01938

Re: Ipswich – Compliance with MA Wellhead Protection Regulations 310 CMR 22.21(2) for Wells 01G, 02G, 03G

Dear Mr. Henry:

The Ipswich Water Department #3144000, is in compliance with DEP Wellhead Protection Regulations 310 CMR 22.21(2) for the above listed wells. Compliance with these regulations also satisfies the wellhead protection conditions of your Water Withdrawal Permit; please retain this letter for your records. The following documents are evidence of your compliance and are on file at the DEP Drinking Water Program:

1. Town of Ipswich *'Water Supply Protection District'*, amended 2003
2. Town of Ipswich, *'Water Supply Protection District Map'*, dated 2004
3. Town of Ipswich *'Board of Health Floor Drain Regulation'*, adopted 2001

The above controls also protect the Zone II extending into the Town of Ipswich from the Town of Rowley. Additionally, the Ipswich Zone II, extending into the Town of Hamilton, is protected by the Town of Hamilton with local controls meeting DEP Wellhead Protection Regulations.

We thank your for your cooperative efforts in protecting public drinking water supplies. If you have any questions concerning this letter, please contact me at 617-556-1070.

Sincerely,

Catherine Hamilton

Catherine Hamilton
DEP/DWP Boston

cc;

Anita Wolovich, DEP/DWP NERO
Town of Rowley, Planning Board

This information is available in alternate format. Call Donald M. Gomes, ADA Coordinator at 617-556-1057. TDD Service - 1-800-298-2207.

DEP on the World Wide Web: http://www.mass.gov/dep
Printed on Recycled Paper

APPENDIX E – ALTERNATIVES ANALYSIS, SITE SCREENING, EARLY NOTICE IN ENVIRONMENTAL MONITOR

Alternatives Analysis
Lynch Site
Ipswich, Massachusetts

Background

The Town of Ipswich Water Department has two active surface-water supplies and five active groundwater supplies. The surface water-supplies, both in the Parker River basin, include Dow Brook (built in 1894) and Bull Brook (1923) Reservoirs, which have a combined storage capacity of about 91 million gallons (MG). The groundwater sources include the Mile Lane Well (built in 1942), Browns Well (1954), both of which are in the Parker River Basin, and the Fellows Road Well (about 1982), the Essex Road Well (about 1979) and Winthrop Well 2 (1960s), all of which are in the Ipswich River basin. Water from the surface-water reservoirs is treated before being introduced into the distribution system. Apart from addition of corrosion-control chemicals, fluoridation and disinfection, all other sources are untreated. The Browns Well experiences high levels of manganese (above 1 milligram per liter), if it is pumped heavily and continuously. The Browns Well is a 400-gpm source, which the Water Department now limits to 200 gpm to manage manganese levels. The wells in the Ipswich River basin also experience water-quality issues (either iron or manganese). The overriding constraint on pumping of the Ipswich River basin wells, however, is the Water-Management Act (WMA) registration, which limits pumpage to 0.2 million gallons per day (mgd) collectively, averaged over the year.

Summary of Water Supply Sources
Ipswich, MA

Water Source	Source Type	Basin	Storage Capacity, million gallons (MG)	Max. Authorized Daily Volume, million gallons per day (mgd)
Dow Brook	Reservoir	Parker	64	2.5 (Dow + Bull Brook)
Bull Brook	Reservoir	Parker	27.4	-
Mile Lane GP Well	Well	Parker	-	0.15
Browns GP Well	Well	Parker	-	0.49*
Fellows Rd Well	Well	Ipswich	-	0.31*
Essex Rd Well	Well	Ipswich	-	0.21
Winthrop Tubular Wells 1 (inactive)	Well	Ipswich	-	-
Winthrop Well 2	Well	Ipswich	-	0.23
Winthrop Well 3 (inactive)	Well	Ipswich	-	-

*Current pumping capacity/days of operation restricted due to manganese levels > 0.3 milligram per liter

Cost Alternative

The Town of Ipswich owns approximately 5.87 of the 6.49 acres of land or about 90% of what is required for Zone I water-supply protection. Ipswich would therefore need to purchase or gain control of only 0.62 acres of land, largely wetland. The Lynch Site would be connected to the water-distribution system near the Mile Lane Well. Electrical power is available on Linebrook Road. The Town of Ipswich owns both the water-distribution and electrical-transmission infrastructure. Connection of both water and electrical power to the Lynch Site would therefore be relatively low in cost. The water from the Lynch Site is not expected to require treatment beyond corrosion control, fluoridation and disinfection, which would also limit cost. If the Lynch Site is capable of producing 400 gpm on a sustained basis, it could provide up to half of the Town's average-day demand. We should also point out that an engineering evaluation performed in 2014 indicated that the cost to build treatment plants for manganese control ranged from $4 million (Browns Well) to $7.25 million (Fellows Road and Essex Road Wells). These solutions are 1.5- to

2.5-times as costly as new wells at the Lynch Property. Operating costs for the treatment-plant options would be much higher than the costs to operate the Lynch wells. Based on the foregoing, Ipswich believes that development of the Lynch Site is the least-cost alternative with potentially great benefit.

Leak Detection Alternative

In 2017, the Ipswich Water Department completed the annual leak-detection survey of its 93 miles of water main, hydrants and valves. In 2017, leakage accounted for about 12,000 gallons per day in losses. The Town continues to perform annual leak detection and make repairs to water mains as needed to conserve water.

Conservation and Demand Management Alternative

Ipswich is committed to water conservation as a means of reducing consumption. In 2003, the Town introduced a seasonal-rate structure for its residential customers to manage summer demands. The summer rate for residential customers, which apply from May 1 to September 30 of each year, is 1.5 times the base rate. For 2018, the summer rate is set at $12.99 per hundred cubic feet, nearly four times the winter rate. This structure has reduced water demand by 15% since 2003. The attached graph shows water consumption for the period 1988 to 2016, indicating a steady decline in consumption over the last 20 years despite two periods of severe drought (2001-2002 and 2015-2016).

Ipswich's average residential consumption (in gallons per capita per day, gpcd) reported in 2017 was 46 gpcd, well below Ipswich's WMA Registration compliance standard of 65 gpcd. Ipswich believes that its pricing, especially its summer-demand pricing structure and monthly billing with graphs of usage, are the principle factors that promote water conservation and lead to the current low residential consumption. Ipswich's unaccounted for water (UAW) reported in 2017 was 15.8 %, above the compliance standard of 10%. Ipswich will continue its annual leak detection program and is committed to reducing UAW to meet the compliance standard.

At its Annual Town Meeting in 2017, the Town adopted a Water-Use Restriction Bylaw. The new by-law grants greater authority to the Water Commissioners or their designee to impose restrictions to reduce consumption "at any time that conditions warrant", including restrictions on private wells. Information is supplied to customers through the Town web site and social media, through bill stuffers and through annual consumer confidence reports.

Other features that help Ipswich manage demand and promote conservation include the following. The Town is 100% metered. The Town has an on-going program to replace customer and master meters. The master meters are calibrated annually. Public buildings are metered and nearly all have been retrofitted with water-saving devices. The Town of Ipswich continues to enforce the plumbing code for new construction and building rehabilitation where installation of water-saving devices and low-flow toilets are required. Ipswich's water system is operated as a full enterprise account, which covers the costs of operations, maintenance, capital improvements and water conservation. The revenue raised through water rates is used exclusively to support the water system. Customers pay for the actual cost of water.

Water meters for all commercial, industrial, residential, small business and municipal accounts are currently read and billed monthly. Furthermore, Ipswich uses Advanced Metering Infrastructure (AMI), which is an integrated system of smart meters, communications networks, and data management systems that enable two-way communication between the utility and its customers. AMI gives the Water Department the ability, for example, to monitor consumption graphically on an hourly basis, and identify leaks quickly.

As illustrated above, the Town's on-going commitment to water conservation and demand management has and will continue to pay dividends. However, conservation and demand management will not

eliminate the need for additional supplies to meet current and future demand and provide resiliency during drought conditions.

Withdrawal Points Alternative

The Town's Ipswich River basin wells are limited under the WMA to supply only 0.2-mgd of the Town's 1.0-mgd average-day demand. The Fellows Road Well in the Ipswich River basin is operated sparingly because of increasing levels of manganese. Partly because of the WMA limitation, Ipswich's surface-water and groundwater sources in the Parker River basin must bear the burden of supplying the Town with water. However, the Mile Lane Well has a capacity of only 105 gpm (0.15 mgd) and the Browns Well is now limited to 200 gpm (0.29 mgd) to manage high levels of manganese. During the 2016 drought, which lasted from summer through the middle of October, the Town was literally draining the reservoirs of water to meet demand, and was within weeks of running out of water. Water use restrictions were imposed early in the season and escalated, as necessary. However, by mid-September the Town was forced to request a Declaration of Water Supply Emergency from DEP, which was granted.

The Town has been proactively searching for new sources of supplies for over 40 years:

- 1970s: The Town and other agencies considered numerous options for new water supply, including a regional water-supply solution, MWRA water, various river impoundments, and pumped storage;
- Mid-1990s: The Town investigated expansion of Bull Brook and Dow Reservoirs;
- 2003: The Town investigated the feasibility of diverting wastewater to water-supply recharge areas;
- 2005: The Town investigated the Ross Property for groundwater supply;
- 2015 to 2017: The Town investigated six sites for potential sources of groundwater supply. The Lynch Site proved to be the most favorable in terms of water-supply capacity, water quality and regulatory approvability. The attached table summarizes the six sites investigated.
- Present: The Town is currently investigating other possible sources of water supply, including desalination, wastewater reuse, and reservoir expansion.

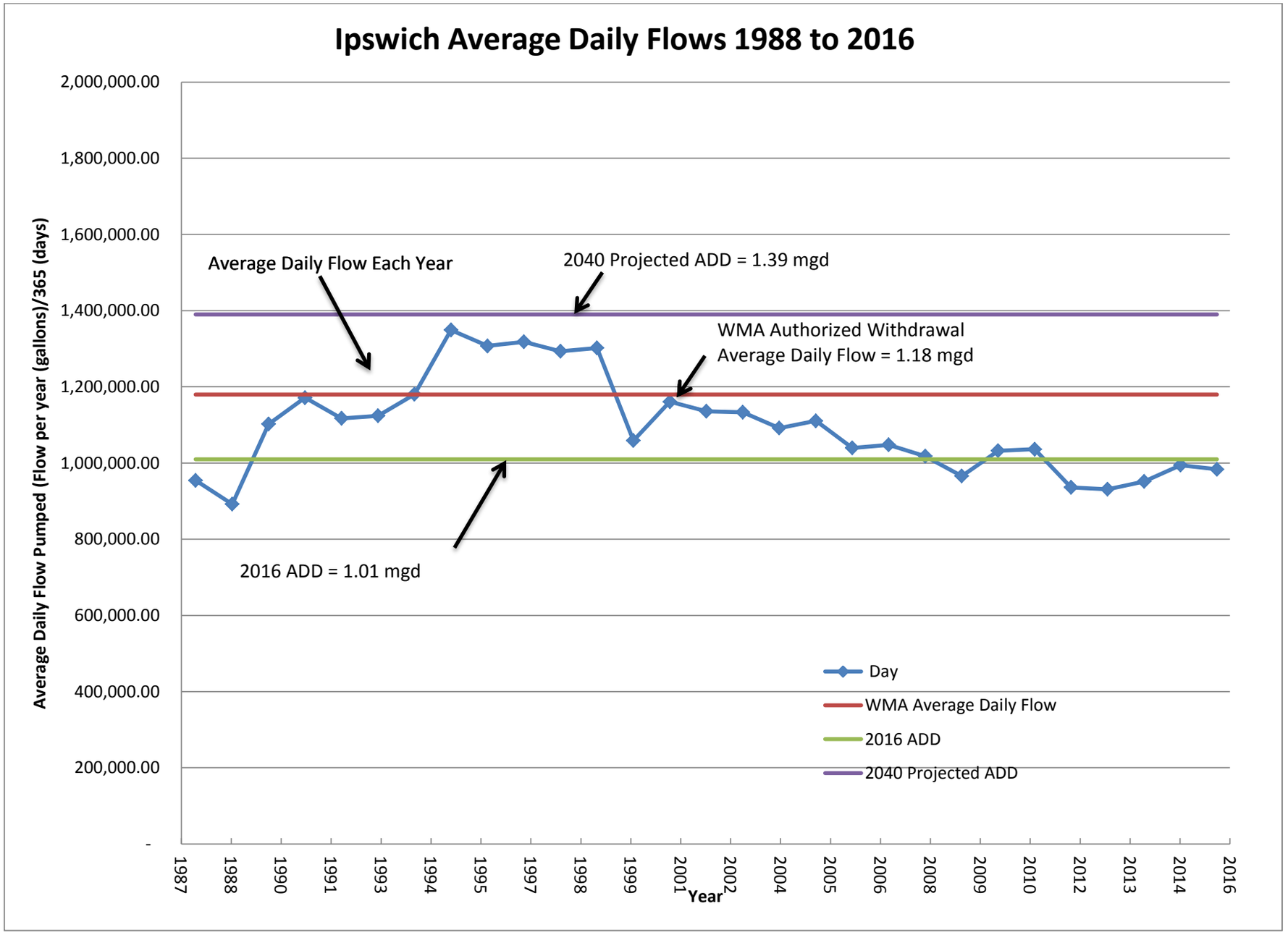
While there may be other well sites or other possible sources of water supply yet to be identified in Ipswich, the Lynch Site represents the best alternative at the present time.

No Action Alternative

The primary benefits of a new source of water supply at the Lynch Site are as follows:

- The project will increase the Ipswich Water Department's overall water-supply capacity. The Town's existing groundwater supplies have lost capacity due to age and/or water quality, or are limited by permit. During periods of dry weather, the reservoirs have limited capacity by virtue of their small size.
- The project will improve overall operational reliability and flexibility, in case the existing supplies or the water treatment plant have to be taken out of service for any reason.
- Projected average-day water demands in the year 2040 are 1.39 mgd, with a projected peak day-demand of 2.86 mgd. The project will improve Ipswich's ability to meet these future water demands.
- The Lynch Site appears to be capable of supplying about 300 to 400 gpm (0.43 to 0.59 mgd) of high-quality drinking water that will not require treatment.
- The project will provide much needed drought resiliency.

Under the "No Action" alternative, none of these benefits will be realized.



X:\Ipswich, MA\60550038 Water Supply Master Plan\400\401 Information from Town\water pumped per month 88-present Avg Daily

Comparison of 2016/2017 Test Well Sites
For Potential New Water Supply
Ipswich, Massachusetts

Location	Test Pumping Rate, gpm	Specific Capacity, gpm/ft	Water-Level Recovery	Potential Well Yield, gpm	Iron, mg/L	Mn, mg/L	Sodium/ Chloride, mg/L	Nitrate-N, mg/L	Comments
Browns Well	NA	> 50	NA	400	0.01-0.08	0.10-0.97			2014-15 water quality
TW 1-16, 15 ft SE Browns Well	64 (4 hrs)	54	91% (after 2 hrs)	400	0.04	0.001	70/137	0.6	Possible replacement well location
TW 2-16, 250 ft south of Browns Well	94 (4 hrs)	181	44% (after 2 hrs)	400 sustained yield uncertain	< 0.02	0.0004	60/110	0.7	Sluggish drawdown and recovery. For 2-hr pumping, 2-hr recovery = 81%; Zone I cannot be acquired.
Lynch Property	171 (8 hrs)	50 (interference, 4 wells)	99% (after 8 hrs)	300 - 400	0.03	0.001	104/122	3.0	Pumping test conducted under severe drought conditions; Partial Zone I acquisition required.
Project Adventure	191 (4 hrs)	20 – 30 (interference, 3 wells)	83% (after 4 hrs)	500 + sustained yield uncertain	< 0.02	< 0.002	63/134	1.5	Partial Zone I acquisition required.
Pony Express	125 (3 hrs)	208	77% (after 3 hrs)	700, sustained yield uncertain	1.53	1.97	26/29	< 0.1	Sluggish recovery. Land acquisition or easement required. High Fe and Mn

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

ARGEO PAUL CELLUCCI
Governor

JANE SWIFT
Lieutenant Governor

BOB DURAND
Secretary

LAUREN A. LISS
Commissioner

February 5, 2001

Site Screening for Siting a New or Expanding Source of Public Water Supply

The Department of Environmental Protection (DEP) is committed to early identification of issues relevant during the New Source Approval process for public water supplies. The Site Exam phase will now require that project proponents complete alternatives analysis, a water conservation questionnaire, the attached site screening document and publish public notice in The Environmental Monitor. Conducting alternatives analysis and assessing water conservation measures earlier in the process, and the use of a preliminary screening tool and public notice will ensure that the project proponent and interested parties will have an opportunity to identify issues and state concerns about proposed source locations. Early identification of issues can help to minimize environmental impact and minimize cost and delay to the project proponent. Identification of these issues will assist the agencies and the proponent in determining whether the proposed source is economically viable and protective of the environment and other water users, and will increase technical and regulatory information needed for pumping test design. The public notice will be published in The Environmental Monitor for proposed public water supply sources subject to the Water Management Act. The Department of Environmental Protection will accept written comments regarding proposed sites for a short time following publication of the notice.

A variety of environmental laws may apply to new source development depending on the location and the project design. Applicable laws may include the Safe Drinking Water Act, the Water Management Act, the Wetlands Protection Act, the Interbasin Transfer Act, the Endangered Species Act, and the Clean Water Act. The Department's Guidelines and Policies for Public Water Systems provide additional guidance about the necessary approvals and the timing of obtaining them.

"Site Screening for Siting New or Expanding Source of Water Supply" will allow proponents to screen each site under consideration, enabling them to make informed decisions in selecting sites and evaluating alternatives for new source development. Project proponents of new sources that will exceed the withdrawal threshold of the Water Management Act noted herein, should apply the screening criteria to each source under consideration.
This guidance should not be considered to be a final determination of the approvability of sites, but is intended to provide direction regarding significant issues that will have to be addressed if a particular site is pursued.

It is the goal of DEP to ensure a reliable supply of safe drinking water at an affordable cost in a manner which has the least possible environmental impact. The Department promotes efficient operation and maintenance of water supply and distribution systems, and the use of storm water management and wastewater disposal systems that recharge groundwater. DEP promotes and implements policies which require the assessment of future demands, the improvement of the efficiency of water supply systems, and conservation to avoid the capital costs and environmental impacts associated with the development of new supplies.

Glenn Haas, Acting Assistant Commissioner
Bureau of Resource Protection

This information is available in alternate format by calling our ADA Coordinator at (617) 574-6872.

DEP on the World Wide Web: http://www.magnet.state.ma.us/dep
Printed on Recycled Paper

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

ARGEO PAUL CELLUCCI
Governor

JANE SWIFT
Lieutenant Governor

BOB DURAND
Secretary

LAUREN A. LISS
Commissioner

REQUEST FOR SITE EXAM
Water Management Program February 5, 2001

Site Screening Worksheet for Siting a New or Expanding Source of Public Water Supply

For a Public Water Supply Pumping 100,000 GPD or Greater

Submit two copies of this form for each source with the Request For Site Exam documentation to DEP/ Drinking Water Program.

Applicant: Ipswich Water Department, Ipswich, MA
Consultant: AECOM, 250 Apollo Drive, Chelmsford, MA Phone: 978-905-2180, D DeNatale
Site Name Lynch Site Basin: Rowley River Basin – draining to Plum Island Sound (Figure 1)

Section A: Demand Management

1. What is the maximum withdrawal rate you are seeking for your proposed source in million gallons per day (mgd)? 0.864 (new sources only)

	Existing	Final 5-yr block Permit Volume	Buildout (2040)
2. What is the average day demand (mgd) of your system?	1.01 mgd (2016)	1.18 mgd	1.39 mgd

3. What is the peak day demand (mgd) of your system? 1.86 mgd (2016)

4.a. What is the approved pumping rate (mgd) of your system? 3.89 mgd (aggregate max. daily approved rate for the active supplies)

b. Do any of these sources have restricted capacity? If so, briefly indicate which sources and the reasons for the capacity restrictions in the space below. Yes, Ipswich River basin well sources are restricted to 0.2 mgd annual average per WMA Registration; Fellows Road Well and Browns Well are now on restricted operation (restricted in terms of pumping rate and days of operation) due to high levels of manganese; Reservoirs have insufficient supply in most summers.

5. Can you meet your average day demand with your largest source off-line? Yes ☐ No x ☐

*Buildout: EOEA Community Preservation Initiative Buildout projections (See Appendix B). If these projections are not available for your town, note the source of your Buildout projections below.

Buildout demand based on Projected demand for year 2040, (AECOM, 2018)

Section A: Demand Management (cont.)

Note: Failure to meet water conservation standards may jeopardize your application.
Prior to commencement of the development of a new public source, the proponent should conduct a thorough analysis of system demand and have a viable water conservation program in place. Complete the Water Conservation Plan and refer to DEP/Water Management conservation guidelines, *Guidelines and Policies for Public Water Systems, Section 10, revised August, 1996, or as amended; and Water Conservation Standards for the Commonwealth of Massachusetts, adopted 1992.*

If your proposed withdrawal involves an interbasin transfer, also refer to DEM/Office of Water Resources Interbasin Transfer Act water conservation measures in, *Appendix A, Interbasin Transfer Act Performance Standards Guidance, approved 8/12/99, and A Guideline to the Application of the Interbasin Transfer Act and Regulations, December 1985.*

Section B. Potential Environmental Impact

Presence of sensitive or multiple receptors may limit site availability for water supply withdrawal.

1. Which of the following sensitive receptors exist within 1000' of your site?
   (Consult the most recent Massachusetts Natural Heritage Program Atlas, MassGIS and other sources.)

- Areas of Critical Environmental Concern Yes _____ No __x__
- Priority habitat for rare and endangered species Yes _____ No __x___
- Lakes and ponds (or other surface water features) Yes __x__ No _____
- Vernal pools Yes _____ No __x__
- Stocked trout streams Yes __x__ No _____
  (See Massachusetts Stocked Trout Waters listing on website: www.state.ma.us/dfwele*)*

Additional considerations:
- Cold water fisheries resource None
- NPDES permit sites (National Pollution Discharge Elimination System)

2. Which of the following potential threats or sensitive receptors exist within one-half mile of your site?
   (Consult the DEP website at www.state.ma.us/dep*, MassGIS and other sources)*

- Hazardous waste sites Yes _____ No __x__
- Wastewater treatment facilities Yes _____ No __x__
- CSOs or SSOs Yes _____ No __x__
- Landfills Yes _____ No __x__
- Agricultural uses Yes __x___ No ____
- Automobile graveyards and junkyards Yes _____ No __x__
- Industrial Park/plant Yes _____ No __x__
- Petroleum and oil bulk stations and terminals Yes _____ No __x__
- Public water withdrawals Yes _____ No __x__
- Private wells Yes ____ No _____

Section B-1. Stream and Basin Section

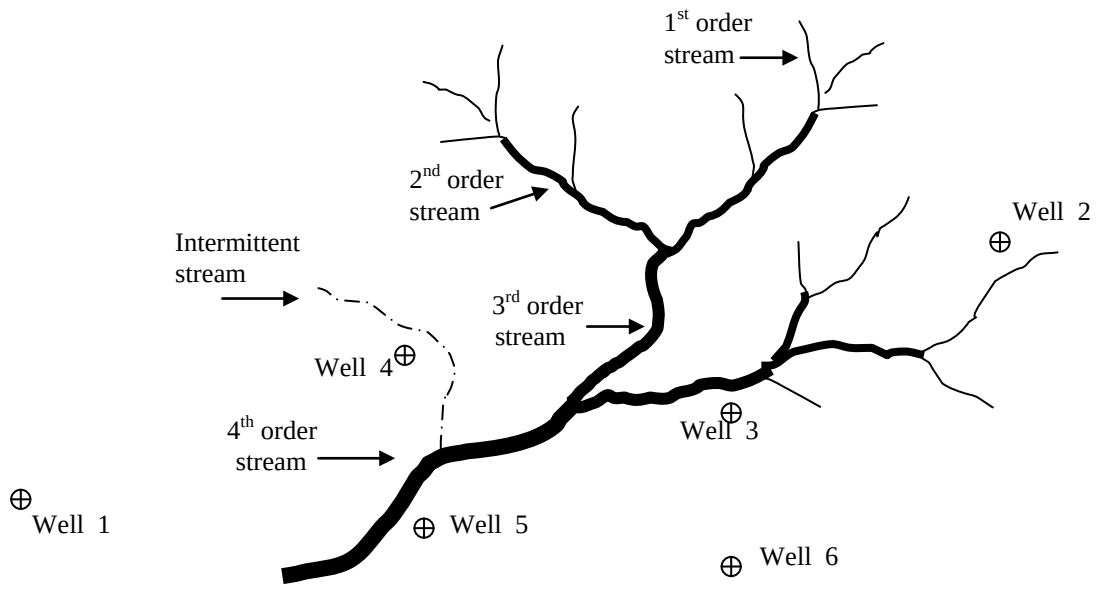
This section is intended to preliminarily evaluate the impacts of proposed sources on streamflow and availability of water in the river basin. The graphic below depicting stream order and well placement illustrates how well location may impact streamflow.

The purpose of this section is not to approve or deny siting a new source, but rather to provide an advisory for caution where siting a withdrawal that may have a significant impact on streamflow.

Stream Order:
A stream of first order is one that has no tributaries. When two streams of first order join, a stream segment of second order begins that may have one or several first-order tributaries along its length. When two streams of second order join, a single stream of third order begins. This stream extends until joined by another third-order river, and there, the fourth order begins, and so on. A junction with a lower-order channel does not change the order of the higher-order stream. (Adapted from the Handbook of Hydrology, 1993)

WATER WITHDRAWAL CONSIDERATION ON STREAMFLOW

PROXIMITY AND STREAM ORDER



Assuming the same pumping rate and a hydrological connection for induced infiltration between a well and a stream, proximity and stream order are two factors which may have a serious impact on flow. Generally, the nearer the withdrawal is to a stream, the greater the impact on flow; and the lower the level of stream order, the greater the impact of a withdrawal on flow. As illustrated above, Wells 1 and 6 may have minimal or no impact on streamflow. Well 5, located near a higher order stream may have less impact on flow than Well 3. Wells 2 and 4 may have the greatest impact on flow due to their close proximity to a first order stream and an intermittent stream.

The following stream screening criteria provides guidance concerning a withdrawal's potential for impact on flow. Generally, for a withdrawal pumping rate less than 7Q10 flow, no significant impact is anticipated. Withdrawals greater than 7Q10 flow, let alone larger pumping volumes greater than 50% of August Median flow, may have significant impacts on flow. Low flow stream statistics (7Q10 and August Median) may be obtained from U.S. Geological Survey (USGS) website noted below. However, statistics obtained from this website are based on unregulated streams and do not take into account cumulative effects on streamflow from existing withdrawals or other impacts, and the proposed withdrawal may warrant further site screening assessment. Stream threshold indicators may also be more restrictive in basins that DEP has determined to be hydrologically stressed.

Responses to the following questions will require internet access to obtain low flow stream statistics from the USGS steamflow statistics website, http://ma.water.usgs.gov/streamstats. The USGS website provides streamflow statistics and basin characteristics for locations of interest by use of an automated procedure that measures characteristics of the land surface area (basin) that drains to the stream and inserts those characteristics into equations that estimate the streamflow statistics (7Q10, August Median, etc).

This methodology is designed to estimate the impact on flow from one proposed withdrawal on an unregulated stream. Withdrawals impacting more than one stream, or where multiple withdrawals or other impacts in the drainage area already exist, will require additional site-specific screening.

Basically, the application allows a user to mouse-click on a point in a stream, from which the program will delineate the contributing watershed drainage area on a map and generate low flow stream statistics along with basin characteristics. Instructions for use are on the website. The USGS display map and corresponding data printout for the proposed withdrawal must be enclosed with this application. Once the low flow statistics have been obtained, the data must be converted into cubic feet per second per square mile (cfsm) and compared to the withdrawal rate.

The click point for the application is the point where the stream intersects the downgradient extent of the preliminary Zone II. The preliminary Zone II delineation is a requirement in the Drinking Water Request For Site Exam part of this application. DEP assumes 100% hydrogeologic communication between the well and the stream so that every drop of water pumped comes from the stream. However, the Department will also consider applied site specific stream depletion methodologies (Jenkins, Barlow, etc.), that attempt to quantify stream flow depletion by wells under Zone II conditions. In such cases, the reduced flow impact may substitute for the withdrawal when comparing the withdrawal rate to stream indicators 7Q10 and 50% of August Median.

To determine the withdrawal's impact on streamflow, follow the steps below.

Step 1: Convert the proposed withdrawal rate given in million gallons per day (Page 1, Section A, Question 1) to gallons per day, and then to cubic feet per second using the following formula:

$$\frac{\textbf{860,000}\ \text{gpd (new sources only)}}{7.48\ \text{gal/cu.ft.} \times 1440\ \text{min/day} \times 60\ \text{seconds/minute}} = \textbf{1.33}\ \text{cfs}$$

Step 2: Determine the contributing drainage area in square miles for the proposed withdrawal location. This area must be determined with the USGS watershed tools by clicking on the stream intersect with the preliminary Zone II at the downgradient point.

What is the contributing drainage area of the proposed withdrawal? **2.59** square miles

What is the distance in feet from the proposed withdrawal to the nearest stream? **160** feet

Step 3: Conversion to cfsm:
Find the flow per unit area (cfsm) for the withdrawal at this location by dividing the cfs flow found in Step 1 by the contributing drainage area in Step 2:

$$\frac{1.33\ \text{withdrawal (cfs)}}{2.59\ \text{drainage area (sq. mi.)}} = \mathbf{0.51\ \ cfsm}$$

Example: Find cfsm for a proposed withdrawal at 0.5 mgd with an upgradient watershed of 5 square miles.
Note: 0.5 mgd converts to .77 cfs

$$\frac{\text{withdrawal (0.5 mgd) or } 0.77\ \text{cfs (Step 1)}}{\text{upgradient watershed } 5\ \text{sq. mi. (Step 2)}} = 0.154\ \text{cfsm (Step 3)}$$

Step 4: The 7Q10 streamflow, measured in cfs, represents the probable minimum flow over a 7-day period that will occur on average once in 10 years. With the USGS website, obtain the 7Q10 cfs flow for the stream location point, convert 7Q10 cfs to cfsm (Step 3), and compare this flow with your proposed withdrawal.

7Q10 flow 0.081 cfs (36 gpm)
7Q10 flow 0.031 cfsm

CAUTION

Withdrawals which are greater than 7Q10 cfsm of a stream have the potential to increase the frequency and duration of low flow, and may result in moderate to significant environmental impact. Such withdrawals may be unapprovable or severely restricted by permit conditions. This guidance should be used as a planning tool, and applicants are encouraged to select alternatives that minimize environmental impact and meet other water supply planning objectives for water quality and productivity. Further analysis will be necessary to determine the potential impact of all proposed withdrawals and mitigating circumstances.

Step 5: With the USGS website, obtain the August Median cfs flow for the stream at the designated point, convert the August Median cfs to cfsm (Step 3), take 50% of August Median (cfsm) and compare this flow with your proposed withdrawal in cfsm.

August Median: 0.482 cfs (216 gpm)
August Median: 0.186 cfsm
50% August Median: 0.093 cfsm

CAUTION

Impacts on streamflow are best determined through physical characteristics of the watershed, site hydrology and pumping tests, but as a screening guideline, a proposed source in which the withdrawal rate of a watershed area is **50% of the August Median** (cfsm) or greater, is considered to have the potential to significantly reduce streamflow. Such withdrawals may be unapprovable or severely restricted by permit conditions. This guidance should be used as a planning tool, and applicants are encouraged to select alternatives that minimize environmental impact and meet other water supply planning objectives for water quality and productivity. Further analysis will be necessary to determine the potential impact of all proposed withdrawals and mitigating circumstances.

Since the August Median statistic may reflect wide ranging and relatively high flows, particularly in small watershed drainage areas, the more conservative 50% of August Median flow was selected as the screening threshold level to protect impacts on river flow from withdrawals.

Section C. Regulatory Review

1. Name all potential water supplies which you have under consideration, including regional sources and those located in other communities, and attach a locus map depicting the location of each.
   Lynch Site: TW 13-16, TW 14-16, TW 15-16, TW 16-16

2. Massachusetts Environmental Policy Act (MEPA) *(MGL ch 30 s. 61 through 62H) (301 CMR 11.00)*
   MEPA provides meaningful opportunities for public review of the potential environmental impacts of projects for which agency action is required. The MEPA review is an informal administrative process of environmental planning that enables the proponent and each participating agency to consider the positive and negative, short-term and long-term, and cumulative potential environmental impacts for all phases of a project. *(See MEPA website at www.ma.state.us/MEPA.)*

   MEPA review thresholds for water: *(301 CMR 11.03(4)) (other non-water thresholds may also apply)*
   ENF and Other MEPA Review if the Secretary So Requires.
   - new withdrawal or expansion of withdrawal of 100,000 or more gpd from a new water source that requires new construction for the withdrawal.

- new withdrawal or expansion of withdrawal of 500,000 or more gpd from a water supply system above the lesser of current system-wide authorized withdrawal volume or three-years' average system-wide actual withdrawal volume.
- construction of one or more new water mains five or more miles in length.
- construction of a new drinking water treatment plant with a capacity of 1,000,000 or more gpd.
- expansion of an existing drinking water treatment plant by the greater of 1,000,000 gpd or 10% of existing capacity.
- alteration requiring a variance in accordance with the Watershed Protection Act, unless the project consists solely of one single family dwelling.
- non-bridged steam crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities.

ENF and Mandatory EIR*:*

- new withdrawal or expansion in withdrawal of
  - 2,500,000 or more gpd from a surface water source; or
  - 1,500,000 or more gpd from a groundwater source.
- new interbasin transfer of water of 1,000,000 or more gpd from a surface or groundwater source or any amount determined significant by the Water Resource Commission.
- construction of one or more new water mains ten or more miles in length.
- new water service to a municipality across a municipal boundary through new or existing pipelines.

Will your water withdrawal require MEPA review Yes [x] No [ ]

3. Water Management Act (WMA) Permit/ DEP Water Management Program *(310 CMR 36.00)*

A water withdrawal permit is required for new or expanded water withdrawals above the threshold volume. Water withdrawal uses may include, but not be limited to **public water supply**; industrial uses; agricultural uses, such as **cranberry growers**; and irrigation uses, such as for **golf courses**.

Threshold volume means:

- an average daily volume of 100,000 gallons for any period of three consecutive months, from a total withdrawal of not less than 9,000,000 gallons; or
- an average daily volume of 100,000 gallons for periods which exceed three consecutive months, calculated by dividing the total withdrawal by the period of operation.
- a permit amendment is required for existing permit holders adding a new source where system wide withdrawal volumes are not being increased.

3a. Will your water withdrawal require a WMA permit? Yes [x] No [ ]

Permit Amendment

3b. Are you currently a Registrant and/or a Permitee under the WMA? Yes [x] No [ ]

If yes, provide registration and permit numbers:

Registration Number(s)	Permit Number(s)
31614401 (Parker)	**WMA Permit #9P2-3-16-144.01 (Parker)**
31714402 (Ipswich)	

4. Interbasin Transfer (IBT) Act Approval / Water Resource Commission *(MGL ch 21 ss. 8B-8D)*

(See Massachusetts Major Basin Map at http://ma.water.usgs.gov/basin)

An interbasin transfer is defined as any transfer of the surface and groundwater, including wastewater of the Commonwealth outside a river basin. A water transfer must cross one of the basin boundaries and a municipal boundary line to be considered an interbasin transfer. If a community is sewered to another town out of the basin of the water supply, the Interbasin Act may be triggered.

An interbasin transfer is any action that increases the ability to transfer water or wastewater out of a donor basin over the present rate of interbasin transfer. Actions requiring review include but are not limited to:

- drilling of production wells;
- significantly increasing the capacity of a well;
- development of a reservoir or enlargement of reservoir storage capacity;

- building of transfer facilities, such as pumps, pipelines, tunnels or other conveyance facilities;
- building of water filtration plants where such plants increase the ability to transfer water out-of-basin;
- changes in any withdrawal constraints contained in any provision of MGL, Special Acts, Judicial decree, regulatory agency rule or operating rule of a water supplier;
- structural change in a wastewater system that causes an increase in the transfer out of a donor basin.

Will your water withdrawal require an IBT application review? Yes [ ] No [x]
see ** below

** If your proposed withdrawal will require an IBT review:

- be advised that certain performance standards, including prerequisite requirements, must be met for application approval. See *Interbasin Transfer Act: Performance Standards Guidance, adopted August 12, 1999.*
- the applicant also must meet with DEM/Office of Water Resources staff before the Alternative Analysis is completed and submitted as part of the Request For Site Exam application.

5. Wetlands Permit / Massachusetts Wetlands Protection Act *(MGL ch 131, s. 40) (310 CMR 10.00)*
   Administered by DEP and Local Conservation Commissions
   Any work in a wetlands or within 100' buffer of the wetlands. This includes creating an access way to the water withdrawal, as well as drilling, pumping, and filling wetlands.

   5a. Will your water withdrawal require a Wetlands Permit? **TBD** Yes [ ] No [ ]

   5b. Is your proposed withdrawal within the 200' riverfront area? Yes [x] No [ ]

6. 404 Permit / Army Corps of Engineers (*Clean Water Act of 1977)*
   Are you planning any dredging or filling for your water withdrawal in a waterway or wetland?
   Section 404 of the Clean Water Act defines the landward limit of jurisdiction as the high tide line in tidal waters and the ordinary high water mark as the limit in non-tidal waters. When adjacent wetlands are present, the limit of jurisdiction extends to the limit of the wetlands.

   Will your water withdrawal require a 404 Permit? Yes [ ] No [x]

7. 401 Permit / DEP 401 Water Quality Certification Program *(314 CMR 9.00)*
   Provides added protection for projects with the potential for large or cumulative impacts to ensure compliance with the surface water quality standards. Actions, involving but not limited to, any one activity listed below, that require a 401 application review are:
   - loss of greater than 5,000 square feet of wetlands;
   - within an Outstanding Resource Water;
   - involving any real estate subdivision;
   - not subject to the Wetlands Protection Act
   - containing rare or endangered species habitat in isolated vegetated wetlands;
   - within a salt marsh;
   - dredging greater than 100 cubic yards.

   Will your water withdrawal require a 401 Permit? Yes [ ] No [x]

APPENDIX A

Department of Environmental Management
Office of Water Resources
Basin Plan Status, August 2000

BASIN	VOLUMES	UPDATES
Hudson River Basin	I, II, III*	
Ipswich River Basin (including communities in the North Coastal)	I, II, III	
Charles River Basin	I, II, summary draft III (never completed)	Demands
Concord River Basin	I; Short Hydrology	Some Demands
Blackstone River Basin	I; conceptual plan (3 versions)	Demands?
Nashua River Basin	I	Demands
Neponset River Basin	I; I,II,III combined plan	Demands
Taunton River Basin	I; I,II,III combined plan	Demands + inflow/outflow
North Coastal	I,II,III combined plan	
Mystic River Basin	Short Hydrology/Demands	
Ten Mile River Basin	Short Hydrology/Demands	
Weymouth-Weir Basin	Draft I; Short hydrology/demands	
South Coastal	Draft I; I,II,III combined plan	
Cape Cod	Basin plan	
Islands	Short Hydrology/Demands	
Deerfield River Basin	Short Hydrology/Demands	
Housatonic River Basin	Basin Plan	
Westfield River Basin	Short Hydrology/Demands	
Farmington River Basin	Short Hydrology (combined with Westfield) No Demands	
Millers River Basin	Short Hydrology/Demands	
Chicopee River Basin	Short Hydrology/Demands	
Connecticut River Basin	Short Hydrology/Demands	
Buzzards Bay	Basin Plan	
Parker	no plan	Demands only

*Unless otherwise noted, Volumes I, II and III make up a full basin plan

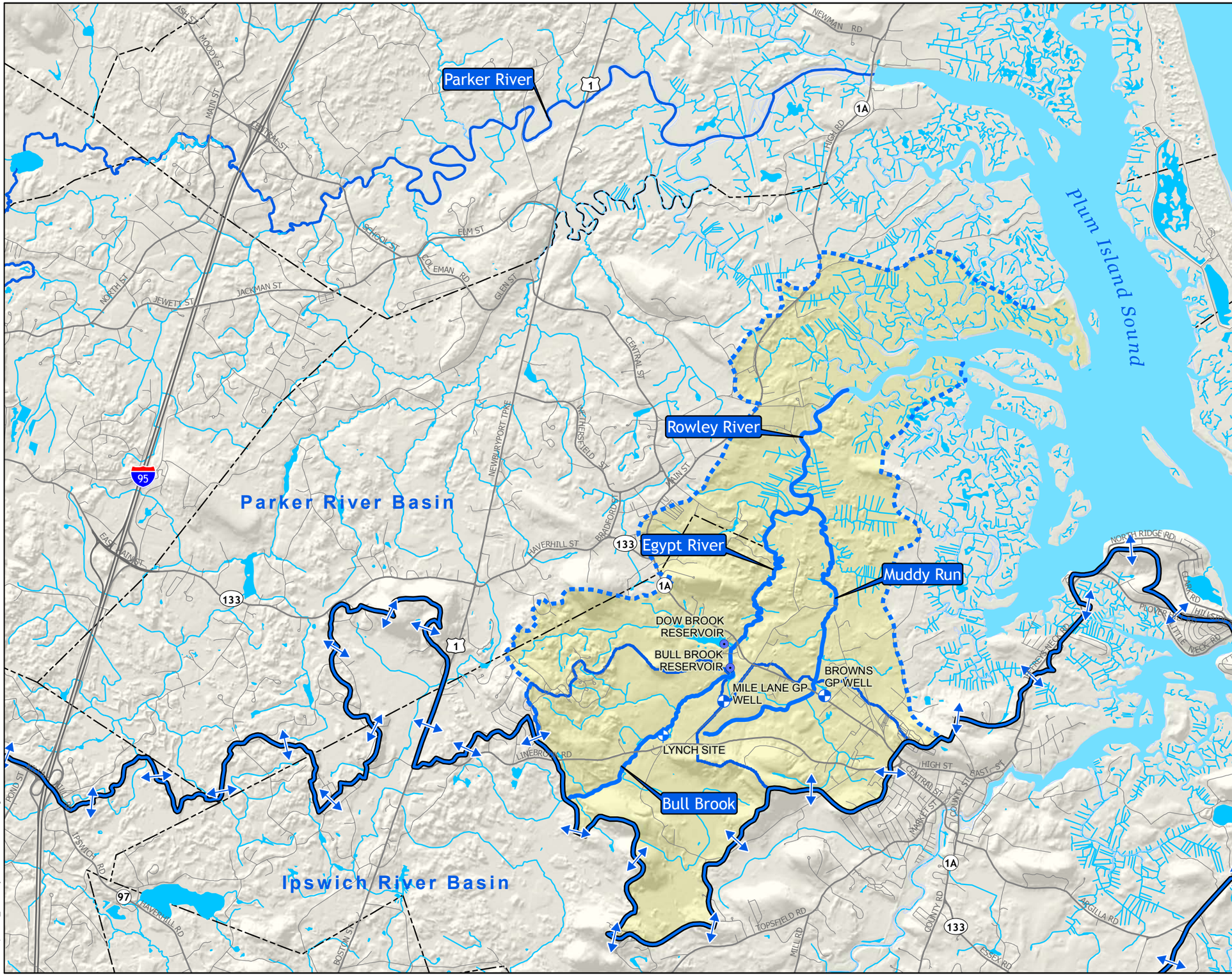
APPENDIX B

Supportive materials:

- Basin Plans (see Appendix A)
  Contact DEM / Office of Water Resources for further information.
- Outstanding Resource Waters (ORWs)
  Contact DEP Regional Office for further information.
- Stream indicators (7Q10 and August Median) and low flow statistics
  USGS Water Resources Data for Massachusetts
  USGS Gazetteers of Hydrologic Characteristics of Streams in Massachusetts
  USGS websites: http://ma.water.usgs.gov/basin
  http://ma.water.usgs.gov/streamstats
- References:
  - Jenkins, C.T., 1970 Computation of Rate and Volume of Stream Depletion By Wells. USGS Techniques of Water-Resources Investigations, Book 4, Chapter D1.
  - Barlow, P.M., 1999 USGS/ Documentation of Computer Program STRMDEPL – A Program to Calculate Streamflow Depletion by Wells Using Analytical Solutions. (Work in progress)
- NPDES sites
  Contact DEP / Watershed Permitting Program / Surface and Groundwater Sections

List of related programs and phone numbers:

EOEA Basin Team Leader Information ……..		617 727-9800
EOEA Community Preservation Buildout …….		617 626-1153
Massachusetts Natural Heritage Program		508 792-7270
MEPA		617 626-1020
MassGIS		617 727-5227
DEM/	Office of Water Resources	617 973-8755
	Water Resource Commission	617 626-1050
	Interbasin Transfer Act	617 973-8745
Army Corps of Engineers / 404 Permit		800 362-4367
DEP/	Boston switchboard	617 292-5500
	Western Region	413 784-1100
	Central Region	508 792-7650
	Northeast Region	978 661-7600
	Southeast Region	508 946-2700
	DEP Basin Chiefs, contact DEP regional offices	
	Water Management Program	617 292-5706
	Drinking Water Program	617 292-5770
	Wellhead Protection Program	617 556-1070
	Wetlands and Waterways	617 292-5695
	401 Water Quality Certification Program	617 292-5655
	Bureau of Waste Site Cleanup	617 292-5648
	DEP GIS	617 556-1115



AECOM Imagine it. Delivered.

Rowley River Basin

Basin Divide (MassGIS Major Basin Datalayer)

Existing Public Water Supply Well

Surface Water Supply Withdrawal

Lynch Site (Proposed Well)

Data supplied by MassGIS and USGS National Hydrography Dataset, 2017.

Figure 1

Rowley River Basin

Ipswich

0 2,000 4,000 8,000 Feet

StreamStats Output Report

State/Region ID	MA	
Workspace ID	MA20180319155203906000	
Latitude		42.69554
Longitude		-70.86997
Time		3/19/2018 11:52:17 AM

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	2.33	square miles
ELEV	Mean Basin Elevation	73.8	feet
LC06STOR	Percentage of water bodies and wetlands determined from the NLCD 2006	27.64	percent
DRFTPERSTR	Area of stratified drift per unit of stream length	0.18	square mile per mile
MAREGION	Region of Massachusetts 0 for Eastern 1 for Western	0	dimensionless
BSLDEM250	Mean basin slope computed from 1:250K DEM	2.764	percent
BSLDEM10M	Mean basin slope computed from 10 m DEM	5.875	percent
PCTSNDGRV	Percentage of land surface underlain by sand and gravel deposits	64.53	percent
FOREST	Percentage of area covered by forest	74.56	percent

Peak-Flow Statistics Parameters 100 Percent Peak Statewide 2016 5156

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.33	square miles	0.16	512
ELEV	Mean Basin Elevation	73.8	feet	80.6	1948
LC06STOR	Percent Storage from NLCD2006	27.64	percent	0	32.3

*** Peak-Flow Statistics Disclaimers ***

Warnings One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Peak-Flow Statistics Flow Report 100 Percent Peak Statewide 2016 5156

Statistic	Value	Unit
2 Year Peak Flood	42.1	ft^3/s
5 Year Peak Flood	69.6	ft^3/s
10 Year Peak Flood	91.3	ft^3/s
25 Year Peak Flood	122	ft^3/s
50 Year Peak Flood	148	ft^3/s
100 Year Peak Flood	174	ft^3/s
200 Year Peak Flood	203	ft^3/s

500 Year Peak Flood	243	ft^3/s	

Flow-Duration Statistics Paramete 100 Percent Statewide Low Flow WRIR00 4135

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.33	square miles	1.61	149
DRFTPERSTR	Stratified Drift per Stream Length	0.18	square mile per mil	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1
BSLDEM250	Mean Basin Slope from 250K DEM	2.764	percent	0.32	24.6

Flow-Duration Statistics Flow Rep 100 Percent Statewide Low Flow WRIR00 4135

PII: Prediction Interval- Lower, PIu: Prediction Interval- Upper, SEp: Standard Error of Prediction, SE: Standard Error (other-- see report)

Statistic	Value	Unit	PII	PIu	SE	SEp
50 Percent Duration	2.26	ft^3/s	0.915	5.56	17.6	17.6
60 Percent Duration	1.59	ft^3/s	0.663	3.77	19.8	19.8
70 Percent Duration	0.953	ft^3/s	0.413	2.17	23.5	23.5
75 Percent Duration	0.732	ft^3/s	0.316	1.68	25.8	25.8
80 Percent Duration	0.625	ft^3/s	0.262	1.47	28.4	28.4
85 Percent Duration	0.456	ft^3/s	0.187	1.1	31.9	31.9
90 Percent Duration	0.35	ft^3/s	0.138	0.866	36.6	36.6
95 Percent Duration	0.197	ft^3/s	0.0677	0.553	45.6	45.6
98 Percent Duration	0.124	ft^3/s	0.0369	0.392	60.3	60.3
99 Percent Duration	0.0887	ft^3/s	0.0248	0.299	65.1	65.1

Low-Flow Statistics Parameters 100 Percent Statewide Low Flow WRIR00 4135

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.33	square miles	1.61	149
BSLDEM250	Mean Basin Slope from 250K DEM	2.764	percent	0.32	24.6
DRFTPERSTR	Stratified Drift per Stream Length	0.18	square mile per mil	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1

Low-Flow Statistics Flow Report 100 Percent Statewide Low Flow WRIR00 4135

PII: Prediction Interval- Lower, PIu: Prediction Interval- Upper, SEp: Standard Error of Prediction, SE: Standard Error (other-- see report)

Statistic	Value	Unit	PII	PIu	SE	SEp
7 Day 2 Year Low Flow	0.199	ft^3/s	0.0649	0.588	49.5	49.5
7 Day 10 Year Low Flow	0.0808	ft^3/s	0.021	0.29	70.8	70.8

August Flow-Duration Statistics P 100 Percent Statewide Low Flow WRIR00 4135

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.33	square miles	1.61	149

BSLDEM250	Mean Basin Slope from 250K DEM	2.764	percent	0.32	24.6
DRFTPERSTR	Stratified Drift per Stream Length	0.18	square mile per mil	0	1.29
MAREGION	Massachusetts Region	0	dimensionless	0	1

August Flow-Duration Statistics Fl 100 Percent Statewide Low Flow WRIR00 4135

PIl: Prediction Interval- Lower, PIu: Prediction Interval- Upper, SEp: Standard Error of Prediction, SE: Standard Error (other-- see report)

Statistic	Value	Unit	PIl	PIu	SE	SEp
August 50 Percent Duration	0.482	ft^3/s	0.194	1.18	33.2	33.2

Bankfull Statistics Parameters 100 Percent Bankfull Statewide SIR2013 5155

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.33	square miles	0.6	329
BSLDEM10M	Mean Basin Slope from 10m DEM	5.875	percent	2.2	23.9

Bankfull Statistics Flow Report 100 Percent Bankfull Statewide SIR2013 5155

Statistic	Value	Unit	SEp
Bankfull Width	20.3	ft	21.3
Bankfull Depth	1.18	ft	19.8
Bankfull Area	23.7	ft^2	29
Bankfull Streamflow	60.6	ft^3/s	55

Probability Statistics Parameters 100 Percent Perennial Flow Probability

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2.33	square miles	0.01	1.99
PCTSNDGRV	Percent Underlain By Sand And Gravel	64.53	percent	0	100
FOREST	Percent Forest	74.56	percent	0	100
MAREGION	Massachusetts Region	0	dimensionless	0	1

*** Probability Statistics Disclaimers ***

Warnings One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Probability Statistics Flow Report 100 Percent Perennial Flow Probability

Statistic	Value	Unit
Probability Stream Flowing Peren	0.932	dim

Ipswich Water Department
Early Notice in Environmental Monitor of Request For Site Exam
April 20, 2018
Submitted by: Douglas De Natale, AECOM, Chelmsford, MA, 978-905-2180
doug.denatale@aecom.com

The Ipswich Water Department is applying to MADEP for a Request for Site Exam for siting a new public water-supply source to withdraw up to 0.58 mgd on average over the calendar year, with a maximum day capacity of approximately 0.86 mgd, from a coastal river basin in Ipswich. (For purposes of Water Management Act permitting, the well site is included in the Parker River basin.) The source is intended primarily to increase the Water Department's overall water-supply capacity and provide drought resiliency for the Town. The Town's existing groundwater supplies have lost capacity due to age and/or water quality, or are limited by permit; the reservoirs are sensitive to drought. The new supply is also intended to provide the Town with operational flexibility and redundancy. Under this project, the Town will not request an increase in its authorized withdrawal under the Water Management Act. The proposed source is on Town-owned land about 200 feet south of Bull Brook and 400 feet north of Linebrook Road in Ipswich.

Written comments on the granting of a DEP permit to conduct additional testing for a new water supply withdrawal are to be filed within thirty (30) days of publication of this notice in the Environmental Monitor. The written comments are to be submitted to the Drinking Water Program Section Chief at the DEP Northeast Regional Office at 205B Lowell Street, Wilmington, Massachusetts, 01887.