

Attachment H: Greenhouse Gas Analysis

***GREENHOUSE GAS ANALYSIS FOR THE
ABBYVILLE 40B DEVELOPMENT***

NORFOLK, MASSACHUSETTS

January 2018

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FOR THE ABBYVILLE 40B DEVELOPMENT
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1.0 INTRODUCTION AND SUMMARY

1.1 Methodology

A greenhouse gas (GHG) emissions analysis was performed for the Abbyville 40B development (the “Project”), a residential development in Norfolk, Massachusetts, consistent with the EEA “Greenhouse Gas Emissions Policy and Protocol” (May 5, 2010; the “Policy”). The Project consists of 56 duplex-style apartments (average area 1,150 sf) and 148 single-family homes (average area 2,088 sf). As discussed in Section 3.0, GHG emissions for the Project are reduced by the following building design and operational energy efficiency measures (EEMs):

- Higher insulation for building envelopes;
- Higher efficiency heating systems;
- Higher efficiency hot water heaters;
- Using interior lighting systems with a lower light power density;
- Installing Energy STAR appliances in the residential units;
- Using LED lighting for Project’s roadways and common areas;
- Sealing, insulating, and testing HVAC supply ducts;
- Installing programmable thermostats in the units;
- Using environmentally friendly building materials; and
- PV solar will be offered as an option for home buyers.

The building design is consistent with Energy STAR Certified Homes (version 3.1), as it applies in Massachusetts. The GHG Policy requires a project to quantify carbon dioxide (CO₂) emissions and identify measures to avoid, minimize or mitigate such emissions, quantifying the effect of proposed mitigation in terms of energy savings and emissions reduction. The Project’s GHG emissions will include: 1) direct emissions of CO₂ from natural gas combustion for space heating and domestic hot water; 2) indirect emissions of CO₂ from electricity generated off-site and used on-site for lighting, building cooling and ventilation, and the operation of other equipment; and 3) transportation emissions of CO₂ from Project traffic.

CO₂ emissions were quantified for: (1) the Base Case, and (2) the Mitigation Alternative, which includes all energy saving measures, see Section 3.3. Whereas Norfolk is not a Stretch Code community, the Base Case is the 9th Edition of the Massachusetts Residential Code (780 CMR 51), which is the IECC 2015 Residential Code with Massachusetts Amendments. This analysis uses the

eQUEST energy design software (version 3.65), which incorporates the DOE-2 building energy use model.

1.2 Summary of Results

The Proponent commits to the CO₂ reduction presented below, but retains the flexibility to achieve this goal using energy efficiency measures that may be refined at the stage of detailed design. Table 2D reveals that the Mitigation Alternative will reduce stationary sources CO₂ emissions by 13.5%, compared to the Base Case.

As discussed in Section 3.5, Transportation Demand Management (TDM) measures will reduce Project-related motor vehicle CO₂ emissions by a small amount, which has been rounded down to 0%. The net reduction of the Project's total CO₂ emissions (stationary sources plus transportation) is 12.0% compared to the Base Case.

1.3 Section 61 Findings

At the completion of construction, the Proponent will provide a certification to the MEPA Office, signed by an appropriate professional. The certification will state either of the following: (1) all of the energy efficiency mitigation measures adopted by the Project as part of the Mitigation Alternative have been implemented; or (2) an equivalent set of energy efficiency mitigation measures that are designed to achieve the same percentage reduction in CO₂ emissions as the Mitigation Alternative, based on the same modeling assumptions in this report, have been adopted or installed.

2.0 TRANSPORTATION GHG EMISSIONS

The transportation portion of the GHG analysis calculated emissions of CO₂ for the traffic study area for three traffic analysis scenarios:

- 2024 No-Build
- 2024 Build without TDMs
- 2024 Build with TDMs

The vehicle miles traveled (VMT) for the eight major roadway segments in the traffic study area was calculated by multiplying the length of each road segment by the average daily traffic (ADT) volume on the segment. Traffic volumes were provided by the Green International Affiliates' "Traffic Impact and Access Study" (April 2017), adjusted for the current building program. The CO₂ emissions for each roadway segment were calculated by multiplying the daily VMT by the EPA MOVES model CO₂ emission factors in grams per mile, using MOVES modeling files. Appendix B presents the VMT and emission calculations. Section 3.5 presents the proposed Transportation Demand Management (TDM) strategies to reduce vehicle trips.

Transportation CO₂ emissions are summarized in Table 1. The emissions listed for the 2024 No-Build and Build cases include both existing volumes on the roadway network and new project-generated trips. The project's transportation emissions are calculated by subtracting the 2024 No-Build values from those for the 2024 Build cases.

The 2024 Build with TDMs case is identical to the 2024 Build case because trip reduction measures for a low-density residential development not served by public transportation have very small effects (<1%) and cannot be accurately quantified. Thus, no credit is taken in the GHG analysis for the transportation mitigation measures discussed in Section 3.5.

TABLE 1
MOTOR VEHICLE CO₂ EMISSIONS SUMMARY
ABBYVILLE 40B DEVELOPMENT

<u>Total Predicted CO₂ Emissions Burden</u>		
<u>2024 No-Build</u>	<u>2024 Build without TDMs</u>	<u>2024 Build with TDMs</u>
2,090.42 kg/day	2,595.52 kg/day Project: 505.11 kg/day	2,595.52 kg/day Project: 505.11 kg/day
840.3 tons/yr	1,043.4 tons/year Project: 203.04 tons/year	1,043.4 tons/year Project: 203.04 tons/year

3.0 GREENHOUSE GAS (GHG) MITIGATION ANALYSIS

The GHG Policy requires that the Proponent identify measures to avoid, minimize, or mitigate GHG emissions. Section 3.1 presents the methodology and summary of results. Sections 3.2 through 3.5 discuss the Project's site, building design, and transportation mitigation measures.

3.1 Methodology and Results

A greenhouse gas (GHG) emissions analysis was performed for the Abbyville 40B development (the "Project"), a residential development in Norfolk, Massachusetts, consistent with the EEA "Greenhouse Gas Emissions Policy and Protocol" (May 5, 2010; the "Policy"). The Project consists of 56 duplex-style apartments (average area 1,150 sf) and 148 single-family homes (average area 2,088 sf).

The GHG Policy requires a project to quantify carbon dioxide (CO₂) emissions and identify measures to avoid, minimize or mitigate such emissions, quantifying the effect of proposed mitigation in terms of energy savings and emissions reduction. The GHG Policy requires quantification of GHG emissions from three sources: direct emissions from on-site stationary sources, indirect emissions from energy generated off-site (electricity), and traffic generated by the Project. The Project's GHG emissions will include: 1) direct emissions of CO₂ from natural gas combustion for space heating and hot water; 2) indirect emissions of CO₂ from electricity generated off-site and used on-site for lighting, building cooling and ventilation, and the operation of other equipment; and 3) transportation emissions of CO₂ from Project traffic.

CO₂ emissions were quantified for: (1) the Base Case, and (2) the Mitigation Alternative, which includes all energy saving measures, see Section 3.3. Whereas Norfolk is not a Stretch Code community, the Base Case is the 9th Edition of the Massachusetts Residential Code (780 CMR 51), which is the IECC 2015 Residential Code with Massachusetts Amendments.

This analysis uses the eQUEST energy design software (version 3.65), which incorporates the U.S. Department of Energy's DOE-2 building energy use model, and CO₂ emission rates of 117.1

lb/MMBtu cubic feet of natural gas¹ and 747 lb/MWhr.² The eQUEST model inputs are summarized in Tables 4 and 5. CO₂ mobile source emissions were calculated using the EPA MOVES model.

Energy use and CO₂ emissions are detailed for the single-family homes and duplex apartments in Tables 2A through 2D in Section 3.3, and the eQUEST model output is provided in Appendix A. Appendix B contains the transportation-related CO₂ emission calculations. Table 3 summarizes total CO₂ emissions for the Project, for the Base Case (buildings that comply with the Code), and the Mitigation Alternative (includes all energy saving measures). The eQUEST model input files have been provided to the Massachusetts Department of Energy Resources (DOER).

The Proponent commits to the CO₂ reduction presented below, but retains the flexibility to achieve this goal using energy efficiency measures that may be refined at the stage of detailed design. Table 3 reveals that the Mitigation Alternative will reduce stationary sources CO₂ emissions by 13.5%, compared to the Base Case. As discussed in Section 3.5, Transportation Demand Management (TDM) measures will reduce Project-related motor vehicle CO₂ emissions by a small amount, which has been rounded down to 0%. The net reduction of the Project's total CO₂ emissions (stationary sources plus transportation) is 12.0% compared to the Base Case.

¹ U.S. Department of Energy, Energy Information Administration.

² ISO New England Inc., 2015 New England Electric Generator Air Emissions Report, Annual Average Emission Rate, Table 1.1, November, 2016.

TABLE 2A
ENERGY AND CO₂ MODELING ABBYVILLE 40B DEVELOPMENT - SINGLE FAMILY HOMES
Effects of Individual Mitigation Measures

<i>Mitigation Measures - eQUEST Model Run</i>	GLA (sf)	Electrical Usage (MW/h/yr)	Electrical Change (%)	Gas Usage (Mcf/yr)	Gas Change (%)	Heating CO ₂ Emissions (tons/yr)	Electrical CO ₂ Emissions (tons/yr)	Total CO ₂ Emissions (tons/yr)	CO ₂ Emissions Change (%)
Base Case	2,088	16.08		43.88		2.57	6.01	8.58	
Higher Heating Efficiency		16.08	0.0%	41.85	-4.6%	2.45	6.01	8.46	-1.4%
Higher Efficiency Hot Water		16.08	0.0%	40.53	-7.6%	2.37	6.01	8.38	-2.3%
Lower Light Power Density		14.32	-10.9%	46.90	6.9%	2.75	5.35	8.09	-5.6%
Energy STAR Equipment		15.80	-1.7%	44.30	1.0%	2.59	5.90	8.50	-0.9%
Increased Wall Insulation		16.08	0.0%	42.42	-3.3%	2.48	6.01	8.49	-1.0%
Lower U Value for Window Glass		16.11	0.2%	41.43	-5.6%	2.43	6.02	8.44	-1.5%
Mitigation Alternative - All Measures Listed Above		14.08	-12.4%	38.01	-13.4%	2.23	5.26	7.48	-12.7%

Note: The results for one SF home are scaled up to 148 SF homes for the total Project.

TABLE 2B
ENERGY AND CO₂ MODELING FOR ABBYVILLE 40B DEVELOPMENT - DUPLEX APARTMENTS
Effects of Individual Mitigation Measures

<i>Mitigation Measures - eQUEST Model Run</i>	GLA (sf)	Electrical Usage (MW/h/yr)	Electrical Change (%)	Gas Usage (Mcf/yr)	Gas Change (%)	Heating CO ₂ Emissions (tons/yr)	Electrical CO ₂ Emissions (tons/yr)	Total CO ₂ Emissions (tons/yr)	CO ₂ Emissions Change (%)
Base Case	1,150	7.46		33.37		1.95	2.78	4.74	
Higher Heating Efficiency		7.46	0.0%	31.42	-5.8%	1.84	2.78	4.62	-2.4%
Higher Efficiency Hot Water		7.46	0.0%	31.47	-5.7%	1.84	2.78	4.63	-2.3%
Lower Light Power Density		6.51	-12.7%	35.23	5.6%	2.06	2.43	4.49	-5.1%
Energy STAR Equipment		7.31	-2.0%	33.62	0.7%	1.97	2.73	4.70	-0.9%
Increased Wall Insulation		7.45	0.0%	32.24	-3.4%	1.89	2.78	4.67	-1.4%
Lower U Value for Window Glass		7.46	0.1%	32.27	-3.3%	1.89	2.79	4.68	-1.3%
Mitigation Alternative - All Measures Listed Above		6.36	-14.7%	29.39	-11.9%	1.72	2.38	4.10	-13.5%

Note: The results for one duplex apartment are scaled up to 56 duplex apartments for the total Project.

TABLE 2C
ENERGY AND CO₂ FOR ABBYVILLE 40B DEVELOPMENT
Outdoor Lighting for Site Roadways and Common Areas

Mitigation Measures	Outdoor Area Lit (sf)	Electrical Usage (MWh/yr)	Electrical Change (%)	Gas Usage (Mcf/yr)	Gas Change (%)	Heating CO₂ Emissions (tons/yr)	Electrical CO₂ Emissions (tons/yr)	Total CO₂ Emissions (tons/yr)	CO₂ Emissions Change (%)
Base Case - ASHRAE Section 9.4.5, Zone 3, 0.100 W/sf	117,000	51.3		0.0		0.0	19.2	19.2	
Mitigation Alternative - LED Lights, 0.035 W/sf		17.9	-65.1%	0.0	0.0%	0.0	6.7	6.7	-65.1%

Annual electrical use assumes 4380 hours/year of outdoor lighting.

TABLE 2D
ENERGY AND CO₂ MODELING FOR ABBYVILLE 40B DEVELOPMENT
Totals for All Buildings and Outdoor Lighting

All Buildings - Combined Mitigation	Electrical Usage (MWh/yr)	Electrical Change (%)	Gas Usage (Mcf/yr)	Gas Change (%)	Heating CO₂ Emissions (tons/yr)	Electrical CO₂ Emissions (tons/yr)	Total CO₂ Emissions (tons/yr)	CO₂ Emissions Change (%)	Energy Use Change (%)
Base Case	2,848.7		8,363.0		489.7	1,064.0	1,553.6		
Mitigation Case	2,458.1	-13.7%	7,271.3	-13.1%	425.7	918.1	1,343.8	-13.5%	-13.4%

TABLE 3
GREENHOUSE GAS (CO₂) EMISSIONS SUMMARY
ABBYVILLE 40B DEVELOPMENT
(TONS/YEAR)

Source	Base Case	Mitigation Alternative	Change in GHG Emissions
Direct Emissions	489.7	425.7	-13.1%
Indirect Emissions	1,064.0	918.1	-13.7%
Subtotal Direct and Indirect Emissions	1,553.6	1,343.6	-13.5%
Transportation Emissions	203.0	203.0	0%
Total CO ₂ Emissions	1,756.6	1,546.6	-12.0%

3.2 Site Design Mitigation Measures

The Project will adopt all reasonable and feasible site design mitigation measures. The Project is committed to the following mitigation measures:

- ***Sustainable Development Principles*** – The development clusters duplex units and single-family homes on the developed portion of the site to conserve land.
- ***Minimize Water Use*** – Drought-resistant plant species will be used in landscaping around the residential units and no irrigation systems will be installed for planted beds in common areas.
- ***Minimize Energy Use Through Building Orientation*** – Residential units will face all possible directions, and approximately half the structures will have front or rear elevations facing south.
- ***Best Practices for Stormwater Design*** – To the extent possible, the stormwater management system will utilize Best Management Practices (BMP).

3.3 Building Design and Operation Mitigation Measures

The eQUEST energy model inputs are summarized in Tables 4 and 5. The Project's Base Case Energy Use Intensity (EUI) is compared to the Pacific Northwest National Laboratory (PNNL) prototype building EUI in Table 6, assuming the ASHRAE 90.1-2013 base code and climate zone 5. The PNNL prototype building is a mid-rise (4-story) apartment building and the closest match to the proposed residential structures. Note that the actual EUI will vary due to differences between the PNNL prototype building and the proposed buildings in terms of building size, number of floors, footprint, building materials, and window area.

- ***Energy Efficient Windows and Building Envelope*** – Building envelope insulation will exceed base code for wall insulation, and window glass, and will meet code for roof insulation in the ceiling above the top floor (R49). Energy modeling shows higher R60 roof insulation produces insignificant, less than 1%, change in energy use. Wall insulation will be R21 batt plus exterior sheathing (wall assembly U=0.058) and window glass will be double-pane, low-e glass, U=0.27. The building envelope design is consistent with the Program Requirements for Energy STAR Certified Homes in Massachusetts (v 3.1).
- ***Higher-Efficiency Heating and Cooling Systems*** – Heating will be provided by condensing gas furnaces with efficiency of 96.1% AFUE and cooling provided by split-system air conditioners with efficiency SEER=13.0. The heating, cooling and hot water appliances are consistent with the Program Requirements for Energy STAR Certified Homes in Massachusetts (v 3.1).

- ***Hot Water Heaters*** – The Base Case assumes gas-fired hot water heaters that comply with federal efficiency standards, which for a 50-gallon heater is Energy Factor (EF) of 0.60, and domestic hot water use of 21 gal/p/d. For the Mitigation Case, a higher efficiency of EF=0.72 is assumed.
- ***Seal, Test and Insulate HVAC Supply Ducts*** – HVAC supply ducts will be sealed, leak tested, and insulated to reduce energy losses.
- ***Energy Efficiency Incentives for Residential Projects*** – Both Eversource and Columbia Gas of Massachusetts offer MassSave incentives for energy-efficient design through the Massachusetts Residential New Construction Program (Low-Rise Path), which encourages projects to meet Energy STAR home certification design goals where practical. The building envelope, heating, cooling and hot water appliances proposed for this Project are consistent with Energy STAR Certified Homes in Massachusetts (v 3.1). The Proponent is pursuing these incentives.
- ***Programmable Thermostats*** – The residential buildings will have programmable thermostats to encourage energy savings during non-occupied hours. The Base Case set points for occupied and unoccupied time periods equal the eQUEST default values: Occupied (cool=76°, heat=70°), Unoccupied (cool=82°, heat=64°). The Mitigation and Base Case values are the same.
- ***Energy Efficient Exterior Lighting*** – Energy efficient LED fixtures will be used to light outdoor common areas and Project roadways.
- ***Energy Efficient Interior Lighting*** – Interior lighting will use CFL and LED lamps to reduce light power density to 0.20 W/SF (whole building method).
- ***Energy STAR Appliances*** – Energy STAR appliances will be used in residential units to reduce plug load, and a 10% energy reduction is credited for this measure.
- ***Use Building Materials with Recycled Content, Building Materials that are Manufactured Within the Region, Use Rapidly Renewable Building Materials, and Use Low-VOC Building Materials*** – Whenever practical, the Project will use environmentally friendly building materials, including materials with recycled content, rapidly renewable building materials, and low-VOC materials. Also when practical, the Project will purchase building materials that are manufactured within the region.

Other building design and operation mitigation measures were considered for the Project, but were rejected because they are either technically/financially infeasible or inappropriate for the Project:

- ***Reduce Energy Demand by Using Peak Shaving or Load Shifting Strategies*** – These measures are not appropriate for residential buildings that must use power during peak periods.
- ***Combined Heat and Power (CHP)*** – CHP requires a host for the constant (year-round) and substantial waste heat generated as part of the process. The Project's thermal loads are relatively low and seasonal only, making CHP economically infeasible.

TABLE 4
SUMMARY OF ENERGY MODELING ASSUMPTIONS
SINGLE FAMILY AND DUPLEX RESIDENTIAL BUILDINGS

Energy Efficiency Measure (EEM)	Base Case (Code)¹	Mitigation Case
Building Envelope (Wood-framed 16" OC, 2x6 cavity)	Roof R49 Wall Assembly U=0.060	Roof R49 ² Wall Assembly U=0.058
Window Glass	U=0.30, DOE Type 2631	U=0.27 DOE Type 2632
Gas Furnace Efficiency	80% AFUE	96% AFUE
Split-System Air Conditioner Efficiency	SEER 13.0	SEER 13.0
Gas-Fired (50 gal) Hot Water Heater	Storage Tank Heater EF = 0.60	Storage Tank Heater EF = 0.72
Light Power Density (Whole Bldg. Method)	0.55 W/SF	0.20 W/SF
Electric Plug Load	0.30 W/SF	10% reduction for Energy STAR appliances
Common Area and Roadway Lighting	Lighting Zone 3 100 W/1,000 SF	LED 35 W/1,000 SF

¹ IECC 2015 Residential Code with Massachusetts Amendments and complies with current federal efficiency standards for residential heating, cooling and hot water appliances (10 CMR 430.32).

² Higher R60 roof insulation produces insignificant, less than 1%, change in energy use.

TABLE 5
SUMMARY OF ACTIVITY AREAS

Building Name Floor Area (sf)	eQUEST Activity Type	% Floor Area
Single Family or Duplex Residential	Residential	100.0

TABLE 6
**COMPARISON OF eQUEST BASE CASE ENERGY USE INTENSITY
TO PNNL PROTOTYPE BUILDING EUI FOR THE ASHRAE 90.1-2013 CODE**

Building Uses	Base Case EUI (kBtu/SF)	Mitigation Case EUI (kBtu/SF)	PNNL EUI (kBtu/SF) ¹
100% Residential			
SF homes	47.3	41.2 (-12.9%)	55.2
Duplex homes	51.1	44.4 (-13.1%)	

¹ PNNL values are ASHRAE 90.1-2013 Base, Climate Zone 5 for a mid-rise (4-story) apartment building.

3.4 Additional Energy Mitigation Measures

The potential for alternative and renewable energy sources to be incorporated into the Project has been examined. The following energy efficiency measures will be studied further at the stage of detailed building design:

Rooftop Photovoltaic (PV) Solar –

All of the residential buildings have sloped roofs. PV panels will be offered as an option that a buyer can add to the home; it will not be a standard feature. The area needed for a PV system is calculated based on 10 kW/1,000 sf of useable roof area. Assuming each residential building (single-family or duplex) has 2,000 sf of roof area and half of the buildings that have north-south facing roofs provide 1,000 sf of south-facing roof area, then each such building could host a 10-kW PV system. Of the 176 residential structures (148 single-family homes, 28 duplex structures), we assume half will have north-south facing roofs, and thus the potential PV installed capacity for the Project is 880 kW, consisting of 88 separate 10-kW residential-sized systems.

The cost feasibility analysis assumes the new DOER SMART program, uses the most recent data from the Massachusetts Energy and Environmental Affairs (EEA) website on Qualified Generation Units,³ and follows guidance from DOER on cost feasibility modeling under the SMART program rules.⁴ The average installed cost for 9 to 10 kW installations starting commercial operation in 2015-2017 is \$4.51 per Watt; this figure includes data posted through January 2017. The installed cost for a single 10-kW residential PV system is estimated at \$45,100.

DOER has replaced SREC incentives with the Solar Massachusetts Renewable Target (SMART) Program, and new regulations were filed with the Secretary of State on August 11, 2017 (225 CMR 20). The anticipated program start-up is in early 2018. Under the new SMART program, instead of SREC payments, a 10-year fixed price is set for projects less than 25-kW in size, and the fixed rate is calculated from the incentive price in an initial auction for larger systems. As a preliminary estimate, DOER has provided estimated the 10-year fixed rate for a 10-kW PV system will be \$0.30/kWh, to which \$0.05/kWh is added for a building-mounted system and a low-income property owner. Depending on the outcome of the initial auction, the actual rates may be different.

A 10-kW PV system is projected to generate 10,326 kWh per year,⁵ which equates to 3.8 tons per year⁶ in GHG emissions reductions. If 88 residential systems were installed, the annual Full Build Mitigation Case CO₂ emissions (Table 4) by 25% = 100% * 334.4 / 1,343.6.

³ <http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/qualified-generation-units.html>.

⁴ Personal communication, Paul Ormond, DOER, July 26, 2017.

⁵ Personal communication, Natalie Howlett, Renewable Energy Project Coordinator, Massachusetts DOER. This figure is 0.2 times 51,632 kWh/year for a 50 kW system.

⁶ Annual PV system electrical generation is 10.3 MWh. Multiplying by the ISO New England emission factor of 747 lb CO₂ per MWh and dividing by 2,000 lb/ton yields an annual CO₂ emission reduction of 3.8 tons/year.

The economics of a PV installation were calculated using the EEA 2015 Revised SREC II Financial Model (model output is in Appendix C), with the following assumptions:

- PV system size of 10 kW
- System cost of \$4.51/Watt
- Financing used for 50% of the system cost.
- No REC payments
- Annual capacity factor of 13.6%
- Electricity revenue of \$0.35/kWh for 10 years

The customer discount rate is defined as the interest rate of return that could be earned in an investment in the financial markets with similar risk. At present, a 20-year U.S. Treasury bond pays in the range of 2-3%; that is the lowest risk investment possible and is not comparable to the risk of investing in a PV system. Corporate bond rates are 3% to 7%, depending on their investment grade.

This analysis assumed a reasonable customer discount rate of 6%. The calculations assume federal tax credits, State tax deductions and SREC values.

For a 10-kW system, the calculated Net Present Value of the PV system is \$2,402. The positive NPV suggests a PV system on the roof of a residential unit is cost feasible. Actual savings for a homeowner will depend on the terms of available financing at the time of purchase. The proponent is offering home buyers in the Project an option to add a PV solar rooftop system to the home.

Cold Climate Air Source Heat Pumps – This section provides an evaluation of cold-climate air source heat pumps (ASHPs). Thermal AECs are available to subsidize some of the equipment cost. The estimated annual AEC income from thermal AECs was calculated using the EEA formula in the “Guideline on Metering and Calculating the Useful Thermal Output of Eligible Renewable Thermal Generation Units – Part 1,” June 8, 2016, Formula 3(E):

$$\text{Annual Income} = (2.5 + (1.63 \times [(Floor_Area - 1500)/1000])) \times 3 \times \$20$$

The calculated annual income totals are as follows and if certain conditions are met the full 10-year income may be available as a lump sum (that figure is in parentheses):

Single-Family House	\$ 207	(\$2,070)
Duplex Apartment	\$ 116	(\$1,160)

An analysis of energy and GHG emission changes associated with heat pumps was done by re-running eQUEST for the Mitigation Case and substituting air source heat pumps for the split-system air conditioners and the gas furnaces. (The eQUEST model output is provided in Appendix A). To ensure a fair comparison, the same cooling EER value for the Mitigation Case was assumed (SEER 13.0). The heat pump was assumed to have an HSPF better than the base code (HSPF=10.0) because HSPF=10 is the minimum value required by the NEEP Cold Climate ASHP Specification v2 (January 2017).

The calculated change in annual energy use (MWhr of electricity and MMBtu of gas) and CO₂ emissions (tons per year, tpy) from using ASHPs are:

Single-Family House	+0.99 MWhr	-19.4 MMBtu	-0.77 tpy
Duplex Apartment	+1.41 MWhr	-19.0 MMBtu	-0.59 tpy

For the Project, use of ASHPs in 148 single-family homes and in 56 duplex apartments would increase electricity use by 226 MWhr/year, would reduce gas use by 3,935 MMBtu per year, and would result in a decrease of 147 tons/year in Mitigation Case CO₂ emissions. Using the latest commercial fuel cost figures from the EIA for Massachusetts of \$154.20/MWhr and \$9.99/MMBtu-gas, using ASHPs would slightly decrease total energy costs for a single-family home (-\$41/year) and slightly increase total energy costs for a duplex apartment (+\$28/year). ASHPs will be considered during the actual MEP design for the project.

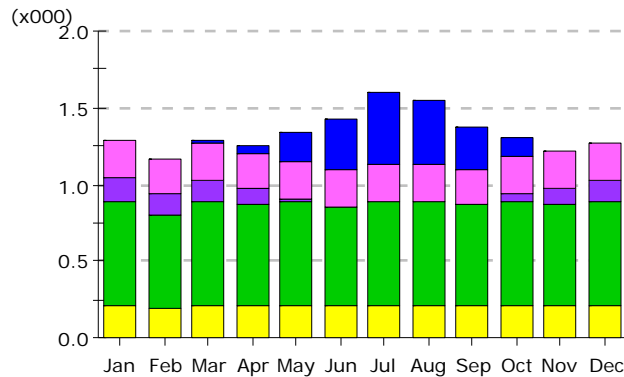
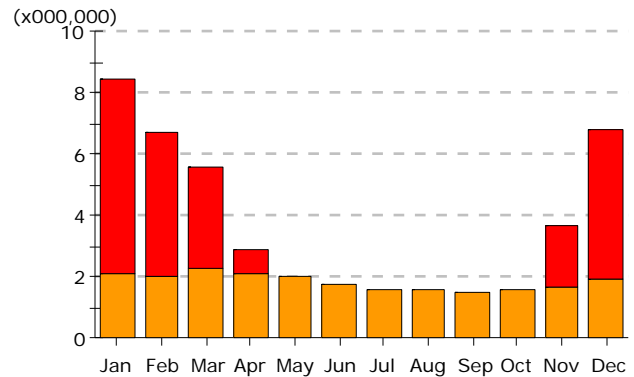
3.5 Transportation Mitigation Measures

There is no fixed-route public transportation serving the Project area, and typical Transportation Demand Management (TDM) measures used for commercial developments do not apply to a low-density residential development. The Proponent is committed to the following transportation mitigation measures. While no studies exist to quantify the trip reduction from mitigation measures for a residential development, we believe the measures listed below in aggregate will reduce vehicle trips by a small number. Since that small reduction (< 1%) cannot be accurately quantified, no reduction in trips or CO₂ transportation emissions is assumed in the analysis.

- ***Roadway Improvements***– The Project will provide off-site roadway improvements on Lawrence, park and Main Streets (improving sight distances, repaving and adding signage), as described in the Green International Affiliates’ traffic impact and access study.
- ***Parking Capacity*** – The Project’s parking design is sized to meet, but not exceed, local parking requirements.
- ***Provide Bicycle Storage*** – Secure bicycle racks will be provided at the Central Common and the Boathouse to encourage residents to bicycle within the development and not drive.
- ***Boathouse On-Site*** – The on-site boathouse with its recreational opportunities for Bush Pond will reduce the number of off-site trips by the residents.

APPENDIX A

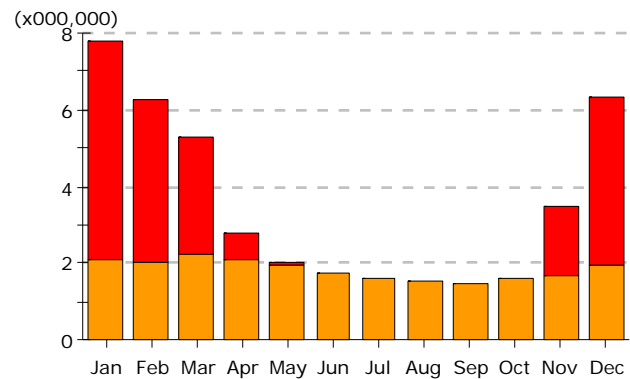
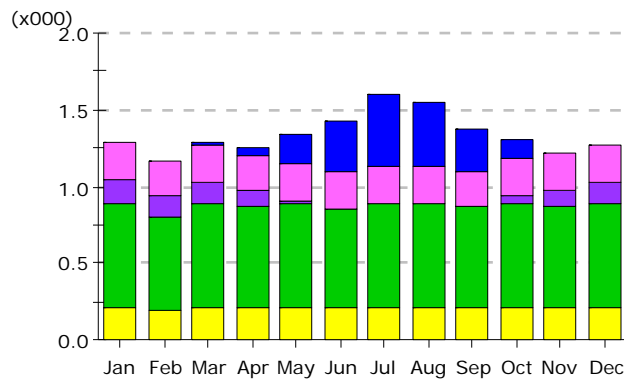
EQUEST MODEL OUTPUT

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.00	0.00	0.02	0.05	0.19	0.33	0.46	0.41	0.28	0.13	0.01	0.00	1.88
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	0.25	0.22	0.24	0.24	0.24	0.23	0.25	0.24	0.24	0.24	0.24	0.25	2.87
Pumps & Aux.	0.14	0.13	0.14	0.11	0.02	-	-	-	0.00	0.04	0.12	0.14	0.85
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.68	0.61	0.68	0.66	0.68	0.66	0.68	0.68	0.66	0.68	0.66	0.68	7.97
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.21	0.19	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	2.50
Total	1.28	1.16	1.29	1.26	1.35	1.42	1.59	1.54	1.38	1.30	1.22	1.27	16.08

Gas Consumption (Btu x000,000)

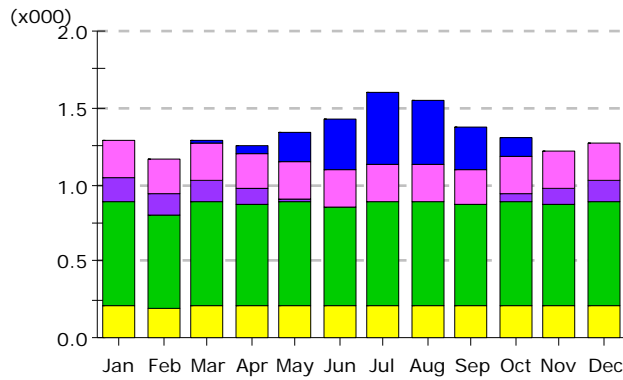
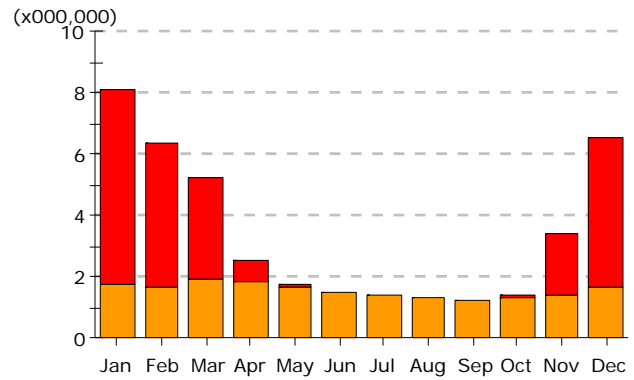
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	6.31	4.67	3.32	0.75	0.03	0.00	-	0.00	0.01	0.03	1.95	4.88	21.95
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	2.08	2.00	2.26	2.11	1.98	1.74	1.60	1.52	1.45	1.57	1.68	1.93	21.92
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	8.39	6.67	5.57	2.86	2.01	1.75	1.60	1.52	1.46	1.61	3.63	6.81	43.88

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.00	0.00	0.02	0.05	0.19	0.33	0.46	0.41	0.28	0.13	0.01	0.00	1.88
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	0.25	0.22	0.24	0.24	0.24	0.23	0.25	0.24	0.24	0.24	0.24	0.25	2.87
Pumps & Aux.	0.14	0.13	0.14	0.11	0.02	-	-	-	0.00	0.04	0.12	0.14	0.85
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.68	0.61	0.68	0.66	0.68	0.66	0.68	0.68	0.66	0.68	0.66	0.68	7.97
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.21	0.19	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	2.50
Total	1.28	1.16	1.29	1.26	1.35	1.42	1.59	1.54	1.38	1.30	1.22	1.27	16.08

Gas Consumption (Btu x000,000)

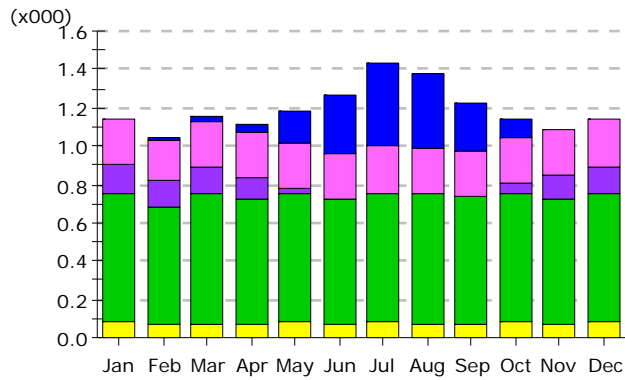
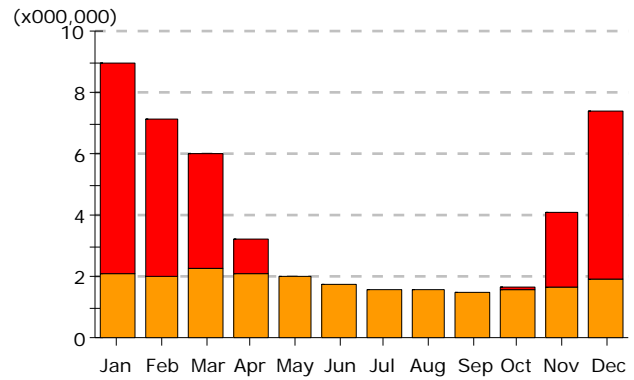
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	5.73	4.24	3.01	0.68	0.03	0.00	-	0.00	0.01	0.03	1.77	4.43	19.92
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	2.08	2.00	2.26	2.11	1.98	1.74	1.60	1.52	1.45	1.57	1.68	1.93	21.92
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	7.81	6.24	5.27	2.79	2.01	1.75	1.60	1.52	1.46	1.60	3.45	6.36	41.85

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.00	0.00	0.02	0.05	0.19	0.33	0.46	0.41	0.28	0.13	0.01	0.00	1.88
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	0.25	0.22	0.24	0.24	0.24	0.23	0.25	0.24	0.24	0.24	0.24	0.25	2.87
Pumps & Aux.	0.14	0.13	0.14	0.11	0.02	-	-	-	0.00	0.04	0.12	0.14	0.85
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.68	0.61	0.68	0.66	0.68	0.66	0.68	0.68	0.66	0.68	0.66	0.68	7.97
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.21	0.19	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	2.50
Total	1.28	1.16	1.29	1.26	1.35	1.42	1.59	1.54	1.38	1.30	1.22	1.27	16.08

Gas Consumption (Btu x000,000)

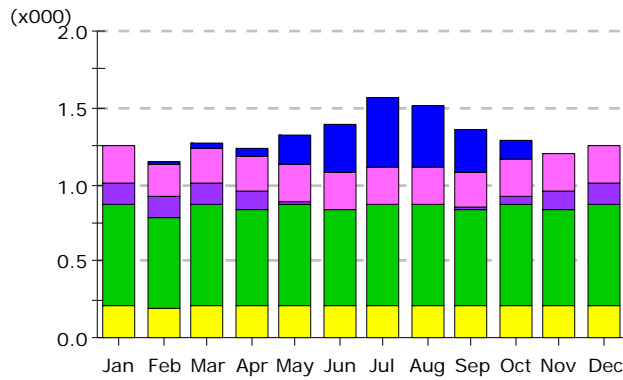
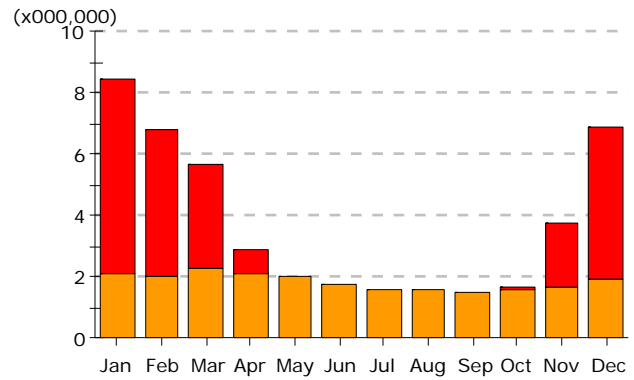
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	6.31	4.67	3.32	0.75	0.03	0.00	-	0.00	0.01	0.03	1.95	4.88	21.95
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.76	1.69	1.91	1.79	1.68	1.48	1.35	1.29	1.23	1.33	1.43	1.64	18.58
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	8.08	6.36	5.23	2.54	1.71	1.48	1.35	1.29	1.24	1.37	3.37	6.52	40.53

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.00	0.00	0.02	0.04	0.17	0.30	0.43	0.39	0.25	0.10	0.01	0.00	1.73
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	0.24	0.22	0.24	0.24	0.24	0.23	0.24	0.24	0.24	0.24	0.24	0.24	2.85
Pumps & Aux.	0.15	0.13	0.14	0.11	0.02	-	-	-	0.00	0.05	0.12	0.14	0.85
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.68	0.61	0.68	0.66	0.68	0.66	0.68	0.68	0.66	0.68	0.66	0.68	7.97
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.08	0.07	0.08	0.07	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.91
Total	1.14	1.04	1.15	1.12	1.19	1.27	1.43	1.38	1.22	1.15	1.09	1.14	14.32

Gas Consumption (Btu x000,000)

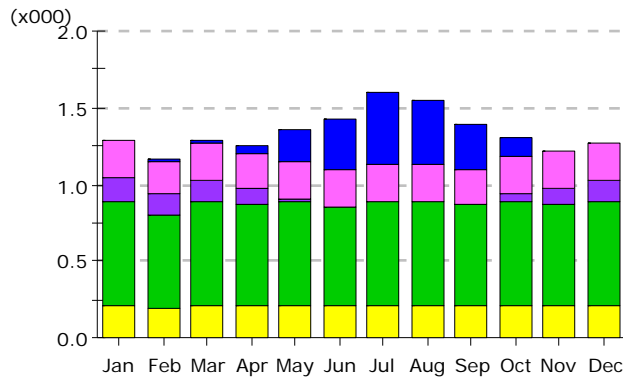
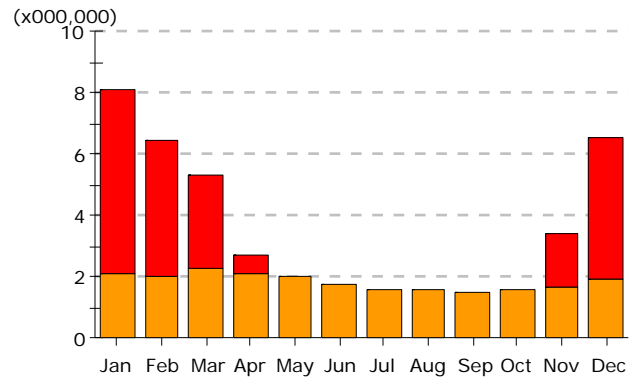
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	6.90	5.17	3.78	1.07	0.06	0.01	0.00	0.00	0.01	0.07	2.44	5.46	24.97
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	2.08	2.00	2.26	2.11	1.98	1.74	1.60	1.52	1.45	1.57	1.68	1.93	21.93
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	8.97	7.17	6.04	3.18	2.04	1.75	1.60	1.53	1.46	1.64	4.13	7.40	46.90

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.00	0.00	0.02	0.05	0.19	0.33	0.45	0.41	0.28	0.12	0.01	0.00	1.86
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	0.24	0.22	0.24	0.24	0.24	0.23	0.24	0.24	0.24	0.24	0.24	0.24	2.86
Pumps & Aux.	0.14	0.13	0.14	0.11	0.02	-	-	-	0.00	0.04	0.12	0.14	0.85
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.66	0.59	0.66	0.64	0.66	0.64	0.66	0.66	0.64	0.66	0.64	0.66	7.73
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.21	0.19	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	2.50
Total	1.26	1.14	1.27	1.24	1.32	1.40	1.57	1.51	1.36	1.28	1.20	1.25	15.80

Gas Consumption (Btu x000,000)

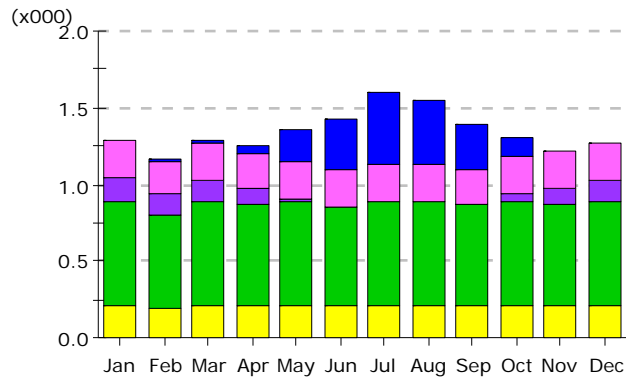
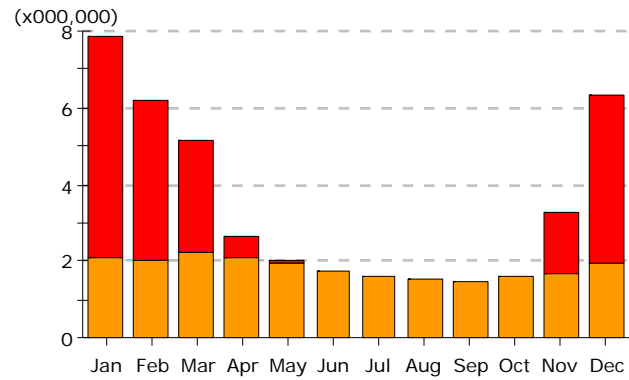
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	6.40	4.74	3.38	0.79	0.03	0.00	0.00	0.00	0.01	0.04	2.02	4.96	22.38
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	2.08	2.00	2.26	2.11	1.98	1.74	1.60	1.52	1.45	1.57	1.68	1.93	21.92
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	8.48	6.74	5.64	2.90	2.01	1.75	1.60	1.53	1.46	1.62	3.70	6.89	44.30

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.00	0.00	0.03	0.05	0.20	0.33	0.46	0.41	0.28	0.13	0.01	0.00	1.91
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	0.24	0.22	0.24	0.23	0.24	0.23	0.24	0.24	0.23	0.24	0.23	0.24	2.85
Pumps & Aux.	0.14	0.13	0.14	0.11	0.02	-	-	-	0.00	0.04	0.12	0.14	0.85
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.68	0.61	0.68	0.66	0.68	0.66	0.68	0.68	0.66	0.68	0.66	0.68	7.97
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.21	0.19	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	2.50
Total	1.28	1.16	1.29	1.26	1.35	1.42	1.59	1.54	1.38	1.31	1.22	1.27	16.08

Gas Consumption (Btu x000,000)

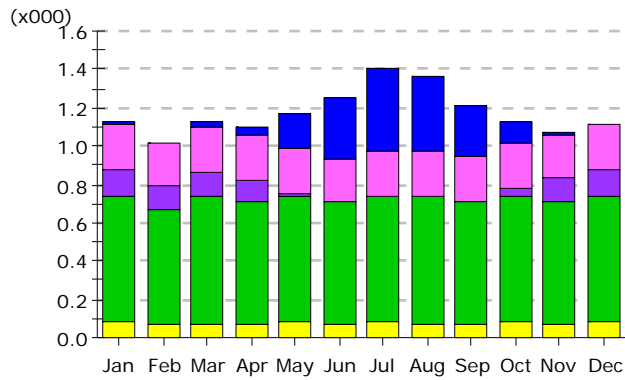
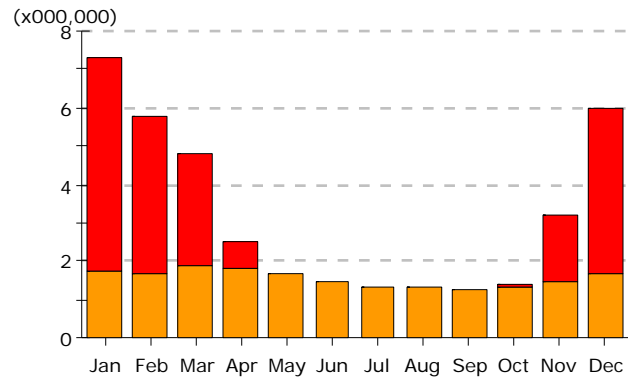
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	5.99	4.40	3.08	0.63	0.01	0.01	0.00	0.00	0.01	0.02	1.75	4.59	20.49
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	2.08	2.00	2.26	2.11	1.98	1.74	1.60	1.52	1.45	1.57	1.68	1.93	21.92
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	8.07	6.40	5.34	2.74	1.99	1.75	1.60	1.52	1.46	1.59	3.43	6.52	42.42

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.00	0.00	0.03	0.05	0.20	0.34	0.46	0.42	0.29	0.13	0.01	0.00	1.94
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	0.24	0.22	0.24	0.24	0.24	0.23	0.24	0.24	0.24	0.24	0.24	0.24	2.85
Pumps & Aux.	0.14	0.13	0.14	0.11	0.02	-	-	-	0.00	0.04	0.12	0.14	0.85
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.68	0.61	0.68	0.66	0.68	0.66	0.68	0.68	0.66	0.68	0.66	0.68	7.97
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.21	0.19	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.21	0.21	0.21	2.50
Total	1.28	1.16	1.29	1.26	1.35	1.43	1.60	1.55	1.39	1.31	1.22	1.27	16.11

Gas Consumption (Btu x000,000)

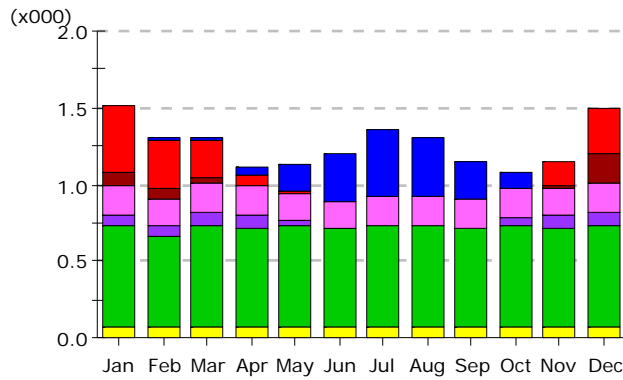
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	5.76	4.22	2.92	0.54	0.01	0.01	0.00	0.00	0.01	0.02	1.61	4.40	19.51
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	2.08	2.00	2.26	2.11	1.98	1.74	1.60	1.52	1.45	1.57	1.68	1.93	21.92
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	7.84	6.22	5.18	2.65	1.99	1.75	1.60	1.53	1.46	1.59	3.29	6.33	41.43

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh x000)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.00	0.00	0.02	0.05	0.18	0.31	0.43	0.39	0.26	0.12	0.01	0.00	1.78
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	0.24	0.22	0.24	0.23	0.24	0.23	0.24	0.24	0.23	0.24	0.23	0.24	2.81
Pumps & Aux.	0.14	0.13	0.14	0.11	0.02	-	-	-	0.00	0.05	0.12	0.14	0.85
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.66	0.59	0.66	0.64	0.66	0.64	0.66	0.66	0.64	0.66	0.64	0.66	7.73
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.08	0.07	0.08	0.07	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.91
Total	1.12	1.02	1.13	1.10	1.17	1.25	1.41	1.36	1.21	1.13	1.07	1.11	14.08

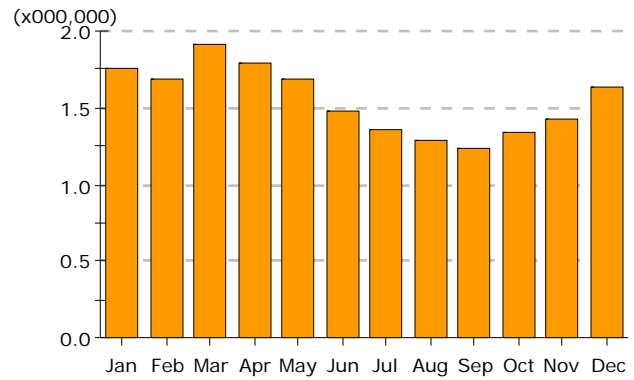
Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	5.55	4.09	2.92	0.69	0.02	0.00	0.00	0.00	0.01	0.03	1.78	4.34	19.43
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.76	1.69	1.91	1.79	1.68	1.48	1.35	1.29	1.23	1.33	1.43	1.64	18.58
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	7.31	5.78	4.83	2.48	1.70	1.48	1.36	1.29	1.23	1.36	3.20	5.97	38.01

Electric Consumption (kWh)

Area Lighting
Task Lighting
Misc. Equipment

Exterior Usage
Pumps & Aux.
Ventilation Fans

Gas Consumption (Btu)

Water Heating
Ht Pump Supp.
Space Heating

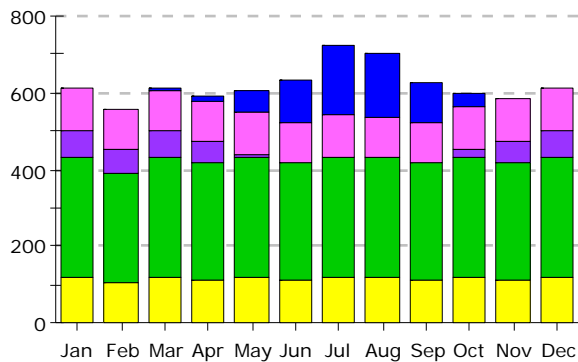
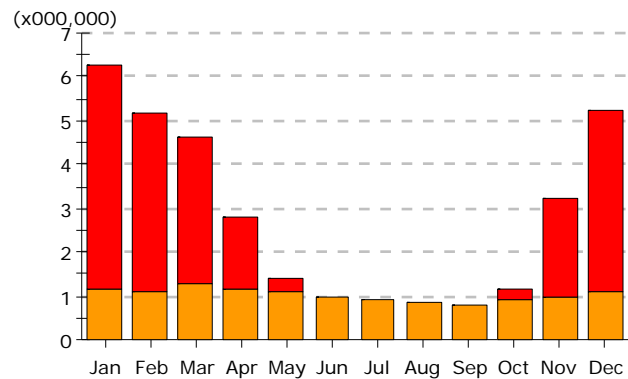
Refrigeration
Heat Rejection
Space Cooling

Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.00	0.00	0.02	0.05	0.17	0.30	0.42	0.38	0.25	0.11	0.01	0.00	1.72
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.43	0.32	0.24	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.30	1.51
HP Supp.	0.09	0.07	0.04	0.00	0.00	-	-	-	-	-	0.02	0.19	0.40
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	0.19	0.17	0.19	0.19	0.19	0.18	0.19	0.19	0.19	0.19	0.19	0.19	2.25
Pumps & Aux.	0.06	0.07	0.08	0.09	0.02	-	-	-	0.00	0.05	0.08	0.08	0.55
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	0.66	0.59	0.66	0.64	0.66	0.64	0.66	0.66	0.64	0.66	0.64	0.66	7.73
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	0.08	0.07	0.08	0.07	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.91
Total	1.51	1.30	1.30	1.10	1.12	1.20	1.35	1.30	1.15	1.08	1.15	1.49	15.07

Gas Consumption (Btu x000,000)

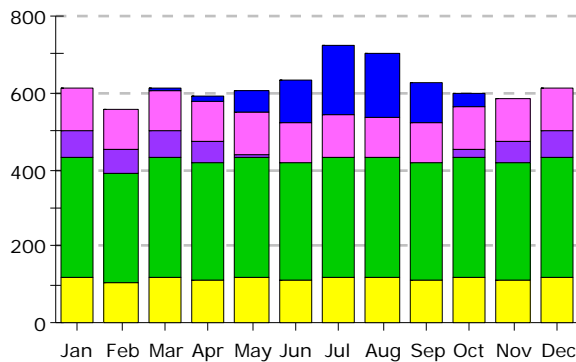
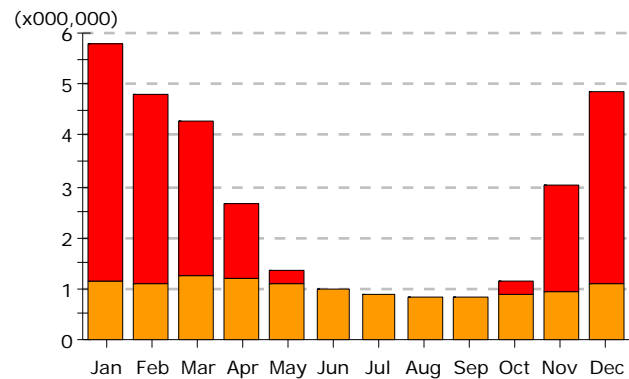
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.76	1.69	1.91	1.79	1.68	1.48	1.35	1.29	1.23	1.33	1.43	1.64	18.58
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1.76	1.69	1.91	1.79	1.68	1.48	1.35	1.29	1.23	1.33	1.43	1.64	18.58

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	2.9	8.9	56.9	115.5	180.8	163.7	100.1	34.9	0.6	-	664.2
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	111.3	99.8	109.1	107.2	109.8	105.8	111.3	109.1	107.2	110.6	107.2	111.3	1,299.8
Pumps & Aux.	72.7	67.2	69.6	56.2	12.3	-	-	-	1.5	23.3	59.8	68.7	431.2
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	312.6	282.5	313.0	302.7	312.9	302.9	312.7	313.0	302.7	312.7	302.6	312.7	3,683.2
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	117.9	105.8	115.7	113.6	116.5	112.3	117.8	115.7	113.7	117.1	113.7	117.9	1,377.7
Total	614.5	555.4	610.4	588.6	608.4	636.5	722.6	701.6	625.2	598.6	583.9	610.6	7,456.2

Gas Consumption (Btu x000,000)

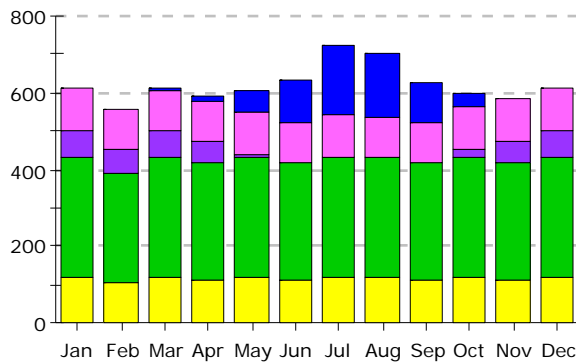
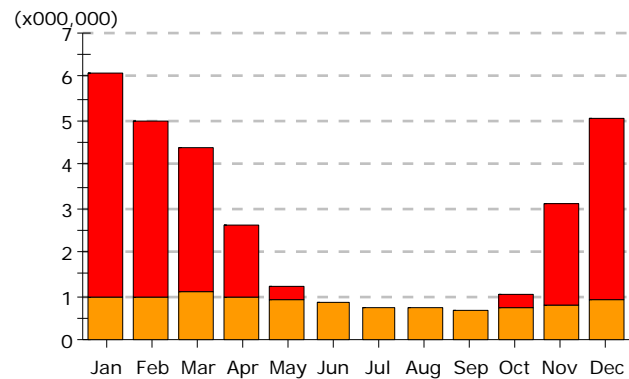
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	5.08	4.06	3.34	1.61	0.26	0.01	0.00	0.00	0.01	0.27	2.29	4.15	21.07
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.17	1.12	1.26	1.18	1.11	0.98	0.90	0.85	0.81	0.88	0.95	1.08	12.29
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	6.24	5.18	4.60	2.79	1.37	0.98	0.90	0.86	0.82	1.15	3.23	5.24	33.37

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	2.9	8.9	56.9	115.5	180.8	163.7	100.1	34.9	0.6	-	664.2
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	111.3	99.8	109.1	107.2	109.8	105.8	111.3	109.1	107.2	110.6	107.2	111.3	1,299.8
Pumps & Aux.	72.7	67.2	69.6	56.2	12.3	-	-	-	1.5	23.3	59.8	68.7	431.2
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	312.6	282.5	313.0	302.7	312.9	302.9	312.7	313.0	302.7	312.7	302.6	312.7	3,683.2
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	117.9	105.8	115.7	113.6	116.5	112.3	117.8	115.7	113.7	117.1	113.7	117.9	1,377.7
Total	614.5	555.4	610.4	588.6	608.4	636.5	722.6	701.6	625.2	598.6	583.9	610.6	7,456.2

Gas Consumption (Btu x000,000)

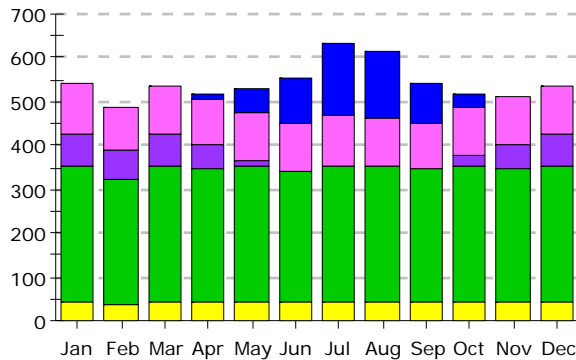
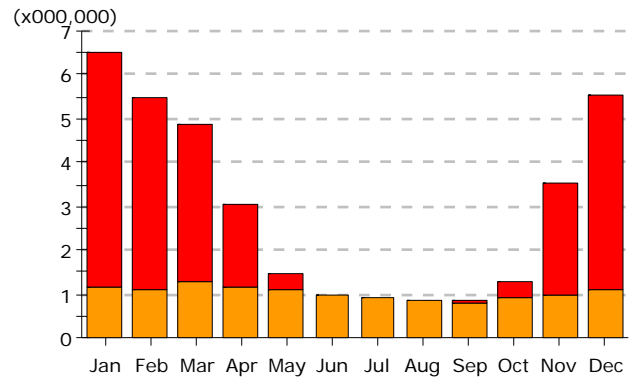
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	4.61	3.69	3.03	1.46	0.24	0.01	0.00	0.00	0.00	0.24	2.07	3.77	19.13
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.17	1.12	1.26	1.18	1.11	0.98	0.90	0.85	0.81	0.88	0.95	1.08	12.29
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	5.77	4.81	4.29	2.64	1.35	0.98	0.90	0.86	0.82	1.13	3.02	4.86	31.42

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	2.9	8.9	56.9	115.5	180.8	163.7	100.1	34.9	0.6	-	664.2
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	111.3	99.8	109.1	107.2	109.8	105.8	111.3	109.1	107.2	110.6	107.2	111.3	1,299.8
Pumps & Aux.	72.7	67.2	69.6	56.2	12.3	-	-	-	1.5	23.3	59.8	68.7	431.2
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	312.6	282.5	313.0	302.7	312.9	302.9	312.7	313.0	302.7	312.7	302.6	312.7	3,683.2
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	117.9	105.8	115.7	113.6	116.5	112.3	117.8	115.7	113.7	117.1	113.7	117.9	1,377.7
Total	614.5	555.4	610.4	588.6	608.4	636.5	722.6	701.6	625.2	598.6	583.9	610.6	7,456.2

Gas Consumption (Btu x000,000)

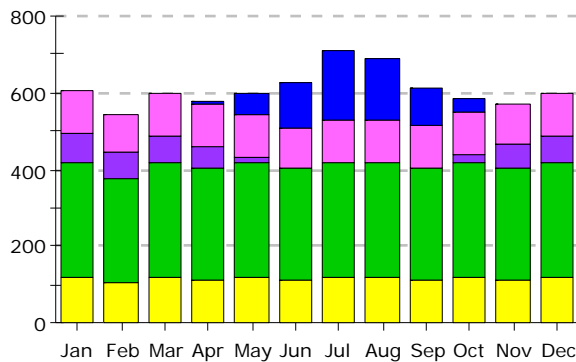
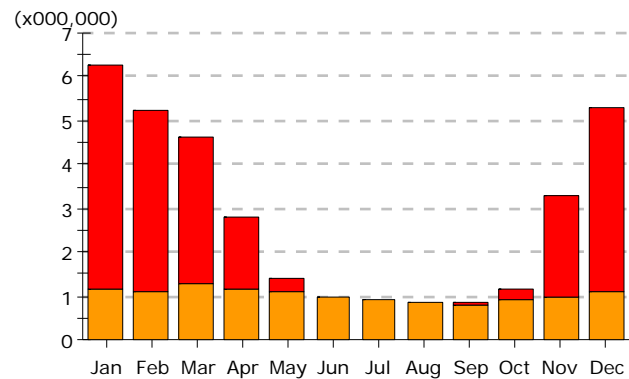
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	5.08	4.06	3.34	1.61	0.26	0.01	0.00	0.00	0.01	0.27	2.29	4.15	21.07
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.99	0.95	1.07	1.00	0.94	0.83	0.76	0.72	0.69	0.75	0.80	0.92	10.40
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	6.06	5.01	4.40	2.61	1.20	0.83	0.76	0.73	0.69	1.02	3.09	5.07	31.47

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	2.4	7.2	49.5	103.8	166.9	150.7	87.9	28.7	0.4	-	597.5
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	111.2	99.8	109.0	107.1	109.8	105.7	111.2	109.0	107.1	110.5	107.1	111.2	1,298.8
Pumps & Aux.	72.7	67.2	69.7	56.5	12.3	-	-	-	1.5	23.4	59.8	68.7	431.8
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	312.6	282.5	313.0	302.7	312.9	302.9	312.7	313.0	302.7	312.7	302.6	312.7	3,683.2
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	42.9	38.5	42.1	41.3	42.3	40.8	42.8	42.1	41.3	42.6	41.3	42.9	501.0
Total	539.4	488.0	536.3	514.9	526.8	553.3	633.6	614.9	540.6	517.8	511.4	535.5	6,512.4

Gas Consumption (Btu x000,000)

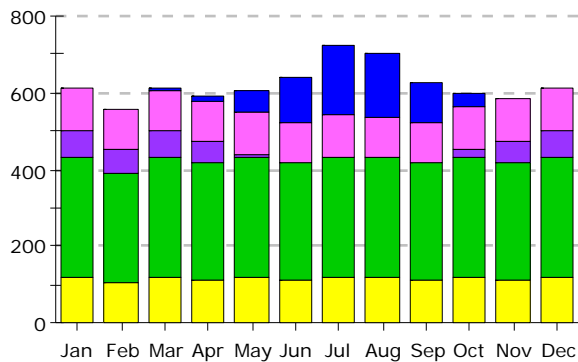
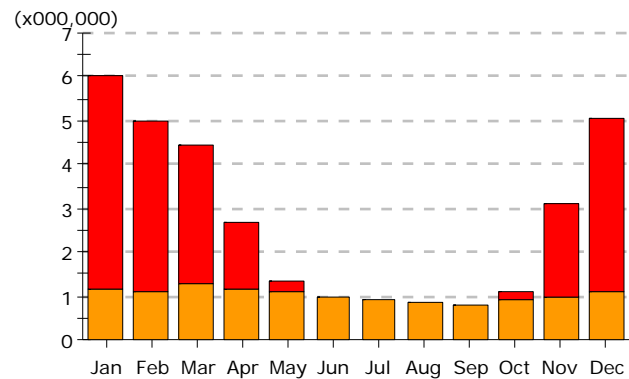
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	5.38	4.33	3.61	1.85	0.34	0.01	0.00	0.00	0.01	0.37	2.58	4.45	22.93
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.17	1.12	1.26	1.18	1.11	0.98	0.90	0.85	0.81	0.89	0.95	1.08	12.30
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	6.54	5.45	4.87	3.03	1.45	0.98	0.90	0.86	0.82	1.25	3.52	5.54	35.23

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	2.7	8.4	55.7	113.8	178.6	161.7	98.3	33.9	0.5	0.0	653.7
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	110.9	99.5	108.8	106.9	109.5	105.4	110.9	108.8	106.9	110.2	106.9	110.9	1,295.3
Pumps & Aux.	72.7	67.2	69.6	56.2	12.3	-	-	-	1.5	23.3	59.8	68.7	431.4
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	301.2	272.2	301.6	291.6	301.5	291.9	301.3	301.6	291.7	301.3	291.6	301.3	3,548.7
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	117.9	105.8	115.7	113.6	116.5	112.3	117.8	115.7	113.7	117.1	113.7	117.9	1,377.7
Total	602.7	544.7	598.5	576.7	595.4	623.4	708.6	687.8	612.1	585.8	572.5	598.8	7,306.9

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	5.12	4.11	3.37	1.64	0.27	0.00	0.00	0.00	0.01	0.28	2.33	4.20	21.33
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.17	1.12	1.26	1.18	1.11	0.98	0.90	0.85	0.81	0.88	0.95	1.08	12.30
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	6.28	5.23	4.64	2.82	1.38	0.98	0.90	0.86	0.82	1.17	3.27	5.28	33.62

Electric Consumption (kWh)**Gas Consumption (Btu)**

Area Lighting
 Exterior Usage
 Water Heating
 Refrigeration

Task Lighting
 Pumps & Aux.
 Ht Pump Supp.
 Heat Rejection

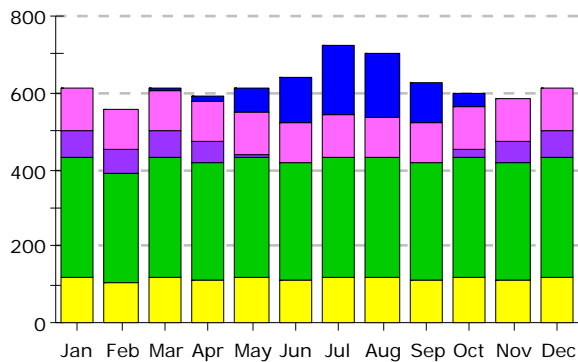
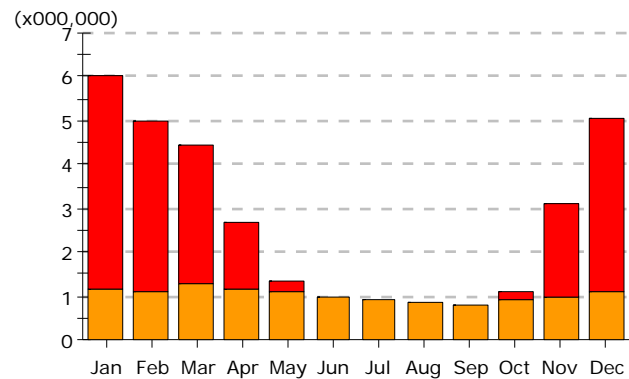
Misc. Equipment
 Ventilation Fans
 Space Heating
 Space Cooling

Electric Consumption (kWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.0	-	3.1	9.4	57.9	116.7	181.8	165.0	102.1	36.8	0.7	-	673.4
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	110.2	98.9	108.1	106.2	108.8	104.8	110.2	108.1	106.2	109.5	106.2	110.2	1,287.4
Pumps & Aux.	72.7	67.2	69.5	56.2	12.3	-	-	-	1.5	23.1	59.8	68.7	431.0
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	312.6	282.5	313.0	302.7	312.9	302.9	312.7	313.0	302.7	312.7	302.6	312.7	3,683.2
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	117.9	105.8	115.7	113.6	116.5	112.3	117.8	115.7	113.7	117.1	113.7	117.9	1,377.7
Total	613.4	554.4	609.6	588.1	608.3	636.7	722.5	701.8	626.2	599.2	583.0	609.5	7,452.8

Gas Consumption (Btu x000,000)

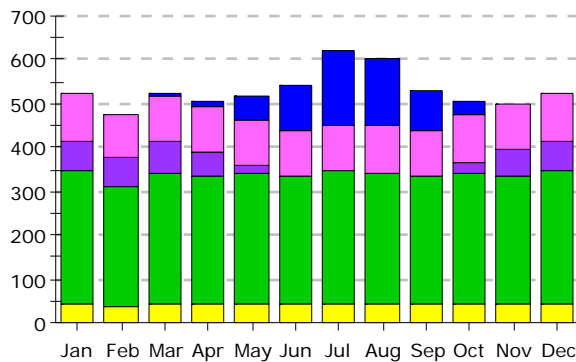
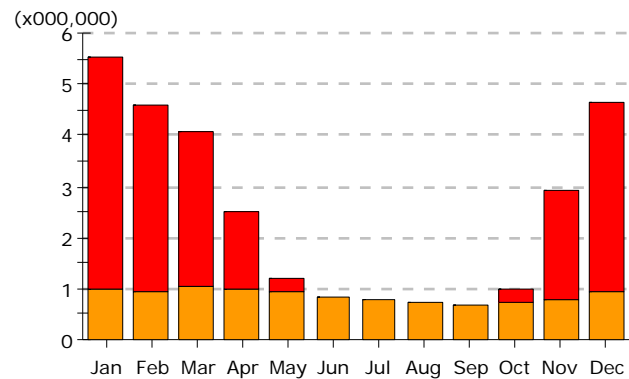
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	4.86	3.88	3.16	1.49	0.23	0.01	0.01	0.01	0.01	0.22	2.13	3.95	19.95
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.17	1.12	1.26	1.18	1.11	0.98	0.90	0.85	0.81	0.88	0.95	1.08	12.29
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	6.02	5.00	4.43	2.68	1.34	0.98	0.90	0.86	0.82	1.11	3.08	5.04	32.24

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	3.3	9.8	58.6	117.6	182.8	165.9	102.7	37.2	0.7	-	678.6
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	110.5	99.1	108.4	106.5	109.1	105.1	110.5	108.4	106.5	109.8	106.5	110.5	1,290.8
Pumps & Aux.	72.7	67.2	69.4	56.1	12.3	-	-	-	1.5	23.1	59.7	68.7	430.7
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	312.6	282.5	313.0	302.7	312.9	302.9	312.7	313.0	302.7	312.7	302.6	312.7	3,683.2
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	117.9	105.8	115.7	113.6	116.5	112.3	117.8	115.7	113.7	117.1	113.7	117.9	1,377.7
Total	613.7	554.7	609.9	588.7	609.3	637.9	723.8	703.0	627.1	599.9	583.3	609.8	7,461.1

Gas Consumption (Btu x000,000)

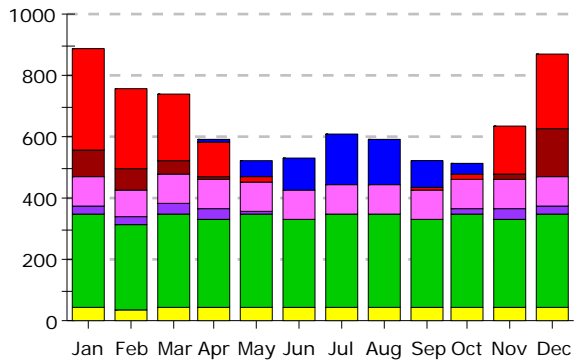
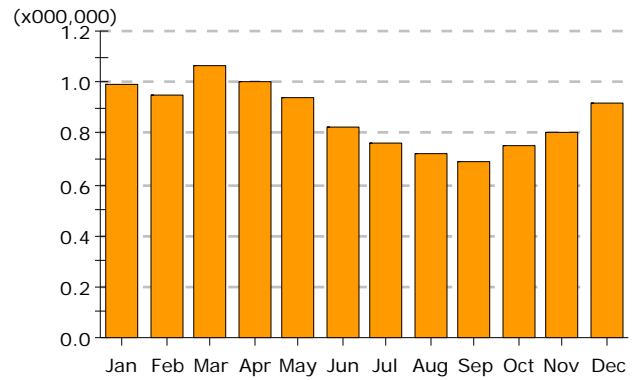
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	4.86	3.88	3.17	1.50	0.23	0.01	0.00	0.01	0.01	0.22	2.13	3.96	19.98
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	1.17	1.12	1.26	1.18	1.11	0.98	0.90	0.85	0.81	0.88	0.95	1.08	12.29
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	6.03	5.00	4.43	2.68	1.34	0.98	0.90	0.86	0.82	1.11	3.08	5.05	32.27

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	2.9	8.2	50.8	105.1	167.6	152.1	90.5	31.1	0.5	-	608.8
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	109.0	97.8	106.9	105.0	107.6	103.6	109.0	106.9	105.0	108.3	105.0	109.0	1,272.8
Pumps & Aux.	72.7	67.2	69.6	56.4	12.3	-	-	-	1.5	23.3	59.8	68.7	431.6
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	301.2	272.2	301.6	291.6	301.5	291.9	301.3	301.6	291.7	301.3	291.6	301.3	3,548.7
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	42.9	38.5	42.1	41.3	42.3	40.8	42.8	42.1	41.3	42.6	41.3	42.9	501.0
Total	525.7	475.6	523.0	502.6	514.5	541.4	620.6	602.6	530.1	506.6	498.3	521.8	6,362.8

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	4.52	3.63	3.00	1.50	0.26	0.00	0.00	0.00	0.00	0.26	2.10	3.73	18.99
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.99	0.95	1.07	1.00	0.94	0.83	0.76	0.72	0.69	0.75	0.80	0.92	10.40
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	5.51	4.57	4.07	2.50	1.19	0.83	0.76	0.73	0.69	1.00	2.90	4.64	29.39

Electric Consumption (kWh)**Gas Consumption (Btu)****Electric Consumption (kWh)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	2.7	7.8	50.7	105.4	168.8	153.3	90.6	30.9	0.5	0.0	610.8
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	332.2	267.7	222.2	111.3	21.2	1.1	0.8	0.9	1.7	21.9	156.8	240.1	1,378.0
HP Supp.	84.8	64.7	43.8	8.1	0.4	-	-	-	-	0.3	18.2	156.3	376.6
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	98.0	87.9	96.1	94.4	96.7	93.2	98.0	96.1	94.4	97.4	94.4	98.0	1,144.6
Pumps & Aux.	28.2	29.4	34.6	34.1	9.0	-	-	-	1.5	19.0	30.7	31.2	217.8
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	301.2	272.2	301.6	291.6	301.5	291.9	301.3	301.6	291.7	301.3	291.6	301.3	3,548.7
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	42.9	38.5	42.1	41.3	42.3	40.8	42.8	42.1	41.3	42.6	41.3	42.9	501.0
Total	887.3	760.3	743.2	588.7	521.9	532.4	611.7	594.0	521.3	513.3	633.6	869.7	7,777.5

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.99	0.95	1.07	1.00	0.94	0.83	0.76	0.72	0.69	0.75	0.80	0.92	10.40
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	0.99	0.95	1.07	1.00	0.94	0.83	0.76	0.72	0.69	0.75	0.80	0.92	10.40

APPENDIX B

WORKSHEETs FOR VMT, VOC, NO_x AND CO₂ EMISSIONS

TABLE B-1
Vehicle Miles Traveled (VMT) in the Traffic Study Area
Abbyville 40B Development

Link I.D.	Link Length (feet)	Link Descriptor	Average Daily Traffic (ADT) (vehicles/day)			Vehicle Miles Traveled (VMT) (miles/day)		
			2024 No-Build	2024 Full Build w/o mitigation	2024 Full Build w/mitigation*	2024 No-Build	2024 Full Build w/o mitigation	2024 Full Build w/mitigation*
1	1,330	Lawrence Street between Site Drive #1 and Site Drive #2	1,050	1,708	1,708	264.5	430.2	430.2
2	1,100	Lawrence Street between Site Drive #2 and Park Street	1,050	2,686	2,686	218.8	559.6	559.6
3	1,280	Park Street between Lawrence Street and Maple Street	3,970	4,609	4,609	962.4	1,117.3	1,117.3
4	4,390	Park Street between Lawrence Street and Main Street	5,680	6,677	6,677	4,722.6	5,551.5	5,551.5
			VMT (miles/day):			6,168.2	7,658.7	7,658.7

*Trip reduction measures for a low-density residential development not served by public transportation have very small (<1%) effects

TABLE B-2
Mesoscale Study Area
Total Daily Carbon Dioxide (CO₂) Emissions
Abbyville 40B Development

Link I.D.	CO ₂ Emission Rate	Vehicle Miles Traveled (VMT) (miles/day)			Mesoscale CO ₂ Emissions (kg/day)		
	(grams/mile)	2024 No-Build	2024 Full Build w/o mitigation	2024 Full Build w/mitigation*	2024 No-Build	2024 Full Build w/o mitigation	2024 Full Build w/mitigation*
1	338.90	264	430	430	89.6	145.8	145.8
2	338.90	219	560	560	74.1	189.6	189.6
3	338.90	962	1,117	1,117	326.2	378.7	378.7
4	338.90	4,723	5,552	5,552	1,600.5	1,881.4	1,881.4
		Total Daily CO₂ Emissions (kg/day):			2,090.42	2,595.52	2,595.52

*Trip reduction measures for a low-density residential development not served by public transportation have very small (<1%) effects.

APPENDIX C

PV COST CALCULATION SPREADSHEETS

Solar Photovoltaic Project Simple Financial Model

RPS Solar Carve-Out II Program v1.0

DATA ENTRY AND FINANCIAL SUMMARY

Key Entry Cells Calculation Cells (Not for Entry)

Select Taxable or Non-Taxable Entity

Project and Customer Cost Assumptions

Solar Photovoltaic System Size Total System Cost w/ at Total System Cost

REC Rebate Assumptions

Rebate's per kW at Total Rebate

Project Performance and Savings/ Cost Assumptions

Annual Net Electricity Export Annual Production Derivation Project Life Electricity Revenue (Avoided Costs) Electricity Revenue (Avoided Costs) Annual Adjustor Solar Renewable Energy Certificate (SREC) Auction Price SREC Term (in Quarters) SREC Revenue Annual Adjustor SREC Contract Price SREC Contract Term Post-SREC Term REC Value Annual Operations and Maintenance Cost Factor Annual Operations and Maintenance Cost Annual Operations and Maintenance Adjustor Future Inverter Replacement Cost Inverter Life, Replace Every X Years

Pre-populated entries in these cells are for sample purposes only and do not reflect information or opinions of DOER. Users should enter values that are specific to their own projects or market information.

Tax Assumptions

Federal Tax Rate State Tax Rate Effective Tax Rate Federal Tax Credit State Tax Deduction 5 Year Accelerated Depreciation Schedule (MACRS) Depreciation Asset Basis Gross Cost Rebate Less 50% of Federal Tax Credit

Asset Basis Financing Assumptions

% Financial w/ Cash % Financial w/ Loan Loan Interest Rate Loan Period Net Cost Customer Discount Rate Loan

Solar Project Financial Analysis Summary

Net Present Value Simple Payback (100% Cash only) Estimated Return on Equity

Disclaimer: This Unofficial Cash Flow Model is intended to provide non-residential entities that are considering the purchase and installation of solar energy equipment with a general understanding of possible financial implications of such purchase and installation. Those entities interested in learning more about the financial implications of the purchase and installation of solar energy equipment are urged to consult their own tax and financial experts. The information contained in the Unofficial Cash Flow Model may not be relied on by anyone for any purposes. Furthermore, the information contained in this model does not necessarily reflect the views of the Department of Energy Resources or the Commonwealth of Massachusetts, and reference to any specific method does not constitute an implied or expressed recommendation or endorsement of it. Neither the Department of Energy Resources nor the Commonwealth of Massachusetts make any warranties or representations, expressed or implied, as to the usefulness, completeness, or accuracy of any processes, methods or other information contained, described, disclosed, or referred to in this model. Finally, neither the Department of Energy Resources nor the Commonwealth of Massachusetts makes any representation that the use of any product, apparatus, process, method, or other information will not infringe privately owned property rights and assumes no liability of any kind or nature for any loss, injury, or damage directly or indirectly resulting from, or occurring in connection with, the use of information contained, described, disclosed, or referred to in this Unofficial Cash Flow Model.

Solar Photovoltaic Project Simple Financial Model
PRO FORMA AND PRODUCTION

Project Output	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14													
Annual Generation (MWh)		11,914	11,854	11,795	11,736	11,677	11,619	11,561	11,503	11,445	11,388	-	-	-	-													
FINANCIAL SCHEDULES																												
INCOME STATEMENT																												
Electricity Revenue (Avoided Cost)	\$	-	\$	4,170	\$	4,149	\$	4,128	\$	4,108	\$	4,087	\$	4,067	\$	4,006	\$	3,986	\$	-	\$	-	\$	-	\$	-	\$	-
CEC Rebate	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
SREC Auction Revenue	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
SREC Contract Revenue	\$	-	\$	4,170	\$	4,149	\$	4,128	\$	4,108	\$	4,087	\$	4,067	\$	4,046	\$	4,026	\$	4,006	\$	3,986	\$	-	\$	-	\$	-
Total Revenue (Avoided Costs)	\$	-	\$	4,170	\$	4,149	\$	4,128	\$	4,108	\$	4,087	\$	4,067	\$	4,046	\$	4,026	\$	4,006	\$	3,986	\$	-	\$	-	\$	-
Replace Inverter?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Operations & Maintenance Costs	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Inverter Replacement Cost	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Total Operating Expenses	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
EBITDA	\$	4,170	\$	4,149	\$	4,087	\$	4,067	\$	4,026	\$	4,006	\$	3,986	\$	3,966	\$	3,946	\$	3,926	\$	3,906	\$	3,886	\$	3,866	\$	3,846
Federal Depreciation Expense	\$	(7,667)	\$	(12,267)	\$	(7,300)	\$	(4,416)	\$	(4,416)	\$	(2,209)	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Interest Expense	\$	(3,497)	\$	(8,118)	\$	(3,429)	\$	(329)	\$	(329)	\$	1,858	\$	4,067	\$	4,006	\$	4,026	\$	4,006	\$	4,006	\$	4,006	\$	4,006	\$	4,006
EBIT	\$	(1,579)	\$	(1,540)	\$	(1,303)	\$	(1,408)	\$	(1,455)	\$	(1,357)	\$	(1,249)	\$	(1,183)	\$	(1,117)	\$	(1,047)	\$	(971)	\$	(890)	\$	(803)	\$	(716)
Federal taxes saved/(paid)	\$	(5,076)	\$	(9,659)	\$	(4,731)	\$	(1,763)	\$	(1,737)	\$	501	\$	2,743	\$	2,822	\$	(2,131)	\$	(1,047)	\$	(971)	\$	(890)	\$	(803)	\$	(716)
State taxes saved/(paid)	\$	1,867	\$	3,472	\$	1,748	\$	710	\$	702	\$	(61)	\$	(864)	\$	(899)	\$	746	\$	340	\$	281	\$	311	\$	281	\$	251
State taxes saved/(paid) [can not deduct federal depreciation expense]	\$	(259)	\$	(261)	\$	(263)	\$	(265)	\$	(268)	\$	(271)	\$	(274)	\$	(279)	\$	(282)	\$	(283)	\$	(285)	\$	(287)	\$	(289)	\$	(291)
Net Income	\$	(3,468)	\$	(6,447)	\$	(3,246)	\$	(1,319)	\$	(1,303)	\$	160	\$	1,605	\$	1,627	\$	1,651	\$	(680)	\$	(631)	\$	(578)	\$	(522)	\$	(472)
CASH FLOW STATEMENT																												
Cash Flow From Operations																												
Net Income	\$	(3,468)	\$	(6,447)	\$	(3,246)	\$	(1,319)	\$	(1,303)	\$	160	\$	1,605	\$	1,627	\$	1,651	\$	(680)	\$	(631)	\$	(578)	\$	(522)	\$	(472)
Federal Depreciation Expense	\$	7,667	\$	12,267	\$	7,300	\$	4,416	\$	4,416	\$	2,208	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Cash Flow From Operations	\$	4,199	\$	5,820	\$	4,114	\$	3,098	\$	3,113	\$	2,358	\$	1,605	\$	1,627	\$	1,651	\$	(680)	\$	(631)	\$	(578)	\$	(522)	\$	(472)
Cash Flow From Investing																												
Installed PV Cost	\$	(45,100)																										
One Time State Solar Investment Tax Deduction (Actual Cash Value)	\$	3,157																										
One Time Federal Solar Investment Tax Credit	\$	13,330																										
Cash Flow From Investing	\$	(28,613)	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Cash Flow From Financing																												
Loan Disbursement	\$	22,550	\$	(589)	\$	(589)	\$	(630)	\$	(674)	\$	(721)	\$	(771)	\$	(825)	\$	(883)	\$	(945)	\$	(1,011)	\$	(1,082)	\$	(1,159)	\$	(1,239)
Loan Repayment (Principal)	\$	(550)	\$	(550)	\$	(589)	\$	(630)	\$	(674)	\$	(721)	\$	(771)	\$	(825)	\$	(883)	\$	(945)	\$	(1,011)	\$	(1,082)	\$	(1,159)	\$	(1,239)
Cash Flow From Financing	\$	22,550	\$	(589)	\$	(589)	\$	(630)	\$	(674)	\$	(721)	\$	(771)	\$	(825)	\$	(883)	\$	(945)	\$	(1,011)	\$	(1,082)	\$	(1,159)	\$	(1,239)
Annual Cash Flow																												
Annual Cash Flow	\$	(5,863)	\$	3,649	\$	5,231	\$	3,465	\$	2,424	\$	2,392	\$	1,566	\$	779	\$	743	\$	706	\$	(2,164)	\$	(1,759)	\$	(1,817)	\$	(1,848)
Cumulative Cash Flow	\$	(5,863)	\$	(2,214)	\$	3,017	\$	6,502	\$	8,926	\$	11,318	\$	12,904	\$	13,583	\$	14,427	\$	15,133	\$	12,949	\$	9,398	\$	7,561	\$	5,734
Simple Payback																												
Simple Payback	\$	1	\$	2	\$	3	\$	4	\$	5	\$	6	\$	7	\$	8	\$	9	\$	10	\$	11	\$	12	\$	13	\$	14
Net Investment	\$	(5,863)	\$	3,017	\$	6,502	\$	8,926	\$	11,318	\$	12,904	\$	13,583	\$	14,427	\$	15,133	\$	12,949	\$	9,398	\$	7,561	\$	5,734	\$	3,903
Simple Payback Year																												
Simple Payback Year	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	

Attachment I: Relevant Correspondence

- NHESP Letter
- MassDEP Central Regional Office Letter
- Phase I Environmental Site Assessment (2017)
(without Attachments)
- Norfolk Water System Subdivision Reviews
for the Preserve at Abbyville and
Abbyville Commons



MASSWILDLIFE

DIVISION OF FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

Jack Buckley, *Director*

July 13, 2017

Thomas DiPlacido
DiPlacido Development Corp.
850 Franklin Street, Suite 8
Wrentham MA 02093

RE: Project Location: 17, 65 and 67 Lawrence Street, Norfolk
Project Description: The Preserve at Abbyville Residential Development
NHESP File No.: **13-32057**

Dear Applicant:

Thank you for submitting the MESA Project Review Checklist, site plans (dated March 15, 2017, Overview Plan dated April 25, 2017) and other required materials to the Natural Heritage and Endangered Species Program of the MA Division of Fisheries & Wildlife (the "Division") for review pursuant to the Massachusetts Endangered Species Act (MESA) (MGL c.131A) and its implementing regulations (321 CMR 10.00).

Based on a review of the information that was provided and the information that is currently contained in our database, the Division has determined that this project, as currently proposed, **will not result in a prohibited Take** of state-listed rare species. This determination is a final decision of the Division of Fisheries & Wildlife pursuant to 321 CMR 10.18. Any changes to the proposed project or any additional work beyond that shown on the site plans may require an additional filing with the Division pursuant to the MESA. This project may be subject to further review if no physical work is commenced within five years from the date of issuance of this determination, or if there is a change to the project.

Please note that this determination addresses only the matter of state-listed species and their habitats. If you have any questions regarding this letter please contact Jesse Leddick, Endangered Species Review Biologist, at (508) 389-6386.

Sincerely,

Thomas W. French, Ph.D.
Assistant Director

cc: Norfolk Conservation Commission
S.M. Lorusso & Sons, Inc.
Stephen Mann, Buckley & Mann, Inc.
Diana Walden, BSC Group, Inc.

MASSWILDLIFE



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Central Regional Office • 8 New Bond Street, Worcester MA 01606 • 508-792-7650

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Matthew A. Beaton
Secretary

Martin Suuberg
Commissioner

November 17, 2017

Buckley & Mann, Inc.
205 Linden Ponds Way
Hingham, MA 02043
Attn: Lois Mann, President

RE: **NOTICE OF AUDIT FINDINGS AND
NOTICE OF NONCOMPLIANCE**
NORFOLK
17 Lawrence Street
RTN: 2-3000173
Enforcement Document Number: 00003655

Dear Mrs. Mann:

On September 7, 2017, Buckley & Mann, Inc. (hereafter referred to as you/your) was notified that the Massachusetts Department of Environmental Protection (MassDEP, the Department) began auditing response actions conducted to address the release of oil and/or hazardous material at the above referenced location. This Notice informs you of the results of MassDEP's audit.

An audit site inspection was conducted on September 13, 2017, by Joe Laughton of MassDEP's Central Regional Office with Tom DiPlacido of DiPlacido Development Corporation in attendance. In particular, the audit focused on the Class A-3 Response Action Outcome, now referred to as a Permanent Solution with Conditions (PS), prepared for the site. Response actions conducted at the site included soil excavation with off-site disposal, on-site soil consolidation with construction of an impermeable cap, implementation of a Notice of Activity and Use Limitation (AUL), and soil, groundwater and surface water sampling.

VIOLATIONS IDENTIFIED

MassDEP has determined that response actions were not performed in compliance with requirements of the Massachusetts Contingency Plan (MCP). The enclosed Notice of Audit Findings and Notice of Noncompliance lists the violation(s) and those action(s) that are required to achieve compliance. Specifically, the Notice of Audit Findings and Notice of Noncompliance contains: (1) the requirement violated, (2) the date and place that MassDEP asserts the requirement was violated, (3) either the specific actions that must be taken in order to return to compliance or direction to submit a written proposal to describing how and when you plan to return to compliance and (4) the deadline for taking such actions or submitting such a proposal.

LIMITATIONS

MassDEP's findings were based on the accuracy of the information reviewed during the audit. These findings do not: (1) apply to actions or other aspects of the site that were not reviewed in the audit, (2) preclude future audits of past, current, or future actions at the site, (3) in any way constitute a release from any liability, obligation, action or penalty under M.G.L. c. 21E, 310 CMR 40.0000, or any other law, regulation, or requirement, or (4) limit MassDEP's authority to take or arrange, or to require any Responsible Party or Potentially Responsible Party to perform, any response action authorized by M.G.L. c. 21E that MassDEP deems necessary to protect health, safety, public welfare, or the environment.

If you have any questions regarding this Notice, please contact Joe Laughton at (508) 849-4018. Please reference the Release Tracking Number, RTN 2-3000173, and Enforcement Document Number, 00003655, in any future correspondence to MassDEP regarding the site.

Sincerely,



Rebecca Woolley
Audits Section Chief
Bureau of Waste Site Cleanup

RW/EJL

Enc. Notice of Audit Findings and Notice of Noncompliance Summary
MassDEP Compliance Fee Schedule

cc/ec: Norfolk Board of Health/Zoning
Tom DiPlacido, Jr. – DiPlacido Development Corporation
CERO: file, database [PS/ACTAUD AUDCOM/NAFNON]
Audit Coordinator, DEP-Boston
Regional Enforcement Coordinator, DEP-CERO
Enforcement Tracking, BWSC, DEP-CERO

NOTICE OF AUDIT FINDINGS AND
NOTICE OF NONCOMPLIANCE SUMMARY

RTN: 2-3000173

Enforcement Doc. Number: 00003655

THIS IS AN IMPORTANT LEGAL NOTICE.
FAILURE TO RESPOND COULD RESULT IN SERIOUS LEGAL CONSEQUENCES.

NAME OF ENTITY IN NONCOMPLIANCE:

Buckley & Mann, Inc.
205 Linden Ponds Way
Hingham, MA 02043

LOCATION WHERE NONCOMPLIANCE OCCURRED OR WAS OBSERVED:

17 Lawrence Street
Norfolk, Massachusetts

DATES WHEN NONCOMPLIANCE OCCURRED OR WAS OBSERVED:

August 20, 2001: Date that Notice of Activity and Use Limitation was recorded at Norfolk
 Registry of Deeds
September 4, 2001: Date that a Class A-3 Response Action Outcome Statement was received
 by MassDEP

DESCRIPTION OF REQUIREMENT(S) NOT COMPLIED WITH:

VIOLATION #1

310 CMR 40.1074: Notice of Activity and Use Limitation

“(1) General Requirements. At any disposal site or portion of a disposal site where a RP, PRP or Other Person is conducting a response action(s) for which a Notice of Activity and Use Limitation has been selected as a form of Activity and Use Limitation pursuant to 310 CMR 40.1070, the following requirements shall be met:

(d) Prior to the recording and/or registration of a Notice of Activity and Use Limitation pursuant to 310 CMR 40.1074(3), current holders of any record interest(s) in the area subject to the proposed Notice (including without limitation, owners, lessees, tenants, mortgagees, and holders of easements or licenses) shall be notified by certified mail, return receipt requested, of the existence and location of oil and/or hazardous material within such area and the terms of such proposed Notice.”

310 CMR 40.1074: Notice of Activity and Use Limitation

“(2) Contents of a Notice of Activity and Use Limitation. A Notice of Activity and Use Limitation shall be documented on Form 1075 or, in the case of CERCLA sites, on a form developed and approved by the Department, and shall contain the following information:

(c) if a person(s) signing the Notice of Activity and Use Limitation is not an individual signing on his/her own behalf, but rather on behalf of an entity (LLC, LLP, limited partnership, etc.), or as trustee, executor, or attorney in fact, documentation consistent with conveyancing standards and practices verifying that the person(s) signing the Notice of Activity and Use Limitation has the authority to sign such document shall be attached as an exhibit to the Notice of Activity and Use Limitation. If the property owner is a corporation, such documentation shall consist of:

1. a Clerk's Certificate of Incumbency from the clerk of the corporation certifying that the person(s) signing the Notice of Activity and Use Limitation on behalf of the corporation held his or her position as of the date of the Notice of Activity and Use Limitation;

(i) a description of the Site Activities and Uses that are inconsistent with maintaining a Permanent Solution and condition of No Significant Risk or maintaining a Temporary Solution and condition of No Substantial Hazard with respect to exposures to oil and/or hazardous material;”

A Notice of Activity and Use Limitation (AUL) was recorded for this site at the Norfolk Registry of Deeds Land Court on August 20, 2001, Certificate Number 154753, Book 774, Page 153. The AUL was signed by Richard Mann as President and Treasurer of Buckley & Mann, Inc. However, the AUL did not contain documentation verifying the signatory authority as required by 310 CMR 40.1074(2)(c).

The AUL consists of a portion of the property and prohibits the excavation of soils at a depth greater than three feet below ground surface without the involvement of a Licensed Site Professional, and any activity that may cause physical, chemical or structural damage to the protective barrier layer in AUL subarea “A”. The Method 1 human health risk assessment that was included within the September 2001 Class A-3 Response Action Outcome Statement (now referred to as a Permanent Solution with Conditions) concluded that concentrations of site contaminants in AUL sub-area “A” were above S-1 soil standards (established to be protective of unrestricted site use). Therefore, the Permanent Solution is predicated on restricting residential use of sub-area “A” with an AUL. The Inconsistent Activity and Uses section of the AUL does not explicitly prohibit residential use, in violation of 310 CMR 40.1074(2)(i).

Prior to recording the AUL, current holders of any record interests in the area subject to the proposed AUL must be notified by certified mail of the existence of the AUL. Documentation regarding record interest holders was not provided to MassDEP, in violation of 310 CMR 40.1074(1)(d).

VIOLATION #2

310 CMR 40.0995: Method 3 Environmental Risk Characterization

“The characterization of risk of harm to the environment shall be conducted for all current and reasonably foreseeable Site Activities and Uses identified in 310 CMR 40.0923. Characterization of the risk of harm to the environment shall include an assessment of chemical data, potential contaminant migration pathways, and an evaluation of biota and habitats at and in the vicinity of the disposal site, as described in 310 CMR 40.0995(2), as well as through the application of Upper Concentration Limits, as described in 310 CMR 40.0995(5).

(1) A Method 3 characterization of the risk of harm to the environment shall be based on the site, receptor and exposure information identified in 310 CMR 40.0901 through 40.0920, as well as any relevant data collected during the response action being performed.

(2) The risk of harm to the site biota and habitats shall be characterized by evaluating ecological parameters using a two-stage approach. In Stage I, the objective is to identify and document conditions which do not warrant a Stage II Risk Characterization, either because of the absence of a potentially significant exposure pathway or because environmental harm is readily apparent and therefore additional assessment would be redundant. If a potentially significant exposure pathway is indicated by the available information per 310 CMR 40.0995(3)(a) and (c), then a Stage II Environmental Risk Characterization is required to characterize the risks posed by those exposures.

(a) A Stage I Environmental Screening shall be performed as described in 310 CMR 40.0995(3) for all disposal sites evaluated using Risk Characterization Method 3, and for those disposal sites evaluated using a Method 3 Environmental Risk Characterization in combination with Method 1 or Method 2 as described in 310 CMR 40.0942.”

“(3) Stage I Environmental Screening. Exposures of site biota and habitats shall be characterized by the Stage I Environmental Screening as follows:

(a) Available evidence shall be evaluated to determine whether there is current or potential future exposure of Environmental Receptors to contamination at or from the disposal site. Sources of such evidence shall include historical records, site data, field observations, statements by present and past residents or employees, and any other relevant source.

1. Evidence of current or potential exposure shall include, but is not limited to:

c. Analytical data indicating the presence of oil and/or hazardous material attributable to the site in question in surface water or sediment (including wetlands);

e. The presence of oil and/or hazardous material at the disposal site within two feet of the ground surface and the potential for such contamination to result in exposure to wildlife.”

A Method 1 risk characterization included in the August 2001 Class A-3 RAO determined that concentrations of site contaminants do not pose a significant risk to human health. However, the evaluation of potential risk to environmental receptors (terrestrial and wetland habitats) was not presented with any detail. Generic statements regarding contaminant concentrations in sediment samples collected from the carbonizer lagoon and trench were made in the RAO, concluding that "...the contaminant concentrations are low, no waste discharged to the area for over 35 years, and the areas are visually normal vegetated wetlands." Sediment samples were collected from the carbonizer lagoon and trench and analyzed for metals and Total Petroleum Hydrocarbons (TPH). Elevated concentrations of chromium, lead, zinc and TPH were detected. In 2001, sediment screening criteria were based on the Lowest Effects Level from the Ontario Ministry of the Environment (1993). The table below compares sediment data to the sediment screening criteria.

Contaminant	Range	Average	Lowest Effects Level
Chromium	< 2 – 450	146	26
Lead	74 – 670	241	31
Zinc	260 – 920	590	120
TPH	860 – 1,300	1,080	not established

Notes: concentrations reported as parts per million (ppm)

As indicated in the above table, concentrations of chromium, lead and zinc exceeded their respective sediment benchmarks. Concentrations above the Lowest Effects Level do not mean that adverse effects to aquatic organisms will occur but suggests that further testing may be necessary.

The undeveloped portion of the disposal site is approximately 12 acres in size. As such, a Stage I Environmental Screening of the terrestrial environment is needed. This should involve an evaluation of habitat quality, as described in Chapter 9 of the Guidance for Disposal Site Risk Characterization (WSC/ORS-95-141).

Failure to include a Stage I Environmental Screening in the August 2001 RAO is a violation of 310 CMR 40.0995.

ACTIONS TO BE TAKEN AND THE DEADLINES FOR TAKING SUCH ACTIONS:

Within **one hundred eighty (180)** days of the date of this Notice you must complete the following:

1. Terminate the Notice of AUL at the Norfolk County Registry of Deeds pursuant to 310 CMR 40.1083 and immediately thereafter submit a new Notice of AUL prepared in accordance with 310 CMR 40.1074 that corrects the violations present above; **and**
2. Submit a revised Permanent Solution Statement prepared in accordance with 310 CMR 40.1000, that corrects violations presented above;

OR

3. Terminate the Notice of AUL, retract the Permanent Solution, submit a Tier Classification Extension request in accordance with 310 CMR 40.0560(7), and submit a Notice of Delay in accordance with 310 CMR 40.0560, using form BWSC-121, explaining the reason for the delay, steps taken to minimize the delay and a schedule detailing the dates proposed for returning the site to regulatory compliance.

Complete the actions specified above and submit a Post-Audit Completion Statement (BWSC-111) prepared in accordance with 310 CMR 40.1170. Please be advised that submissions to MassDEP should be made via electronic submissions through the eDEP program:
<https://edep.dep.mass.gov/DEPLLogin.aspx>.

If you fail to revise the Permanent Solution Statement within the specified deadline, MassDEP may continue to treat this site as a Tier II disposal site and require you to pay compliance fees until a Permanent or Temporary Solution in compliance with the MCP has been achieved. Should you fail to comply with the requirements contained in this notice, MassDEP will invalidate the Permanent Solution submittal and will amend its records to indicate that an invalid Permanent Solution has been filed.

Please be advised that all requests for applications for Financial Inability to perform response actions should be directed to Ms. Wanda Kopczyk of the MassDEP Boston Office at (617)348-4055

If the required actions are not completed by the deadlines specified, an administrative penalty may be assessed for every day after the date of this Notice that the noncompliance occurs or continues. MassDEP reserves its rights to exercise the full extent of its legal authority in order to obtain full compliance with all applicable requirements, including, but not limited to, criminal prosecution, civil action including court-imposed civil penalties, or administrative action, including administrative penalties imposed by MassDEP.

For the Department of Environmental Protection:

Date: Nov. 17, 2017

By: Rebecca J. Woolley
Rebecca Woolley
Audits Section Chief
Bureau of Waste Site Cleanup



IC Environmental Management, Inc.

25 Tia Place
Franklin, MA 02038

Phone: 508-498-8236
Fax: 508-541-7443

PHASE I – ENVIRONMENTAL SITE ASSESSMENT

For The Property Identified As:

**Former Buckley & Mann Manufacturing Site
17 Lawrence Street
Norfolk, Massachusetts 02056**

Prepared For:

**DiPlacido Development Corporation
850 Franklin Street, Suite 8
Wrentham, Massachusetts 02093**

Prepared By:

**IC Environmental Management, Inc.
25 Tia Place
Franklin, Massachusetts 02038**

IC Project Number: 1717

August 1, 2017

PHASE I – ENVIRONMENTAL SITE ASSESSMENT

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Appendices

Appendix A	Site Maps Norfolk Assessors Map with Topography MassDEP Priority Resource Map Test Pit Location Plan Monitor Well Plan, January, 2015 Monitor Well Plan, April, 2015 Norfolk Water System, Lawrence Street Test Well Siting Plan
Appendix B	EDR Database Report
Appendix C	Environmental Records Assessors Records MassDEP Sites/Reportable Release/AUL Database Excerpt SEMS Database Excerpt, Norfolk Buckley & Mann, Inc., Activity and Use Limitation (AUL)
Appendix D	Test Pit Logs / Analytical Reports
Appendix E	Site Photographs
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1.0 INTRODUCTION

1.1 PURPOSE

This Phase I Environmental Site Assessment Report (Phase I Report) was conducted to evaluate the property identified as 17 Lawrence Street, in Norfolk, Norfolk County, Massachusetts (herein referred to as “the Subject Site”) for the presence of any *Recognized Environmental Conditions* with respect to the range of contaminants within the scope of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and petroleum products. As such, this Site Assessment is intended to satisfy one of the requirements to qualify for the “innocent landowner defense” of CERCLA liability. This report also incorporates changes to the CERCLA Liability Act by addressing “All Appropriate Inquiry” (AAI) into the conditions associated with the Subject Site. Additionally, the Subject Site and surrounding area were reviewed for *Reportable Releases*, defined in the Massachusetts Department of Environmental Protection (MassDEP) regulations, and to determine the regulatory status and environmental conditions of each *Reportable Release*. The term *Recognized Environmental Conditions* means the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property; (1) due to any release to the environment; (2) under conditions indicative of a release to the environment; (3) under conditions that pose a material threat of a future release to the environment.

1.2 SCOPE OF SERVICES

In order to provide an environmental assessment for the Subject Site, a scope of work was prepared which included background research and on-site reconnaissance. Specifically, this Phase I Report included the following tasks:

- Perform site reconnaissance of the subject property, to include all structures, as well as a visual review of adjacent properties;
- Review available Local records and files, including the Assessors, Town Clerk, Planning Department, Water Department, Conservation Commission, Board of Health, Fire Department and other pertinent agencies;
- Review oil and hazardous material release records available for the Subject Site and surrounding area through EPA and MassDEP on-line databases;
- Review RCRA hazardous waste generator information for the Subject Site and surrounding properties. Review underground storage tank (UST) information for the Subject Site and surrounding properties;
- Excavate test pits and collect soil samples for analytical testing to characterize soil conditions in the vicinity of the former manufacturing buildings;
- Perform groundwater gauging, sampling and analytical testing events from select on-site groundwater monitoring wells to characterize surficial aquifer conditions across the Site;
- Establish the hydrogeological characteristics of the Subject Site by reviewing topographic features and available reference data. Visually inspect all surface water bodies located on or abutting the Subject Site;

- Review aerial photographs, if any, of the Subject Site. Review historical atlases, fire insurance rate maps, street directories, and other available reference material. Review documents and reports provided by the client and/or property owner, if available;
- Compile pertinent data and prepare a Phase I Report, which shall provide an opinion with regard to the identification of any *Recognized Environmental Conditions* and compliance with Massachusetts General Law, Chapter 21-E.

There may be environmental issues and/or conditions at the Subject Site that parties may wish to assess in connection with real estate that are outside the scope of this Site Assessment. The following are several non-scope considerations: asbestos-containing materials; radon; lead-based paint; lead in drinking water; wetlands; regulatory compliance; industrial hygiene; indoor air quality and high voltage power lines.

1.3 SIGNIFICANT ASSUMPTIONS

During the course of this investigation, no significant assumptions concerning the Subject Site were made.

1.4 LIMITATIONS AND EXCEPTIONS

The information provided in this Site Assessment is based upon personal interviews and a review of available documents and records. This report is subject to the limitations of historical documentation, the availability and accuracy of pertinent records, recollections of people contacted, and specific areas of investigation. This report has been prepared in accordance with generally accepted industry site assessment practices. No other warranty is expressed or implied. Liability is limited to the cost of performing this Site Assessment.

The on-site investigation took into account the natural and constructed features of the Subject Site and was concerned with conditions that present a historic, existing or imminent risk of release to the environment. The conditions outlined in this report are based upon, and limited to the specific areas investigated and the accuracy of available documentation.

This Phase I Report has been prepared on behalf of and for the exclusive use of user(s) described in Section 1.6 solely for the use in an environmental assessment of the Subject Site. This Phase I Report and findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party in whole or in part, without the prior written consent of IC Environmental Management, Inc.

1.5 SPECIAL TERMS AND CONDITIONS

No special terms and conditions were included in the proposal to complete this environmental investigation.

1.6 USER RELIANCE

This Phase I Environmental Site Assessment was performed by IC Environmental Management, Inc., following email authorization to proceed from Mr. Tom DiPlacido Jr., of DiPlacido Development Corporation. The findings and opinions outlined in this report may be relied upon by DiPlacido Development Corporation, as well as Rockland Trust.

2.0 SITE DESCRIPTION

2.1 LOCATION AND LEGAL DESCRIPTION

The Subject Site is the location of the Former Buckley & Mann Textile Manufacturing Facility. The Site is located in Norfolk, Massachusetts and consists of three contiguous parcels of land referenced by the Town of Norfolk Assessor as Map 6, Lot 2-3-1 (136.64 acres), Lot 2-3-2 (2.41 acres), and Lot 2-3-3 (1.68 acres). The Site has a total land area of approximately 140.73 acres. A Copy of the Assessors Map is available for review in Appendix A. The Subject Site is located at 42.0963 degrees north latitude and -71.3552 west longitude.

2.2 SITE AND VICINITY CHARACTERISTICS

The Town of Norfolk is located in Norfolk County and has an estimated population of 11,227 as recorded in 2010. Norfolk covers 14.8 square miles and has a population density of 757 per square mile.¹ Norfolk is located approximately 19 miles southwest of Boston. Norfolk is generally bordered by Medfield to the north; Walpole to the east; Wrentham to the south; and Medway and Franklin to the west.

The Subject Site is located on the northern side of Lawrence Street, to the northwest of Eagle Drive and Cranberry Meadow Road. The Subject Site and surrounding areas are shown on the Site Maps and Aerial Photographs, which are available for review in Appendix A of this report.

2.3 DESCRIPTION OF STRUCTURES

Structures currently on the Site are limited to several concrete slabs of former manufacturing buildings, located on the south-central portion of the property adjacent to Lawrence Street. There is also a "Consolidation Area" to the northwest of the former site buildings which contains the encapsulated contaminated soil and debris generated during remedial activities performed at the Site in 1999. There are no active utilities currently servicing the Site.

2.4 CURRENT USE OF THE PROPERTY

At the present time, the Site is vacant and un-occupied.

2.5 CURRENT USES OF THE ABUTTING PROPERTIES

The Site is abutted to the north by undeveloped wooded areas, to the east by single family residential properties, to the south by Lawrence Street and single family residential properties, and to the west by a former gravel pit and undeveloped woodlands.

¹ From: <http://www.city-data.com/city/norfolk-massachusetts.html>

3.0 USER-PROVIDED INFORMATION

3.1 TITLE RECORDS

The property owner provided no title records. According to records at the Norfolk Assessor's Office, Buckley & Mann, Inc., is listed as the current owner. The current deed reference for the Site is listed by the Norfolk County Registry of Deeds in Land Court Document Book 774, Page 0153, dated May 18, 1999.

3.2 ENVIRONMENTAL LIENS OR INSTITUTIONAL LAND USE LIMITATIONS

A review of available records at the Norfolk County Registry of Deeds and Massachusetts Department of Environmental Protection (MassDEP) Sites Database found an Activity and Use Limitation (AUL) listed for the Subject Site. This AUL was recorded on a plan registered in the Norfolk County Land Registration Office, Certificate of Title Number 154753, Book 774, Page 153, dated August 20, 2001. A copy of the AUL document is available for review in Appendix C.

3.3 SPECIALIZED KNOWLEDGE

The following documents were reviewed during the preparation of this assessment report:

- Class A-3 Response Action Outcome and Release Abatement Completion Report, Buckley & Mann, Inc., Norfolk, MA, prepared by Camp Dresser & McKee, Inc., (CDM), dated August, 2001
- Removal Specialists Project Close-Out Documentation of Asbestos Abatement and Demolition, Buckley & Mann, Inc., Norfolk, MA, Volume 1 and Volume 2, dated October 25, 2011
- Limited Subsurface Investigation, Former Buckley & Mann, Inc., Norfolk, MA, prepared by Kurz Environmental, Inc., dated October 1, 2013

3.4 VALUATION REDUCTION FOR ENVIRONMENTAL ISSUES

A review of the Norfolk Assessor's records found the total current assessed value for the three Site parcels to be \$970,400.00. There was no record or knowledge of a decrease in value of the property due to any established environmental issues. All information obtained from the Norfolk Assessor's Office is found in Appendix C.

3.5 OWNER, PROPERTY MANAGER, AND OCCUPANT INFORMATION

Buckley & Mann, Inc., is the property owner and has occupied the Site since the turn of the twentieth century. Access to the property is currently managed by DiPlacido Development Corporation. The principle site contact is Tom DiPlacido Jr.

3.6 REASON FOR PERFORMING THE SITE ASSESSMENT

This Site Assessment was performed as part of an evaluation of the current Site conditions in support of a potential property transfer.

4.0 RECORDS REVIEW

4.1 STANDARD ENVIRONMENTAL SOURCES

IC Environmental Management, Inc., obtained an Environmental Data Resources, Inc.,TM Report for the Subject Site from EDR of Shelton, Connecticut. The report presents the available information from State and Federal databases for properties within the prescribed ASTM search radii. Other sources included available on-line databases from the Town of Norfolk, Norfolk County Registry of Deeds, MassDEP, and US EPA. Pertinent excerpts from these sources are presented in Appendix B and Appendix C. The following information was found concerning the Subject Site and surrounding area:

- The Subject Site was listed by the MassDEP as a Disposal Site due to the historical operation of the property as a textile manufacturer dating back to the turn of the twentieth century. Further details of this release will be provided later in this report section. There are no other listed disposal sites within a one half mile radius of the Site.
- The Subject Site was identified as a former Resource Conservation and Recovery Information Act (RCRA) hazardous waste generator. The Site was assigned EPA ID # MAD001017342.
- The Subject Site was not listed on the National Priority List (NPL). No NPL sites were listed within a one mile radius;
- The Subject Site was not listed on the Emergency Response Notification System (ERNS) list;
- The Subject Site is not listed in the Superfund Enterprise Management System (SEMS), formerly the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS). There are no SEMS listed sites located within a one half mile radius of the Subject Site;
- The Subject Site is not listed as a solid waste landfill. No solid waste landfills were identified within a one half mile radius of the Subject Site;
- A Norfolk Fire Department inquiry found record of the removal of three (3) underground storage tanks (UST's) from the Site in October of 1986. The UST's included 1 x 2,000 gallon gasoline, 1 x 3,000 gallon wool oil, and 1 x 250 gallon diesel fuel.

Based on a review of the MassDEP listed releases and specifically release sites within a one mile radius of the Subject Site, the emphasis for potential environmental impact to the Site was placed on those releases which are currently active and/or located at or in close proximity to the Subject Site. The documented historic release conditions at the Subject Site, as well as the

historical utilization of the Site for textile manufacturing meet these criteria and will be explained further.

Release Tracking Number, RTN 3-000173

A number of environmental related assessments were performed at the Subject Site from 1986 through 2000 by Camp Dresser & McKee. The discovery of chromium, lead, and polycyclic aromatic hydrocarbons (PAH's) in soils and traces of PAH's in shallow groundwater at the Site exceeded reportable concentrations outlined in the Massachusetts Contingency Plan (MCP). This condition was reported to the MassDEP on January 15, 1993 and Release Tracking Number 3-000173 was issued to the release. In addition, soil samples collected from the bottom of Lagoon #1 and Lagoon #2 reported naphthalene and methylnaphthalene above reportable MCP concentrations. The physical scope of the environmental Site investigations was limited to approximately 12 acres of the 140 acre property. The 12 acres were comprised of a 2-acre former on-site landfill; 3 lagoons each approximately 1 acre in size; and 7 acres of adjacent land between the Tail Race and the Mill River. Please refer to Appendix A for Site Maps.

A remediation plan, which consisted of the on-site consolidation of contaminated soils, the removal and off-site disposal of higher levels of lead and chromium soils, and off-site disposal of asbestos containing materials, was completed in August of 2001. A Class A-3 Response Action Outcome (RAO) and Release Abatement Measure (RAM) Completion Report was then submitted to the MassDEP on behalf of Buckley & Mann by CDM. By MCP definition, a Class A-3 RAO means that a permanent solution to the release has been achieved; that the level of oil and hazardous material in the environment has not been reduced to background levels; that one or more activity and use limitations (AUL's) have been implemented pursuant to 310 CMR 40.1012 to maintain a level of no significant risk and; oil and hazardous material at the disposal site do not exceed an upper concentration limit in soil or groundwater listed in 310 CMR 40.0996(7).

The area of the Site designated by the RAO consists of the previously referenced 12 acre portion of the property. The areas designated under the AUL included Subarea A, the former landfill area east of the Tail Race and Subarea B, as well as the former wastewater treatment lagoons west of the Tail Race. The area utilized for on-site consolidation of contaminated materials is located within Subarea A. This is referred to as the "Consolidation Area". It is estimated that approximately 4,550 cubic yards of material was consolidated and that this material consisted of soil, building demolition debris, coal ash, textile debris, and abandoned equipment. The Consolidation Area was then graded, covered with a geotextile fabric and 3 feet of clean sand fill, and then was seeded to provide a vegetated cap. Please refer to the attached AUL Document in Appendix C for further details and site diagrams.

Demolition and Asbestos Abatement

Once the above referenced assessment and remediation work was completed, the next phase of Site cleanup involved the demolition of the remaining buildings on the Site. The buildings were reported to be in disrepair from years of inactivity, vandalism, and weather. The scope of

this cleanup included the performance of an asbestos survey, preparation of a Notice of Intent, preparation of an asbestos removal notification, issuance of an Order of Conditions from the Town of Norfolk, and the demolition of the structures. From July through September of 2011, the asbestos abatement and demolition activities were performed at the Site. A project summary prepared by Axiom Partners, Inc., (Asbestos Abatement Consultant) reported a total of 1,760 cubic yards of asbestos containing material was removed from the Site.

4.2 PHYSICAL SETTING SOURCES

In general, the topography at and in the vicinity of the Site is defined by the Mill River which traverses the Site from Bush Pond in the southeast to the northwest property boundary. The River forms a small valley with elevation differences varying from approximately 160 feet above sea level near the River, to 250 feet on the eastern and western sides of the Site. The River drains run-off from the Site and the surrounding hillsides.

According to previous subsurface investigation reports and the Bedrock Map of Massachusetts, by E-an Zen dated 1983, the bedrock in the vicinity of the Subject Site consists of rhyolite and shale. No bedrock outcrops were observed on the Site. The soil component at and in the vicinity of the Site has been identified as primarily glacial till and stratified drift.

Bush Pond, the Mill River and wetlands associated with the Mill River are located on the Site. Groundwater at the Site has been measured at depths ranging from less than 2 feet to 20 feet below grade due to the variation in topography across the property. Groundwater flow direction at the Site has been calculated to be toward the Mill River and Tail Race. It should be noted that subsurface conduits or channeling may influence the local groundwater flow direction. Please refer to Appendix A for the Site Maps.

4.3 HISTORIC USE OF THE SUBJECT SITE

Based on a review of available information from previous investigations of the property, as well as records at the Norfolk Town Hall, the Buckley & Mann facility manufactured textile products at this location for over 90 years until production ended in 1994 and the operation was moved to Canton, MA. The Site has been vacant since 1994 and all existing buildings on the Site were demolished in 2011 with the exception of the concrete slabs.

4.4 HISTORIC USE OF ABUTTING PROPERTIES

The historic use of abutting properties is as follows. The property to the north has no history of development. The properties to the east are single family residential, but were undeveloped prior to the early 1980's. The properties to the south are single family residential which were undeveloped until the middle 1980's. The property to the west was formerly operated as a gravel mining operation dating back to the 1960's. This property is currently undeveloped and vacant.

5.0 SITE INVESTIGATION ACTIVITIES

5.1 TEST PIT EXCAVATION AND SOIL SAMPLING

On August 20, 2014, a representative of IC Environmental Management, Inc., (ICEM) was at the Subject Site to oversee the excavation of twenty-three (23) test pits to characterize soils adjacent to former manufacturing buildings and process areas in the south central portion of the Site in association with the potential redevelopment of the property for residential use. The test pits were excavated with a 315C Caterpillar Excavator operated by RE Anderson Corporation. Please refer to Appendix A for the location of the Test Pits.

Representative soil samples collected at each test pit location were screened in the field for the presence of Total Organic Vapor (TOV) by jar headspace method with a MiniRae 2000 Photoionization Detector (PID). The PID headspace screening was performed as a way to identify potential petroleum or volatile organic compound contamination in the test pit soils. The screening results are also utilized to assist in the selection of soil samples designated for laboratory testing. The PID was pre-calibrated to yield TOV in parts per million expressed in a volume over volume ratio (V/V) as benzene. A TOV result less than 10 ppm is not considered significant when field screening for petroleum or volatile organic compound contamination.

During the test pit excavation, no unusual odors were detected from any soil samples collected. The TOV screening results reported no readings above 0.3 ppm TOV. Test Pit Logs, which are available for review in Appendix D, provide a description of the soil conditions and general observations made at each location.

Select soil samples from nine test pit locations were submitted under a chain of custody to GeoLabs, Inc., of Braintree, Massachusetts for laboratory analysis. The sampling selection was based primarily on field observations as there were no significant TOV readings recorded during test pit excavation activities. These field observations included the presence of discolored soils, presence of demolition debris, and/or proximity to former known process areas of the Site. Specifically, composite soil samples from TP-1, TP-2, TP-4, TP-5, TP-10, TP-12, TP-14, TP-15 and TP-17 were analyzed for Priority 14 Metals. A composite sample from TP-10 was also analyzed for Extractable Petroleum Hydrocarbon (EPH) with Target Analytes because this test pit was visually the most discolored, contained debris, and was considered to represent the highest probability for contamination.

The Priority 14 Metals analysis was selected because elevated chromium and lead was historically identified in Site soils and the chosen test method included both metals. The EPH with Targets analysis was selected because it identifies a number of specific carbon chains and polycyclic aromatic hydrocarbons (PAH's), which were also previously identified in soils at the Site. All analytical results were compared to reportable concentrations outlined in the Massachusetts Contingency Plan (MCP) Oil and Hazardous Materials List. The groundwater classification at the Site is designated as GW-1 based on the property being located within the Zone II drainage area established by the Town of Franklin for public water supply wells west of the Mill River approximately 1.5 miles downstream to the north, and GW-3 as all groundwater in the State must be designated GW-3 to protect surface water. The soils at the

Site, with the exception of the Consolidation Area, are classified as S-1 because the property is located within the geographic boundary of a groundwater resource area categorized as GW-1, and the Site has potential for residential and/or recreational use. The soils within the Consolidation Area are designated S-2.

The analytical results from the soil samples collected from the nine test pits reported a number of detectable priority metals at each location. Of the detectable metals results, the concentration of Nickel at TP-3 (23.3 mg/Kg), TP-5 (22.7 mg/Kg), and TP-15 (22.2 mg/Kg) exceeded the corresponding Reportable Concentration (RC) S-1 Standard of 20 mg/Kg. The composite soil sample from TP-10 analyzed for EPH with Targets reported no concentrations above the corresponding RCS-1 Standards. All detectable laboratory results are presented in Table 5.1. All Laboratory Reports are available for review in Appendix D. Based on visual observations made during test pit excavation and CDM's reference to coal ash being present on the Site during prior assessment and remediation activities, it is likely the presence of the coal ash contributed to the elevated nickel. The MassDEP has a reporting exemption for fill material containing coal or wood ash.

Table 5.1
Analytical Results from Test Pit Soil Samples

Analyte	Test Pit Locations									
	RCS-1 (mg/Kg)	TP-1 (mg/Kg)	TP-2 (mg/Kg)	TP-4 (mg/Kg)	TP-5 (mg/Kg)	TP-10 (mg/Kg)	TP-12 (mg/Kg)	TP-14 (mg/Kg)	TP-15 (mg/Kg)	TP-17 (mg/Kg)
Priority 14 Metals										
Antimony	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	20	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	1000	18.4	46.1	23.1	28.5	53.4	18.8	19.8	24.8	29.6
Beryllium	100	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	70	ND	ND	ND	ND	5.34	ND	ND	ND	ND
Chromium	100	ND	17.9	13.7	8.1	21.0	5.78	5.95	10.5	9.43
Lead	200	19.8	115	24.5	30.6	118	ND	ND	10.1	24.6
Nickel	20	ND	19.5	23.3	22.7	9.33	8.87	12.4	22.2	8.62
Selenium	400	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	100	ND	24.5	ND	ND	ND	ND	ND	ND	ND
Thallium	8	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	400	6.28	11.3	13.9	9.58	16.3	6.99	6.77	10.3	13.6
Zinc	1000	68.6	115	44.5	37.7	239	20.2	26.2	36.6	48.5
Mercury	20	0.16	ND	ND	ND	ND	0.28	ND	ND	ND
EPH		NS	NS	NS	NS		NS	NS	NS	NS
C11-C22 Aromatics	1000					ND				
C9-C18 Aliphatics	100					ND				
C19-C36 Aliphatics	300					21.9				
EPH Targets		NS	NS	NS	NS		NS	NS	NS	NS
Phenanthrene	10					0.51				
Fluoranthene	1000					0.51				
Pyrene	1000					0.43				
Benzo(a)anthracene	7					0.21				
Chrysene	70					0.29				
Benzo(b)fluoranthene	7					0.19				

Notes:

ND – Analyte was not detected at test method detection limit.

NS – Not Sampled for Testing.

Only Detectable Results of EPH with Target Analytes are listed.

Concentrations which exceed MCP RCS-1 Standards are bolded and in red.

5.2 GROUNDWATER SAMPLING (APRIL, 2015)

On April 2, 2015, representatives of ICEM were at the Site to measure the depth to groundwater at all existing on-site monitoring wells and to sample six (6) monitoring wells in the vicinity of the Consolidation Area. As previously referenced, the Consolidation Area is located to the northwest of the former site buildings and contains the encapsulated contaminated soil and debris generated during previously completed remedial activities. The purpose of the groundwater sampling was to characterize current groundwater conditions, specifically priority metals and volatile organic compounds in this area of the Site. A representative of United Consultants, Inc., assisted ICEM with locating the on-site monitoring wells, as access and visibility was impacted by heavy undergrowth and 6 to 8 inches of snow.

The wells sampled were MW-1DX, EW-2, MW-3, EW-1, MW-6, and MW-5. Please refer to Appendix A for the Site Monitor Well Plan prepared by United Consultants. The depth to groundwater at each well was measured with a Solonist interface probe. The groundwater depth ranged from 1.4 feet below grade at MW-5 to 20.77 feet below grade at MW-1DX. The large variation in groundwater depth across the Site is attributed to the variation in the property topography and the proximity to Mill Brook. The wells closest to Mill Brook recorded the lowest depth and the wells in the adjacent hills recorded the highest depth to groundwater. The groundwater sample from MW-1DX was collected utilizing low-flow equipment and methods. The remaining groundwater samples were collected with dedicated Teflon bailers in accordance with MassDEP guidance due to the above referenced access issues. All groundwater samples were properly preserved and packaged for delivery under a chain of custody to GeoLabs, Inc., for laboratory analysis. Specifically, samples from all six wells were analyzed for Priority 14 Metals, and samples from MW-3 and MW-6 were analyzed for volatile organic compounds (VOC's) by EPA Method 8260C. These wells were chosen as MW-3 is located to the west of the Consolidation Area near the Tail Race and MW-6 is located to the east of the Consolidation Area.

In addition to the gauging and sampling activities, groundwater from the six wells was also screened in the field for the presence of Total Organic Vapor (TOV) by jar headspace method with a MiniRae 2000 Photoionization Detector (PID). The PID headspace screening was performed as a way to identify potential petroleum or volatile organic compound contamination in the wells. The PID was pre-calibrated to yield TOV in parts per million expressed in a volume over volume ratio (V/V) as benzene. A TOV result less than 10 ppm is not considered significant when field screening for petroleum or volatile organic compound contamination. No unusual odors were noted and the TOV results recorded no detectable readings in any groundwater sample collected.

The analytical results from groundwater samples collected from the six monitoring wells reported detectable dissolved arsenic at MW-1DX (0.069 mg/L), EW-2 (0.022 mg/L), MW-3 (0.020 mg/L), MW-6 (0.032 mg/L), and MW-5 (0.036 mg/L). A detectable concentration of dissolved zinc was also reported at EW-1 (0.312 mg/L). No other dissolved priority 14 metals were reported. Of the detectable metals results, only the concentration of dissolved arsenic in five of the six wells exceeded the corresponding Reportable Concentration (RC) GW-1 Standard of 0.01 mg/L. With regard to the presence of VOC's, a detectable concentration of

trichloroethene was detected at MW-3 (3.02 ug/L) which does not exceed the corresponding RCGW-1 Standard. No other VOC was detected in either sample analyzed from MW-3 and MW-6. All detectable laboratory results from this sampling round are presented in Table 5.2. All Laboratory Reports are available for review in Appendix D.

Table 5.2
Analytical Results from 4/02/2015 Groundwater Samples

Sample Location		MW-1DX	EW-2	MW-3	EW-1	MW-6	MW-5
Analyte	RCGW-1						
14 Priority Metals	(mg/L)						
Antimony	0.006	ND	ND	ND	ND	ND	ND
Arsenic	0.01	0.069 mg/L	0.022 mg/L	0.020 mg/L	ND	0.032 mg/L	0.036 mg/L
Barium	2	ND	ND	ND	ND	ND	ND
Beryllium	0.004	ND	ND	ND	ND	ND	ND
Cadmium	0.004	ND	ND	ND	ND	ND	ND
Chromium	0.1	ND	ND	ND	ND	ND	ND
Lead	0.1	ND	ND	ND	ND	ND	ND
Nickel	0.1	ND	ND	ND	ND	ND	ND
Selenium	0.05	ND	ND	ND	ND	ND	ND
Silver	0.007	ND	ND	ND	ND	ND	ND
Thalium	0.002	ND	ND	ND	ND	ND	ND
Vanadium	0.03	ND	ND	ND	ND	ND	ND
Zinc	0.9	ND	ND	ND	0.312 mg/L	ND	ND
Mercury	0.002	ND	ND	ND	ND	ND	ND
VOC's by 8260C		NS	NS		NS	ND	NS
Trichloroethene	0.005			3.02 ug/L			
Depth to Groundwater		20.77 feet	3.75 feet	2.65 feet	4.45 feet	1.9 feet	1.4 feet

Notes:

ND – Analyte was not detected at test method detection limit.

NS – Not Sampled for Testing.

Only Detectable Results of EPA Method 8260C analytes are listed.

Concentrations which exceed MCP RCGW-1 Standards are bolded and in red.

5.3 GROUNDWATER SAMPLING (JUNE, 2015)

On June 10, 2015, representatives of ICEM were at the Site to measure the depth to groundwater at all on-site monitoring wells and to sample groundwater from the monitoring wells which were not sampled in April of 2015. In addition, a groundwater sample was also scheduled for collection at one Town of Norfolk Observation Well located to the northwest of the Subject Site on an adjacent parcel. The purpose of the groundwater sampling was to characterize the groundwater conditions hydraulically upgradient of the Consolidation Area as well as the Town Well. Due to lack of precipitation from April to June, the target on-site monitoring wells were measured and found to be dry with the exception of MW-3DX and MW-9DX. These two wells and Town of Norfolk Observation Well, WS-3, were sampled and analyzed for priority 14 metals. It should be noted that no VOC analysis was performed on samples collected from these wells because there was no history of industrial activity at these locations, and no significant VOC's were reported from the groundwater samples analyzed near the Consolidation Area, which would be expected to present the most likely location for contamination.

The groundwater samples were collected with dedicated Teflon bailers in accordance with MassDEP guidance and all groundwater samples were properly preserved and packaged for delivery under a chain of custody to an alternate laboratory, R.I. Analytical Laboratories (RAI). At the time of sample collection, a PID headspace screening was performed. As with prior groundwater samples collected from the Site, no unusual odors were noted and no detectable TOV results were recorded from any groundwater sample collected.

The analytical results of the arsenic testing reported no detectable dissolved arsenic at any monitoring well location. Based on these results, the previously reported elevated arsenic results from groundwater collected in April and June of 2015 may have been the result of laboratory equipment contamination or testing method issues. Therefore in order to confirm the September results, one additional round of sampling was proposed and it was decided to split these samples for analysis at two laboratories as a quality control measure. The analytical results from this sampling round are presented in Table 5.4.

Table 5.4
Analytical Results from 9/23/2015 Groundwater Samples

Sample Location		MW-1DX	MW-5	WS-3	MW-3DX	MW-9DX
Analyte	RCGW-1 (mg/L)					
Dissolved Arsenic	0.01	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L

5.5 GROUNDWATER SAMPLING (OCTOBER, 2015)

On October 20, 2015, ICEM was at the Site to gauge and sample the same five monitoring wells. The samples from these monitoring wells, MW-1DX, MW-9DX, MW-5, MW-3DX, and WS-3 were also tested specifically for arsenic. As previously referenced, the groundwater samples were collected with dedicated Teflon bailers in accordance with MassDEP guidance. All groundwater samples were properly preserved and packaged for delivery under a chain of custody to both RAI and Spectrum Analytical Laboratory.

The analytical reports from both laboratories reported no detectable dissolved arsenic at any of the monitoring well locations. Based on these results, it was concluded that the elevated arsenic reported from earlier sampling rounds did not properly characterize the dissolved arsenic concentration of groundwater at the Site and should be discounted. The laboratory results from the October sampling round is presented in Table 5.5 below.

Table 5.5
Analytical Results from 10/20/2015 Groundwater Samples

Sample Location		MW-1DX	MW-5	WS-3	MW-3DX	MW-9DX
Analyte	RCGW-1 (mg/L)					
Dissolved Arsenic RI Analytical	0.01	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L	<0.001 mg/L
Dissolved Arsenic Spectrum Analytical	0.01	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L	<0.004 mg/L

6.0 SITE RECONNAISSANCE

6.1 METHODOLOGY AND LIMITING CONDITIONS

The reconnaissance of the Subject Site was conducted in accordance with generally accepted site assessment practices. On July 28, 2017, Peter Cook of IC Environmental Management, Inc., conducted a review of the Subject Site. At the time of inspection the weather was fair and the ambient temperature was 78° F.

6.2 GENERAL SITE SETTING

The Subject Site is situated within a predominately residential area in the southwest corner of the Town of Norfolk. The Site is located on the northern side of Lawrence Street, to the northwest of Eagle Drive and Cranberry Meadow Road.

6.3 SITE OBSERVATIONS

The observations of the Site were made with an emphasis on the usage and storage of oil and/or hazardous materials (OHM's). The Subject Site occupies a total land area of approximately 140.73 acres. Special emphasis was placed on the south central portion of the property formerly utilized by Buckley & Mann, Inc., for textile manufacturing. Structures in this area of the property include six concrete slab foundations of former manufacturing buildings, as well as the "Consolidation Area" to the northwest of the former site buildings. To the east of the former manufacturing area is Bush Pond. To the west of the former manufacturing area is undeveloped woodland. The area surrounding the Consolidation Area consists of the Tail Race, Mill River and associated wetlands, as well as three (3) former treatment lagoons. To the north of the Mill River, the Site is mostly undeveloped woodland. The property is currently vacant. There are no active utilities serving the Subject Site and access to the Site is controlled by concrete barriers.

With the exception of some demolition debris composed primarily of concrete and brick in the vicinity of the former building slabs, there was no significant trash or other debris noted in this portion of the Site. There was also no visual evidence of staining in any gravel access area or stressed vegetation noted in the area of the former buildings.

A visual inspection of the surface waters on the Site, which included Bush Pond, Mill River, Tail Race, and lagoons found no visual evidence of oil sheen, debris, or stressed vegetation. An inspection of the Consolidation Area revealed the area to be in satisfactory condition with no visual evidence of damage to the geotextile material covering the area. The visual inspection of the wooded areas in the western and northern portion of the Site found no evidence of debris, trash, or excess tree deadfall. Upon completion of site reconnaissance, there was no visual evidence of the use or storage of oil and/or hazardous materials (OHM's) in any area of the Site.

7.0 FINDINGS

The findings of the Phase I Environmental Site Assessment undertaken by IC Environmental Management, Inc., are as follows:

- The Subject Site is the location of the Former Buckley & Mann Textile Manufacturing Facility. The Site consists of three contiguous parcels of land referenced by the Town of Norfolk Assessor as Map 6, Lot 2-3-1 (136.64 acres), Lot 2-3-2 (2.41 acres), and Lot 2-3-3 (1.68 acres). Textiles were manufactured on the Site from approximately 1900 to 1994. The Site has been vacant since 1994 and all existing buildings on the Site were demolished in 2011 with the exception of the concrete slabs.
- The Subject Site was formerly listed as a RCRA hazardous waste generator. The Subject Site was not listed on the ERNS list. The Subject Site was not listed as a NPL site or a SEMS site. No NPL sites or CERCLIS sites were located within a one mile radius of the Subject Site. The Subject Site is not listed as a solid waste landfill. There are currently no registered UST's at or abutting the Site.
- The Subject Site was listed by the MassDEP in 1993 as a Disposal Site following the discovery of chromium, lead, and polycyclic aromatic hydrocarbons (PAH's) in soils and traces of PAH's in shallow groundwater at the Site. Release Tracking Number (RTN) 3-000173 was issued to identify this release condition. In August of 2001, the RTN was closed with a Class A-3 Response Action Outcome (RAO) Statement.
- In association with the Class A-3 RAO, an activity and use limitation (AUL's) was implemented at the Site. This AUL was registered in the Norfolk County Land Registration Office, Certificate of Title Number 154753, Book 774, Page 153, dated August 20, 2001.
- An inspection of the Consolidation Area revealed the area to be in satisfactory condition with no visual evidence of damage to the geotextile material covering the area.
- Soil samples collected from test pits excavated in the vicinity of the former manufacturing buildings for priority metals and extractable petroleum hydrocarbons (EPH) reported the concentration of Nickel at four locations which exceeded the corresponding RCS-1 Standard. The composite sample analyzed for EPH with Targets reported no concentrations above the corresponding RCS-1 Standards. Based on visual observations made during test pit excavation and prior references to coal ash being present on the Site, it is likely the presence of the coal ash contributed to the elevated nickel.
- Groundwater samples were collected from on-site monitoring wells for priority metals and volatile organic compounds analysis. Initial testing reported elevated arsenic concentrations at 6 well locations. Following the re-sampling of these well locations

and analytical testing from two other certified laboratories, no detectable dissolved arsenic was reported at any of the monitoring well locations sampled. No other tested constituent exceeded any Reportable Concentration (RC) GW-1 Standard.

8.0 OPINIONS

Based upon a review of environmental information pertaining to the Subject Site, there is a history of textile manufacturing from approximately 1900 to 1994. There is a record of the release of chromium, lead, and polycyclic aromatic hydrocarbons (PAH's) in soils and traces of PAH's in shallow groundwater at the Site. There is a record of the placement of an AUL on the Site to restrict access to materials consolidated during remediation activities on the Site. At this time, no further action is required under the Massachusetts Contingency Plan for the Site, with the exception of the maintenance and annual inspection of the integrity of the "Consolidation Area". There was no record of any other documented releases within a one half mile radius of the Site. Following the collection and analytical testing of on-site soil and groundwater from the Site, no new release conditions were reported.

9.0 CONCLUSIONS

IC Environmental Management, Inc., has performed a Phase I Environmental Site Assessment, in conformance with the scope of services, for the property identified as 17 Lawrence Street, Norfolk, Massachusetts. Any exceptions to, or deletions from this practice were described in Section 1.4 of this Phase I Report. Based upon the information presented in this assessment, IC Environmental Management, Inc., has determined that the presence of the Consolidation Area on the Site meets the definition of a **Recognized Environmental Condition**. It should be noted however, that this environmental condition has been managed in accordance with the Massachusetts Contingency Plan and that the Site is currently in compliance with MassDEP regulations.

10.0 DATA GAP IDENTIFICATION/DEVIATIONS

As part of AAI, identification of data gaps in the information developed as part of the inquiry that affect the ability of the environmental professional to identify conditions indicative of releases or threatened releases of hazardous substances on, at, in, or to the Subject Site was conducted. No deviations and deletions from ASTM Practice E 1527-13 were made during this site assessment investigation.

11.0 ADDITIONAL SERVICES

No additional services were provided as part of this assessment.

12.0 SIGNATURE OF ENVIRONMENTAL PROFESSIONAL

This report is dated August 1, 2017, and is signed by a duly authorized individual. Additionally, it is declared that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in the AAI rule. I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property.

A handwritten signature in black ink, appearing to read 'P. F. Cook', is written over a horizontal line.

Peter F. Cook
Environmental Engineer

13.0 QUALIFICATIONS OF RESPONSIBLE ENVIRONMENTAL PROFESSIONALS

The investigation of the Subject Site described in this assessment report was performed by Peter F. Cook (Environmental Engineer), hereinafter referred to as the "Site Investigator". The Site Investigator has received a baccalaureate degree from an accredited institution of higher education in a relevant discipline of engineering, environmental science, or earth science and the equivalent of five (5) years of full-time relevant experience. The Site Investigator is familiar with the provisions of the Massachusetts General Law, Chapter 21-E (as it may be from time to time amended) and all implementing regulations under said law, including materials that are defined as "oil" and "hazardous materials". References in this report to oil and/or hazardous materials refer to said terms as defined in M.G.L. Chapter 21-E and implementing regulations. The Site Investigator is knowledgeable and familiar with hazardous substances as defined by the Comprehensive Environmental Responsibility, Compensation, and Liability Act (CERCLA) of 1980, as amended. Additional qualifications are included in Appendix E.

Appendix A

Site Maps

17 Lawrence Street, Norfolk, MA



MassDEP ^{MA} Bureau of Waste Site Cleanup

Site Information:

17 LAWRENCE STREET NORFOLK, MA
3-000000173

NAD83 UTM Meters:
4663395mN, 305204mE (Zone: 19)
August 2, 2017

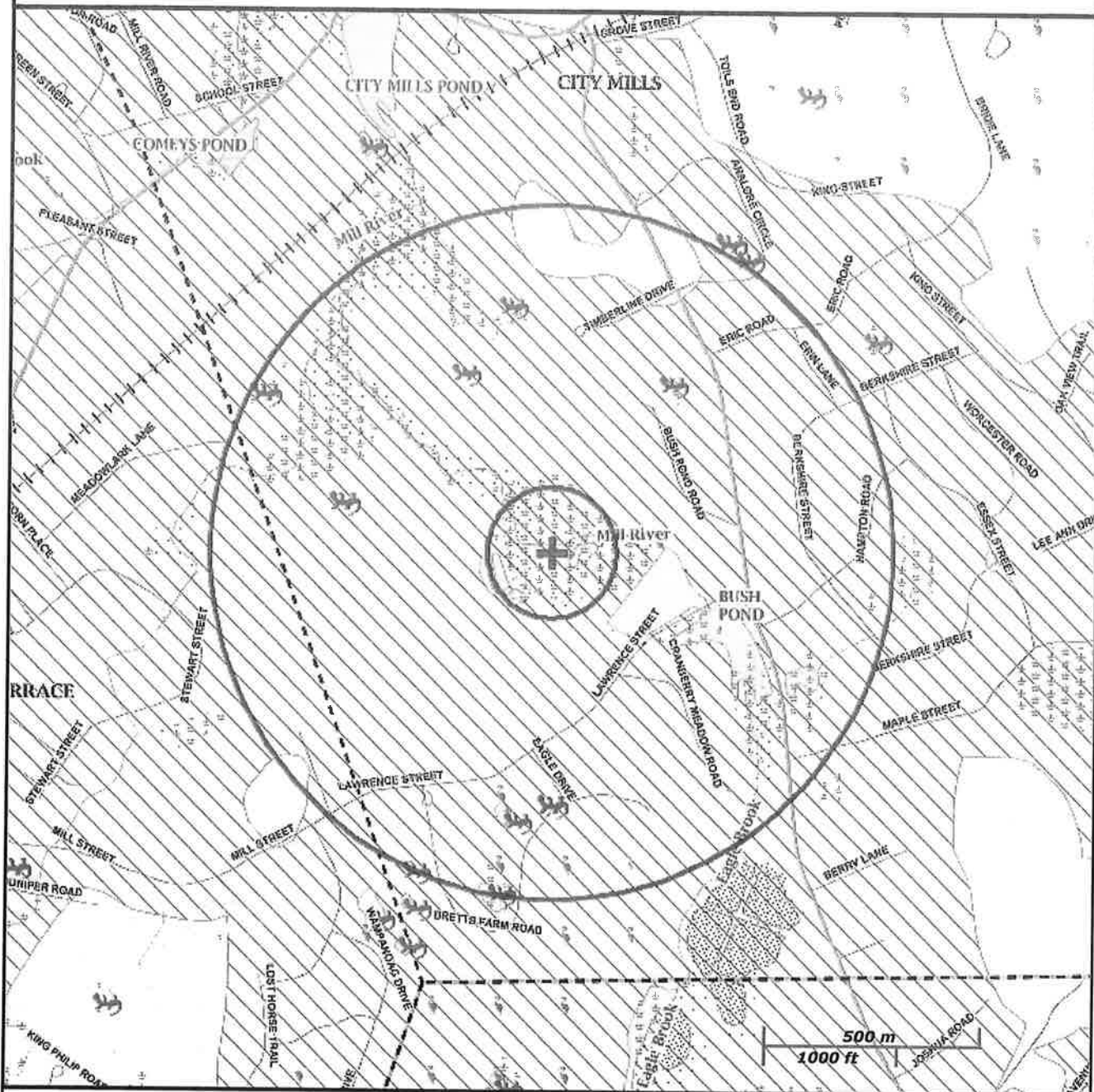
Phase 1 Site Assessment Map: 500 feet & 0.5 Mile Radii

The information shown is the best available at the date of printing. However, it may be incomplete. The responsible party and LSP are ultimately responsible for ascertaining the true conditions surrounding the site. Metadata for data layers shown on this map can be found at:
<http://www.mass.gov/mgis/>



MassDEP

Commonwealth of Massachusetts
Department of Environmental Protection



Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail

Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct

Basins: Major, PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam

Aquifers: Medium Yield, High Yield, EPA Sole Source.....

Non Potential Drinking Water Source Area: Medium, High (Yield)...

PWS Protection Areas: Zone II, IWPA, Zone A

Hydrography: Open Water, PWS Reservoir, Tidal Flat

Wetlands: Freshwater, Saltwater, Cranberry Bog

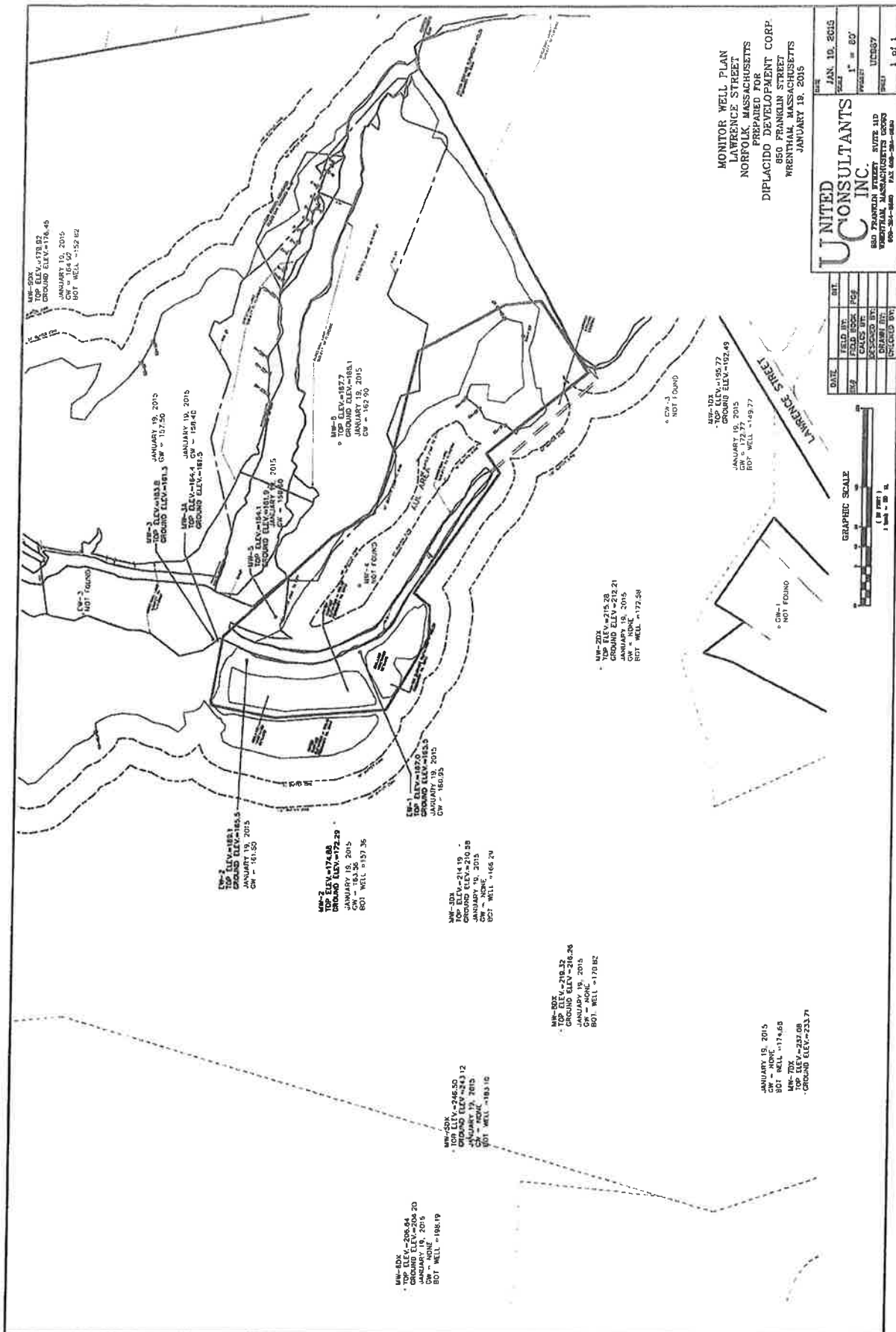
FEMA 100yr Floodplain; Protected Open Space; ACEC

Est. Rare Wetland Wildlife Hab; Vernal Pool: Cert., Potential

Solid Waste Landfill; PWS: Com GW, SW, Emerg., Non-Com



17 LAWRENCE STREET, NORFOLK, MA
TEST PIT LOCATION PLAN



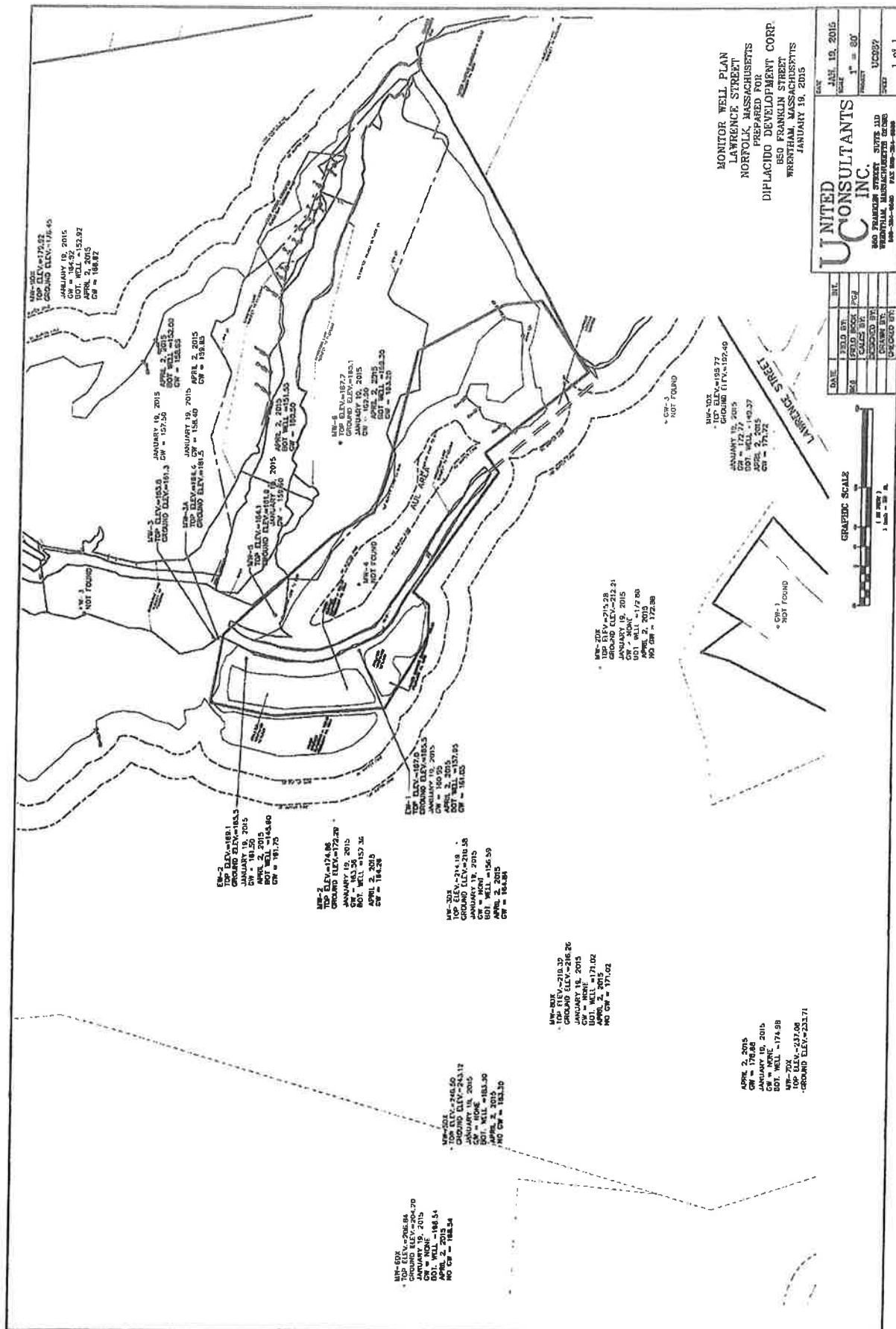


Figure 1.
Norfolk Water System
Lawrence Street
Test Well Siting

- Legend**
- ✦ Borings
 - ◆ New Wells
 - ⊕ Existing Wells
 - ||||| Dirt Road/Path
 - ▭ Norfolk Parcels
 - BYW
 - 100-ft Wetland Buffer
 - Riparian Zones
 - Parcel 400-ft Buffer
 - Perennial Stream
 - Intermittent Stream
 - Shoreline
 - Marsh/Bog
 - Wooded marsh
 - Open Water

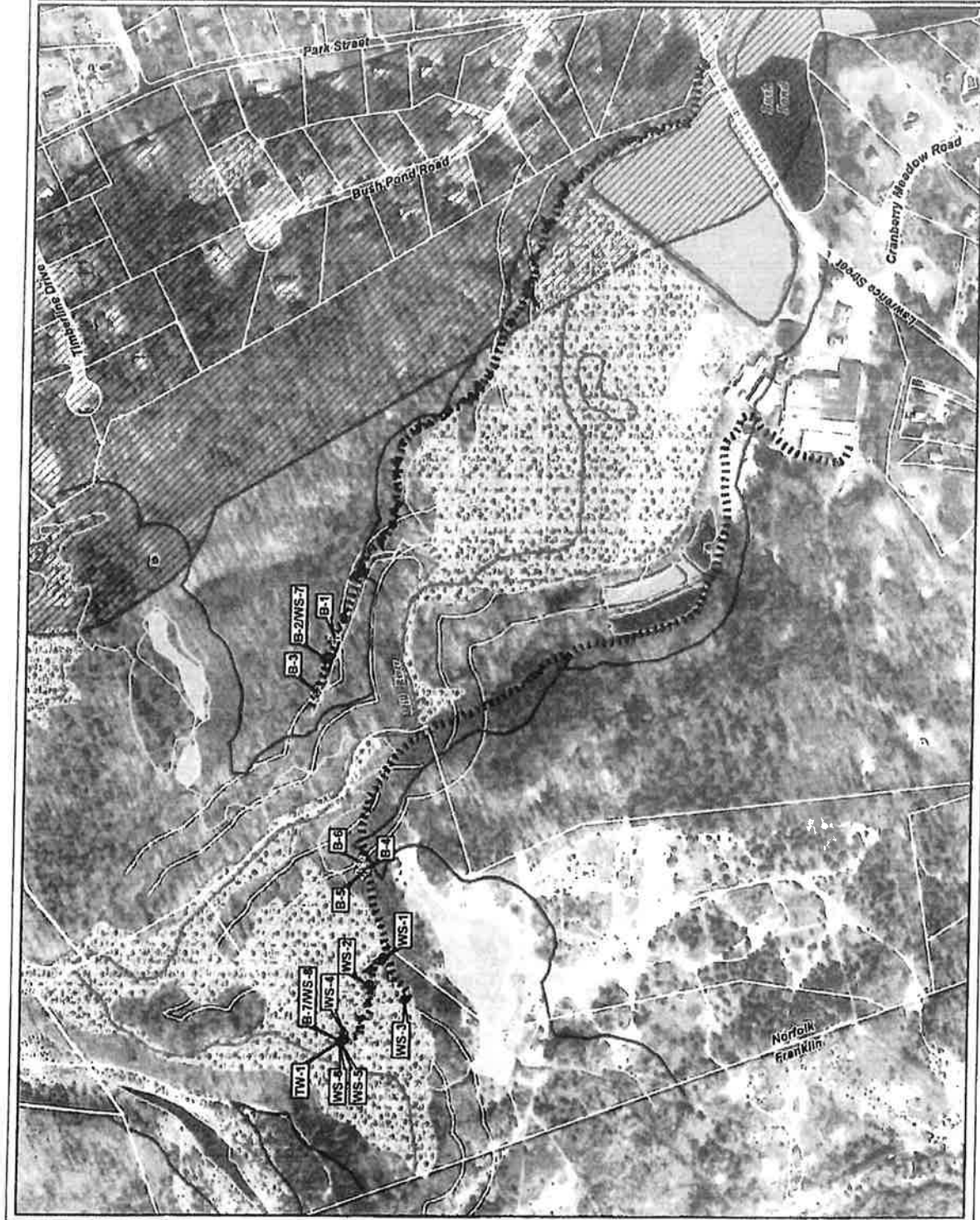
- Notes:**
1. Borings & Well locations field located by EPG
 2. WS-1 through WS-4 are 2" monitoring wells with 1" piezometer, unknown install date
 3. WS-5 and WS-6 are 2.5" diameter wells installed in 1992
 4. WS-7 is a 2" monitoring well, WS-8 is a 2" test well, with stainless steel screen, installed in July 2013
 5. TW-1 is a 4" test well, with stainless steel screen, installed in July 2013
 6. Property Lines shown are approximate based on Town of Norfolk Assessor Maps



August 2013



Environmental 22 Partners
A partnership for environmental protection



Norfolk Water System Subdivision Review

Subdivision Name: The Preserve at Abbyville

Owner: Abbyville Development, LLC.
850 Franklin Street
Wrentham, MA 02093

Engineer: United Consultants, Inc.
850 Franklin Street
Wrentham, Massachusetts 02093

Reviewed By: Ryan J. Allgrove, P.E.

Date: July 28, 2017

At the request of the Norfolk Department of Public Works, Environmental Partners Group, Inc. has completed an assessment of the water system hydraulics associated with the proposed Preserve at Abbyville residential development. The Preserve at Abbyville is located in the southwestern area of Norfolk primarily within the parcel of land at 17 Lawrence Street. This assessment is based on subdivision plans prepared by United Consultants, Inc. dated March 15, 2017 and documents available on the Town of Norfolk Zoning Board of Appeals website. All hydraulic simulations for the Preserve at Abbyville incorporated the proposed water main infrastructure within the Abbyville Commons subdivision.

Water Demand

The proposed Preserve at Abbyville residential development consists of one hundred forty-eight residential units. The following table summarizes the estimated water usage for the development based on information from the Town's most recent DEP Annual Statistical Reports (ASR).

Usage Scenario	Calculation	Estimate Usage
Average Day Demand (ADD)	154 gpd / residential service x 148 Units	22,792 gpd
Maximum Day Demand (MDD)	2.2 x ADD	50,142 gpd
Peak Hour Demand (PHD)	2 x MDD	100,284 gpd

Static Pressure Requirements

Water distribution system static water pressure refers to the pressure in a main when there is no water flowing and reflects the water level in the storage tank(s). Based on DEP Guidelines and Policies for Public Water Systems, the normal working pressure in the distribution system should be approximately 60 pounds per square inch (psi) and not less than 35 psi. The hydraulic grade line (HGL) for the Norfolk water system fluctuates between 365 feet (USGS Datum) when the tanks are full to 355 feet when the water level in the tanks is down 10 feet. In order to maintain a minimum pressure of 35 psi at a HGL of 365 feet, a water customer must be connected to the water system at an elevation no higher than 284 feet (USGS datum). Elevations greater than 284 feet will result in static pressures less than the DEP required pressure of 35 psi.

Based on the finished grade elevations (NAVD 88 datum) shown on the plans, the proposed dwellings will meet minimum DEP pressure requirements. During typical water system operations, pressures at the proposed dwellings and along Lawrence Street will range from 48 psi to 81 psi.

Fire Flow Requirements

In accordance with DEP Guidelines and Policies for Public Water Systems, water system design must maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow (including fire flow conditions). The Norfolk water system hydraulic model was used to calculate the available fire flow in connection with the Preserve at Abbyville development. Based on the proposed distribution system network with 12-inch and 8-inch ductile-iron piping, the lowest available fire flow occurs at the intersection of Lawrence Street at Eagle Drive. Approximately 1,650 gpm fire flow is available while maintaining a 20 psi residual pressure within the entire water system.. A schematic diagram of the modeled network is provided in Figure 1. Fire flow guidelines set forth by the Insurance Services Office (ISO) for one and two family dwellings are summarized in the table on the following page:

ISO Needed Fire Flows (one and two family dwellings)

Distance between Dwellings (feet)	Needed Fire Flow (gpm)
Greater than 100	500
31 – 100	750
11 – 30	1000
Less than 10	1500

Based on the proposed dwelling spacing, the project represents a fire flow requirement of 1,000 gallons per minute (gpm). Actual fire flow requirements should be confirmed by the developer.

Water System Materials

All water system materials shall be as per DPW specifications (latest version). Water mains to be 8-inch ductile iron pipe, class 52, conforming to AWWA C150 and AWWA C151, push on type joints with gaskets conforming to AWWA C111, double cement lined inside conforming to AWWA C104, and asphalt seal coated outside (coal tar coated outside conforming to AWWA 203 in areas where groundwater levels are above the pipe laying depth). All pipe fittings shall be ductile iron, class 350 mechanical joint conforming to AWWA C153. All fittings shall be restrained with Megalug Series 1100. Water mains shall have a minimum of five feet of cover. All gate valves shall be US Pipe Metroseal 250 or American Flow Control Model AFC2500 resilient wedge seated valves conforming to AWWA C-509, open left. Hydrants shall be American Darling (American Flow Control) B62B open right, conforming to AWWA C-502 (Dry Barrel Hydrants) and painted red.

Water service pipe shall be 1” polyethylene tubing, PE4710 with tracer wire. Copper tubing shall not be used. Corporation valves shall be Mueller 300 ball type with Mueller “CC” inlet thread and pack joint connection outlet. Curb stops shall be Mueller Mark II Oriseal Curb Valve Model P-15219N. Curb stop boxes shall be buffalo style.

All material specifications shall be submitted to the Norfolk DPW for review and approval prior to installation.

Hyannis:
396 North Street, Hyannis, MA 02601
TL 508.568.5103 • FX 508.568.5125

Headquarters:
1900 Crown Colony Drive, Suite 402, Quincy, MA 02169
TL 617.657.0200 • FX 617.657.0201

Woburn:
18 Commerce Way, Suite 2000, Woburn, MA 01801
TL 781.281.2542 • FX 781.281.2543

Pressure Testing and Chlorination

Water mains shall be tested at minimum of 150 psi or 150% of the static pressure (whichever is greater) for a minimum of two hours. Water mains will have an allowable leakage determined by the DPW. Water mains shall be chlorinated as per AWWA standards with a minimum of 48 hours of contact time. Water mains shall be flushed until chlorine has been eliminated and sampled for total coliform by the DPW. The main shall be tested again after 24 hours of contact time with non-chlorinated water by the DPW.

Distribution System Piping

The proposed Lawrence Street water main extension needed for the proposed subdivision was also reviewed for discontinuities, looping, valve, and hydrant placement. The following comments require a response from the developer:

- Please provide further detail on how the proposed 12” ductile-iron water main will cross the culvert on Lawrence Street at Bush Pond.
- Please note whether you intend to cut in a 12” by 12” tee or use a tapping sleeve and valve to make the connection at the intersection of Lawrence Street and Park Street.
- Shutdowns shall be limited to 4 hours and shall be coordinated with the Town’s Department of Public Works.
- GIS records indicate that there is an existing 12” water main stub on Lawrence Street from Park Street. Confirm with water department and excavate a test pit as required to utilize the existing stub if possible.
- Service stubs shall be installed to the property line of the parcels on Lawrence Street along the water main extension route. Gated side street stubs should be installed at Cranberry Meadow Road, Eagle Drive and Bretts Farm Road.

- It is recommended that the Lawrence Street extension be 12-inch for the entire length rather than reduce to 8-inch after Elliot Boulevard. This will provide a high capacity main in the event that an interconnection with Franklin or a new storage tank on Lawrence Street are pursued.

Lawrence Street Well

As part of the Town’s ongoing well exploration program, a potential groundwater supply source was identified in 2013 at the 17 Lawrence Street Site on the west side of the Mill River. A four-inch test well (TW-1) was installed and a 5-day pump test was performed to evaluate potential well yield. Further testing at higher flow rates was recommended to determine if the well is viable as a public water supply source.

Based on available mapping, it appears that the potential groundwater source (TW-1) is located approximately 600 feet from the nearest proposed residential parcel within the Preserve at Abbyville subdivision. It should be confirmed by the developer that the proposed subdivided parcels are not within 400 feet of any potential water supply source. MassDEP requires the Town own or control the 400 foot radius (Zone 1) around a public water supply.

Elevated nitrate levels at the potential well due to the development are of additional concern. The preliminary water quality testing result for nitrate was 3.55 mg/L. MassDEP has established a planning goal of preventing a 5 mg/L nitrate load for public supply wells. Nitrate levels above 5 mg/L are subject to MassDEP regulations for Water Supply Protection (310 CMR 22.21 2.d), which would require a public water supplier to prepare a nitrate management plan if nitrate levels exceed 5 mg/L during any testing. The maximum contaminant level (MCL) for nitrate/nitrite (total) is 10 mg/L. The development’s proposed septic systems in relative close proximity to the potential well could result in elevating nitrate levels above the “planning threshold.”

Recommendations

The Norfolk water distribution system can provide acceptable pressures to the proposed Preserve at Abbyville residential development. The pressures in the development benefit from their elevation and it is not anticipated that they will fluctuate significantly during high usage periods. In addition,

hydraulic modeling results indicate that the Norfolk water system can also provide fire flows typically considered adequate for similar residential areas. Actual fire flow requirements for the development should be confirmed by the developer.

The Preserve at Abbyville residential development will increase the water system demand for the Town of Norfolk by approximately 22,792 gpd representing approximately 38% of the new services that the system can support through 2019 under the Town's existing Water Management Act (WMA) permit, as described in EPG's 2017 Water Supply Assessment report. The combined reliable daily capacity of the Gold Street and Spruce Road facilities (0.96 MGD) is approximately equal to the Town's current summer maximum day demands (2015 Maximum Day = 0.93 MGD). Projected maximum day demands for the proposed development of 0.05 MGD will increase the system's reliance on storage to meet high demand periods and increase the likelihood that an interconnection with a neighboring Town will need to be activated. The pace of this development's construction should be closely monitored in conjunction with other development in Town to ensure that WMA permit limits are not exceeded. Approximately 50 new water services per year can be supported by the WMA permit through 2029.

Additionally, the Town's existing available water supply sources cannot support its existing water customers if either of its two sources are rendered inoperable or placed out of service. If either the Gold Street Wells or the Spruce Road Wells are out of service, the Town would have to rely on emergency interconnections with neighboring communities to meet seasonal water demands. EPG recommends that the Town continue to pursue development of a new water supply source to meet projected future demands and minimize Norfolk's dependence on existing interconnections with the communities of Wrentham and Franklin.

Additional testing and study is needed at the Lawrence Street well site to determine its viability as a public water supply for the Town and to understand the potential effects the development could have on water quality. It is recommended that an aquifer test be performed using a minimum 8-inch diameter test well to stress the aquifer and evaluate potential well yield. If the aquifer test has favorable results, a groundwater flow study should be performed to determine the development's effects on nitrate levels at the well. In the interim, the limits of the 400-ft radius for TW-1 should be confirmed and the Zone 1 area reserved from development.

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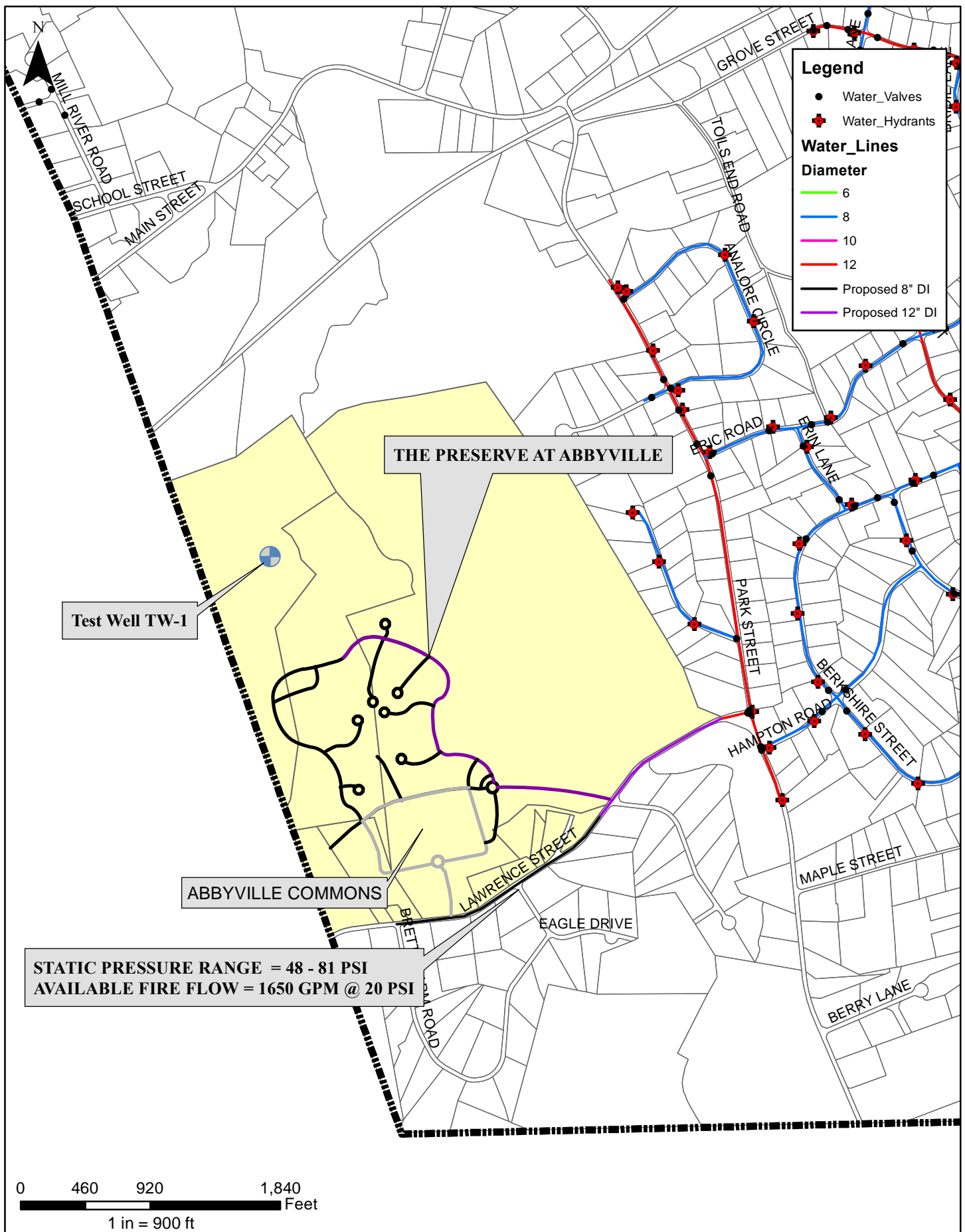


FIGURE 1
THE PRESERVE AT ABBYVILLE
JULY 28, 2017

Norfolk Water System Subdivision Review

Subdivision Name: Abbyville Commons

Owner: Abbyville Development, LLC.
850 Franklin Street
Wrentham, MA 02093

Engineer: United Consultants, Inc.
850 Franklin Street
Wrentham, Massachusetts 02093

Reviewed By: Ryan J. Allgrove, P.E.

Date: July 28, 2017

At the request of the Norfolk Department of Public Works, Environmental Partners Group, Inc. has completed an assessment of the water system hydraulics associated with the proposed Abbyville Commons residential development. Abbyville Commons is located in the southwestern area of Norfolk within the parcel of land at 17 Lawrence Street. This assessment is based on subdivision plans prepared by United Consultants, Inc. dated March 15, 2017 and documents available on the Town of Norfolk Zoning Board of Appeals website. All hydraulic simulations for Abbyville Commons incorporated the proposed water main extension on Lawrence Street and water infrastructure within the Preserve at Abbyville subdivision.

Water Demand

The proposed Abbyville Commons residential development consists of forty-eight residential units. The following table summarizes the estimated water usage for the development based on information from the Town's most recent DEP Annual Statistical Reports (ASR).

Usage Scenario	Calculation	Estimate Usage
Average Day Demand (ADD)	154 gpd / residential service x 48 Units	7,392 gpd
Maximum Day Demand (MDD)	2.2 x ADD	16,262 gpd
Peak Hour Demand (PHD)	2 x MDD	32,524 gpd

Static Pressure Requirements

Water distribution system static water pressure refers to the pressure in a main when there is no water flowing and reflects the water level in the storage tank(s). Based on DEP Guidelines and Policies for Public Water Systems, the normal working pressure in the distribution system should be approximately 60 pounds per square inch (psi) and not less than 35 psi. The hydraulic grade line (HGL) for the Norfolk water system fluctuates between 365 feet (USGS Datum) when the tanks are full to 355 feet when the water level in the tanks is down 10 feet. In order to maintain a minimum pressure of 35 psi at a HGL of 365 feet, a water customer must be connected to the water system at an elevation no higher than 284 feet (USGS datum). Elevations greater than 284 feet will result in static pressures less than the DEP required pressure of 35 psi.

Based on the finished grade elevations (NAVD 88 datum) shown on the plans, the proposed dwellings will meet minimum DEP pressure requirements. During typical water system operations, pressures at the proposed dwellings will range from 61 psi to 74 psi.

Fire Flow Requirements

In accordance with DEP Guidelines and Policies for Public Water Systems, water system design must maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow (including fire flow conditions). The Norfolk water system hydraulic model was used to calculate the available fire flow within the Abbyville Common development at the proposed hydrant at the intersection of Annie Loop and Buckley Boulevard. This hydrant has the highest elevation in the subdivision and lowest static pressure. Based on the proposed distribution system network with 8-inch ductile-iron piping, model simulations show that approximately 1,725 gpm fire flow is available at 20 psi residual pressure. A schematic diagram of the modeled network is provided in Figure 1. Fire flow guidelines set forth by the Insurance Services Office (ISO) for one and two family dwellings are summarized in the table on the following page:

ISO Needed Fire Flows (one and two family dwellings)

Distance between Dwellings (feet)	Needed Fire Flow (gpm)
Greater than 100	500
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Less than 10	1500

Based on the proposed dwelling spacing, the project represents a fire flow requirement of 1,000 gallons per minute (gpm). Actual fire flow requirements should be confirmed by the developer.

Water System Materials

All water system materials shall be as per DPW specifications (latest version). Water mains to be 8-inch ductile iron pipe, class 52, conforming to AWWA C150 and AWWA C151, push on type joints with gaskets conforming to AWWA C111, double cement lined inside conforming to AWWA C104, and asphalt seal coated outside (coal tar coated outside conforming to AWWA 203 in areas where groundwater levels are above the pipe laying depth). All pipe fittings shall be ductile iron, class 350 mechanical joint conforming to AWWA C153. All fittings shall be restrained with Megalug Series 1100. Water mains shall have a minimum of five feet of cover. All gate valves shall be US Pipe Metroseal 250 or American Flow Control Model AFC2500 resilient wedge seated valves conforming to AWWA C-509, open left. Hydrants shall be American Darling (American Flow Control) B62B open right, conforming to AWWA C-502 (Dry Barrel Hydrants) and painted red.

Water service pipe shall be 1” polyethylene tubing, PE4710 with tracer wire. Copper tubing shall not be used. Corporation valves shall be Mueller 300 ball type with Mueller “CC” inlet thread and pack joint connection outlet. Curb stops shall be Mueller Mark II Oriseal Curb Valve Model P-15219N. Curb stop boxes shall be buffalo style.

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Pressure Testing and Chlorination

Water mains shall be tested at minimum of 150 psi or 150% of the static pressure (whichever is greater) for a minimum of two hours. Water mains will have an allowable leakage determined by the DPW. Water mains shall be chlorinated as per AWWA standards with a minimum of 48 hours of contact time. Water mains shall be flushed until chlorine has been eliminated and sampled for total coliform by the DPW. The main shall be tested again after 24 hours of contact time with non-chlorinated water by the DPW.

Distribution System Piping

The water system of the proposed subdivision was not reviewed for discontinuities, looping, valve, and hydrant placement. Shutdowns shall be limited to 4 hours and shall be coordinated with the Town's Department of Public Works.

Lawrence Street Well

As part of the Town's ongoing well exploration program, a potential groundwater supply source was identified in 2013 at the 17 Lawrence Street Site on the west side of the Mill River. A four-inch test well (TW-1) was installed and a 5-day pump test was performed to evaluate potential well yield. Further testing at higher flow rates was recommended to determine if the well is viable as a public water supply source.

Based on available mapping, it appears that the potential groundwater source (TW-1) is located approximately 600 feet from the nearest proposed residential parcel within the overall Abbyville development (Commons/Preserve). It should be confirmed by the developer that the proposed subdivided parcels are not within 400 feet of any potential water supply source. MassDEP requires the Town own or control the 400 foot radius (Zone 1) around a public water supply.

Elevated nitrate levels at the potential well due to the development are of additional concern. The preliminary water quality testing result for nitrate was 3.55 mg/L. MassDEP has established a planning goal of preventing a 5 mg/L nitrate load for public supply wells. Nitrate levels above 5 mg/L are subject to MassDEP regulations for Water Supply Protection (310 CMR 22.21 2.d), which would require a public water supplier to prepare a nitrate management plan if nitrate levels exceed 5

mg/L during any testing. The maximum contaminant level (MCL) for nitrate/nitrite (total) is 10 mg/L. The development's proposed septic systems in relative close proximity to the potential well could result in elevating nitrate levels above the "planning threshold."

Recommendations

The Norfolk water distribution system can provide acceptable pressures to the proposed Abbyville Commons residential development. The pressures in the development benefit from their elevation and it is not anticipated that they will fluctuate significantly during high usage periods. In addition, hydraulic modeling results indicate that the Norfolk water system can also provide fire flows typically considered adequate for similar residential areas. Actual fire flow requirements for the development should be confirmed by the developer.

The Abbyville Commons residential development will increase the water system demand for the Town of Norfolk by approximately 7,392 gpd representing approximately 12% of the new services that the system can support through 2019 under the Town's existing Water Management Act permit, as described in EPG's 2017 Water Supply Assessment report. The combined reliable daily capacity of the Gold Street and Spruce Road facilities (0.96 MGD) is approximately equal to the Town's current summer maximum day demands (2015 Maximum Day = 0.93 MGD). Projected maximum day demands for the proposed development of 0.016 MGD will increase the system's reliance on storage to meet high demand periods and increase the likelihood that an interconnection with a neighboring Town will need to be activated. The pace of this development's construction should be closely monitored in conjunction with other development in Town to ensure that WMA permit limits are not exceeded. Approximately 50 new water services per year can be supported by the WMA permit through 2029.

Additionally, the Town's existing available water supply sources cannot support its existing water customers if either of its two sources are rendered inoperable or placed out of service. If either the Gold Street Wells or the Spruce Road Wells are out of service, the Town would have to rely on emergency interconnections with neighboring communities to meet seasonal water demands. EPG recommends that the Town continue to pursue development of a new water supply source to meet projected future demands and minimize Norfolk's dependence on existing interconnections with the

communities of Wrentham and Franklin

Additional testing and study is needed at the Lawrence Street well site to determine its viability as a public water supply for the Town and to understand the potential effects the development could have on water quality. It is recommended that an aquifer test be performed using a minimum 8-inch diameter test well to stress the aquifer and evaluate potential well yield. If the aquifer test has favorable results, a groundwater flow study should be performed to determine the development's effects on nitrate levels at the well. In the interim, the limits of the 400-ft radius for TW-1 should be confirmed and the Zone 1 area reserved from development.

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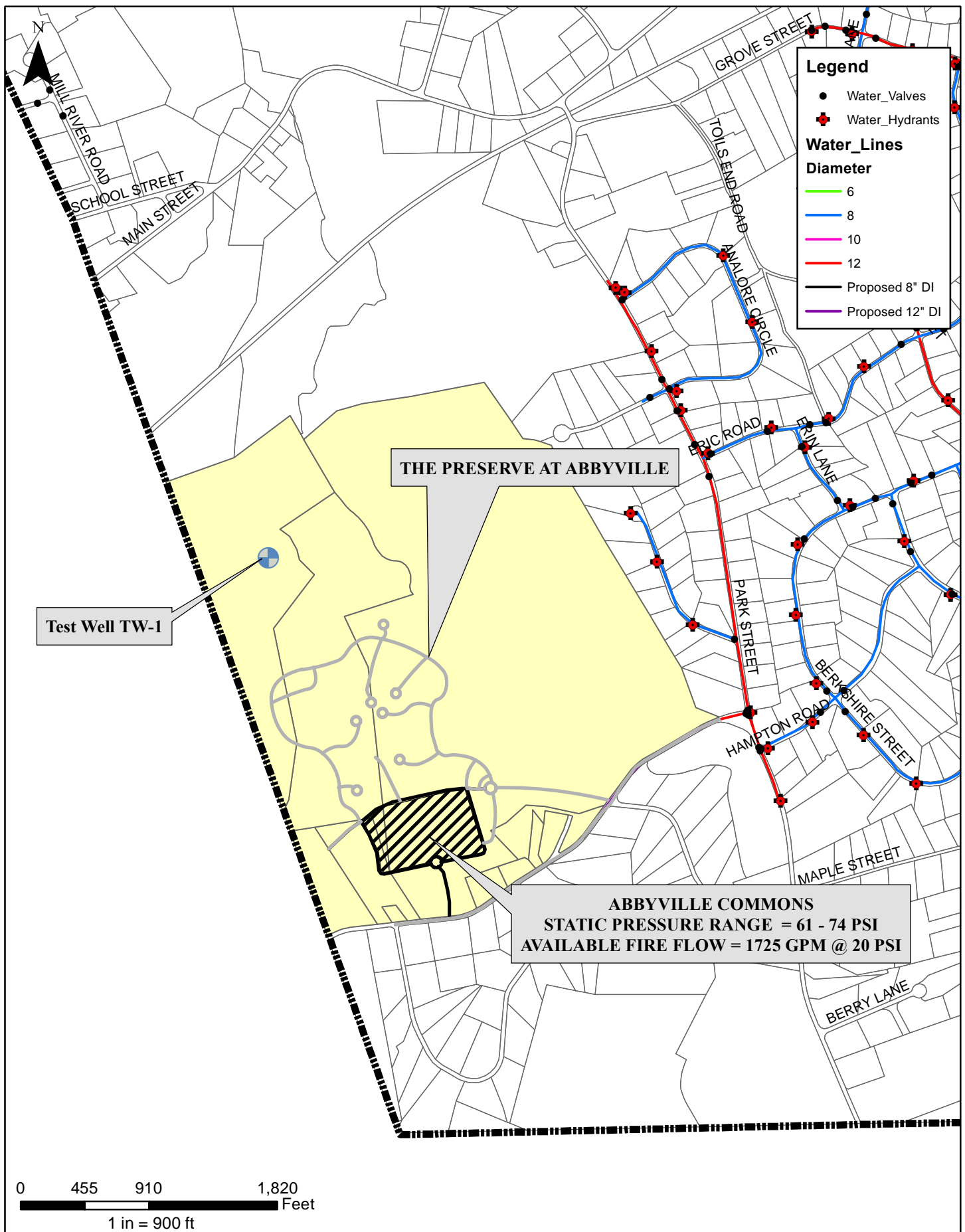


FIGURE 1
ABBYVILLE COMMONS
JULY 28, 2017