GrowthPoint
Southern Rhode Island Growth Reinforcement Project

West Warwick, Warwick, and East Greenwich, Rhode Island

PREPARED FOR

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Glossary

BMPs:	Best Management Practices
dB(A):	Decibel, on the A-weighted scale. A decibel is a logarithmic unit of measurement that expresses the magnitude of a sound. A-weighting is used to emphasize the range of frequencies where human hearing is most sensitive.
Distribution System:	Distribution mains and other distribution infrastructure responsible for delivering natural gas to end-users/customers.
EFSB:	Rhode Island Energy Facility Siting Board
Environmental Monitor:	Inspects environmental conditions within the construction site, reviews the contractors' compliance with environmental permit conditions during the construction phase of a project, and makes recommendations for corrective actions to protect sensitive environmental resources proximate to a construction site.
FEMA:	Federal Emergency Management Agency
Glacial till:	Type of surficial geologic deposit that consists of boulders, gravel, sand silt, and clay mixed in various proportions. These deposits are predominantly nonsorted, nonstratified sediment and are deposited directly by glaciers.
Gneiss:	Light and dark, medium- to coarse-grained metamorphic rock characterized by compositional banding of light and dark minerals, typically composed of quartz, feldspar, and various amounts of dark minerals.
LNG:	Liquefied Natural Gas
PUC:	Rhode Island Public Utilities Commission
Regulator Station:	Equipment installed for the purpose of automatically reducing and regulating the gas pressure in the downstream main, holder, pressure vessel or compressor station piping to which it is connected.
Reinforcement:	Any of a number of approaches to improve the capacity of the system, including rebuilding, uprating, and adding additional distribution mains.
RIDEM:	Rhode Island Department of Environmental Management
RIDOT:	Rhode Island Department of Transportation
RIGIS:	Rhode Island Geographic Information System
R.I.G.L.:	Rhode Island General Laws
RIHPHC:	Rhode Island Historical Preservation and Heritage Commission
RINHP:	Rhode Island Natural Heritage Program
RIPDES:	Rhode Island Pollutant Discharge Elimination System
Schist:	Light, silvery to dark, coarse to very coarse-grained, strongly to very strongly layered metamorphic rock whose layering is typically defined by parallel alignment of micas. Primarily composed of mica, quartz and feldspar; occasionally spotted with conspicuous garnets.

TMDL:	Total Maximum Daily Load, Maximum allowed pollutant load to a water body without exceeding water quality standards.
USDA:	United States Department of Agriculture
USFWS:	United States Fish and Wildlife Service
USGS:	United States Geological Survey
Watercourse:	Rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs, and all other bodies of water, natural or artificial, public or private.
Wetland:	Land, including submerged land, which consists of any of the soil types designated as poorly drained, very poorly drained, alluvial or floodplain by the U.S. Department of Agriculture, Natural Resources Conservation Service. Wetlands include federally jurisdictional wetlands of the U.S. and navigable waters, freshwater wetlands or coastal resources regulated by a state or local regulatory authority. Jurisdictional wetlands are classified based on a combination of soil type, wetland plants, and hydrologic regime, or state-defined wetland types.

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Introduction

This Siting Report is in support of The Narragansett Electric Company d/b/a National Grid (the Company) Petition for a Declaratory Order (Petition) that is filed with the EFSB in connection with the GrowthPoint—Southern Rhode Island Growth Reinforcement Project (Project).

The southern Rhode Island service territory, includes the cities, towns and villages of Warwick, West Warwick, East Greenwich, Coventry, Cranston, Exeter, Kingston, Narragansett, North Kingstown, South Kingstown, Scituate, Wakefield, West Greenwich and West Kingston, and is served by the Cranston Take Station. The over 30,000 customers[1] in this part of the Company's service territory are served by almost 600 miles of distribution infrastructure, including approximately 77 miles of distribution main operating at pressures 99 pound-force per square inch gauge (psig) and above (the Southern RI Distribution Mains). There is a

[1] This number includes end-user distribution residential, commercial, and retail customers.

[redacted] maximum allowable operating pressure (MAOP) system, operating at [redacted] in this area and is presently operating at maximum capacity. The Company utilizes LNG vaporization at the Exeter LNG facility to pressure support [redacted] is specifically required because the existing distribution infrastructure does not have sufficient capacity to transport gas from the gate stations to the extremities of the system in the [redacted]

Current growth forecasts indicate that maximum vaporization capacity at the Exeter LNG facility will be exceeded by 2019. To address these capacity issues, the Company proposes to reinforce the Southern RI Distribution Mains by installing approximately five miles of new 20-inch steel distribution main parallel to the existing 12-inch distribution main located beneath Route 2 (a RIDOT right-of-way) through the municipalities of Warwick, West Warwick, and East Greenwich.[2] The proposed parallel distribution main will be constructed to be In-Line Inspected (commonly known as ILI), initially operated at 99 psig and designed for a MAOP of 200 psig to meet future demand. The Project will comprise approximately seven percent of the existing Southern RI Distribution Mains.

Building this Project will increase system capacity to meet forecasted growth and maintain system pressure. The installation of a second distribution main proposed by the Project will also improve the reliability of the natural gas system in the area by decreasing the Company's dependence on pressure support from the Exeter LNG facility and by introducing redundancy that reduces the risk associated with a distribution main being out of service. This Project further addresses system issues on the 99 psig feeder system that currently limit regional targeted growth projects on downstream distribution systems reviewed by Operations Engineering as gas capacity requests.

The Southern RI Distribution Mains are "associated with the transfer of…gas…via pipeline," making them a "major energy facility" pursuant to the Energy Facility Siting Act. R.I. Gen. Laws § 42-98-3(d). See also § 1.2(p) of the EFSB's Rules of Practice and Procedure. The Company is submitting its Petition based on its belief that the Project does not constitute an

[2] At 90% design, the length of the distribution main to be installed will be approximately 5,780 feet in West Warwick, 620 feet in Warwick and 20,210 feet in East Greenwich.

"alteration" of a major energy facility because the reinforcement of the existing Southern RI Distribution Mains is not "a significant modification to a major energy facility…which will result in a significant impact on the environment or the public health, safety and welfare." R.I. Gen. Laws § 42-98-3(b). Indeed, this proposed distribution main reinforcement is analogous to an electric reconductoring project, which the EFSB has determined is not an "alteration" of a major energy facility requiring a full application under the Energy Facility Siting Act, R.I. Gen. Laws §§ 42-98-1, et seq., unless the EFSB concludes that the reconductoring project "may result in a significant impact on the environment or the public health, safety and welfare." See § 1.2(d) of the EFSB's Rules of Practice and Procedure. The installation of approximately five miles of distribution main parallel to an existing distribution main located wholly within RIDOT's right of way along Route 2 does not create significant new impacts on the environment, public health, safety or welfare.

Consistent with the requirements of § 1.6(f) of the EFSB's Rules of Practice and Procedure, which apply (in relevant part) to electric reconductoring projects that do not require an application under the Energy Facility Siting Act, the Company submits this Siting Report in support of its Petition for a Declaratory Order that the Project does not constitute an alteration. The Purpose and Need for the Project are detailed in Section 2.0, and Section 3.0 provides a detailed description of the Project components. Section 3.0 also includes a description of the construction practices, safety and public health considerations, estimated costs for the Project, and anticipated Project schedule. Section 4.0 includes a review of the alternatives that were considered and the reasons why each alternative was rejected. Detailed descriptions of the characteristics of the natural and social environment within and immediately surrounding the Project location are included as Sections 5.0 and 6.0. Section 7.0 of this report identifies the potential impacts of the Project on the natural and social environment. Section 8.0 summarizes proposed mitigation measures which are intended to offset or eliminate the potential impacts associated with the Project.

This Siting Report has been prepared by the Company with contributions from numerous employees and consultants retained by the Company. The description of the affected natural and social environments and impacts analyses were prepared by Vanasse Hangen Brustlin, Inc. (VHB) and other consultants to the Company.

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Purpose and Need

2.1 Introduction

The Company strives to provide its customers with high quality, reliable gas service at the lowest possible cost, while minimizing adverse environmental and social effects associated with the construction and operation of the system. The southern Rhode Island service territory is defined as the area supplied south of the Cranston Take Station, which includes the cities, towns and villages of Warwick, West Warwick, East Greenwich, Coventry, Cranston, Exeter, Kingston, Narragansett, North Kingstown, South Kingstown, Scituate, Wakefield, West Greenwich and West Kingston. [redacted]. This service territory includes approximately 77 miles of distribution mains [redacted]

[redacted] for average daily temperatures 30 degrees Fahrenheit and colder. Starting this past winter of 2017-18, growth forecasts exceeded redundant vaporization capacity from the Exeter LNG facility. If growth continues as forecasted, it is possible that gas pressures will fall below minimum, resulting in a risk of loss of service to customers during periods of peak winter demand.

As described in Section 1.0, the Company proposes the Project to address these capacity issues. The Project also will improve system operating pressures and reliability, and allow the Company to meet existing and future customer demand, enabling firm growth and economic development.

2.2 Planning Process

The Company's planning process is based on a comprehensive methodology for forecasting customer load requirements using a series of econometric models to determine the annual growth expected for Residential Heating, Residential Non-Heating, and Commercial and Industrial markets for both Sales and Transportation services. To determine the projected growth over the forecast period, the econometric models used historical economic, demographic, and energy price data, as well as weather data to determine total energy demand. The Company then analyzes load reductions expected to be achieved through the implementation of its revised energy-efficiency programs, because such reductions are exogenous to the demand forecast generated by the econometric models. The goal of the natural gas energy efficiency programs is annual reduction in usage; there are no programs that are specifically targeted toward peak reduction. Because the Company's econometric forecast is based on historical data, which does not fully incorporate the increasing penetration of the Company's energy efficiency programs in the Residential and Commercial and Industrial sectors, the Company reviewed its historical energy efficiency efforts and adjusted its retail demand forecast (downward) to reflect the increases in energy efficiency efforts.

To ensure that the Company maintains adequate supplies in its portfolio to meet the projected customer load requirements, the next step in the planning process involves an analysis to define the planning standards for the coldest planning year, known as the "design year", and the coldest planning day, known as the "design day." After determining the forecasted customer requirements, the Company then designs a resource portfolio to meet those requirements in the most reliable and cost-effective manner possible.

As part of the Company's resource portfolio, Long Term Planning and Operations Engineering, in coordination with Sales, Project Engineering, and Project Management, developed the Project to increase system capacity for forecasted growth, and improve system reliability. This project increases capacity needed for the forecasted growth by installing a 20-inch distribution main in parallel to the existing distribution main and improves system reliability by decreasing the Company's dependence on pressure support from the Exeter LNG Facility and reducing the risks associated with loss of one of the distribution mains in this area. Further, this Project addresses system capacity issues on the 99 psig feeder system that currently limit regional targeted growth projects on downstream

distribution systems reviewed by Operations Engineering as gas capacity requests. The Gas capacity request process is designed to identify reinforcements that address local or regional issues restricting growth for an individual customer. Gas capacity request reinforcements do not provide additional capacity to the system and cannot be expected to accommodate future growth. Therefore, this Project is needed as a gas system reinforcement project.

Additionally, the Project provides more cost effective and long-term system benefits than constructing multiple customer specific sales reinforcement projects. Customer specific reinforcement projects only address the individual customer and do not improve pressures, reliability, or capacity on the overall system.

2.3 Planning Studies—Need Analysis

When developing the Gas System Reinforcement and Reliability Programs, Long Term Planning uses a more in-depth analysis of customer growth to the zone/zip code level based on zone growth factors (percentages) provided by the Forecasting and Analytics group. Long Term Planning uses this forecasted growth to calculate a growth factor (percentage) for each zip code. These zip code growth factors are then used to allocate the overall customer growth forecasted for Rhode Island to the validated Synergi network analysis computer models. The result of this methodology is that some zip codes (cities, towns) show positive growth while others may show negative growth. By better simulating where the customer growth is expected to occur, the overall accuracy of the reinforcement projects that must be constructed in order to support each region's average annual system growth are identified. These projects are designed to maintain minimum system design pressures during periods of peak demand, (i.e. design weather conditions), thus ensuring continuous service to all customers on the network in compliance with Federal and State Codes. The peak demand for a given territory is based on the same forecast that is filed annually with the PUC and used to develop the gas supply portfolio. The System Reinforcement program is a critical component for enabling that gas supply to be delivered to the firm customer. Design weather conditions have been established for Rhode Island as -3°F (68 Heating Degree Day).

2.4 Project Need

As discussed in the Company's fiscal year (FY) 2019 Gas Infrastructure, Safety, and Reliability (ISR) Plan approved by the PUC on March 8, 2018, in Docket 4781, the Company determined that the Project is needed to maintain continuous service to all customers on the southern Rhode Island service territory distribution network during periods of peak demand (i.e., design weather conditions) while increasing capacity in an area that is currently constrained. The results of the growth analysis (described above) performed on the gas distribution network predicts that for the 2022/23 winter, using the current Gas Supply send-out forecast, approximately 3,750 customers could experience below minimum design pressures and be at risk of losing service if design conditions were experienced. Based on historical weather data, 68 Heating Degree Day conditions are only expected to occur once every 100 years. The estimated restoration cost (i.e., relight, plus claims) for such an event is approximately $6.5M, based on an estimated $1,750/customer. To avoid this situation, The Company may need to impose a moratorium on all new gas service requests as well as

requests for expansion of existing gas service to prevent service interruptions to existing customers.

As discussed in Section 1.0, the Company's service territory around the Southern RI Distribution Mains is unique because there are fewer interstate pipelines than other areas. Thus, the Company relies on LNG for pressure support at warmer temperatures as compared with other parts of its service territory, which traditionally rely on LNG for peak shaving on design days. The additional capacity from the Project should reduce reliance on the Exeter LNG facility for pressure support. As each phase of this Project is completed, unsold capacity could be considered as a reduction in dependence at the Exeter LNG facility because the need for pressure support would be reduced.

2.5 Conclusion

The benefit of installing this reinforcement is to allow for continued growth in the Southern Rhode Island service territory, and to maintain adequate system pressure, above minimum design, to prevent the loss of service to customers. Without the proposed Project, if growth continues as expected, by the 2022/2023 winter, the Company may have to impose a moratorium on new service connections or up to 3,750 customers could see below minimum pressures and would be at risk of losing service. In addition, several regulator station inlet pressures are predicted to fall below minimum, which would cause problems on the downstream pressure systems if the stations cannot maintain their outlet set pressure. The Project is being developed to address several issues, including: (1) maintaining minimum code required pressures, especially in light of forecasted growth (2) increasing gas system reliability, and (3) reducing reliance on Exeter LNG facility for pressure support.

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Project Description and Proposed Action

3.1 Introduction

The Project includes the design, procurement, construction, testing and completion of the Project. This is a multi-phase project designed to cost-effectively reinforce and improve the reliability of the system and increase capacity in the currently constrained Southern Rhode Island area. The scope of work includes the installation of a new 20-inch steel distribution main designed for a MAOP of 200 psig and constructed to be ILI.

The Project involves the installation of approximately 28,500 linear feet (LF) of 20-inch 200 psig distribution main from the existing 200 psig distribution main near Regulator Station RIS-133 located at Cowesett Road, Warwick to the South Country Trail, East Greenwich as shown on Figure 2-1. The Project is located entirely within the limits of Route 2, a RIDOT right of way, within the municipalities of Warwick, West Warwick, and East Greenwich (refer to Figure 2-2). The new distribution main will be placed in-service in phases with normal operation at 99 psig with the potential to operate at 200 psig once a district regulator station is installed in the future near South Road, East Greenwich. Based on current forecasts each segment will add immediate growth capacity. Once all of the segments are completed, it is expected that approximately 1,100 dekatherms per hour of additional capacity will be available.

3.2 Construction and Maintenance Overview

The proposed construction methodology, as well as special crossing techniques, dewatering, laydown/staging, and cleanup and restoration are described in the balance of this section.

3.2.1 Trenching and Distribution Main Installation

The Project will be constructed primarily using the open-cut method of construction. This technique involves installing the new distribution main typically in approximately 20-foot lengths at a time. Work required to join the sections of pipe (welding, radiography, and coating) will predominantly be performed in the trench. If bending of the pipe is needed, it will be completed using a pipe-bending machine prior to being lowered into the trench. Installation of fittings for offsets may be installed in the trench or in sections at grade and lowered into the trench for joining to the newly installed distribution main. As the work-day proceeds, newly installed distribution main will be backfilled and compacted, and pavement will be restored.

The footprint for trench excavation will typically be four feet wide by five feet deep (refer to Figure 3-1 for typical cross sections of the installation trench). In locations where welding will be performed or where the proposed distribution main will pass under existing utilities, the excavated area will be larger, typically 10 feet long by 6 feet wide and up to 8 feet deep to accommodate a shoring box. These shoring boxes will be required approximately every 40 to 80 feet along the proposed distribution main.

During installation, all welds will be nondestructively tested. In non-destructive testing, a radiographic or X-Ray test is performed on every weld in the field. An X-Ray is taken of the weld around the pipe's circumference and the X-Ray is reviewed by a trained technician to confirm the acceptability of the weld in accordance with API Standard 1104. If any unacceptable flaws are detected, that portion of the weld will be ground out and repaired, or cut out and replaced. This test is termed "nondestructive" testing because it does not degrade the integrity of the weld.

The construction sequence will proceed as follows:

- **Establishment of Controls.** Existing utilities will be flagged. Erosion and sedimentation control measures will be installed per a soil erosion and sediment control plan (SESC) that the Company, with input from local agencies and contractor, will prepare. The SESC will address in detail construction staging, materials delivery, and other considerations associated with construction including relevant environmental protection issues. As agreed upon with local authorities, measures called for by a Traffic Management Plan (e.g., barrels, warning signs, police details) will be put in place.
- **Worksite Preparation.** The trench location will be staked on the ground or marked on the pavement. As necessary, pavement will be saw-cut and removed for off-site recycling or proper disposal. If the trench passes near utility poles, the poles and lines will be temporarily supported as needed.
- **Excavation/Trenching.** The trench will be excavated using a backhoe or excavator, or by vacuum excavation, and a trench box and/or shoring will be installed where needed. For

the proposed distribution main, the trench will be approximately four feet wide and five feet deep. At locations of in-trench welds, the trench will be widened to accommodate two welders. To minimize hauling by truck and to expedite backfilling, excavate will be stockpiled next to the trench on the pavement or shoulder, or will be temporarily stockpiled in a dump truck. At locations where stockpiling is unacceptable due to pavement width or local environmental conditions, excavate will be loaded onto trucks for transport to a prepared storage location, which will be coordinated with local authorities. Suitable bedding materials (typically, six inches of sand) will be placed in the trench.

Once excavated, the trench will be sheeted and shored as required by soil conditions, Occupational Safety and Health Administration (OSHA) safety rules, and state and local regulations. Shoring is designed to permit passage of traffic adjacent to the trench and will allow for the trench to be covered with a steel plate to allow traffic over the trench during non-working hours.

- **Welding.** The Company's welding procedures will be utilized on this Project. All welding will be performed in accordance with all applicable state and federal codes (USDOT Title 49, Part 192) as well as industry standards. In addition, all welds will be inspected using non-destructive methods. Typically, pipe lengths will be welded in the trench. Some welding may occur outside of the trench and will be placed into the trench using equipment such as a backhoe, standard excavator or a side boom.
- **Cathodic Protection.** The proposed coated steel distribution main will be protected from corrosion in three ways: (1) the replacement distribution main will be shipped to the Project site with a protective exterior coating (called Pritec), which is added after the manufacturing process; (2) a similar coating (tape or shrink sleeves) will be applied to all field welds during construction; and (3) cathodic protective devices (e.g., Magnesium Anode bed system)5 will be installed during construction.
- **Backfill and Compaction.** Four to six inches of sand padding will be placed around the circumference of the installed pipe, and then suitable backfill will be placed above the pipe and compacted. A broad plastic marking/warning tape will be placed above the pipe to help ensure that future excavation does not inadvertently damage the pipe. Generally, a minimum of three feet of cover is placed above the pipe; where the pipe must be shallower (i.e., with less than three feet of cover) due to utility conflicts or ledge, concrete shielding or steel plates will be placed above the pipe for protection. Backfill beneath paved areas will generally be placed in lifts six to twelve inches thick, with proper compaction performed after placement of each lift.

  Backfill and compaction operations will be carried out in strict compliance with procedures established by RIDOT.

  Where the trench location requires cutting of pavement, pavement restoration will be carried out in compliance with RIDOT standards. Generally, all pavement excavations will be repaired with same-day permanent patches unless specifically agreed to by the town. Typically, temporary patches are only permitted for work between December 1 and March 31, when bituminous concrete is not available, or if the excavation must be reopened within five working days (e.g., to continue work after a weekend). Where concrete road base is encountered, sections will be replaced per direction from RIDOT and town

requirements. In general, the length of new excavation completed each day will equal the length of proposed distribution main installed, backfilled, and compacted.

If, at the end of the day, construction is not complete along an active section, any street openings will be covered with steel plates and marked with drums and yellow flashers until pavement patching is accomplished. Openings in the shoulder will be protected and barricaded to ensure traffic and pedestrian safety.

- **Shoulder Repair and Revegetation.** The shoulder will be graded to its pre-existing contours, with slight mounding to allow for settlement. Any disturbed vegetated areas will be loamed and seeded to match pre-existing vegetation. Any lawn-edge that has been affected by proposed distribution main installation, including equipment passage, will be hand-dressed, seeded, and mulched.
- **Final Inspection and Alignment Marking.** The alignment will be checked by a supervisor to ensure the area is properly restored, swept, and tidy. Alignment markers will be installed at intervals to indicate the presence of the newly-installed gas line. Where the new distribution main is installed beneath pavement, flat permanent markers will be set into the pavement to mark the location.

3.2.2 Special Crossing Techniques

Trenchless crossing techniques (e.g., jack-and-bore and Horizontal Directional Drilling (HDD) are typically used where either: (1) open trenching is not feasible from a construction perspective due to subsurface infrastructure, bridges, culverts, or railroad tracks; or (2) open trench construction is not practical due to traffic conditions. These techniques are described briefly below.

A total of eight trenchless crossings are being considered along the proposed route. These crossings and the proposed crossing methods are summarized in the table below.

Crossing #	Location	Type	Proposed Crossing Method
1	Near Route 95, East Greenwich, RI	Three 8′ x 40″ concrete boxes	Jack and Bore
2	Near Pine Glen Drive, East Greenwich, RI	8′ x 4′ concrete box	Jack and Bore
3	Near Middle Road, East Greenwich, RI	5′ x 3′ concrete box	Jack and Bore
4	Near On Semi Way, East Greenwich, RI	7′ x 3′ concrete box	Jack and Bore
5	Near 2034 S County Trail, East Greenwich, RI	8′ x 5′ concrete box	Jack and Bore
6	Near 2100 S County Trail, East Greenwich, RI	5′ x 4′ concrete box	Jack and Bore
7	Near Meadowbrook Road in East Greenwich, RI	Approximately 700′ drill	HDD
8	Route 2/Route 4 Crossing in East Greenwich, RI	Approximately 1300′ drill	HDD

3.2.2.1 Jack-and-Bore

Jack-and-bore techniques are used to install a steel or concrete pipe or casing horizontally under a conflicting object. This method is typically used for shorter crossings (less than approximately 200 feet), such as for the crossing of railroads, ditches, streams, streets, interstate highways, and crossing under shallower existing underground facilities. A jack-and-bore installation is accomplished by digging a bore pit on one side of the feature to be crossed and a receiving pit on the other side to the designed depth. The bore pit houses the drilling and jacking equipment, while the receiving pit receives the pipe on the other side of the feature being crossed.

The pipe or casing is then jacked (pushed) in the bore hole as it is being drilled under the feature. When using a casing, after the casing has been cleaned out, smaller pipes are installed inside the casing in which the proposed distribution main will later be installed. This project will not be using casings in its jack and bore processes. Instead, the pipe will be coated with abrasive resistant coating and jacked directly through the bore hole.

Once the jack-and-bore equipment is in place, it must remain in place and the drill pits must remain open until the operation is completed. Dimensions of the bore pits and receiving pits for the six crossings will be approximately 20-40 feet long, 10 feet wide, and between 14-18 feet deep; the placement of these pits at the six jack-and-bore locations will be within the existing rights-of-way and will not be located in any mapped habitat for rare or endangered species.

3.2.2.2 Horizontal Directional Drilling

HDD is typically used for comparatively deep and long crossings such as those under interstate highways, water bodies, and railroads. This method commonly involves drilling a hole under a conflicting object from one side to the other, then pulling the pipes (in a bundle) back through the bore hole.

An HDD installation generally requires a larger temporary construction footprint than a jack-and-bore because the boring equipment is larger, and the supporting equipment requires more space. Once the pullback process begins, it cannot be stopped until the pipes are in place.

There are two bridges along the Project route which the Company plans to cross using HDD. The first location is at the Route 2 crossing of Frenchtown Brook, across from Meadowbrook Road. The Company plans to locate the entry pit slightly to the north of the Frenchtown Brook bridge along the shoulder of Route 2, and the exit pit will be slightly to the south of the Frenchtown Brook bridge along the shoulder of Route 2. The total drill length will be approximately 700 feet, and the maximum depth will be approximately 40 feet below existing grade.

The second HDD location is at the Route 2 crossing with Route 4 in East Greenwich. The entry pit is planned for the grass island by the Route 4 entry ramp from the southbound lane of Route 2. The exit pit is planned for the shoulder of Route 2 near the southern exit of the RIDOT park-and-ride facility. The total drill length will be approximately 1300 feet, and the

maximum depth will be approximately 20 feet below the existing grade of Route 4 and 41 feet below the existing grade of Route 2.

3.2.2.3 Bridge Attachments

As discussed above, the Company proposes to cross under Frenchtown Brook and Route 4 using HDD. Although RIDOT was amenable to attaching the distribution main to the bridges, RIDOT stated that it prefers the Company use HDD. In the event there are unforeseen design or construction challenges with HDD, the Company may cross by attaching to the bridges after consulting further with RIDOT.

If the Company attaches to the bridge near Meadowbrook Road, the proposed distribution main will be attached and supported to the side of the bridge via pipe hangers and pipe rollers. Sections of the pipe that extend past where they can be supported by pipe hangers and rollers off the bridge will be supported by concrete pipe supports prior to extending below grade. If the Company attaches to the bridge at the Route 2 crossing with Route 4 in East Greenwich, the proposed distribution main will be supported by pipe hangers and rollers on one side of the center bay of the Route 4 overpass. These rollers and hangers will be supported by brackets welded to the bridge I-beam.

If the Company attaches to one or both of the above referenced bridges, the proposed distribution main will be designed to accommodate thermal expansion and contraction of the distribution main itself, and the Company will work with RIDOT, Town Engineers and their consultants to make sure that the added load from the pipe is within acceptable limits.

3.2.3 Dewatering

Dewatering of the pipe trench will be necessary in areas where groundwater is encountered, where soils are saturated, or at times when the trench is affected by storm water. Dewatering will likely be necessary in areas where the route is adjacent to wetlands or streams, or other bodies of water. Standard erosion control practices will be employed to minimize erosion during trenching operations and construction activities in general. In all areas with shallow depth to groundwater, construction methods will be employed to make the construction trench as shallow as possible. The dewatered fluid will be discharged into a frac tank, straw bale and geotextile fabric settling basin or dewatering filter bag which will be located in an upland area. The pump intake will not be allowed to rest on the bottom of the excavation throughout dewatering to prevent sediment intake.

Secondary containment of pumps will be used to avoid contaminants from entering wetlands and waterbodies. The basin/bag and all accumulated sediment will be removed following dewatering operations, and the area will be seeded and mulched. Dewatering locations will be approved by an Environmental Monitor, whose role is described below in Section 8.2.1.5.

Under no circumstances will trench water or other forms of turbid water be directly discharged onto exposed soil or into any wetland, waterbody, or stormwater structure.

3.2.4 Laydown and Staging

The Company's contractor will identify laydown/staging areas necessary to complete construction. Although these specific locations have not yet been identified, if they are located within state-regulated freshwater wetlands, proper regulations will be followed, and permits secured from RIDEM, if necessary.

3.2.5 Cleaning and Testing Procedures

Following the proposed distribution main installation, pressure testing is required by code and Company standards to verify that the replacement distribution main is leak-tight and capable of safely withstanding its rated pressure. The proposed distribution main in this Project will be tested with a hydrostatic test, likely performed in phases as Project segments are completed so they can be put into service. For testing purposes, the line is pressurized to a minimum one-and-one-half times its MAOP (i.e., 1.5 x 200 psig, or 300 psig) using potable water and monitored for at least four hours. Upon completion of testing, the water will be removed from the main, directed into holding tanks and transported off-site by the contractor to an approved wastewater treatment facility.

3.2.6 Construction Phases

The proposed distribution main installation is expected to be installed in several phases spanning consecutive construction seasons. The duration of each phase is still being developed but is currently anticipated to be as follows:

Contractor Mobilization	Late March 2019
Receipt of Materials (Phase 1)	Early April, 2019
Construction Start Phase 1 - 12,600'	Mid-April 2019
Construction Tie in	November 1, 2019
Restoration	Throughout construction and concluding in December 2019
Contractor Demobilization	December 2019
Receipt of Materials (Phases 2 and 3)	March 2020

Construction Start Phase 2 - 11,000'	Early April 2020
Construction Tie in	November 1, 2020
Restoration	Throughout construction and concluding in December 2020
Contractor Demobilization	December 2020
Construction Start Phase 3 - 3,000'	Early April 2021
Construction Tie in	November 1, 2021
Restoration	Throughout construction and concluding in December 2021
Contractor Demobilization	December 2021

After the construction and testing of each phase of the project, the new distribution main will be tied over to the existing 12-inch 99 psig distribution main that runs parallel to the proposed distribution main. The newly installed distribution main will then be gassed in to ensure increased capacity as the project is built over consecutive construction seasons.

3.2.7 Construction Hours

The Company's typical work hours are daytime hours (7:00 AM to 5:00 PM). The Company is in discussions with RIDOT on construction hours and will abide with RIDOT's construction hour requirements and any day or seasonal restrictions. We will notify the municipalities of planned nighttime work/extended construction hours. Project construction, including pressure testing, gassing-in of the new distribution main, and certain aspects of the HDD

operations may require work throughout the night, which will be coordinated with RIDOT and the municipalities.

3.2.8 Maintenance

The new distribution main assets will be maintained according to the Company's Integrity Management Program (IMP). This program conforms to the requirements set forth in 49 C.F.R 192 subpart O for transmission pipelines.[3] However, the Company has implemented a voluntary IMP for all its mains operating at and above 125 psig in agreement with the PUC. The new distribution main will be designed for in-line inspection and will be inspected in accordance with the Company's IMP. Additional maintenance of the new distribution main will be compliant with Company standards and policies for leak survey and inspection of cathodic protection systems.

3.3 Safety and Public Health Considerations

The Company will design, build, and maintain the facilities for the proposed Project so that the health and safety of the public are protected. This will be accomplished through adherence to applicable federal, state, and local regulations, and industry standards and guidelines established for protection of the public.

The facilities will be designed in accordance with sound engineering practices using established design codes and guides published by, among others, the American Society for Mechanical Engineers (ASME), the Institute of Electrical and Electronic Engineers (IEEE), the American Society of Civil Engineers (ASCE), the American Concrete Institute (ACI), and the American National Standards Institute (ANSI).

Practices which will be used to protect the public during construction will include, but not be limited to, establishing traffic control plans for construction traffic on local streets to maintain safe driving conditions and restricting public access to potentially hazardous work areas.

The Company will comply with all conditions and requirements imposed by RIDEM[4] and RIDOT[5], the two permit-granting agencies for the Project.

[3] The proposed distribution main does not meet the criteria for a transmission pipeline.

[4] Rhode Island Pollutant Discharge Elimination System Notice of Intent Stormwater General Permit for Construction Activity and RIDEM Request for Preliminary Determination.

[5] RIDOT Utility Permit.

Following construction of the facilities, the disturbed ground will be restored to its original grade and/or condition.

3.3.1 Hazardous Substances

The Company anticipates using standard construction materials such as diesel fuel, hydraulic oil, gasoline, and drilling lubricants. Once selected, the Company will confirm with its contractor whether any construction materials can be considered hazardous substances. Any hazardous substances used during construction will be utilized in accordance with manufacturers' specifications and applicable state and federal regulations.

Several state-listed spill or hazardous waste sites are located on or adjacent to the Project route. The former Stanley-Bostitch, Inc. (SBI) hazardous waste site at 1 Briggs Drive in East Greenwich extends onto and beyond the proposed distribution main location within RIDOT's right of way along Route 2. Soil and groundwater in the vicinity of the SBI site will be handled in accordance with RIDEM approvals and remedial operation requirements.

3.4 Project Community Outreach

The Company believes in an open, transparent and regular two-way dialogue with project stakeholders throughout the life of its projects. The Company has launched a comprehensive campaign to educate and inform neighborhood residents, municipal officials, and businesses about the full scope of work to be undertaken to support this Project. This multi-faceted campaign includes:

- Meetings with municipalities and relevant governmental organizations with interest in the project scope.
- Open House events.
- A user-friendly, interactive website.
- A Project hotline.
- Social media for additional community access (Twitter)
- Fact sheets, door hangers, FAQs, timelines, etc.
- Advertising.
- A Project Ombudsman who serves as a single point-of-contact for the public.

The team will continue to maintain a high level of outreach to discuss the Project, receive comments, and answer questions throughout the permitting and construction phases.

3.4.1 State and Local Meetings

The Project team has met, and will continue to meet as needed, with all relevant governmental bodies with interest in, or impacted by, the Project scope. To date, the Project team has met with the City of Warwick and the Towns of East Greenwich and West Warwick to outline the Project need, benefits and high-level details around proposed Project routes, local impacts, and tentative Project schedule. In addition, the Project team has briefed t

RIDOT and other relevant state agencies (including Commerce RI). The Project team will continue to meet regularly with all governmental stakeholders throughout the Project schedule to ensure a timely flow of information and provide opportunities for input.

3.4.2 Open Houses

The Company is fully committed to providing the community with the opportunity to see the Project plans and responding to questions and concerns. There will be community open house meetings held in the Project footprint to provide interested parties with an opportunity to learn more about the Project and ask questions of project subject matter experts (all information about Company-hosted meetings will be made available on our website).

3.4.3 Project Website

A Project website is available at ¬¬¬GrowthPointRI.com. This website provides Project information, including background, updates, and contact resources. The Company will keep the Project website up-to-date for the duration of the Project. A dedicated e-mail address – info@nationalgrid.com – is also available for interested parties to send questions or comments. The Project e-mail is listed in all Project outreach materials including fact sheets, mailings, the website, social media (on Twitter, @GrowthPointRI), and signage at community events.

3.4.4 Project Hotline

A toll free number (877-423-1803) and a local number (401-234-1138) have been designated as the Project Hotline for the GrowthPoint Project. The Project Hotline numbers are listed in all Project outreach materials including fact sheets, mailings, the website, social media, and signage at community events. A Project representative staffs the toll free hotline and the Company pledges to respond no later than the next business day.

3.4.5 Abutter Meetings

The Company representatives expect to meet individually with any Project abutters who have questions specific to their particular properties through the life of the Project. In addition, the project team will be sending letters via U.S. Mail to keep them abreast of project developments throughout the project schedule.

3.4.6 Door-to-Door Outreach

In more residential neighborhoods, The Company will engage in a door-to-door outreach campaign, canvassing all residents and any businesses adjacent to Project activities. The purpose of this outreach is to provide information and answers to questions. If a resident is not available, the Company representative will leave Project-related information at the door. A similar effort will be undertaken with affected businesses along the project route.

3.4.7 Construction Communication Plan

Building off the existing outreach and communications plan, The Company will develop a comprehensive construction communication plan to update residents, businesses, fire, police, emergency personnel, and municipal officials on work schedules, work locations, and construction activities. In addition to the Project website, hotline, email and twitter account, this plan will include, as needed, work area signage; construction notifications; and direct contact with Project abutters.

The Company's Project Ombudsman will be responsible for coordinating outreach during construction and serving as a single point of contact for the public. The Project website will be kept up-to-date throughout Project construction. Project information also will be communicated through various town and businesses websites as permitted.

3.5 Project Costs

3.5.1 Projected Operation and Maintenance Costs

Annual operation and maintenance activities for distribution mains typically include periodic leak surveys and cathodic protection inspections. Because the new distribution main will be installed in parallel to an existing main within RIDOT's right of way along Route 2, any incremental operation and maintenance associated with the new distribution main will be negligible.

3.5.2 Estimated Project Costs

The Company prepared an estimate of the costs associated with the proposed Project. Estimates are prepared prior to the development of detailed engineering plans using historical cost data, data from similar projects, and other stated assumptions of the Project engineer. Estimated costs in 2019 dollars include costs of materials, permitting, internal and external labor, police details, equipment, and Allowance for Funds Used During Construction (AFUDC). The estimated cost of the proposed Project is approximately $81.3M. This Project cost estimate does not include the launching and receiving stations nor the regulator station that the Company anticipates constructing at some future time.

3.6 Project Schedule

The Company has developed a preliminary schedule based on time duration estimates of Project permitting and licensing, detailed engineering, materials acquisition, and construction. Due to RIDOT's restrictions on work within Route 2 during the winter season, construction is scheduled to occur in the Spring-Fall of 2019, 2020, and 2021.

4

Alternatives to the Proposed Action

4.1 Introduction

The Company's foremost concern in developing the Project was to ensure that the plan selected to meet the gas needs is the most appropriate in terms of cost, reliability and ability to meet the timeline for the identified need. Alternatives to the Project have been evaluated to ensure that these objectives are met.

This section describes the alternatives that were identified to address gas distribution system needs in the Southern Rhode Island area. Five (5) "planning alternatives" were evaluated including a No-Build Alternative, Exeter Take Station Alternative, New Main from Providence to Warwick Alternative, New Main from Westerly to Kenyon Alternative, and the Project Route which is a New Main from Warwick to East Greenwich. These alternatives are described in Section 4.2. Section 4.3 evaluates routing alternatives for the new gas main which includes the Project Route, an eastern alternative and a western alternative.

4.2 Project Alternatives

4.2.1 No-Build Alternative

The No-Build Alternative does not respond to projected growth for this area and, based on 2022/23 projections, puts up to 3,750 customers at risk of losing service. In addition, this

alternative does not allow the Company to meet its regulatory obligation to provide safe and reliable service. While there would be no capital expense associated with this alternative, this alternative would prevent the Company from responding to gas capacity requests activity in southern RI as new customer requests could not be supported and the Company likely would need to impose a moratorium on all new gas service requests as well as requests for expansion of existing gas service. The No-Build Alternative would also continue to require the Company to heavily depend on pressure support from the Exeter LNG facility for winter operations pressure support, which is expected to exceed maximum capacity by 2019.

As part of its No-Build Alternative analysis, the Company considered the impacts of energy efficiency on the Project's need. The Company offers a broad array of energy efficiency programs to its Rhode Island customers. Consistent with R.I. Gen. Laws § 39-1-27.7 and PUC Docket No. 4684, the Company's programs are designed to create energy and economic costs savings for Rhode Island consumers. The Company proposed a 2018 Energy Efficiency Plan with a gas savings goal of 1.01% of 2015 natural gas load, which is equivalent to 414,795 MMBtu.

While the Company's many energy efficiency programs will help its customers manage their energy costs, they are not, on their own, an acceptable alternative to the Project. The gas energy efficiency programs are designed to reduce annual natural gas consumption, but are not specifically designed to reduce peak demand. Moreover, they are not intended to alleviate location-specific capacity constraints like those affecting the Southern RI Distribution Mains. Thus, it is difficult to determine their impact on peak demand and, consequently, the location-specific need for the Project. Even if the programs achieved an equivalent annual peak demand reduction (roughly 1%), this minor savings would not obviate the risk to existing customers as well as the need for a moratorium in the absence of the Project.

As described in the its Gas Long-Range Resource and Requirements Plan for the Forecast Period 2017/18 to 2026/27, filed in PUC Docket No. 4816 on March 30, 2018, the Company already considered the impacts of energy efficiency on its retail demand forecasts. Specifically, the Company determined an expected annual energy efficiency savings based on a three-year average of actual 2014 through 2016 savings, which are already included in the econometric forecasting models. The Company further reduced its forward-looking demand forecast by expected incremental savings that are not reflected in the models. Thus, even including energy efficiency, the Project is still needed.

Moreover, the No-Build Alternative with respect to environmental impact primarily means a continuation of the status quo. Therefore, while there would be no direct environmental impacts, there would also be no benefits. For example, the Project provides environmental benefits in the way of lower carbon dioxide ("CO2") emission by enabling the continued conversion from other sources, such as oil to natural gas, and the option of using natural gas over oil as a heat source in new construction. As more specifically set forth in Section 7 below, assuming the current average of 350 oil-to-gas conversions per year, the Project will to enable the reduction of between approximately 635 tons of CO2 per year (with no concurrent furnace efficiencies) to 1,470 tons of CO2 per year (with concurrent furnace efficiencies) from such conversions. Assuming 647 new residential units expected to be

enabled by the project, the Company has estimated that the Project also will prevent an additional 1,176 tons of CO2 emissions If the total of 14,000 oil-to-gas conversions or new gas services enabled by the Project are achieved, the Project will reduce CO2 emissions by a total of approximately 25,438 tons of CO2 (with no concurrent furnace efficiencies) to 58,777 tons of CO2. in total, if furnace efficiency measures are implemented. The No Build alternative may also have detrimental environmental impacts if the Company has to impose a moratorium, resulting in no further annual CO2 reductions that currently are being realized from the oil-to-gas conversions.

For all these reasons, the Company rejected the No-Build Alternative.

4.2.2 Exeter Take Station Alternative

The Exeter Take Station Alternative proposes the installation of a new Kinder Morgan/Tennessee Gas Pipeline take station within the vicinity of the existing Exeter LNG Facility. This installation would be part of an incremental supply agreement with Kinder Morgan/Tennessee Gas Pipeline and would require the installation of approximately 17 miles of transmission pipeline extension from the end of Cranston lateral near the existing Cranston Take Station to Exeter. The new transmission pipeline would require approval from the Federal Energy Regulatory Commission, which would require more lengthy permitting. There may also be work required upstream of Cranston. The high level conceptual estimate of the cost of the pipeline extension and new take station build is approximately $450 M.

This alternative does not respond to projected growth for this area and, based on 2022/23 projections from June 2017 annual forecast, puts up to 3,750 customers at risk of losing service. In addition, this alternative does not allow the Company to meet its regulatory obligation to provide safe and reliable service. While there would be no direct capital expense associated with this alternative, since costs for these types of projects are covered in the cost of gas, this alternative would prevent the Company from responding to gas capacity requests activity in southern RI because new customer requests could not be supported. The Exeter Take Station Alternative would also require the Company to continue heavy dependency on pressure support from the Exeter LNG facility for winter operations pressure support, which is expected to exceed maximum capacity by 2019. For these reasons, the Exeter Take Station Alternative was rejected as it does not address the identified need.

4.2.3 New Distribution Main from Providence to Warwick Alternative

This alternative involves the construction of approximately 17 miles of 16-inch and 12-inch distribution mains. This alternative includes five miles of 12-inch 200 psig distribution main from the Allens Avenue plant in Providence to the inlet of district regulator RIS-107 in Warwick, then extending approximately 12 miles of 16-inch and 12-inch 99 psig distribution main near the inlet of district regulator RIS-066. This alternative allows the incremental supply volume to be supplied from Enbridge pipeline. However, this alternative requires construction in more densely populated areas with higher traffic volumes and more existing utilities. Thus, this alternative would take longer to construct than the Project due to its length and location. Further, this alternative does not allow the Company to tie into the 99 psig system in a phased approach, which would allow for incremental growth capacity as

segments are completed. Rather, the additional capacity needed for customer growth would not be realized until the entire 17 miles of the main are completed. Considering that this alternative would be three times as long as the proposed Project, the Company concluded that this alternative could not be constructed by the winter of 2022/2023 and would be more costly than the proposed Project. Therefore, the Company dismissed this alternative from further consideration, because it would not be able to meet the identified need in the time required and is very likely to be more costly.

4.2.4 New Distribution Main from Westerly to Kenyon Alternative

This alternative involves the construction of approximately 14 miles of 12-inch 200 psig distribution main from the Westerly Take Station to the approximate location of Kenyon Industries, a potential new customer in Kenyon. This project can only go forward if a five-mile extension of the existing 99 psig distribution main in South Kingstown is completed by Kenyon prior to completion of the 14-mile distribution main extension. This alternative would also require upstream transmission upgrades to Enbridge's Algonquin Pipeline, because the pipe that feeds the Company's Westerly Take Station is only 4.5 inches in diameter. Such upgrades would likely be FERC-jurisdictional, greatly increasing permitting times and costs.

Moreover, the new distribution main contemplated by this alternative would likely impact the Great Swamp Management Area, and would increase environmental impacts, permitting costs and construction time. Therefore, the Company dismissed this alternative from further consideration because it would not be able to meet the identified need in the time required and is very likely to be more costly.

4.2.5 New Distribution Main from Warwick to East Greenwich (Preferred option)

This alternative involves the construction of approximately 26,600 linear feet (LF) of 20 inch, 200 MAOP distribution main from the existing 200 psig main near Regulator Station RIS-133 located at Cowesett Road, Warwick to the South Country Trail, East Greenwich. The new distribution main would be constructed in phases. Upon the completion of each phase the distribution main would be put into service at 99 psig. A benefit of this alternative is that it allows for additional customer growth as each phase is put into service. This alternative also

is anticipated to have the shortest construction period and lowest cost than the other project alternatives. The current estimate for the distribution main is $81.3M.[6]

Sometime in the near future, the Company will install a new 200 psig to 99 psig district regulator station near South Road, East Greenwich. After construction of the regulator, the distribution main will be able to achieve normal operation at 200 psig.

4.2.6 Conclusion on Project Alternatives

For the reasons summarized in the previous sections, the Company concluded that the new distribution main from Warwick to East Greenwich is the preferred option because it resolves the gas system constraints with the shortest construction period and lowest cost and is the only project that achieves the timeline required to meet the identified need.

4.3 Route Alternatives

4.3.1 Reuse Existing Route (Proposed)

As discussed in more detail in Section 3, the Company proposes to construct the new gas distribution main underneath Route 2 in Warwick, West Warwick and East Greenwich. This is the shortest of the alternative routes which makes it the most cost-effective solution. In total, this route encompasses approximately 26,600 total feet, and would entail eight culvert crossings, one underpass crossings and one overpass bridge crossing This solution also allows each phase to be put into service upon completion of each construction season which allows for the use of added capacity as the project progresses.

This route will begin where a previous 20-inch distribution main was completed, in the area of 509 Quaker Lane, West Warwick. Quaker Lane is classified as State Route 2 and is within RIDOT's jurisdiction. The entire preferred route is designed within RIDOT's right of way. The route proceeds southerly along Route 2, a four lane highway, from 509 Quaker Lane for 1.2 miles, after which the road transitions to a two lane roadway and continues for 3.9 miles until it terminates at the intersection of Route 2 and South Rd. Along the way, the route passes underneath Interstate 95, through eight stream crossing culverts, and through the bridge overpass over Route 4.

A major advantage of this route over all the other routes considered is that it will be collocated with the existing 99 psig system, which enables a phased construction approach,

[6] A launching and receiving station will be installed at the beginning and end of the distribution main to allow for in-line inspection. The cost estimates for the Project route and alternative routes considered do not include the launching and receiving stations nor the regulator station that the Company anticipates constructing at some future time.

whereby a portion of the 20-inch can be installed and temporarily tied into the existing system at 99 psig, until the entire route is completed. Being able to stagger construction while still providing incremental growth capacity will better enable the Company to gauge growth projections over the next few years and make more sound decisions on whether additional capital expenditure is warranted for additional capacity.

4.3.2 Eastern Route - Alternative 1

This route begins at 509 Quaker Lane and continues south to Division Road, where it veers east until it hits Route 4. From here it continues south until the Route 2 bridge is reached, where it crosses through Route 4 and terminates at South Road. In total, this route encompasses approximately 28,800 total feet, 22,600 feet of which is highway construction. It also would entail three culvert crossings, three underpass crossings and one highway crossing.

There are two potential options within this route, either to route the line off the shoulder (outside of the clear zone) or within the median. Although paving restoration is minimal as compared to the primary route, grade work would be higher, especially at the areas with steeper grade changes. The grading work would require that soil be brought in or removed and add costs and time to the project schedule. There also appears to be a higher chance of encountering rock based on outcroppings that are visible on this route that would require drilling or blasting, thus adding further costs and time to the project schedule. The portion of Route 4 from Middle Road to South Road in East Greenwich contains a drainage system in the location where the distribution main would be constructed. Construction along this portion would be extremely challenging as there would be added constructability constraints and significant impacts to the stormwater management feature.

Yet another major disadvantage to this route is the inability to tie into the 99 psig system in a phased approach, unless a 2,000-foot section of pipe is installed along Middle Road. The estimated cost for the Eastern Route Alternative 1 is approximately $108.1M. The Company dismissed this routing alternative as a result of (1) the approximately additional $32M in costs, (2) the difficulty with phasing construction to tie into the existing 99 psig system and (3) the additional required construction time.

4.3.3 Eastern Route - Alternative 2

This is alternative shares the same route as the Primary route until it reaches Middle Road. From here the route travels east until it reaches Route 4 and then travels the same path as Eastern Alternative 1 to South Road. This route would enable some phased construction and tie in at Middle Road upon completion of that section of the overall project. This route entails approximately 29,100 total feet of construction including 14,400 feet of highway construction, three culvert crossings, three underpass crossings and one highway crossing.

The route has the same drawbacks as Eastern Alternative 1 and is approximately 2,500 feet longer than the proposed route path. Two additional underpass crossings are required, one of which appears difficult to perform from an initial check. A crossing of the highway would be required at a certain point, which could be straightforward if appropriate traffic control

measures are incorporated. If routed along the shoulder, it is expected that a moderate number of trees would need to be removed. Also, approximately 3.1 miles of 20-inch distribution main construction and a highway crossing would need to be performed in a single phase to add network benefits.

Consequently, Alternative 2 would be more costly than the preferred route and Alternative 1, would take longer to construct and would have greater impacts on the environment. As a result, the Company dismissed this routing alternative as an option.

4.3.4 Western Route - Alternative 3

This alternate route begins at 509 Quaker Lane and continues to Division Road. It then continues west through a residential area for 1.6 miles to Shippeetown Road, and continues south on Shippeetown for about one mile, east on Middle Road for 0.37 miles, 2.43 miles on Tillinghast Road, and then east for about one mile on South Road until it terminates near South Road. This route entails approximately 40,100 feet of construction, six culvert crossings, one major bridge span and one underpass crossing.

Due to the significantly increased distance and numerous culvert creek crossings, Alternative 3 would be much more costly, would take longer to construct and would have greater impacts on the environment. In addition, the company would not have the ability to phase construction and tie into the 99 psig system without very significant additional distribution main lengths to tie the 20-inch and 99 psig system together. The estimated cost to construct the distribution main on Alternative Route 3 is approximately $108.9M. The Company dismissed this routing alternative as a result of (1) the approximately additional $32M in costs, (2) the inability to phase construction to tie into the existing 99 psig system and (3) the additional time required to construct 40,100 feet of distribution main that likely will not allow for construction to be completed in time to meet the identified need.

4.3.5 Western Route - Alternative 4

This alternative follows a similar path as Alternative 3 until Frenchtown Road, after which the route continues east onto Route 2, and continues south to terminate at South Road. This route entails five culvert crossings, one major bridge span and one underpass crossing and at approximately 41,500 total feet is the longest of the alternative routes.

This route avoids some of the difficult creek crossings on the primary route, but still contains at least one difficult creek crossing. The alternative route will share some of the same highly developed areas as the primary. The increased distance of this alternative will add costs and lengthen the project schedule. The Company dismissed this route from further consideration due its length, the resultant anticipated increase in cost and construction timelines, and the decreased ability to perform phased construction as noted for Alternative 3.

4.3.6 Western Route - Alternative 5

This alternative shares the same route as the Primary route until it reaches Middle Road. From here the route travels west on Middle Road, south on Tillinghast Road, and east on

South Road where it terminates. This route entails approximately 35,600 feet of construction, six culvert crossings, one major bridge span, and one underpass crossing.

From Middle Road, the route to the termination point is approximately 9,100 feet longer than the distance from here to the termination point along the primary route. There are five culvert crossings on the sections of the alternate route, three of which appear to be difficult, two of which may require a trenchless crossing. There is also a major bridge span along South Rd. There may be less traffic disturbance on this route and fewer utilities to contend with, which are the only apparent advantages of this route. In order to see network benefits, the entire route length of 4.4 miles would need to be constructed and gassed-in. Thus, phasing segments in to see the benefits of added capacity over the project lifetime will not be achievable.

The estimated cost to construct the distribution main on Alternative Route 5 is approximately $86.1M. The Company dismissed this routing alternative as a result of the approximately additional $14M in costs and the inability to phase construction to tie into the existing 99 psig system.

4.3.7 Route Comparison

The table below provides a comparison summary between the 5 alternatives to the proposed primary route.

Route Identification	Project Highlights	Approx. Footage[7]	Pipe Size	MAOP	Length in Excess of Primary Route
Primary Route	› 7 culvert crossings › one major bridge span, one minor underpass crossing › multiple utilities expected › curb to curb paving restoration possible	26,600	20"	200psig Operate at 99 psig initially	0

[7] For comparison, all route lengths have been rounded to the nearest 100 feet.

Route Identification	Project Highlights	Approx. Footage[7]	Pipe Size	MAOP	Length in Excess of Primary Route
Alternative 1	› 3 culvert crossings › 3 underpass crossings › one highway crossing › minimal expected utilities on highway portion › minimal paving restoration required › significant gradework likely › potential permitting pushback	28,800	20"	200psig Operate at 99 psig initially	2,200
Alternative 2	› 3 culvert crossings › 3 underpass crossings › one highway crossing › minimal expected utilities on highway portion › minimal paving restoration required › significant gradework likely › potential permitting pushback	29,100	20"	200psig Operate at 99 psig initially	2,500
Alternative 3	› 6 culvert crossings › one major bridge span › potential HDD at one stream crossing › moderate utilities expected › curb to curb paving restoration potential › 1 underpass crossing	40,100	20"	200psig Operate at 99 psig initially	13,500
Alternative 4	› 5 culvert crossings › one major bridge span › moderate utilities expected › curb to curb paving restoration potential › 1 underpass crossing	41,500	20"	200psig Operate at 99 psig initially	14,900
Alternative 5	› 6 culvert crossings › one major bridge span › potential HDD at one stream crossing › moderate utilities expected › curb to curb paving restoration potential › 1 underpass crossing	35,600	20"	200psig Operate at 99 psig initially	9,000

4.3.8 Route Alternatives Conclusion

For the reasons summarized in the previous sections, the Company concluded that installing the new distribution main within the limits of Route 2 would be greatly preferred over the eastern or western alternatives because it is the most direct route and shortest route, the width of Route 2 provides for easier construction, and the costs and environmental impacts

are anticipated to be less than the other alternatives. Further, the shorter route allows for the shortest construction schedule and allows for a phased construction approach that allows tying into the parallel 99 psig distribution upon completion of each phase. Consequently, the preferred route allows for the required capacity and reliability improvements in the most timely manner that allows the Company to meet the identified need and at a lower cost than the alternative routes.

4.4 Conclusion

The Company has evaluated multiple plans to respond to forecasted growth in the area. The Company has also evaluated routing alternatives for the proposed new distribution main. Based on the analysis above, the Company has determined that installing a new distribution main within the limits of Route 2 is superior to the alternatives considered. Construction of the Project as proposed will allow the Company to continue to provide reliable gas service to its customers at reasonable cost and with minimal environmental impacts.

5

Description of Affected Natural Environment

This section of the Siting Report describes the existing natural environment that may be affected by the proposed Project, both within and surrounding the proposed gas distribution main extension route. This section includes a detailed description of all environmental characteristics within and immediately surrounding the proposed Project. The following section describes the specific natural features which have been assessed for the evaluation of impacts and the preparation of a mitigation plan. Information pertaining to existing site conditions has been obtained through available published resource information, the Rhode Island Geographic Information System (RIGIS) database, various state and local agencies, and field investigations of the Project Route.

5.1 Project Study Area

A Project Study Area was established to accurately assess the existing environment within and immediately surrounding the Project Route. The Study Area consists of a one-thousand-foot wide corridor centered on the existing Project Route that extends from Quaker Lane, West Warwick near Regulator Station #133 at the intersection of Cowesett Road and

continues south through South Country Trail, to the intersection of South Road, East Greenwich (refer to Figure 5-1). The boundaries of this corridor were determined to allow for a detailed inventory of existing conditions within and adjacent to the Project Route.

5.2 Climate and Weather

Rhode Island has a moist continental climate with four distinct seasons (Rhode Island Secretary of State, n.d.). Its weather is tempered by sea winds, particularly in the Seaboard Lowland, which has a more moderate climate than the rest of New England. Although the Bay has a modifying effect, temperatures in Rhode Island tend to fluctuate by large ranges both daily and annually (National Climatic Data Center, 2011). The mean annual temperature of Rhode Island's inland areas, such as East Greenwich, is 49 degrees Fahrenheit, with an average minimum temperature of 25 degrees Fahrenheit and an average maximum temperature of approximately 70 degrees Fahrenheit (National Climatic Data Center, 2011; City of Newport, 2004). Rhode Island is characterized by an even distribution of precipitation throughout the year with an annual average of 42 to 46 inches over most of the state, with approximately 20 inches of that total attributed to snowfall in the coastal Narragansett Bay regions (National Climatic Data Center, 2011). Due to its proximity to the belt of generally eastward air movement which interacts to produce storm systems, Rhode Island experiences a considerable diversity of weather over the short term and long-term scale (National Climatic Data Center, 2011).

Although Rhode Island experiences a diversity of weather, the effects of climate change in the state are measurable. According to the 2017 Rhode Island Executive Climate Change Coordinating Council Report, the average air temperature in Rhode Island has increased by 2.2 degrees Fahrenheit from 1970 to 2016 and the winter temperature in Narragansett Bay has risen by nearly 4 degrees Fahrenheit at the surface since the 1960s. Climate change has also resulted in a higher frequency of rainfall events that lead to flooding and longer periods of hot, dry weather that strain the state's water resources. These climate effects have begun to impact the local economy; farmers experience less predictable rainfall which translates to uncertain crop yields while the fishing industry has been forced to adapt to a change in fish species composition from cold-water, bottom-dwelling species to warm-water, water-column species. Rhode Island will experience warmer temperatures, more extreme weather events such as intense precipitation and flooding, less snow cover, and sea level rise (2017 Rhode Island Executive Climate Change Coordinating Council Report, 2017).

5.3 Geology

5.3.1 Bedrock Geology

The Study Area is located within the Seaboard Lowland section of the New England physiographic province. The Study Area primarily consists of topography and bedrock associated with the Narragansett Bay Group – Rhode Island Formation (Pennsylvanian Age), and Scituate Igneous Suite – West Bay Area (Devonian Age). This area consists of granite, volcaniclastic rocks, alkali-feldspar granite, monzonite/monzodiorite, granodiorite, Pondville

conglomerate, and Rhode Island formation. (Hermes et al., 1994). This formation is part of the Esmond-Dedham Subterrane Narragansett Bay Group - deposited upon older rocks of both West Bay and East Bay parts of the Esmond-Dedham subterrane (Hermes et al. 1994).

The primary rock type in this area is alkali-feldspar granite which belongs to the Scituate Igneous Suite (Hermes et al. 1994).

From Camp Fogarty to a distance of approximately one-half mile south, an additional bedrock type known as the Narragansett Bay Group – West Bay and East Bay Area (Pennsylvanian Age) is present (Hermes et al. 1994). The primary rock type in this area is Rhode Island formation and consists of sandstone, graywacke, shale, and conglomerate. (Hermes et al. 1994).

5.3.2 Surficial Geology

The present landscape of the Study Area, as with much of the northeastern United States, was shaped by the repeated advance and retreat of glaciers since the Pleistocene epoch between 2.5 and 3 million years ago (Raposa and Schwartz, 2009). The last glacial period to affect the Study Area was the Wisconsin ice sheet, approximately 10,000 to 12,000 years ago (Raposa and Schwartz, 2009). The surficial geology in the study area is generally derived from two depositional processes, one associated with the action of the advancing ice sheet overriding the landscape and the other by materials washed out in front of the retreating glacier by meltwaters.

Glacial till deposits were formed as the glacial front advanced and overrode the landscape. This process would reshape the landform, grinding down hills and depositing material in valleys creating the streamlined elongate hills with axes oriented along the direction of glacier travel known as “drumlins”. The northern portion of the Study Area is generally centered along the axis of a drumlin. The material deposited by this process is classified as glacial till and consists of a mix of separates sized from boulders and stones down to sand, silt and clay.

Glacial outwash or glaciofluvial deposits consist of materials that were sorted and deposited by the abundant meltwater which flowed from the wasting glacier front. This material is typically composed of rounded stones and contains gravels and sands deposited in recognizable layers by glacial meltwater. Silt and clay sized separates were generally washed out of these materials and carried away in the meltwater streams. Glacial outwash deposits are present in the Study Area between Frenchtown Road/Route 402 and South Road.

The boundary between areas of till and outwash deposits is often characterized by an abrupt change in slope. Both glacial till and outwash deposits may be capped by windblown deposits of silt, known as loess.

5.3.3 Geological Hazards

Geological hazards, such as earthquakes or fault zones, could have negative impacts on the gas distribution main extension lines. Rhode Island is located in a region of the North American plate and falls within seismic zone 2A with 10-14 percent ground acceleration,

which translates to a "moderate" seismic hazard (Petersen et al. 2008; US Seismic Zone Map). This means that people may experience moderate intensity shaking that can lead to slight damage during an earthquake event (FEMA Earthquake Hazard maps). There are no significant geologic fault lines in Rhode Island or New England, and the U.S. Geological Survey (USGS) Earthquake Hazards Program identifies all of Rhode Island as occurring in a low seismic risk area (<2 percent peak ground acceleration). Earthquakes that occur in the northeast, which is considered an intraplate area, do not meet the assumptions of the plate tectonic theory since there is no obvious relationship between earthquake occurrence and fault lines in intraplate areas (Kafka, 2014).

A commonly accepted explanation for the occurrence of earthquakes in the northeast is that "ancient zones of weakness" are being reactivated by the present stress field (Kafka, 2014). This theory hypothesizes that pre-existing faults and other geologic features formed during ancient geological episodes persist today and that earthquakes occur when present-day stress is released along these zones of weakness (Kafka, 2014). Earthquakes occur infrequently in Rhode Island and surrounding New England and therefore present a minimal risk for the design life of the Project.

5.3.4 Sand and Gravel Mining

Although mining activities occur in Rhode Island, there are no quarries or regulated facilities located in the Study Area, likely due to the developed areas and unsuitable surficial geology.

5.4 Soils

Detailed information concerning the physical properties, classification, agricultural suitability, and erodibility of soils in the vicinity of the Study Area are presented in this section. Descriptions of soil types identified within the Study Area were obtained from the Natural Resources Conservation Service (NRCS) Web Soil Survey[8] , and the Soil Survey of Rhode Island (Rector, 1981). The Soil Survey delineates map units that may consist of one or more soil series and/or miscellaneous non-soil areas that are closely and continuously associated on the landscape. In addition to the named series, map units include specific phase information that describes the texture and stoniness of the soil surface and the slope class. A total of 35 named soil series have been mapped within the Study Area. Table 5-1 lists the characteristics of the 35 soil phases (lower taxonomic units than series) found within the Study Area. Figure 5-2 depicts soil classes grouped by erodibility hazard and hydric soil presence.

[8] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed [October 31, 2017].

Table 5-1 Soil Phases within Study Area

Soil Map Unit Symbol	Soil Phase	Acres	Drainage Class	Percent Slope
BhA	Bridgehampton silt loam	75.1	wd to mwd	0 to 3
BhB	Bridgehampton silt loam	20.8	wd to mwd	3 to 8
BmA	Bridgehampton silt loam, till Substratum	34.6	wd to mwd	0 to 3
BmB	Bridgehampton silt loam, till Substratum	253.1	wd to mwd	3 to 8
BnB	Bridgehampton-Charlton complex, very stony	350.2	wd to mwd	0 to 8
BoC	Bridgehampton-Charlton complex, extremely stony	57.2	wd to mwd	3 to 15
CdB	Canton and Charlton fine sandy loams	22.5	wd	3 to 8
CdC	Canton and Charlton fine sandy loams	36.7	wd	8 to 15
CeC	Canton and Charlton fine sandy loams, very rocky	8.4	wd	3 to 15
EfA	Enfield silt loam	2.5	wd	0 to 3
EfB	Enfield silt loam	47.5	wd	3 to 8
FeA	Freetown, mucky peat	273.5	vpd	0 to 2
HkC	Hinckley gravelly sandy loam	8.4	ed	rolling
MmB	Merrimac sandy loam	6.5	sed	3 to 8
NaB	Narragansett silt loam	52.2	wd	3 to 8
NbB	Narragansett very stony silt loam	19.1	wd	0 to 8
NbC	Narragansett very stony silt loam	10.9	wd	8 to 15
NeC	Newport silt loam	3.6	wd	8 to 15
PbB	Paxton very stony fine sandy loam	30.2	wd	0 to 8
QoC	Quonset gravelly sandy loam, rolling	44	ed	rolling
RaB	Rainbow silt loam, 3 to 8 % slopes	8.1	mwd	3 to 8

Soil Map Unit Symbol	Soil Phase	Acres	Drainage Class	Percent Slope
Rc	Raypol silt loam	22.4	pd	-
Rf	Ridgebury, Whitman, And Leicester extremely stony fine sandy loams	376.6	pd and vpd	-
Ru	Rippowam fine sandy loam	26.6	pd	-
ScA	Scio silt loam	4.8	mwd	0 to 3
StA	Sutton fine sandy loam	12.1	mwd	0 to 3
SwA	Swansea mucky peat	9.1	VPD	0 to 2
Tb	Tisbury silt loam	10.1	mwd	-
UD	Udorthents-Urban land complex	2292.5	variable	-
Ur	Urban land	231.6	variable	-
W	Water	2.5	subaquatic	0
WbB	Wapping silt loam	21.4	mwd	3 to 8
WcB	Wapping very stony silt loam	22.5	mwd	0 to 8
WhB	Woodbridge fine sandy loam	11	mwd	3 to 8
WoB	Woodbridge very stony fine sandy loam	4.7	mwd	0 to 8

Notes: ed – excessively drained
wd – well drained
mwd – moderately well drained
swed – somewhat excessively drained
pd – poorly drained (hydric)
vpd – very poorly drained (hydric)
8-15 percent slope – highly erodible

Source: Soil Survey of Rhode Island (Rector, 1981), Soil Data Mart (USDA NRCS website: http://soildatamart.nrcs.usda.gov/Report.aspx?Survey=RI600&UseState=RI)

5.4.1 Soil Series

The soil series detailed in the following subsections have been identified within the Study Area. The classification follows that published in the Soil Survey of Rhode Island (Rector, 1981).

5.4.1.1 Bridgehampton Series

The Bridgehampton series consists of coarse-silty well drained to moderately drained soils formed in outwash and glacial till deposits. Surface ranges from nonstony to extremely stony with slopes ranging from 0 to 15 percent on the mainland.

5.4.1.2 Canton and Charlton Series

The Canton series is classified as coarse-loamy over sandy or sandy skeletal, mixed, mesic Typic Dystrudepts (National Cooperative Soil Survey, 2010). These well drained soils formed in glacial till derived mainly from schist and gneiss. The similar Charlton series is classified as coarse-loamy, mixed, mesic Typic Dystrudepts (National Cooperative Soil Survey, 2010). These soils were also formed in glacial till derived mainly from schist and gneiss. Charlton soils have a finer textured substratum than Canton soils. Because these series are similar they are grouped and mapped together as an association.

5.4.1.3 Enfield Series

The Enfield series consists of coarse-silty over sandy or sandy-skeletal, mixed, well drained soils formed in silt mantled outwash deposits. Slopes range from 0 to 15 percent.

5.4.1.4 Freetown

The Freetown series consists of very deep, very poorly drained organic soils formed in highly decomposed organic material. They are commonly in depressions or on level uplands and alluvial plains. Slope ranges from 0 to 2 percent.

5.4.1.5 Hinckley Series

The Hinckley series consists of sandy-skeletal, mixed, excessively drained soils formed in glaciofluvial deposits. Slopes range from 0 to 35 percent.

5.4.1.6 Merrimac Series

The Merrimac series consists of sandy, somewhat excessively drained soils formed in outwash deposits. Slopes range from 0 to 8 percentage.

5.4.1.7 Narragansett Series

The Narragansett series consists of coarse-loamy, mixed, well drained soils formed in glacial till. Slopes range from 0 to 15 percent.

5.4.1.8 Newport Series

The Newport series consists of well drained loamy soils formed in lodgement till derived mainly from dark sandstone, conglomerate, argillite, and phyllite. The soils are very deep to bedrock and moderately deep to a densic contact. They are nearly level through moderately steep soils on till plains, low ridges, hills and drumlins.

5.4.1.9 Paxton Series

The Paxton series consists of coarse-loamy, well drained soils formed in compact glacial till. The surface ranges from nonstony to extremely stony. Slopes range from 0 to 15 percent.

5.4.1.10 Quonset Series

The Quonset series consists of sandy-skeletal, excessively drained soils formed in glaciofluvial deposits. Soils are on terraces and outwash plains. Slopes range from 0 to 15 percent.

5.4.1.11 Rainbow Series

The Rainbow series consists of coarse-loamy, moderately well drained soils formed in silt mantled compact glacial till. The soils are on drumlins and glacial till plains. Slopes range from 0 to 8 percent.

5.4.1.12 Raypol Series

The Raypol series consists of coarse-loamy over sandy or sandy skeletal poorly drained soils formed in windblown or water-deposited silts. The soils are in depressions mainly on terraces and outwash plains. Slopes range from 0 to 3 percent.

5.4.1.13 Ridgebury Series

The Ridgebury Series consists of coarse-loamy, poorly drained soils formed in compact glacial till. The soils are in depressions, drainageways, and nearly level areas of glacial upland hills and drumlins. Slopes range from 0 to 3 percent.

5.4.1.14 Scio Series

The Scio series consists of coarse-silty, well drained soils formed in silt mantled glacial till. The soils are on the side of slopes and crests of glacial upland hills and in depressions in terraces and outwash plains. Slopes range from 0 to 8 percent.

5.4.1.15 Sutton Series

The Sutton series consists of coarse-loamy, moderately well drained soils formed in glacial till. The soils are on side slopes and in depressions of upland hills. The surface ranges from nonstony to extremely stony. Slopes range from 0 to 8 percent.

5.4.1.16 Tisbury Series

The Tisbury series consists of coarse-silty over sandy or sandy skeletal well drained soils formed in glaciofluvial deposits. The soils are on outwash terraces. Slopes range from 0 to 3 percent.

5.4.1.17 Udorthents Series

Udorthents are moderately well drained to excessively drained soils that have been cut, filled, or eroded, typically by anthropogenic processes. The areas have had more than two feet of the upper part of the original soil removed or have more than two feet of fill on top of the original soil. Udorthents are extremely variable in texture. They are on glacial till plains and gravelly outwash terraces.

5.4.1.18 Urban Land

Urban land consists mostly of sites for buildings, paved roads and parking lots. The areas are mostly rectangular and range from 5 to 100 acres. Soils included in this unit are small intermingled areas of Udorthents, somewhat excessively drained Merrimac soil, well drained Canton, Charlton, and Newport soils; moderately well drained Pittstown, Sudbury and Sutton soils.

5.4.1.19 Wapping Series

The Wapping series consists of coarse-loamy, moderately well drained soils formed in silt mantled glacial till. The soils are on the side of slopes or in depressions of glaciated uplands. Slopes range from 0 to 8 percent.

5.4.1.20 Woodbridge Series

The Woodbridge series consists of coarse-loamy moderately well drained soils formed in glacial till. The soils are on lower slopes and crests of upland hills and drumlins. Slopes range from 0 to 8 percent.

5.4.2 Prime Farmland Soils

Prime farmland, as defined by the United States Department of Agriculture (USDA), is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when it is treated and managed using acceptable farming methods.

Rhode Island recognizes 35 prime farmland soils (USDA, 2012). Prime farmland soils can be used for cropland, pastureland, rangeland, forestland, or other land. Urbanized land and water are exempt from consideration as prime farmland. The proposed Project will cross 10 prime farmland soil units as listed in Table 5-2. Within the Study Area, prime farmland soils exist on land occupied by commercial, institutional, industrial, recreational, agricultural and residential land uses, cleared right of way, forestland, and roads.

Table 5-2 USDA Prime Farmland Soils within the Study Area

Soil Map Unit Symbol	Name	Percent Slope
BhA	Bridgehampton silt loam	0 to 3
BmA	Bridgehampton silt loam	0 to 3
CdB	Canton and Charlton fine sandy loams	3 to 8
EfA	Enfield silt loam	0 to 3
MmB	Merrimac sandy loam	3 to 8
NaB	Narragansett silt loam	3 to 8
ScA	Scio silt loam	0 to 3
StA	Sutton fine sandy loam	0 to 3
WbB	Wapping silt loam	3 o 8
WhB	Woodbridge fine sandy loam	3 to 8

Source: Soil Survey of Rhode Island (Rector, 1981).

5.4.3 Farmland of Statewide Importance

Farmland of statewide importance is land that is designated by the Rhode Island Department of Administration Division of Planning to be of statewide importance for the production of food, feed, fiber, forage, and oilseed crops (USDA, 2012). Generally, farmlands of statewide importance include those lands that do not meet the requirements to be considered prime farmland, yet they economically produce high crop yields when treated and managed with modern farming methods. Some may produce as high a yield as prime farmland if conditions are favorable.

In order to extend the additional protection of state regulation to prime farmland, the State of Rhode Island has expanded its definition of farmland of statewide importance to include all prime farmland areas. Therefore, in Rhode Island, all USDA designated prime farmland soils are also farmland of statewide importance.

Table 5-3 lists soil units designated as farmland soils of statewide importance that are found within the Study Area. Bailey's Farm is located within the Project Study Area.

Table 5-3 Farmland Soils of Statewide Importance within the Study Area

Soil Map Unit Symbol	Phase	Percent Slope
BhB	Bridgehampton silt loam	3 to 8
BmB	Bridgehampton silt loam, till Substratum	3 to 8
CdC	Canton And Charlton fine sandy loams	8 to 15
EfB	Enfield silt loam	3 to 8
HkC	Hinckley gravelly sandy loam	rolling
NeC	Newport silt loam	8 to 15
QoC	Quonset gravelly sandy loam	rolling
Rc	Raypol silt loam	-
Ru	Rippowam fine sandy loam	-

Source: Soil Survey of Rhode Island (Rector, 1981).

5.4.4 Potentially Erosive Soils

The erodibility of a soil is dependent upon the slope of the land occupied by the soil and the texture of the soil. NRCS has characterized soil map units as "highly erodible", "potentially highly erodible", or "not highly erodible" due to sheet and rill erosion (USDA, 1993). This determination is done by using the Universal Soil Loss Equation (USLE). The USLE relates the effects of rainfall, soil characteristics, and the length and steepness of slope to the soil's tolerable sheet and rill erosion rate (see Figure 5-2).

Soils are given an erodibility factor (K), which is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values in Rhode Island range from 0.10 to 0.64 and vary throughout the depth of the soil profile with changes in soil texture. Very poorly drained soils and certain floodplain soils usually occupy areas with little or no slope. Therefore, these soils are not subject to erosion under normal conditions and are not given an erodibility factor. Soil map units described as strongly sloping or rolling may include areas with slopes greater than eight percent and soil map units with moderate erosion hazard are listed in Table 5-4.

Table 5-4 Soil Mapping Units with Potential Steep Slopes within the Study Area

Soil Map Unit Symbol	Soil Phase	Percent Slope	Erodibility Hazard	Surface K Values
BhB	Bridgehampton silt loam	3 to 8	Phel	0.64
BmB	Bridgehampton silt loam	3 to 8	Phel	0.64
BnB	Bridgehampton-Charlton complex, very stony	0 to 8	Phel	0.64
BoC	Bridgehampton-Charlton complex, extremely stony	3 to 15	Phel	0.64
CdB	Canton and Charlton fine sandy loams	3 to 8	Phel	0.24
CdC	Canton and Charlton fine sandy loams	8 to 15	Hel	0.24

Soil Map Unit Symbol	Soil Phase	Percent Slope	Erodibility Hazard	Surface K Values
CeC	Canton and Charlton fine sandy loams, very rocky	3 to 15	Phel	0.24
EfB	Enfield silt loam	3 to 8	Phel	0.1
HkC	Hinckley gravelly sandy loam	10	Phel	0.1
MmB	Merrimac sandy loam	3 to 8	Phel	0.1
NaB	Narragansett silt loam	3 to 8	Phel	0.24
NbB	Narragansett very stony silt loam	0 to 8	Phel	0.24
NbC	Narragansett very stony silt loam	8 to 15	Phel	0.24
NeC	Newport silt loam	8 to 15	Hel	0.24
PbB	Paxton very stony fine sandy loam	0 to 8	Phel	0.24
QoC	Quonset gravelly sandy loam, rolling	10	Phel	0.1
RaB	Rainbow silt loam	3 to 8	Phel	0.24
WbB	Wapping silt loam	3 to 8	Phel	0.24
WcB	Wapping very stony silt loam	0 to 8	Phel	0.24
WhB	Woodbridge fine sandy loam	3 to 8	Phel	0.24
WoB	Woodbridge very stony fine sandy loam	0 to 8	Phel	0.24

Source: Soil Survey of Rhode Island (Rector, 1981) and United States Department of Agriculture, Natural Resources Conservation Service, Highly Erodible Soil Map Units of Rhode Island, Revised January 1993.
Hel Highly Erodible
Phel Potentially Highly Erodible

5.5 Surface Water

The Study Area lies largely within the Narragansett Bay drainage basin of Rhode Island. A drainage basin is the area of land that drains water, sediment, and dissolved materials to a common outlet at some point along a stream channel (Dunne and Leopold, 1978), and is synonymous with watershed. Narragansett Bay extends approximately 28 miles from north to south and approximately 11 miles at its widest point from west to east (Chinman and Nixon, 1985). The Narragansett Bay watershed is composed of nine subwatersheds and those that are located within the Hunt River and Greenwich Bay. The bodies of water that are located within these watersheds are Saddle Brook, Fry Brook, Frenchtown Brook, and the Hunt River. The Narragansett Bay Basin flows south into Rhode Island and Block Island sounds, and ultimately the Atlantic Ocean.

The waters of the State of Rhode Island (meaning all surface water and groundwater of the State) are assigned a Use Class which is defined by the most sensitive uses which it is intended to protect. Waters are classified according to specific physical, chemical, and biological criteria which establish parameters of minimum water quality necessary to support the water Use Classification. The water quality classification of the major surface waters within the Study Area are identified in the descriptions of the water courses that follow. Classification use of all water courses within the Study Area are presented in Table 5 5.

The Study Area is drained by waterways which generally flow to the east and southeast into Narragansett Bay. Figure 5-3 depicts surface waters within the Study Area.

Pursuant to the requirements of Section 305(b) of the Federal Clean Water Act, waterbodies which are determined to be not supporting their designated uses in whole or in part are considered impaired, and placed on the Clean Water Act, Section 303(d) List of Impaired Waters or have a total maximum daily load (TMDL) assessment where they are prioritized and scheduled for restoration. The causes of impairment are those pollutants or other stressors that contribute to the actual or threatened impairment of designated uses in a waterbody. Causes include chemical contaminants, physical parameters, and biological parameters. Sources of impairment are not determined until a TMDL assessment is conducted on a water body.

The Study Area is crossed by Class A and Class B streams. The northern route crossings of Saddle Brook and Fry Brook are Class B waters. These are designated for fish and wildlife habitat and primary and secondary contact recreational activities. They shall be suitable for compatible industrial processes and cooling, hydropower, aquaculture uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value. Moving south, the Frenchtown Brook and Hunt River are Class A waters. Similar to Class B, these waters are designated for primary and secondary contact recreational activities and for fish and wildlife habitat. They shall be suitable for compatible industrial processes and cooling, hydropower, aquaculture uses, navigation, and irrigation and other agricultural uses. These waters shall have excellent aesthetic value.

Table 5-5 Surface Water Resources within the Study Area

Water Body Name	Town	Use Classification	Approximate Location
Saddle Brook (and tributaries)	West Warwick/ Warwick	B	North and south of the Study Area intersection with Interstate 95.
Fry Brook (and tributaries)	East Greenwich	B	North of Middle Road, parallel to the Study Area, and crossings north of Briggs Drive
Frenchtown Brook (and tributaries)	East Greenwich	A	Crossings south of Frenchtown Road at Ayrault Road
Hunt River (and tributaries)	East Greenwich	A	Crosses Route 2 0.25 miles south of South Road. Also crosses South Road 475 feet southeast of Route 2.

Source: RIDEM, Water Quality Regulations (December 2010); RIDEM Appendix A. 2014 Index of Waterbodies and Category Listing.

Classification

A: Primary and secondary contact recreational activities and for fish and wildlife habitat. Suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have excellent aesthetic value.

B: Fish and wildlife habitat and primary and secondary contact recreational activities. Suitable for compatible industrial processes and cooling, hydropower, aquacultural uses, navigation, and irrigation and other agricultural uses. These waters shall have good aesthetic value.

Table 5-6 Surface Water Resource TMDLs Impairments within the Study Area

Water Body Name	Impairment

Water Body Name	Impairment
Saddle Brook (and tributaries)	Fecal Coliform
Fry Brook (and tributaries)	Fecal Coliform
Frenchtown Brook (and tributaries)	Enterococcus
Hunt River (and tributaries)	Fecal Coliform

5.5.1 Saddle Brook

Saddle Brook is a state-designated Class B watercourse runs from west to east that drains to the Maskerchugg River near the Interstate 95/Route 4 interchange. The Maskerchugg River drains into Greenwich Cove. In 2005, Saddle Brook was included in the TMDL Analysis for Greenwich Bay Waters for Pathogens/Bacteria Impairments (RIDEM 2005). At that time fecal coliform concentrations were greater than the water quality standards. Sources of fecal coliform are likely confined to stormwater. A TMDL was finalized in 2006 and Saddle Brook was identified as being impaired by Fecal Coliform.

5.5.2 Fry Brook

Fry Brook is a third-order stream located entirely within the town of East Greenwich, Rhode Island. The watershed is approximately 1,986 acres in size and drains several wetland areas. Several smaller tributaries join the stream as it flows southeast, approximately 6.2 miles, towards its confluence with the Hunt River. A TMDL was finalized in 2001 and Fry Brook was identified as being impaired by Fecal Coliform.

5.5.3 Frenchtown Brook

Frenchtown Brook is a state-designated Class A 8.6 mile watercourse located in East Greenwich and West Greenwich. Its headwaters are located about 3.3 miles due west of the Study Area, Frenchtown Brook begins as two branches on either side of Bates Trail in a forested area to the southeast of Carr Pond in West Greenwich, RI. The branches flow east across the town border with East Greenwich and join in a wetland area near Wightmans Corner. The brook continues east, through residential and commercial developments along Frenchtown Road, and crosses Tillinghast Road. The brook then flows just north of Frenchtown Elementary School and crosses Frenchtown Road near the intersection with Routes 2 and 4. Frenchtown Brook continues east, through a more heavily developed commercial section of East Greenwich including the Stanley-Bostitch Corporation, a hand and power tool manufacturing plant, and eventually empties into the Hunt River near Route 403. Water quality sampling from 2007-2009 indicated enterococci levels higher than allowed for the water quality Class A. A TMDL was finalized in 2011 and Frenchtown Brook was identified as being impaired by enterococcus.

5.5.4 Hunt River

The Hunt River is a Class B freshwater stream. The Hunt River watershed drains approximately 25 square miles in Exeter, North Kingstown, East Greenwich, West Greenwich,

Coventry, West Warwick, and Warwick. The Hunt River is formed by multiple tributaries originating in East Greenwich, RI and emptying into Narragansett Bay just south of Greenwich Bay. Water quality sampling from 2007-2009 indicated enterococci levels higher than allowed for the water quality Class A in one particular segment. A TMDL was finalized in 2001 and the Hunt River was identified as being impaired by Fecal Coliform.

5.5.5 Floodplain

Special Flood Hazard Areas are areas that are subject to inundation by the one percent annual chance flood. Based on available FEMA Flood Insurance Rate Mapping for the towns of West Warwick, Warwick, and East Greenwich, portions of the Study Area lie within Zone A and Zone AE Special Flood Hazard Areas (SFHA). Zone A denotes that the Base Flood Elevation (i.e. the water-surface elevation of the one percent annual chance flood) has not been determined. Zone AE denotes areas that have a one percent annual chance of flooding and Base Flood Elevations have been determined.

Zone A SFHA is located in the following areas within the Study Area moving from north to south:

- Northwest of the intersection of Quaker Lane and Interstate 95.
- Fry Brook crossing near Route 2 and Pine Glen Drive. Continues south along Route 2, for about 0.7 miles.
- North of Biggs Drive/Route 2
- Route 2/Meadowbrook at the Frenchtown Brook crossing
- Wetland area north and east of the South Road/Route 2 intersection

Zone AE SFHA is located in the following areas within the Study Area:

- Route 2 crossing with Frenchtown Brook, south of Frenchtown Road/Route 402.

Floodway is located in the following areas within the Study Area:

- Route 2 crosses through the regulatory floodway for Frenchtown Brook, just south of Frenchtown Road/Route 402.

It is recognized that, by definition provided in the RIDEM Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act (RIDEM 2014) (the RIDEM Freshwater Wetland Rules), a floodplain is the land area adjacent to a river, stream, or other body of flowing water that is, on average likely to be covered with flood waters resulting from a one percent annual chance flood event. In the event that these floodplains are not mapped by FEMA then a registered Professional Engineer may be enlisted to determine the base flood elevation.

5.5.6 Surface Water Protection Areas

There are no drinking water reservoirs located within the Study Area. The Hunt/Potowomut Resource Protection Area includes the portion of the Study Area south of Interstate 95. The Hunt River is an active anadromous fish run, and the communities rely on the watershed's

groundwater for their potable water. Several conservation groups, including the Audubon Society and local land trusts, have been active in protecting tracts of land along the Hunt River. Most notable is the Davis Wildlife Refuge (0.50 miles east of Route 2), which contains one of the state's largest bogs. State, federal, local and private agencies have focused on the non-point source pollution impacts in the watershed and its contributions to Greenwich Bay.

5.6 Groundwater

Groundwater resources within the Study Area are depicted in Figure 5-3. The presence and availability of groundwater resources is a direct function of the geologic deposits in the Study Area. The northern two thirds of the Study Area are classified as GA (RIDEM, 2009). These groundwater resources are presumed suitable for public drinking water use without prior treatment, however these resources have a lower potential yield and quality than that of the highest state classification, GAA. The GA class is subject to the same groundwater quality standards and preventative action limits for organic and inorganic chemicals, microbiological substances, and radionuclides as the GAA classification. The southern third of the Study Area is located within in area classified as GAA. Groundwater classified GAA are those groundwater resources that are known or presumed to be suitable for drinking water use without treatment and are located in either the state's major stratified drift aquifers, the wellhead protection area, or groundwater dependent areas.

About 2.25 miles of the Study Area is located in a groundwater recharge area, approximately 0.5 miles of which bisects a groundwater reservoir.

A small portion of the Study Area just south of Frenchtown Road borders on a community wellhead protection area (CWHPA). This is the portion of an aquifer through which groundwater moves to a well. The community well serves year-round residents; at least 15 service connections or at least 25 individuals. Examples include municipal wells and wells serving nursing homes, condominiums, and mobile home parks.

5.6.1 Sole Source Aquifers

With the exception of the area between, Cowesett Road and Major Potter Road, the Study Area is located wholly within the Hunt-Annaquacket-Pettaquamscutt Sole Source Aquifer. See Figure 5-3.

5.7 Vegetation

Most of the Study Area immediately adjacent to the Project Route has been developed for commercial, residential, and industrial uses. However, the Study Area contains a variety of upland vegetative cover types typical of southern New England. These types include oak/pine forest, shrubland, hayfield, old field, and managed lawn. This section of the Siting Report focuses on upland communities. Wetland communities are discussed in Section 5.8 of this Siting Report.

5.7.1 Deciduous Forest Associations

Forested cover types within the Study Area are typically dominated by deciduous trees thought to be a mix of oaks and maples. Although these woodlands may appear similar throughout the Study Area, differences in the structure and composition of species in these forests may occur. Soil drainage class, position on the landscape, and slope aspect are important factors in determining the plant associations present at a particular site.

The forests on well-drained and moderately well drained acidic soils are typically composed of red oak, black oak and/or scarlet oak (Quercus rubra, Q. velutina, and/or Q. coccinea). White oak (Q. alba) is a common component, but rarely dominant. Other common associates, especially in moister sites, include black birch (Betula lenta), black gum (Nyssa sylvatica), red maple (Acer rubrum) and sassafras (Sassafras albidum). Occasionally pitch pine (Pinus rigida) or white pine may be encountered. Unless thinned, crown closure is generally greater than 75 percent.

The forested region of the western side of the Study Area, south of Middle Road and south of Frenchtown Road are part of larger contiguous forests.

5.7.2 Agricultural Areas

Agricultural land managed in corn and row crops are encountered along the southern half of the route and within the Study Area.

5.8 Wetlands

Wetlands have been identified as resources potentially providing ecological functions and societal values. Wetlands are characterized by three criteria including the (i) presence of undrained hydric soils, (ii) a prevalence (>50 percent) of hydrophytic vegetation, and (iii) wetland hydrology, soils that are saturated near the surface or flooded by shallow water during at least a portion of the growing season.

5.8.1 Study Area Wetlands

State-regulated freshwater wetlands and streams have been identified within the Study Area. Figure 5-4 depicts wetlands within the Study Area mapped using the wetlands shapefile from the RIGIS website. Based on the provisions of the Rhode Island Fresh Water Wetlands Act and the RIDEM Freshwater Wetland Rules, State-regulated fresh water wetlands include swamps, marshes, bogs, forested or shrub wetlands, emergent plant communities and other areas dominated by wetland vegetation with evidence of wetland hydrology. Swamps are defined as wetlands dominated by woody species and are three acres in size, or greater. Marshes are wetlands dominated by emergent species and are one acre or greater in size. Emergent wetlands communities are areas similar to marshes in vegetation composition; however, they are less than one acre in size. Forested and shrub wetlands are also dominated by woody species, similar to swamps, but do not meet the three-acre size criterion.

The upland area within 50 feet of the edge of a swamp, marsh, or bog is regulated as the 50-foot Perimeter Wetland under the RIDEM Freshwater Wetland Rules. Emergent wetland communities, forested wetlands, and shrub wetlands do not merit a 50-foot Perimeter Wetland.

In addition to these vegetated wetland communities, Rhode Island also regulates activities in and around streams and open water bodies, which include Rivers, Ponds, and Areas Subject to Storm Flowage (ASSF). A River is any perennial stream indicated as a blue line on a USGS 7.5-minute series topographic map. If the River or stream is less than 10 feet wide, the area within 100 feet of each bank is regulated as 100-foot Riverbank Wetland. If the River or stream is greater than 10 feet wide, the area within 200 feet of each bank is regulated as 200-foot Riverbank Wetland.

A Pond is an area of open standing or slow-moving water present for six or more months during the year and at least one-quarter acre in size. Ponds have a 50-foot Perimeter Wetland associated with the boundary. An ASSF is defined as any body of flowing water as identified by a scoured channel or change in vegetative composition or density that conveys storm runoff into or out of a wetland.

Wetland vegetation community types and their dominant plant species located within the existing Project route are described below.

5.8.1.1 Ponds

There are a few small ponds within the southern portion of the Study Area, but none are specifically named.

5.8.1.2 Swamp

Swamps are defined as areas at least three acres in size, dominated by woody vegetation, where groundwater is at or near the ground surface for a significant part of the growing season. A 50-foot Perimeter Wetland is applied to Swamps regardless of whether they support forest or shrub cover types.

Dominant species in Swamps with shrub cover include sweet pepperbush (Clethra alnifolia), highbush blueberry (Vaccinium corymbosum), winterberry (Ilex verticillata), and swamp azalea. Other species located in these swamps include arrowwood (Viburnum dentatum), Bebb willow, alder (Alnus sp.), and silky dogwood (Cornus amomum). Drier portions of Shrub Swamps are often densely overgrown with wild grape (Vitus labrusca) and greenbrier. Common species in the herbaceous layer include cinnamon fern (Osmunda cinnamomea), sensitive fern, poison ivy, and dewberry (Rubus hispidus). Shrub Swamp generally occurs in areas where wetlands are in the managed route and trees are periodically removed.

Forested Swamps are not present within the Project Route. Dominant canopy species in forested Swamps within the Study Area include red maple, willow (Salix sp.), black gum, American elm (Ulmus americana) and swamp white oak (Quercus bicolor). Winterberry, highbush blueberry, arrowwood, and spicebush (Lindera benzoin) are typical shrubs found in forested Swamps. Skunk cabbage, cinnamon fern, false hellebore (Veratrum viride), and royal fern (Osmunda regalis) are common in the herb stratum.

5.8.1.3 Marsh

Marshes are wetlands at least one acre in size where water is generally above the surface of the substrate and where the vegetation is dominated by emergent herbaceous species. The best example of Marsh in the Study Area is located along the Hunt River east of the Project Route south of Interstate-95 (I-95). Marsh vegetation is typically dominated by broad-leaved cattail (Typha latifolia) and common reed (Phragmites australis) with lesser amounts of buttonbush (Cephalanthus occidentalis), marsh fern (Thelypteris palustris), woolgrass (Scirpus cyperinus), and purple loosestrife (Lythrum salicaria).

5.8.1.4 Rivers and Stream/Intermittent Streams

A River is a body of water designated as a perennial stream by the US Geologic Survey (a blue line stream on a USGS topographic map). One river is located within the Study Area: the Hunt River. Streams and intermittent streams are flowing bodies of water or watercourses that are not rivers which flow long enough each year to develop and maintain a defined channel. Streams often are associated with the headwaters of named Rivers and tributaries with downstream confluences. The Study Area is crossed by Saddle Brook, Fry Brook, Frenchtown Brook, and their tributaries. Further descriptions of these watercourses are provided in Section 5.5 of this Siting Report.

5.8.1.5 Emergent Plant Community

Emergent plant communities within the Study Area are associated with areas that are mown with sufficient frequency to control the establishment of woody vegetation. Within the Study Area they include portions of agricultural fields, pastures and lawns. Common species associated with these areas include rough-stemmed goldenrod, New England aster (Symphotrichum novae-angliae), Joe-Pye weed (Eupatoriadelphus maculatus), sensitive fern, soft rush, and reed canary grass (Phalaris arundinacea).

5.8.1.6 Shrub/Forested Wetland

Wetlands that are not Swamps or Marshes and are dominated by woody vegetation are classified as either Shrub Wetlands or Forested Wetlands. In the Project route, Shrub Wetlands often include highbush blueberry, sweet pepper bush, arrowwood, multiflora rose, winterberry, and elderberry (Sambucus canadensis). Associated herbaceous species may include skunk cabbage, cinnamon fern, and jewelweed (Impatiens capensis).

Forested wetlands are located within the Route 2 and Interstate 95 interchange infields, as well as between Route 4 and South County Trail north of South Road. Vegetation includes red maple, American elm, and black gum with an understory generally consisting of vegetation mentioned previously in the shrub wetland.

5.8.1.7 Floodplain

A floodplain is the land area adjacent to a river or stream or other body of flowing water that is, on the average, likely to be covered with flood waters resulting from a one percent annual

chance flooding event. These regulated floodplain areas include areas mapped by FEMA, as well as un-mapped floodplain.

5.8.1.8 Area Subject to Storm Flowage

ASSFs are channel areas and water courses which carry storm, surface, groundwater discharge or drainage waters out of, into, and/or connect freshwater wetlands or coastal wetlands. ASSFs are recognized by evidence of scouring and/or a marked change in vegetative density and/or composition. Some of the drainage ditches associated with the agricultural field north of Frenchtown Road classify as ASSFs.

5.9 Wildlife

The wildlife species present within the Study Area vary according to the habitat resources present. The suitability of a habitat for a particular species is influenced by its setting (inland, terrestrial, wetland/deep water, etc.) along with current and historic land management practices which affect the floristic composition and structure of the vegetation cover types present. The proposed Project includes work proximate to 11 different habitats that are identified in New England Wildlife: Habitat, Natural History and Distribution (DeGraaf and Yamasaki, 2001). Habitat resources are variable across the Study Area.

The Project is oriented in a north to south direction and is removed from coastal habitats. The proposed road route passes through a largely commercialized area though some intact and isolated woodlands, farmlands, and residential housing developments also occur. The Project route is located either within existing roadway or its cleared shoulder and passes over perennial and intermittent streams.

An overall list of wildlife species expected to occur within the Study Area has been compiled based upon the major habitats present. This list relies on the species geographical distribution data provided by DeGraaf and Yamasaki (2001) and August et al. (2001) with information on certain amphibians and reptiles supplemented by Amphibians and Reptiles of Connecticut and Adjacent Regions by Klemens (1993). It should be noted that individual species may not occur in any given part of the Study Area even if apparently suitable habitat is present.

Table 5-7 on the following pages provides a list of vertebrates (amphibian, reptiles, birds, and mammals) with the potential to occupy specific habitats in the Project Study Area.

Table 5-7 Expected and Observed Wildlife Species in the Study Area

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	Shrub/ Old Field	Ag. Field	Grass Field	Lawn Fairway	Red Maple Swamp	Wet Meadow	Shallow Marsh	Shrub Swamp	Pond	Lake	Stream	River	Riparian	Debris Pile	Structure
AMPHIBIANS AND REPTILES																
Spotted Salamander	X					X	X	X	X	X				X		
Northern Redback Salamander	X	X													X	
Four-toed Salamander	X					X	X	X	X			X			X	
Northern Two-Lined Salamander	X											X		X		
American Toad	X	X	X	X		X	X	X	X	X	X			X		
Northern Spring Peeper	X					X	X	X	X	X				X		
Gray Treefrog	X					X	X	X	X	X	X			X		
American Bullfrog								X	X	X	X	X	X	X		
Green Frog						X	X	X	X	X	X	X	X	X		
Northern Leopard Frog						X	X	X	X					X		
Pickerel Frog	X			X		X	X	X		X	X	X		X		
Common Snapping Turtle	X	X	X	X				X	X	X	X	X	X	X		
Spotted Turtle	X	X	X	X		X	X	X	X	X		X		X		
Wood Turtle	X	X	X	X		X	X	X	X	X	X	X	X	X		
Eastern Box	X	X		X		X	X	X	X			X		X		

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Turtle																
Painted Turtle						X	X	X	X	X	X	X	X	X		
Common Musk Turtle		X		X			X	X	X	X	X	X	X	X		
Northern Water Snake							X	X	X	X	X	X	X	X		X
Northern Red-bellied Snake	X	X				X			X						X	X
Northern Brown Snake	X	X		X		X	X	X	X	X	X	X		X	X	X
Common Garter Snake	X	X		X		X	X	X	X	X		X		X	X	X
Ribbon Snake	X					X	X	X	X	X		X		X		
Eastern Hognose Snake	X	X	X	X		X		X						X	X	X
Northern Ringneck Snake	X					X									X	X
Northern Black Racer	X	X		X		X		X	X					X	X	X
Eastern Smooth Green Snake	X	X		X		X	X	X	X						X	
Eastern Milk Snake	X	X		X		X									X	X
BIRDS (X=expected to occur; B=breeding in Rhode Island; M=migrant/visitor)																
Double-crested Cormorant[B]										X	X		X	X		
Least Bittern[B] (Rare)								X	X							

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Great Blue Heron[B]	X					X	X	X	X	X	X	X	X	X		
Great Egret[B]										X	X					
Snowy Egret[B]																
Little Blue Heron[B]																
Green Heron[B]	X					X	X	X	X	X	X	X	X	X		
Black-crowned Night Heron[B]								X	X	X						
Yellow-crowned Night Heron[B]								X	X	X						
Glossy Ibis[B]				X			X	X	X							
Turkey Vulture[B]	X	X	X	X												
Canada Goose[B]			X	X	X		X	X		X		X	X	X		
Mute Swan[B]			X	X			X	X	X	X	X	X	X			
Wood Duck[B]	X							X	X	X	X	X	X	X		
American Widgeon[M]								X		X						
American Black Duck[B]							X	X	X	X	X	X	X	X		
Mallard[B]			X	X			X	X	X	X	X	X	X	X		
Canvasback[M]																
Ring-necked Duck[M]								X	X	X	X	X	X	X		
Bufflehead[M]											X	X	X			
Common										X	X	X	X			

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Goldeneye[M]																
Common Merganser[M]	X									X	X	X	X	X		
Osprey[B]										X	X	X	X			X
Bald Eagle[M]											X					
Northern Harrier[M]																
Sharp-shinned Hawk[M]	X												X			
Cooper's Hawk[B] (Rare)	X	X		X												
Northern Goshawk[B] (Rare)	X	X		X												
Red-shouldered Hawk[B]	X								X					X		
Broad-winged Hawk[B]	X			X												
Red-tailed Hawk[B]	X	X	X	X					X							
Rough-legged Hawk[M]		X	X	X			X	X	X							
American Kestrel[B]	X	X	X	X			X	X								
Peregrine Falcon[M]		X	X	X	X		X	X	X				X	X		
Ring-necked Pheasant[B]		X	X	X												

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Ruffed Grouse[B]	X	X														
Wild Turkey[B]	X	X	X	X												
Northern Bobwhite[B] (Rare)	X	X	X	X												
Virginia Rail[B]								X								
Sora[B] (Rare)							X	X	X	X						
Killdeer[B]			X				X							X		X
Willet[B]																
Spotted Sandpiper[B]				X						X	X	X	X	X		
Wilson's (Common) Snipe[M]		X					X	X	X					X		
American Woodcock[B]	X	X	X				X		X					X		
Ring-billed Gull[B]																
Herring Gull[B]										X	X		X			
Common Tern[B]											X					
Rock Pigeon[B]			X	X												X
Mourning Dove[B]	X	X	X	X												X
Black-billed Cuckoo[B]	X	X							x							
Yellow-billed Cuckoo[B]	X	X														

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Barn Owl[B] (Rare)			X	X												X
Eastern Screech-Owl[B]	X	X		X			X	X						X		
Great Horned Owl[B]	X	X	X	X			X	X	x					X		
Long-eared Owl[B]	X	X	X	X			X	X								
Short-eared Owl[M]			X	X			X	X								
Northern Saw-whet Owl[B] (Rare)	X			X										X		
Common Nighthawk[B] (Rare)	X	X	X	X			X							X		X
Whip-poor-will[B]	X	X		X												
Chimney Swift[B]		X	X	X			X									X
Ruby-throated Hummingbird[B]	X	X				X			X							
Belted Kingfisher[B]										X	X	X	X	X		
Red-bellied Woodpecker[B]	X													X		
Downy Woodpecker[B]	X	X				X								X		
Hairy Woodpecker[B]	X					X								X		

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Northern Flicker[B]	X	X	X	X		X									X	X
Eastern Wood-Pewee[B]	X	X				X			X					X		
Acadian Flycatcher[B] (Rare)	X					X								X		
Willow Flycatcher[B]	X	X				X			X							
Least Flycatcher[B]	X					X								X		
Eastern Phoebe[B]	X	X		X		X			X							X
Great Crested Flycatcher[B]	X	X				X										
Eastern Kingbird[B]	X	X		X		X	X	X	X				X	X		
Northern Shrike[M]	X	X		X		X	X	X								
White-eyed Vireo[B]	X	X				X			X					X		
Warbling Vireo[B]	X	X				X								X		
Red-eyed Vireo[B]	X					X								X		
Blue Jay[B]	X	X		X		X								X		
American Crow[B]	X	X	X	X		X										
Fish Crow[B]								X		X	X	X	X	X		

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
(Rare)																
Horned Lark [B] (Rare)			X	X												
Purple Martin[B]		X	X	X			X	X		X	X	X	X	X		X
Tree Swallow[B]	X	X	X	X		X	X	X	X	X	X	X	X	X		
Northern Rough-winged Swallow[B]	X	X	X	X			X	X		X		X	X	X		
Bank Swallow[B]	X	X	X	X			X	X		X		X	X	X		
Barn Swallow[B]	X			X			X	X		X		X	X	X		X
Black-capped Chickadee[B]	X	X				X			X					X		
Tufted Titmouse[B]	X	X				X			X					X		
Red-breasted Nuthatch[B] (Rare)	X					X										
White-breasted Nuthatch[B]	X	X				X								X		
Brown Creeper[B]	X					X								X		
Carolina Wren[B]	X	X				X		X	X					X		
House Wren[B]	X	X		X		X			X					X		X
Winter Wren[M]	X					X			X					X		
Marsh Wren[B]								X	X							
Golden-crowned Kinglet[B] (Rare)	X					X										

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Ruby-crowned Kinglet[M]	X					X										
Blue-gray Gnatcatcher[B]	X	X				X			X							
Eastern Bluebird[B]	X	X		X		X			X							X
Veery[B]	X					X								X		
Hermit Thrush[B]	X	X				X			X							
Wood Thrush[B]	X					X								X		
American Robin[B]	X	X	X	X		X			X					X		
Gray Catbird[B]	X	X		X		X			X					X		
Northern Mockingbird[B]	X	X							X							
Brown Thrasher[B]	X	X												X		
European Starling[B]	X	X	X	X										X		X
Cedar Waxwing[B]	X	X				X			X		X			X		
Blue-winged Warbler[B]	X	X		X					X							
Nashville Warbler[B] (Rare)	X								X							
Yellow Warbler[B]	X	X				X			X					X		
Chestnut-sided Warbler[B]		X				X			X							
Yellow-rumped		X				X			X					X		

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Warbler[M]																
Black-throated Green Warbler[B]	X					X										
Pine Warbler[B]	X															
Prairie Warbler[B]	X	X														
Black–and-white Warbler[B]	X					X								X		
American Redstart[B]	X					X			X					X		
Worm-eating Warbler[B]	X															
Ovenbird[B]	X					X										
Northern Waterthrush[B]	X					X			X							
Common Yellowthroat[B]	X	X				X	X	X	X	X				X		
Canada Warbler[B]	X					X			X					X		
Scarlet Tanager[B]	X															
Eastern Towhee[B]	X	X				X										
American Tree Sparrow[M]	X	X		X			X	X	X					X		
Chipping Sparrow[B]	X		X	X												
Field Sparrow[B]		X	X	X												
Vesper		X	X	X	X		X									

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Sparrow[M]																
Savannah Sparrow[B]			X	X			X	X								
Grasshopper Sparrow[B] (Rare)			X	X												
Fox Sparrow[M]	X	X														
Song Sparrow[B]	X	X	X	X		X	X	X	X					X		
Swamp Sparrow[B]							X	X	X	X				X		
White-throated Sparrow[B] (Rare)	X	X		X		X								X		
Dark-eyed Junco[B] (Rare)	X			X												
Lapland Longspur[M]			X	X												
Snow Bunting[M]			X	X			X	X								
Northern Cardinal[B]	X	X				X			X					X		
Rose-breasted Grosbeak[B]	X	X				X			X					X		
Indigo Bunting[B]	X	X		X										X		
Bobolink[B]				X			X	X								
Red-winged Blackbird[B]			X	X		X	X	X	X	X				X		
Eastern Meadowlark[B]			X	X						X						
Rusty Blackbird[M]						X								X		

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Common Grackle[B]	X		X	X		X	X	X	X		X			X		X
Brown-headed Cowbird[B]	X	X	X	X		X		X						X		
Orchard Oriole[B] (Rare)	X					X								X		
Baltimore Oriole[B]	X	X				X			X					X		
Pine Grosbeak[M]	X		X													
Purple Finch[B]	X	X				X										
House Finch[B]	X															X
Common Redpoll[M]	X	X	X	X				X	X							
Pine Siskin[M]	X	X		X		X			X					X		
American Goldfinch[B]	X	X	X	X		X	X	X	X					X		
Evening Grosbeak[M]	X					X								X		
House Sparrow[B]		X	X	X												X
MAMMALS																
Virginia Opossum	X	X	X	X		X	X	X	X					X	X	
Masked Shrew	X	X		X		X	X	X	X					X		
Northern Short-tailed Shrew	X	X		X		X	X	X	X					X		
Eastern Mole	X	X	X	X	X	X										

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	Shrub/ Old Field	Ag. Field	Grass Field	Lawn Fairway	Red Maple Swamp	Wet Meadow	Shallow Marsh	Shrub Swamp	Pond	Lake	Stream	River	Riparian	Debris Pile	Structure
Star-nosed Mole						X	X	X	X	X	X	X	X	X		
Little Brown Myotis	X	X	X	X		X	X	X	X	X	X	X	X	X		X
Northern Myotis	X	X	X	X		X	X	X	X	X	X	X	X	X		X
Silver-haired BatM	X	X	X	X		X	X	X	X	X	X	X	X	X		
Eastern PipistrelleB	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Big Brown BatB	X	X	X	X		X	X	X	X	X	X	X	X	X		X
Red BatB	X	X	X	X		X	X	X	X	X	X	X	X	X		
Hoary BatM	X	X	X	X		X	X	X	X	X	X	X	X	X		
Eastern CottontailB	X	O		X			X	X	O					X	X	
Snowshoe HareB	X	X						X	X					X		
Eastern ChipmunkB	O	O		X												
WoodchuckB	X	X	X	X											X	
Gray SquirrelB	X					X								X		
Red SquirrelB	X					X										
Southern Flying SquirrelB	X					X										
White-footed MouseB	X	X		X		X	X		X					X	X	X
Southern Red-backed VoleB	X	X	X	X		X			X					X		

	Terrestrial Habitats									Aquatic Habitats					Other	
	Oak/Pine Forest	**Shrub/ Old Field**	**Ag. Field**	**Grass Field**	**Lawn Fairway**	**Red Maple Swamp**	**Wet Meadow**	**Shallow Marsh**	**Shrub Swamp**	**Pond**	**Lake**	**Stream**	**River**	**Riparian**	**Debris Pile**	**Structure**
Meadow VoleB	X	X		X		X	X	X	X					X		
Woodland VoleB	X	X		X		X										
MuskratB							X	X	X	X	X	X	X	X		
Southern Bog LemmingB (Rare)	X	X		X		X	X	X						X		
Norway RatB		X	X	X		X									X	X
House MouseB		X	X	X		X									X	X
Meadow Jumping MouseB	X	X		X		X	X	X	X					X		
CoyoteB	X	X		X		X	X	X	X					X	X	
Red FoxB	X	X	X	X		X	X	X	X					X	X	
Gray FoxB	X	X				X	X	X	X					X	X	
RaccoonB	X	X	X	X		X	X	X	X					O	X	
ErmineB (Rare)	X	X	X	X		X		X	X					X	X	X
Long-tailed WeaselB	X	X	X	X		X	X	X	X					X		X
MinkB	X					X	X	X	X	X	X	X	X	X		
Striped SkunkB	X	X	X	X		X	X	X	O					X	X	X
River OtterB	X							X	X	X	X	X	X	X		
Bobcat	X	X				X	X		X							
White-tailed DeerB	O	O	X	X	X	X	X	X	O					X		

5.10 Fisheries

The RIDEM Division of Fish and Wildlife conducted fish surveys in Rhode Island's streams and ponds between 1993 and 2002. Table 5-8 summarizes the fish that were found in major waterways associated with the Project Study Area. Data were not available for Scrabbletown Brook. Electro-fishing was the primary sampling method used, though trap nets, seine hauls and gill nets were used where the waterways were not accessible with the electro-fishing boat. The Hunt River is the only watercourse/waterbody present within the Study Area that is a RIDEM stocked trout water.

American eel was found in every waterbody and stream sampled. This species is catadromous meaning they will migrate from freshwater to oceans in order to spawn. The presence of American eel in every surveyed waterbody and stream demonstrates the presence of existing migration routes from Narragansett Bay or the Atlantic Ocean.

Table 5-8 Observed and Anticipated Fish in Study Area (Libby, 2007)

Waterbody	Ale	Eel	AS	BS	BH	Bg	BT	BB	BwT	CP	GS	LMB	LD	PMK	RP	SD	WS
Hunt River	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Frenchtown Brook		X	X			X	X					X	X	X	X		X
Fry Brook		X					X										X

X: Reported as present in Fish Surveys

Ale: Alewife, Eel: American eel, AS: Atlantic Salmon, BS: Banded sunfish, BH: Blueback Herring, Bg: Bluegil, BT: Brook Trout, BB: Brown Bullhead, BwT: Brown trout, CP: Chain pickerel, GS: Golden shiner, LMB: Large-mouth bass, LD: Longnose Dace, PMK: Pumpkinseed, RP: Redfin pickerel, SD: Swamp darter, WS: White Sucker.

Source: Rhode Island Department of Environmental Management, Division of Fish and Wildlife "A Preliminary Summary of Fish Surveys That Were Conducted in Rhode Island's Streams and Ponds Between 1993 and 2002, "Alan D. Libby.

5.11 Rare and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation System was queried on December 3, 2015 to determine if any federally listed or proposed, threatened and endangered species protected under the Federal Endangered Species Act are located within the Study Area. This query resulted in the identification of the red knot (Calidris canutus rufa) and the northern long-eared bat (Myotis septentrionalis), both federally threatened species. The red knot breeds in the Arctic tundra and relies on stopover habitat along the east coast as it migrates to southern Argentina (Auduobon.org, accessed December 4, 2015). The red knot's stopover habitat includes coastal mudflats, tidal zones, and sandy beaches (Auduobon.org, accessed December 4, 2015). Suitable nesting habitat for this species is not present in the Study Area. The Project Area may host suitable habitat for the northern long-eared bat which roosts singly or in colonies within live and dead trees (USFWS, 2015a).

In April 2015 the USFWS listed the northern long-eared bat as a threatened species under the federal Endangered Species Act (ESA) due to severe population declines that have been caused by white nose syndrome. Section 7 consultation with the USFWS under the ESA is

required if the Project will involve tree removals within 150-feet of occupied roost trees or within 0.25 miles of any Northern Long-earned Bat hibernaculum. The Company coordinated with the RIDEM Division of Fish and Wildlife on July 30, 2018 requesting this information, and RIDEM responded on July 31, 2018 that there are no known northern long-eared bat maternity roost trees or hibernacula in or near the Project area. Further coordination under the ESA will not be required for the Project.

The Rhode Island Natural Heritage Program (RINHP) database hosted on the RIDEM Environmental Resource Mapping website identifies one Natural Heritage Program polygon that is located within the Study Area that covers a small area near Middle Road in East Greenwich. VHB requested information concerning this polygon from Paul Jordan, the Supervising Geographic Information System Specialist from RIDEM, and received his reply on May 21, 2018. Mr. Jordan indicated that the species represented within the polygon is red wakerobin (*Trillium erectum*), an upland perennial forb with dark red to red-purple -brown flowers. Although this state-endangered plant is located within the larger Study Area, it is not located within the Project route and will not be affected by the Project.

5.12 Air Quality

The National Ambient Air Quality Standards (NAAQS) were established by the Federal Clean Air Act Amendments (CAAA) and are designed to protect both public health and welfare (EPA NAAQS). Air quality analyses for projects that may impact motor vehicular traffic are required to evaluate their impact on ozone (O3) and carbon monoxide (CO).

Rhode Island developed a State Implementation Plan (SIP) in 1982 to comply with the 1977 CAAA requirements for O3 and CO. While three pollutants, CO, Nitrogen Oxide (NOx), and Volatile Organic Compounds (VOCs), play a role in O3 formation, the Environmental Protection Agency (EPA) determined in 1980 that SIPs must require the reduction of VOCs as the most effective strategy to achieve the O3 standard. The 1990 CAAA requires states to update their SIPs to evaluate the impact of reducing all three pollutants.

The State of Rhode Island is required by the CAAA to attain the NAAQS "as expeditiously as practicable." In March 2003, the RIDEM submitted the "Rhode Island Attainment Plan for the One-Hour National Ambient Air Quality Standard" to the EPA as a revision to the SIP (RIDEM Office of Air Resources, 2003). The plan demonstrated that Rhode Island would attain the one-hour ozone standard by 2007 (RIDEM Office of Air Resources, 2003). In the Attainment Plan, Rhode Island agreed to submit to EPA by December 31, 2004 a mid-course review demonstrating that Rhode Island remained on track to attain the one-hour standard by 2007 (RIDEM Office of Air Resources, 2003). In December 2004 the RIDEM submitted the "Mid-Course Review of the Rhode Island Attainment Plan for the One-Hour Ozone National Ambient Air Quality Standard" to the EPA which demonstrated that Rhode Island was still on track to attain the one-hour standard by 2007 (RIDEM Office of Air, 2004).

The EPA revoked the one-hour standard as of June 15, 2005 and subsequent planning and emissions reduction efforts were required to focus on achieving the more stringent 8-hour standard (EPA, Green Book).

In April 2008 the RIDEM submitted the "Revision of the Rhode Island State Implementation Plan to Address Interstate Transport of Pollutants Affecting Attainment and Maintenance of the 8-Hour Ozone and Fine Particulate Matter (PM2.5) National Ambient Air Quality Standards" to the EPA as a revision to the State's SIP (RIDEM, 2008). The plan demonstrated that emissions from Rhode Island sources do not contribute significantly to downwind ozone attainment and will not prevent downwind areas from attaining the NAAQS by their required attainment dates (RIDEM, 2008). Based on the findings in this Siting Report, it is not anticipated that the proposed Project will have a significant effect on the air quality of downwind areas.

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6

Description of Affected Social Environment

This section is a detailed description of all social and environmental characteristics of the proposed site including the land uses within and proximate to the Project route, visual resources in the vicinity of the Project, and the public roadway systems in the area. The proposed Project is located within Route 2, an existing RIDOT right of way, in the municipalities of Warwick, West Warwick, and East Greenwich, Rhode Island (the Host Communities).

As per Sections 45-22.2-2, et seq. of the Rhode Island General Laws, Rhode Island Comprehensive Planning and Land Use Act, all cities and towns are required to adopt and periodically update Local Comprehensive Land Use Plans. In compliance with these requirements, Warwick and E. Greenwich adopted their Comprehensive Plan Updates in 2014. West Warwick remains in the process of updating its Plan; therefore, the current West Warwick Plan (2005) was reviewed for this section and supplemented with current information where available.

6.1 Population Trends

The total population within the Host Communities has decreased slightly between 1990 and 2010 as shown in Table 6-1. Warwick and West Warwick are expected to continue to decline in population while East Greenwich is expected to grow by 2040 (Table 6-2). The Host

Communities can be characterized as being a mix of suburban and rural areas with a 2010 population that accounted for about 12 percent of the total State population (Table 6-1).

Table 6-1 Population Trends, 1990-2010

				Change			
				1990-2000		2000-2010	
Area	1990	2000	2010	Absolute	Percent	Absolute	Percent
State of Rhode Island	1,003,464	1,048,319	1,052,567	44,855	4.5%	4,248	0.4%
Warwick	85,427	85,808	82,672	381	0.4%	(3,136)	(3.6%)
West Warwick	29,268	29,581	29,191	313	1.1%	(390)	(1.3%)
East Greenwich	11,865	12,948	13,146	1,083	9.1%	198	1.5%
Host Community Total	126,560	128,337	125,009	1,777	10.6%	(3,328)	(2.6%)
% of State Populations	12.6%	12.2%	11.8%				

Notes:
( ) Negative
Source: U.S. Census Bureau, 1990, 2000, and 2010 Censuses as per Rhode Island Statewide Planning http://www.planning.ri.gov/documents/census/popcounts_est/pop_cities_towns_1990-2010.pdf

According to the Rhode Island Statewide Planning population projects, the population of Warwick is projected to decrease by 4.2 percent (3,492 people) between 2010 and 2020 and West Warwick's population is projected to also decline by 2.4 percent by 2030 (689 people). East Greenwich is expected to increase their population by 2.4 percent in 2020 (313 people; Rhode Island Division of Planning, 2013). By 2040 Warwick's population is expected to drop by nearly 10 percent from 2010 levels (7,971 people) and West Warwick's population is expected to modestly decrease from 2010 levels by 4.4% percent (1,286). By 2040, East Greenwich is expected to have increased their population by 9 percent (1,196 people; Rhode Island Division of Planning, 2013).

Table 6-2 Population Projections, 2010-2040

					Change			
					2010-2020		2030-2040	
Area	2010	2020	2030	2040	Absolute	Percent	Absolute	Percent
State of Rhode Island	1,052,567	1,049,177	1,070,677	1,070,104	(3,390)	(0.3%)	(573)	(0.1%)
Warwick	82,672	79,243	77,751	74,701	(3,492)	(4.2%)	(3,050)	(3.9%)
West Warwick	29,191	28,502	28,496	27,902	(689)	(2.4%)	(594)	(2.1%)
East Greenwich	13,146	13,459	14,048	14,342	313	2.4%	294	2.1%
Host Community Total	125,009	121,204	120,295	116,945	(3,805)	(3.0%)	(3,350)	(2.8%)
% of State Population	11.9%	11.6%	11.2%	10.9%				

Notes:
( ) Negative
Source: Rhode Island Division of Planning, Rhode Island Statewide Planning Program. Rhode Island Population Projections 2010-2040.

6.2 Employment Overview and Labor Force

Recent population growth, urbanization, and a substantial commuter-based population have produced greater demands for and a wider selection of trades and services. According to the Rhode Island Commerce Corporation, Rhode Island as a whole has enormous growth potential in the health and life science industry due to the emerging biotechnology companies. The financial services sector is extremely important to Rhode Island employing over 32,000 individuals. Many manufacturers that invest in technologies and workforce training to compete in the global market have corporate or divisional headquarters in Rhode Island. Labor force and employment trends are shown in Table 6-3.

Table 6-3 Labor Force and Employment Estimates, 1990-2017

	State	Warwick	West Warwick	East Greenwich
2017 (December)				
Labor Force	554,893	46,177	16,173	6,902
Resident Employment	530,346	44,472	15,442	6,629
Resident Unemployment	24,547	1,705	731	273
Unemployment Rate	4.4%	3.7%	4.5%	4.0%
2010				
Labor Force	564,052	47,679	16,854	7,025
Resident Employment	500,927	42,586	14,792	6,291
Resident Unemployment	63,125	5,093	2,062	734
Unemployment Rate	11.2%	10.7%	12.2%	10.4%
2000				
Labor Force	543,561	47,592	16,249	6,614
Resident Employment	521,313	45,810	15,529	6,360
Resident Unemployment	22,248	1,782	720	254
Unemployment Rate	4.1%	3.7%	4.4%	3.8%
1990				
Labor Force	525,361	46,689	16,262	6,403
Resident Employment	492,002	44,0.29	15,183	6,100
Resident Unemployment	33,359	2,660	1,079	303
Unemployment Rate	6.3%	5.7%	6.6%	4.7%
Total Employment Changes 1990-2017	38,344	443	259	529

Source: Rhode Island Department of Labor and Training, Labor Force Statistics, Not Seasonally Adjusted, 1976-December 2017. http://www.dlt.ri.gov/lmi/laus/state/unadj.htm
Rhode Island Department of Labor and Training, Warwick Labor Force Statistics, Not Seasonally Adjusted, 1990-December 2017. http://www.dlt.ri.gov/lmi/laus/town/town.htm
Rhode Island Department of Labor and Training, West Warwick Labor Force Statistics, Not Seasonally Adjusted, 1990-December 2017. http://www.dlt.ri.gov/lmi/laus/town/town.htm
Rhode Island Department of Labor and Training, East Greenwich Labor Force Statistics, Not Seasonally Adjusted, 1990-December 2017. http://www.dlt.ri.gov/lmi/laus/town/town.htm

Historically, the leading employment sectors in the Host Communities have been health care and social services, accommodation and food services, government, and retail. Recently, however, there has been a general shift away from retail employment to the professional and technical services sector.

Currently, the health, and social services sector is the largest source of employment in the Host Communities (see Table 6-4). Accommodation and food services are ranked second in the employment sector. These categories are predicted to continue to make up the largest employers in the future.

Table 6-4 Employment by Industry, 2010 and 2016

	Warwick		West Warwick		East Greenwich		Host Communities	% of Total
	2010	2016	2010	2016	2010	2016	Total (2016)	
Agr., Forestry, Fishing & Hunting	19	*	-	-	16	*	0	0
Mining	-	-	*	-	-	-	0	0
Utilities	*	-	-	-	-	*	0	0
Construction	1,803	2,225	247	360	191	172	532	1.3
Manufacturing	3,337	2,829	1,326	1,278	496	309	1,587	3.7
Wholesale Trade	1,667	1,785	267	298	276	176	474	1.1
Retail Trade	7,139	7,702	944	906	698	890	1,796	4.2
Transportation & Warehousing	1,929	2,167	279	464	88	78	542	1.3
Information	541	412	*	*	23	53	53	0.1
Finance, Insurance	3,038	2,552	657	116	276	257	373	0.9
Real Estate, Rental & Leasing	1,150	1,137	60	58	110	63	1,258	3.0
Professional and Technical Services	1,762	1,960	126	215	541	757	2,932	6.9
Mgmt. of Companies & Enterprises	1,313	1,602	*	*	112	*	1,602	3.8
Admin. Support & Waste Mgmt.	1,947	2,287	127	261	235	251	2,799	6.6
Educational Services	1,052	615	41	79	204	736	1,430	3.4
Health Care & Social Services	8,429	8,287	775	859	1,296	1,623	10,769	25.3
Arts, Entertainment, & Recreation	484	646	51	28	147	75	749	1.8
Accommodation & Food Services	4,919	5,740	662	709	1,063	1,313	7,762	18.3
Other Services, except Public Admin.	1,675	1,723	314	288	281	318	2,329	5.5
Unclassified Establishments	*	*	-	*	-	*	0	0
Government	4,228	3,873	965	976	687	691	5,540	13.0
Total	46,433	47,556	7,696	7,654	6,739	7,987	42,527	100.00%

Notes: * Some data not available to avoid revealing data of a specific employer

Source: Rhode Island Department of Labor and Training: Quarterly Census of Employment and Wages, City and Town Report – 2016 Annual
http://www.dlt.ri.gov/lmi/es202/town/2016.htm
Rhode Island Department of Labor and Training: Census of Employment & Wages, City and Town Summary – 2010 Annual
http://www.dlt.ri.gov/lmi/pdf/town10ann.pdf

6.3 Land Use

This section describes existing and future land use within the Study Area and addresses those features which might be affected by the Project.

6.3.1 Study Area Land Use

As depicted in Figure 6-1, several dominant land uses are present within the Project Area. While the Study Area primarily falls within commercial areas, other land uses within the Study Area include residential, forest, industrial, institutional, and agricultural.

The northern section of the study area from Cowesett Road south along the West Warwick and Warwick municipal boundary is largely developed commercial. At Division Street (East Greenwich and Warwick municipal boundary), the commercial land use transitions into more industrial, forest, and residential uses. South of Frenchtown Road/Route 402, the Study Area goes through commercial and residential areas with forest and wetland areas at the terminus south of South Road.

There are several commercial-zoned parcels located in the northern portion of the Study Area. These commercial areas have been established to serve community and town-wide shopping and service needs. Local commercial space is occupied by businesses such as automobile dealerships, home improvement, grocery, and furniture stores.

The residential areas are generally single-family homes in 1/4 to 1/8 acre lots. The eastern side of the Project Route has more contiguous areas of residential land, especially south of Frenchtown Road/Route 402.

The primary industrial areas within the Study Area include a dental group and veterinarian south of Division Road/Route 401, a semiconductor facility south of Middle Road, and a vacant industrial area north of Frenchtown Road on Briggs Drive, the former SBI facility, all in East Greenwich.

Educational and Institutional facilities located within the Study Area include the Stork's Nest Child Academy at 2260 South County Trail, National Guard, and a daycare.

Medical and health facilities located within the Study Area include University Orthopedics at 1598 South County Trail, Kent County Hospital outpatient buildings at 1351 South County Trail, and a pediatrician. All of these facilities are located in East Greenwich.

The Study Area also encompasses several parcels of forest and agricultural land.

6.3.2 Land Use Along the Project Route

From a north to south oriented view, the gas line extension will run within the limits of Route 2 from Cowesett Road in West Warwick to South Road in East Greenwich. The total centerline length is approximately five miles.

6.3.3 Open Space and Recreation

The Study Area does not cross through any designated open space areas. The small scattered vacant areas are generally designated as drainage easements. Just south of

Division Street, the Study Area includes an undeveloped recreation area that is part of New England Institute of Technology.

6.3.4 Compatibility with Future Land Use Planning

In order to assess future land use, an analysis of current and future zoning was undertaken. Typically, towns and cities manage future growth through zoning regulations which provide a degree of control over a community. The Study Area is zoned primarily for commercial, residential, industrial, institutional, and forest.

The most current future land use plan developed by the Town of West Warwick is part of the 2005 Comprehensive Plan. This plan suggests that future land uses within the Study Area will include general commercial areas and business parks. These predicted uses are consistent with the present use of the Study Area.

The current land use of the Study Area in Warwick consists of commercial areas, forested land, and residential areas. Warwick's 2014 Comprehensive Plan for 2033 predicts that these uses will change only slightly within the Study Area: the area will be mainly commercial with a small pocket of residential space.

In East Greenwich, the Study Area is a mix of commercial, forest, residential, industrial, agriculture, and institutional land uses. The 2012 East Greenwich Comprehensive Plan predicts the industrial areas will be zoned as light industrial (office park-type development), and a large area of current industrial space on the west side of the Study Area, west of Route 4 at the terminus will be public/government space. Low density residential is expected to remain the same yet decrease in density south of Frenchtown Road.

The Project will be located underground within the limits of an existing roadway, so it is expected to be compatible with existing and future land uses.

6.3.5 SBI Site

The SBI site is a RIDEM-designated Site Investigation and Remediation Site listing with identification number SR-09-1473, is. The SBI property, a 78-acre parcel of land, is situated on the western side of South County Trail and contaminants extend from two primary source areas [referred to as the old landfill (western portion of the facility) and the former storage area (FSA)] easterly across the roadway to numerous properties on the eastern side of the South County Trail and is located at 1 Briggs Drive in East Greenwich, Rhode Island. SBI operated at this location from as early as 1956 until approximately 2011. SBI was a manufacturer of nails, staples, and nail/staple driving equipment. The facility has reportedly been occupied by other commercial and light manufacturing businesses since 2011.

The primary contamination was due to historic use and disposal of solvents during SBI operations. Wastes generated at the facility included zinc sludge, waste solvents, waste lubricating oils, and metals from finishing operations. The primary environmental contaminants relating to the SBI site are solvents resulting in volatile organic compounds (VOCs) being present within portions of the project route in the vicinity of the SBI site.

6.4 Visual Resources

The visual quality of a place is determined by the perceived aesthetic value of the available views, as influenced by topography, vegetation, and land use. The gas distribution main extension will be buried along an existing road, and there are no anticipated effects on visual resources associated with the distribution main.

6.5 Noise

6.5.1 Introduction

Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work, or recreation. Sound (noise) is described in terms of loudness, frequency, and duration. Loudness is the sound pressure level measured on a logarithmic scale in units of decibels (dB). For community noise impact assessment, sound level frequency characteristics are based upon human hearing, using an A weighted [dB(A)] frequency filter. The A weighted filter is used because it approximates the way humans hear sound. Sound levels are made up of individual components called octave band frequencies. The dB(A) sound levels are weighted to focus on the octave band frequencies that humans hear best. A pure tone condition can occur when a sound can be distinctly heard as a single pitch or set of single pitches. Generally, a 1 or 2 dB(A) increase is not perceptible to the average person. A 3 dB(A) increase is a doubling of acoustic energy, but is just barely perceptible to the human ear. A 10 dB(A) increase is a tenfold increase in acoustic energy, but is perceived as a doubling in loudness to the average person.

6.5.2 Noise Impact Criteria

The State of Rhode Island does not have regulations that set community noise exposure criteria or abatement measurements. Instead, noise abatement criteria are instituted by the municipalities of Rhode Island. Each municipality has developed noise impact criteria as follows:

Table 6-6 Town of West Warwick Sound Limit, dB(A)

Receiving Land Use	Time	Sound Limit
Residential	7 AM to 9 PM	55
	9 PM to 7 AM	50

Source: Section 12-56- Machinery, equipment, fans, and air conditioning. Town of West Warwick, Rhode Island Code of Ordinances, Published 1996

Table 6-7 City of Warwick Sound Limit, dB(A)

Receiving Land Use	Time	Sound Limit
Residential use or zone, or other public area	8 AM to 10 PM	60
	10 PM to 8 AM	50

Source: Maximum Permissible Noise Levels, City of Warwick, Rhode Island Code of Ordinances, Section 40-13 Effective May 1996.

Table 6-8 Town of East Greenwich Ambient Sound Limit, dB(A)

Receiving Land Use	Time	Sound Limit
R-6, R-10, R-20, R-30	7 AM to 10 PM	60
R-6, R-10, R-20, R-30	10 PM to 7 AM	55
F, F-1, F-2	7 AM to 10 PM	60
F, F-1, F-2	10 PM to 7 AM	55
CD, CL, CH	7 AM to 10 PM	70
CD, CL, CH	10 PM to 7 AM	65
W	7 AM to 10 PM	70
W	10 PM to 7 AM	65
M	Anytime	75

Exceptions: The emission of sound relative to permitted construction and demolition activities, provided that such activities do not occur between 9:00 PM and 7:00 AM.

6.5.3 Project Sound Levels and Conclusion

The operation of a buried natural gas distribution main is not expected to affect the existing sound levels within the Project Area.

6.6 Cultural Resources

Because this Project will require state permitting, the Rhode Island Historical Preservation and Heritage Commission (RIHPHC) will review the Project under the Rhode Island Historic Preservation Act (RIGL 42-45-1 et seq.), for any potential effects [as that term is defined at 36 CFR 800.16(i)] on properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places and the State Register of Historic Places, including previously unidentified properties. The Company has begun the state review process with RIHPHC.

6.7 Transportation

The transportation needs of the Study Area are served by a state road (Route 2). The gas distribution main extension is proposed within Route 2 (also known as Quaker Lane in West Warwick and South County Road in East Greenwich). This is a state-owned road.

7

Impact Analysis

This chapter presents an analysis of the potential impacts of the Project on existing environmental and social conditions within the Study Area. As with any construction project, potential adverse impacts can be associated with the construction, operation or maintenance of a gas distribution main extension. These impacts have been minimized by the careful location of facilities and by the adoption of numerous mitigation practices.

This Project will be constructed in a manner that minimizes the potential for adverse environmental impacts. A monitoring program will be conducted by the Company to ensure that the Project is constructed in compliance with all relevant licenses and permits and applicable federal, state, and local laws and regulations. Design and construction mitigation measures will ensure that construction related environmental impacts are minimized.

7.1 Geology

The Project will have negligible impact on the bedrock and surficial geologic resources of the Project Study Area. The Project Study Area consists of lodgement till with pockets of glaciofluvial deposits.

7.2 Soils

Construction activities which expose unprotected soils have the potential to increase natural erosion and sedimentation rates. Soil compaction and decreased infiltration rates may result from equipment operations. Minor grading may be necessary to prepare a work site for installation. Standard the Company construction techniques and BMPs such as the installation of compost filter sock (CFS), temporary pavement patching, the re-establishment of vegetation and dust control measures, will be employed to minimize any short- or long-term effects due to construction activity. These devices will be inspected by the Environmental Monitor frequently during construction and supplemented, repaired or replaced when needed. The Company will develop and implement a Soil Erosion and Sediment Control (SESC) Plan which will detail BMPs and inspection protocols.

Excess soil from construction will either be returned to the excavated area, spread and stabilized along the road shoulder in upland areas when appropriate, or removed from the Site for disposal at an approved facility.

Potentially highly erodible soils occur within the Study Area. However, on all slopes greater than eight percent which are above wetland and other sensitive areas, disturbed soils will be stabilized with straw or chipped brush mulch to prevent the migration of sediments.

The Study Area crosses areas designated as prime farmland soils. In addition, the Project Study Area crosses areas of Farmland of Statewide Importance. These soils exist on land occupied by commercial, institutional, industrial, recreational, agricultural and residential land uses, forestland, and roads. The Project is located within a state roadway and is not expected to affect the designated farmland soil units within the Study Area.

7.3 Surface Water

Any impact of the Project upon surface watercourses will be minor and temporary. Construction activities temporarily increase risks for erosion and sedimentation that may temporarily degrade existing water quality; however, appropriate BMPs will be implemented and maintained to effectively control sediment. In addition, construction equipment will not cross any open channel rivers or streams along the construction corridor.

The major surface water features within the Project route include Saddle Brook, Fry Brook, Frenchtown Brook, Hunt River, and their associated tributaries. Construction mats may be used to facilitate construction activities adjacent to surface water features as conditions warrant. Access to the Project Route adjacent to these watercourses will be provided without impacting the channels by using Route 2 or its cleared road shoulder. Sedimentation and erosion within these watercourses will be minimized through the implementation of BMPs prior to construction activities.

Potential impacts to surface waters if sediment transport is not controlled include increased sedimentation (locally and downstream) and subsequent alterations of benthic substrates, decreases in primary production and dissolved oxygen concentrations, releases of toxic substances and/or nutrients from sediments, and destruction of benthic invertebrates. Erosion and sedimentation controls will effectively minimize the potential for this situation to occur. The implementation and maintenance of stringent erosion and sedimentation control

BMPs will limit the levels of Project related sedimentation and will minimize adverse impacts to surface waters.

7.3.1 Water Quality

The primary potential impact to water quality from any major construction project is the increase in turbidity of surface waters in the vicinity of construction resulting from soil erosion and sedimentation from the disturbed site. A second potential impact is the spillage of petroleum or other chemical products near waterways. Disturbance to previously undisturbed areas will be minimized through the use of existing roadway breakdown lane and cleared shoulder whenever possible. Equipment will not be refueled or maintained near wetland or surface water resources. Therefore, it is anticipated that any adverse impacts to water resources resulting from installation of the proposed gas distribution main will be negligible.

The removal of vegetation prior to construction may result in increased erosion potential so that slightly higher than normal sediment yields may be delivered to area streams and wetlands during a heavy rainfall. However, these short-term impacts should be minor as a result of the relatively small area to be disturbed, the use of selective clearing within 25 feet of streams, the implementation of erosion control measures and the short duration of construction activities. In addition, a detailed SESC Plan will be designed and implemented which will confine sediment within the immediate construction area and minimize impacts to downstream areas.

7.3.2 Hydrology

Some minor, temporary impacts to surface drainage can be expected during installation of the gas distribution main. These impacts will be associated with installation of the gas distribution main under or near existing stream culverts. The topography within the work corridor will not change as a result of the Project.

The hydrology of surface waters will not be significantly affected during or after construction since the gas distribution main will be installed within the roadway/shoulder and under the existing culvert without disturbing the stream or its channel substrate. A slightly higher rate of storm water runoff may result from the clearing of vegetation which would otherwise function to absorb some of the precipitation and slow the rate of runoff. These impacts will be short-term because vegetative cover will quickly reestablish in the construction corridor following construction.

7.3.3 Floodplain

Based on available FEMA mapping, SFHA is located along, Fry Brook, Frenchtown Brook, and the Hunt River along the Project Route and within the Study Area. The one percent annual chance flood represents the extent of flooding that would result during a storm event having a one percent chance of occurring per year. It is recognized that by definitions provided in the RIDEM Freshwater Wetland Rules, all rivers, streams and intermittent streams have one percent annual chance flood though they may not be mapped by FEMA.

The Project will not result in a discharge of fill to mapped SFHAs.

7.4 Groundwater

Potential impacts to groundwater resources within the Project route as a result of construction activity will be negligible. Equipment used for the construction of the gas distribution main will be properly maintained and operated to reduce the chances of spill occurrences of petroleum products. Refueling of equipment will be conducted in upland areas. Within primary groundwater recharge areas, special safeguards will be implemented to assure the protection of groundwater resources. Refueling equipment will be required to carry spill containment and prevention devices (i.e., absorbent pads, clean up rags, five gallon containers, absorbent material, etc.) at all times. In addition, maintenance equipment and replacement parts for construction equipment will be on hand to repair failures and stop a spill in the event of equipment malfunction. Following construction, the normal operation and maintenance of the gas distribution main will pose no threat to groundwater resources.

7.5 Vegetation

Impacts to vegetation will be minor as the gas distribution main extension will be installed within the road ROW. Vegetation within the work areas will be mown if needed. Incidental tree removal may be required where trees are present along the staging areas.

A well-managed right of way is required to maintain the reliability of the gas distribution main system. Where the gas distribution main is to be installed proximate to the edge of pavement and in areas where the cleared road shoulder is narrow, following construction, some vegetation management may be necessary to prevent tree roots from growing into or around the pipes.

The Company manages vegetation on its ROWs through integrated procedures combining removal of danger trees, hand cutting, targeted herbicide use, and mowing. Three methods of targeted herbicide treatments are utilized: basal application, cut stump treatment, and foliar application.

The appropriate method of vegetation management is chosen by a Company forester or arborist in accordance with the Company's vegetation management policy. The typical maintenance cycle for this is four years, although occasionally site specific conditions may require a shorter cycle. Any permits necessary for vegetation management operation are obtained prior to the initiation of management procedures.

7.6 Wetlands

Construction of the Project may result in temporary impacts to wetland resources.

The gas distribution main extension is expected to be installed within an existing road and is not expected to cross any undisturbed wetlands. Appropriate erosion and sediment control measures will minimize impacts to nearby wetlands from adjacent disturbed areas.

7.7 Wildlife

During construction, temporary displacement of wildlife may occur due to disturbance from the operation of construction equipment. Specifically, wildlife currently utilizing the forested edge of the Route 2 right of way may be displaced by the construction of the Project. The species affected during the construction of the gas distribution main are expected to be limited in number since the majority of the construction occurs within an existing roadway. Effects will be localized to the immediate area of construction around the gas distribution main. The displacement of wildlife is anticipated to be a temporary impact as it is expected that existing wildlife utilization patterns will resume during the operational phase of the Project.

Impacts to sensitive habitats of rare, threatened or endangered species will be avoided through careful Project planning which has involved a route inventory, an evaluation of avoidance and mitigation of potential impacts, and close coordination with the RIDEM. No impacts to rare, threatened or endangered species are anticipated for construction of the Project.

7.8 Social and Economic Impacts

Based on the proposed location of the Project, the greatest potential for social impact is the interaction of construction on current and future land uses abutting Route 2.

7.8.1 Social Impacts

The Project will enable the Company to continue to provide and expand service of reliable natural gas to commercial/industrial developments, businesses, and communities in East Greenwich and North Kingstown. The ability to choose gas over oil will provide energy cost savings, thus lowering consumer and business expenses and boosting local purchasing power and economic activity. The Company estimated that the cost savings per residential customer who either converts from oil to gas, or is able to elect gas over oil for a new service, will be approximately $1,100 in 2018 dollars. The proposed Project does not require, nor will it lead to residential or business displacement. Temporary construction impacts, primarily related to construction traffic and equipment operation are expected to be minor; however, the Project will not adversely impact the overall social and economic condition of the Study Area. As described above, the gas distribution main will be installed along an existing State road right of way. Therefore, the Project will not require the acquisition of property or disrupt orderly planned development, thus avoiding adverse impacts.

In order to minimize social impacts, the Company has engaged in outreach as described in Section 3.4. The Company will also appoint an Ombudsman to serve as a contact for abutters during the construction phase of the Project.

7.8.2 Population

Project construction and maintenance will have no impact on the population but will improve existing gas service reliability and availability to the population growth trends in

East Greenwich, Rhode Island. It also will allow the Company to provide the capability to serve residential, commercial and industrial developments planned for the future.

7.8.3 Employment

The Company estimates that the construction of the Project will have beneficial effects on the area economy by creating approximately 413 job years from 2018 through 2023 for the construction period. Of these, 206 are direct construction jobs while 207 are indirect and induced jobs. It is also estimated that spending on pipeline construction will raise Rhode Island Gross State Product by $29.0 million, real personal income by $22.4 million and State Tax Revenues by $1.4 million.

Once constructed, it is estimated that the distribution main will accommodate economic growth in southwestern Rhode Island and allow the state to continue its economic development efforts in this area. This development includes expansions and new businesses already underway at Quonset Business Park and surrounding communities. The Project will enable this development and the 2,248 technical and manufacturing jobs associated with it as well as the development of 647 new residential units that are currently planned. By meeting the current and projected demands for increased natural gas capacity in the area, the construction of the Project will enable both commercial and residential development and expansion to support the state's effort to stimulate additional growth and economic activity in the region.

7.9 Land Use and Recreation

The following discussion addresses the compatibility of the proposed gas distribution main with various land uses along the proposed route.

7.9.1 Land Use

Land use impacts can be separated into short-term and long-term impacts. Short-term land use impacts may occur during the construction phase of the proposed Project. Impacts associated with the construction phase of the Project will be temporary, and most present land uses within the existing route could resume following construction. The Company will provide notification of the intended construction plan and schedule to affected abutters so that the effect of any temporary disruptions may be minimized.

The Project is proposed entirely within an existing road right of way. The installation of the gas distribution main within the existing right of way will be consistent with the established land use and therefore will not present long-term land use impacts.

7.9.1.1 Residential

Residential areas are located in proximity to the Project. In many locations, existing vegetation will continue to provide visual screening of the construction from residences. Because the proposed gas distribution main will be installed under an existing roadway, the Project will not displace any existing residential uses, nor will it adversely affect any future development proposals.

7.9.1.2 Agriculture

The proposed Study Area crosses a number of areas which are presently in agricultural use, but the Project is located along the State Route 2 right of way. There are no anticipated impacts to nearby agricultural areas.

7.9.1.3 Educational Institutions

Educational facilities located with the Study Area include Happy Hearts Learning Center preschool at 2608 South County Trail, The Stork's Nest Child Academy preschool at 2260 South County Trail, and Sargent Rehabilitation Center (a special needs learning center) at 800 Quaker Lane. No impacts to these facilities are expected.

7.9.1.4 Commercial and Industrial

The proposed Project crosses several business areas. These businesses include industrial, commercial, retail, office, recreational and agricultural uses. Normal business operations will not be adversely affected by the Project. No displacement of business will result from the Project. During construction, access to abutting businesses will be coordinated with the owners and provided with temporary road plates when necessary.

7.9.2 Recreation

No existing recreational uses will be displaced by the Project.

7.9.3 Consistency with Local Planning

As documented in the Purpose and Need section of this Siting Report, the area is projecting growth in the light industrial and residential markets. West Warwick, Warwick, and East Greenwich all have Comprehensive Plans which describe the municipal plans and goals regarding future development and growth in each community. Each municipality's Comprehensive Plan was evaluated with regard to expressed town/city-wide goals. The proposed Project was then evaluated for consistency with the local planning initiatives in each community.

Because the proposed Project will use an existing State route, it will not alter existing land use patterns and will not adversely impact future planned development. The Project will provide an increased quantity of gas service to support the growth and development envisioned by the Comprehensive Plans of the communities in the Project area.

7.10 Visual Resources

7.11 The gas distribution main will be buried within the existing Route 2 right of way. There are no permanent anticipated impacts to visual resources associated with the proposed distribution main. The gas distribution main will be buried underground, and there are no anticipated above-ground facilities Noise

7.11.1 Gas Distribution Main

The proposed gas distribution main will not generate an audible sound level under normal operating conditions. As a result, the existing ambient noise levels will not be altered by the Project installation.

7.11.2 Construction Noise

Temporary noise impacts will occur during construction of the Project. Proper mufflers will be required to control noise levels generated by construction equipment.

The Company's typical work hours are daytime hours (7:00 AM to 5:00 PM). . Project construction including pressure testing, gassing-in of the new distribution main, and certain aspects of the HDD operations may require work throughout the night or on weekends, which will be coordinated with RIDOT and the municipalities.

7.12 Transportation

Any construction-related traffic increase will be intermittent, temporary, and will cease once construction of the Project is completed. The Company's contractor will coordinate closely with the RIDOT and municipalities to develop acceptable traffic management plans for work within public rights-of-way. The contractor will follow a pre-approved work zone traffic control plan and where required, utilize police details. The traffic control plan will be designed so vehicles traveling adjacent to the construction site will do so safely and with minimal disruption to traffic along the public way. Following construction, traffic activity will be minimal and will occur only when the gas distribution main has to be inspected or maintained. As a result, the construction and operation of the gas distribution main will have minimal impact on the traffic of Route 2 and the surrounding area roadways.

7.13 Cultural Resources

The Company contracted The Public Archaeology Laboratory, Inc. (PAL) to conduct a cultural resources due diligence and archaeological sensitivity assessment for the proposed Project. PAL reviewed cultural resources information on file at the RIHPHC and conducted an in-field assessment of the Project area to evaluate the potential for the Project to affect historic or archaeological resources; PAL also reviewed soil borings to assess the Project route's archaeological sensitivity. PAL concluded that the proposed Project will have no effect on any significant historic or archaeological resources (those listed in or eligible for listing in the

National Register of Historic Places) and recommends that the Company consult with the RIHPHC.

7.14 Air Quality

7.14.1 Construction Impacts

Exposed soils will be wetted and stabilized as necessary to suppress dust generation, and after a gas distribution main segment is backfilled, a paved surface will be reestablished which will not be susceptible to erosion, consequently fugitive dust emissions will be low. In addition, minimal quantities of earth will be moved or disturbed during construction. Therefore, any impacts from fugitive dust particles will be of short duration and localized.

Due to the transitory nature of the construction, air quality in the Project location will not be significantly affected by construction along a State route. Emissions produced by the operation of construction machinery (nitrogen oxides, sulfur oxides, carbon monoxide, and particulate matter) are short-term and not generally considered significant.

7.14.2 Operation Impacts

In part, air quality is a function of area wide emissions of ozone precursors (carbon monoxide, nitrogen oxide, and volatile organic compounds) from the change in daily traffic volumes along lengths of area roadways. The Project itself will not generate air emissions. The Project will not change traffic and emissions parameters, nor affect the travel characteristics of the vehicles traveling in West Warwick, Warwick, or East Greenwich, Rhode Island. Therefore, the mobile source emissions will not be changed due to the proposed Project.

The Project will have no adverse climate change impacts or negative effects on sea levels. In fact, because the Project will help enable the Company to satisfy requests for oil-to-gas conversions and also new natural gas services that may otherwise choose other fossil fuel options for heating, the Project will bring capacity to the area enabling the current annual forecast of approximately 300-400 services a year to more than 14,000 new oil-to-gas conversions within 100 feet of the distribution main at a capacity of 3,000 dekatherms. If we expand to further than 100 feet from the distribution main, the number of customers would increase to 18,000 customers and 4000 dekatherms per hour. The Company's 80x50 goal is to convert all oil customers to Natural Gas or to alternative sources like heat pumps.

The ability to continue the current average of 350 oil-to-gas conversions per year will prevent the emission of approximately 635 tons of CO2 per year (with no furnace efficiency improvements) or approximately 1,470 tons of CO2 per year if furnace efficiency improvements are implemented in conjunction with the conversions. Assuming 647 new residential units expected to be enabled by the Project, the Company has estimated that the Project also will prevent an additional 1,176 tons of CO2 emissions. If the total of 14,000 oil-to-gas conversions or new gas services enabled by the Project are realized, the Project will prevent the emission of approximately 25,438 tons of CO2 (with no furnace efficiency improvements) or a total of approximately 58,777 tons of CO2, if furnace efficiency improvements are implemented in conjunction with any conversions.

7.15 Safety and Public Health

Because the proposed facilities will be designed, built and maintained in accordance with the standards and codes as described in Section 3.4, the public health and safety will be protected.

8

Mitigation Measures

Mitigation measures will effectively minimize Project impacts on the natural and social environment. Mitigation measures have been designed for the Project to minimize impacts associated with each phase of construction. Many of these measures are standard proven procedures that the Company incorporates in all gas distribution main construction projects. Others are site specific measures designed to meet the needs of this particular Project. These measures are described in the following sections.

8.1 Design Phase

The Company has incorporated design measures to reduce the impacts associated with the construction and operation of the Project. These measures include alignment, design, and use of an existing state roadway, which has resulted in the avoidance and minimization of residential and wetland impacts, and soil disturbance. Further, a wetland mitigation plan, which includes the implementation of BMPs (i.e., compost or wood chip mulch filter sock, vegetation management, etc.) during and following construction, to minimize impacts associated with the proposed Project, will be filed with the RIDEM application for the Project.

The following sections detail the various measures that were implemented in the design phase of the Project to reduce impacts to the natural and social environment.

8.1.1 Mitigation of Natural Resource Impacts

A number of environmental considerations were evaluated during route selection and analysis, including: wetlands, rare species, water quality and water supply protection, land use, subsurface contamination, and floodplain. Potential short-term and long-term impacts to wildlife are not anticipated. Vehicle and equipment traffic will be limited to the existing roadway as much as practical. Long-term mitigation efforts will include minimizing permanent wetland disturbance and maintaining wetland functions following construction.

Overall, the proposed mitigation plan has been designed to minimize impacts to environmental resources resulting from the proposed Project.

8.1.1.1 Wetlands

The Project will have no direct impacts to adjacent wetlands, but will involve construction in and along roadways that pass through the buffer zones of several wetland areas.

The proposed Project does not require any filling or clearing of wetlands, and waterway crossings will be completed by installing the gas distribution main within the roadbed either above (when conditions allow) or below existing culverts.

8.1.1.2 SBI Site

The Company has assessed soil and groundwater conditions along the project route adjacent to the SBI facility. Based on the results of the assessment, appropriate mitigation measures will be implemented as approved by RIDEM. Construction within the limits of and adjacent to the SBI site will be conducted in compliance with the requirements of the RIDEM Office of Waste Management and applicable regulations, including approved soil and groundwater management plans that will be developed as part of the project.

8.1.2 Mitigation of Social Resource Impacts

In addition to avoiding and minimizing impacts to the natural environment within the Project right of way, several design practices have been incorporated to minimize or avoid impacts to the surrounding social environment. To minimize impacts, the proposed gas distribution main will be installed within the existing roadway layout beneath pavement or the cleared roadway shoulder. Vegetation clearing will be limited so that a visual buffer between residences and the Project is maintained where possible.

The Company has engaged and will continue to engage in community outreach to advise abutters and others of Project plans.

8.2 Construction Phase

Given that the Project will be constructed within existing roadway layout beneath pavement or cleared roadway shoulder. The “stove pipe” method of distribution main construction will be used. The Company will implement several measures during construction which will minimize impacts to the environment. These include the use of the existing roadway, installation of erosion and sedimentation controls, supervision and inspection of

construction activities within resource areas by an Environmental Monitor and minimization of disturbed areas. The following section details various mitigation measures which will be implemented to minimize construction related impacts.

8.2.1 Mitigation of Natural Resource Impacts

The proposed natural gas distribution main will be installed within existing roadway layout beneath pavement or the cleared roadway shoulder, thus no permanent impacts to wetlands or water bodies are anticipated. The Project will involve construction within Riverbank Wetlands associated with the various stream crossings along the proposed route.

The Company's objective is to minimize the potential for erosion and sedimentation impact during distribution main construction, and to effectively restore any disturbed areas. The Company will meet these objectives by implementing the erosion and sediment control measures described in this section. In general, the measures are designed to minimize erosion and sedimentation by:

- Minimizing the quantity and duration of soil exposure;
- Protecting areas of critical concern during construction by redirecting and reducing the velocity of runoff;
- Installing and maintaining erosion and sediment control measures during construction;
- Establishing vegetation where required as soon as possible following completion of construction; and
- Inspecting the construction route and maintaining erosion and sediment controls as necessary until final stabilization is achieved and final inspections completed.

8.2.1.1 Wetlands

Construction in close proximity to wetlands will be managed to avoid indirect impacts related to erosion and sedimentation. The Company is committed to ensuring that indirect impacts are avoided and minimized, and as such a SESC Plan will be prepared for the Project that will specify implementation of erosion control measures, including:

- Environmental monitoring of the Project to ensure compliance with the SESC Plan, RIPDES General Permit, and all other environmental permits;
- Placement of erosion and sedimentation controls such as CFS, at appropriate locations along road shoulders whenever the work zone is located within 100 feet of a wetland or within 200 feet of a perennial waterbody;
- Temporary erosion control barriers will be inspected on a daily basis in areas of active construction or equipment operation, on a weekly basis in areas with no construction or equipment operation, and within 24 hours of a storm event that is 0.25 inches or greater; and
- In road segments where stormwater is directed to a local storm drain, installation and maintenance of silt sacks within each catch basin to prevent sedimentation to the storm drain system, and stockpiling of trench spoils in a manner that will prevent them from being washed with stormwater into nearby storm drains.

Procedures for refueling and lubricating construction equipment will be established to ensure safety and spill prevention. In all cases, secondary containment, spill containment gear, and absorption materials will be maintained for immediate use in the event of any inadvertent spills or leaks.

The proposed gas distribution main installation would qualify as exempt in accordance of the Rule 6.10 under the RIDEM Rules and Regulations Governing the Administration and Enforcement of the Fresh Water Wetlands Act as long as the underground distribution main is installed in the existing roadway or its cleared shoulder; no in stream or under stream work is required, no grades are changed within Floodplain, no tree clearing is required[9], and the existing culverts are not permanently blocked or disrupted by the Project. BMPs for erosion and sediment control will be deployed in the work area to minimize disturbance to sensitive wetlands that occur adjacent to the Project Area.

8.2.1.2 Rare Species

Given that the Project will be installed within existing roadway layouts beneath pavement or within ten feet of that pavement, the Project will have no impacts on rare species or rare species habitat. Therefore, no associated mitigation measures are proposed.

8.2.1.3 Water Quality and Water Quality Supply Protection

The Project will have no operational impacts related to water quality or water supplies, and hence no associated mitigation measures are proposed.

8.2.1.4 Land Use

The Project alignment is within an existing roadway, beneath pavement or the cleared road shoulder, and tree clearing is not anticipated. Given that the Project will have no permanent effect on existing land uses, no associated mitigation measures are proposed. Temporary mitigation measures are discussed in Section 3.2 (Construction and Maintenance Overview).

8.2.1.5 Supervision and Monitoring

Throughout the entire construction process, the services of an Environmental Monitor will be retained. The primary responsibility of the monitor will be to oversee construction activities including the installation and maintenance of erosion and sedimentation controls, on a routine basis to ensure compliance with federal and state permit requirements, the Company's policies and other commitments. The Environmental Monitor will be a trained environmental scientist responsible for supervising construction activities relative to

[9] As discussed above, minor incidental tree removal may be required in certain areas.

environmental issues. The Environmental Monitor will be experienced in the erosion control techniques described in this Siting Report and will have an understanding of wetland resources that require protection.

During periods of prolonged precipitation, the monitor will inspect all locations to confirm that the environmental controls are functioning properly. In addition to retaining the services of an Environmental Monitor, the contractor will be required to designate an individual to be responsible for the daily inspection and upkeep of environmental controls. This person will also be responsible for providing direction to the other members of the construction crew regarding matters of wetland access and appropriate work methods. Additionally, all construction personnel will be briefed on Project environmental compliance issues and obligations prior to the start of construction. Regular construction progress meetings will provide the opportunity to reinforce the contractor's awareness of these issues.

8.2.2 Mitigation of Social Resource Impacts

Traffic management, cultural resources, open space and conservation land, noise, and visual features were considered with respect to existing conditions and potential Project-related impacts.

8.2.2.1 Traffic Management

Given that the Project is proposed within existing roadway layouts, the Company has assessed potential traffic-related impacts and has proposed the mitigation measures described below.

Police details and other appropriate traffic management measures will be used to maintain traffic flow, and traffic management will always be coordinated with RIDOT and municipal officials.

Prior to construction, the Company will work closely with the RIDOT and municipalities to develop a Traffic Management Plan for construction. Issues to be addressed in the Traffic Management Plan include:

- Width and lane locations of the work zone to minimize impacts to vehicular traffic;
- Work schedule and duration of lane closures, road closures, or detours (where applicable)
- Traffic-control devices such as barricades, reflective barriers, advance warning signs, traffic regulation signs, traffic-control drums, flashers, detour signs, and other protective devices will be placed as shown on plans and as approved by the applicable municipalities;
- Locations where temporary provisions may be made to maintain access to homes and businesses;
- Routing and protection of pedestrian and bicycle traffic;
- Maintenance of school bus service;
- Communication with adjacent businesses so critical product deliveries are not interrupted by construction;

- Determination of the impact to roadway level of service due to short-term lane closure(s), if necessary;
- Notification to municipal officials, local businesses, and the public of the timing and duration of closed curbside parking spaces and travel way restrictions;
- Coordination with police and fire departments; and
- Management of impact to egress by emergency vehicles.

The scope of the Traffic Management Plan will include an analysis of the roads affected by Project construction. The Traffic Management Plan will be submitted for review and approval by appropriate municipal authorities prior to construction.

8.2.2.2 Cultural Resources

The Project is within an area that has been assessed by PAL as having no/low archaeological sensitivity and will therefore have no effect on archaeological resources. The Project is in the vicinity of several recorded historic architectural properties and crosses an historic district that is eligible for listing in the National Register. However, the Project will have no effect on those historic architectural properties and no related mitigation is proposed.

8.2.2.3 Open Space, Conservation, and Recreational Areas

The Project is proposed within existing roadway beneath pavement or within its cleared shoulder. As a result of the chosen route and proposed construction layout, the Project will have no impacts to protected and recreational open space. Therefore, no associated mitigation measures are proposed.

8.2.2.4 Visual Impact

Other than during the construction period, this Project will have negligible visual impacts because the Project will be below ground.

Because the distribution main will be installed in existing roadway layouts beneath pavement or within ten feet of pavement, only limited incidental tree removal may be needed to accommodate construction. Thus, no additional mitigation measures are proposed.

8.2.2.5 Noise Mitigation

While intermittent increases in noise levels are expected during construction activities, the Company is committed to minimizing these impacts. As part of this commitment, the Company is further analyzing potential temporary noise impacts associated with the two HDD operations. The Company is undertaking this additional analysis because special equipment is required for the HDDs, including a drill rig, and the HDD may require 24-hour operations. If the Company determines that temporary noise impacts are expected from the HDD operations that materially exceed standard construction noise impacts, the Company will evaluate additional noise mitigation strategies and work with its Contractor to implement noise mitigation during HDD operations. Potential mitigation strategies include, but are not limited to, sound-attenuating equipment and temporary sound barriers (e.g.,

sound curtains, walls and/or fences). The Company will make every reasonable effort to minimize noise impacts from construction.

8.3 Post-Construction Phase

Following the completion of construction, the Company uses standard mitigation measures on all gas distribution main projects to minimize the impacts of projects on the natural and social environment. These measures include revegetation and stabilization of disturbed soils, vegetation management practices and vegetation screening maintenance in sensitive areas. Other measures are used on a site specific basis. The Company will implement the following standard and site specific mitigation measures for the proposed Project.

8.3.1 Mitigation of Natural Resource Impacts

Restoration efforts, including final pavement resurfacing, and seeding of disturbed areas, will be completed following construction. Construction debris will be removed from the Project site and disposed of at an appropriate landfill. Pre-existing drainage patterns, ditches, roads, fences, and stone walls will be restored to their former condition, where appropriate.

8.3.2 Mitigation of Social Resource Impacts

When repaired or reconstructed, sidewalks will be made accessible pursuant to the Americans with Disabilities Act ("ADA"). Vegetation (if there is any in the shoulder of the road) will be restored or enhanced, and plans will be reviewed by authorized officials; no trees will be removed. Lighting standards will be replaced in kind or reinstalled, and plantings will be suitably restored.

Where the trench location requires cutting of pavement, pavement restoration will be carried out in compliance with The Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction (2013). Generally, all pavement excavations will be repaired with same-day permanent patches unless specifically agreed to by the RIDOT/Town. Typically, temporary patches are only permitted for work between December 1 and March 31, when bituminous concrete is not available, or if the excavation must be reopened within five working days (e.g., to continue work after a weekend). In general, the length of new excavation completed each day will equal the length of distribution main installed, backfilled, and compacted.

The alignment will be checked by a supervisor to ensure the area is properly restored, swept, and tidy. Alignment markers will be installed at intervals to indicate the presence of the newly-installed gas line. Where the distribution main is installed beneath pavement, flat permanent markers will be set into the pavement to mark the location.

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9

Conclusion

This Siting Report presents a comprehensive overview of the Project, including the existing natural and social environment, potential impacts, and the measures that will be implemented to avoid, minimize or mitigate these impacts.

Based on the analysis presented herein, there are no significant long-term impacts associated with the Project. The implementation of appropriate BMPs and mitigation measures during construction will avoid or minimize the construction phase impacts to environmental resources and the social environment. Thus, the short-term impacts will be temporary and negligible.

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