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GLOSSARY OF ACRONYMS

ACEC: Area of Critical Environmental Concern
ASCE: American Society of Civil Engineers
AURA: Adjacent Upland Resource Area
BLSF: Bordering Land Subject to Flooding
BVW: Bordering Vegetated Wetland
CEII: Critical Energy Infrastructure Information
CELT: Capacity, Energy, Loads, and Transmission
CGWP: Certified Ground Water Professional
CHG: Commonwealth Heritage Group, Inc.
CMP: Conservation and Management Permit
CSO: Contract supply obligation
dBA: Decibels
DCR: Massachusetts Department of Conservation and Recreation
DFW: Division of Fisheries and Wildlife
DPU: Department of Public Utilities
DR: Demand resources
EE: Energy efficiency
EEA: Energy and Environmental Affairs
EF: Electric fields
EFSB: Energy Facilities Siting Board
ELF: Extremely low frequency
EMF: Electric and magnetic fields
FAA: Federal Aviation Administration
FCA: Forward Capacity Auction
FCM: Forward Capacity Market
GHG: Greenhouse gas
GWSA: Global Warming Solutions Act
HDD: Horizontal directional drilling
HDPE: High density polyethylene
HLPD: Hudson Light & Power Department
ICES: International Committee on Electromagnetic Safety
ICNIRP: International Commission on Non-Ionizing Radiation Protection
J&B: Jack and bore
kV/m: Kilovolts per meter
kV: Kilovolt

LCOE: Levelized cost of entry
LEI: London Economics International
LTE: Long-time emergency
MassDEP: Massachusetts Department of Environmental Protection
MassDOT: Massachusetts Department of Transportation
MCP: Massachusetts Contingency Plan
MCRT: Mass Central Rail Trail
MDAR: Massachusetts Department of Agricultural Resources
MEPA: Massachusetts Environmental Policy Act
MESA: Massachusetts Endangered Species Act
MF: Magnetic fields
mG: Units of milligauss
MHC: Massachusetts Historical Commission
MWPA: Massachusetts Wetlands Protection Act
NELS: Northeast Logistics, LLC
NEP: New England Power Company d/b/a National Grid
NERC: North American Electric Reliability Corporation
NHESP: Natural Heritage and Endangered Species Program
NOAA: National Oceanic and Atmospheric Administration
NPCC: Northeast Power Coordinating Council
NPDES: National Pollutant Discharge and Elimination System
NTAs: Non-transmission alternatives
OH: Overhead
ORW: Outstanding Resource Water
PAC: Planning Advisory Committee
psi: pounds per square inch
PV: Solar photovoltaic
PVC: Polyvinyl chloride
REC: Renewable energy credit
RSP: Regional System Plan
SCADA: Supervisory control and data acquisition
SELCO: Shrewsbury Electric and Cable Operations
SEMA/RI: South Eastern Massachusetts/Rhode Island
STE: Short-time emergency
SVT: Sudbury Valley Trustees
SWPPP: Storm Water Pollution Prevention Plan
TARA: PowerGEM Transmission Analysis and Reliability Assessment
TMP: Traffic Management Plan

UG: Underground
ULSD: Ultra-low-sulfur diesel
UNT: Unnamed tributary
URAM: Utility-Related Abatement Measure
US EPA: United States Environmental Protection Agency
USACE: United States Army Corps of Engineers
USFWS: U.S. Fish and Wildlife Service
USGS: United States Geological Survey
VP: Vernal pool
WHO: World Health Organization
XLPE: Cross-linked polyethylene
YOP: Yearly Operating Plan

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EXECUTIVE SUMMARY

NSTAR Electric Company d/b/a Eversource Energy proposes to construct a new, approximately 9-mile, underground 115-kilovolt electric transmission line sited primarily along an unused railroad corridor owned by the Massachusetts Bay Transportation Authority. This "New Line" passes through the municipalities of Sudbury, Hudson, Stow and Marlborough, and will connect Eversource's Sudbury Substation to Hudson Light and Power Department's substation. The "Sudbury-Hudson Transmission Reliability Project" consists of the New Line and necessary modifications at the Sudbury Substation.

The Project is one of approximately 40 transmission solutions that emerged from an extended study of the regional transmission system performed by the ISO New England Inc. that identified and addressed reliability needs for the New England transmission system that serves northern Massachusetts and southern New Hampshire. In addition to maintaining the reliable and secure delivery of electricity, these transmission solutions substantially increase the power import capacity to the Greater Boston area, enabling access to lower cost, cleaner power sources. Together, they are expected to reduce transmission congestion costs while allowing lower cost electricity generation from outside the area to serve capacity needs within the area.

The Project itself will resolve potential thermal overloads and low voltage conditions that could result in the loss of electric service to approximately 80,000 customers in Berlin, Framingham, Grafton, Hudson, Marlborough, Northborough, Shrewsbury, Stow, Southborough and Westborough, totaling over 400 megawatts of load. In addition to satisfying the transmission need determined by ISO-NE, the Project will support the region's economic growth and increased demand for electricity by introducing a second source of transmission supply and will produce new property tax revenue for the municipalities in which the new facilities are located.

Eversource considered many geographically distinct routes for the New Line, including the use of both overhead and underground designs. The Company conducted extensive community outreach, participating in numerous working meetings with the municipalities, government officials, residents and other stakeholders. After carefully considering and analyzing the input received, the Company's analysis demonstrated the clear advantages of constructing the Project underground along the MBTA corridor. The Company determined that this approach will best balance the goals of minimizing cost and environmental impacts while meeting the identified needs.

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The Project itself will resolve potential thermal overloads and low voltage conditions that could result in the loss of approximately 80,000 customers in Berlin, Framingham, Grafton, Hudson, Marlborough, Northborough, Shrewsbury, Stow, Southborough and Westborough, totaling over 400 megawatts of load. In addition to satisfying the transmission need determined by ISO-NE, the Project will support the region's economic growth and increased demand for electricity by introducing a second source of transmission supply and will produce new property tax revenue for the municipalities in which the new facilities are located.

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Moreover, siting the New Line on the vacant MBTA corridor importantly provides another, significant benefit – reuse of the existing, linear transportation ROW affords Eversource the opportunity to partner with the Massachusetts Department of Conservation and Recreation ("DCR") by coupling construction of the Project with the development of the planned regional Mass Central Rail Trail ("MCRT"), a multi-use trail that will be managed by DCR. The MCRT will traverse the state from west to east and will advance region-wide trail network connections. The MCRT will bring a number of advantages to its users, surrounding communities, and the Commonwealth as a whole.

The coupling of the Project and the MCRT will result in cost efficiencies and environmental benefits that will be achieved by constructing the access road, required for construction and future maintenance, to serve as the base for the multi-use trail. The Company will also refurbish and repurpose the existing bridges. Furthermore, the Company will appropriately mitigate any impacts to the natural environmental arising from the construction and impacts on residents and businesses alike will be greatly reduced by the joint endeavor. Both the MBTA and the DCR support constructing the underground Project as proposed by the Company.

The Company seeks authority to construct and operate the Project to fulfill its obligation to ensure the safe and reliable transmission of electric power. As described in greater detail in the remaining sections of this Analysis, the Project meets the Energy Facilities Siting Board's standards on need, alternatives, routing, and minimization of environmental impacts under G.L. c. 164, § 69J and, therefore, should be approved.

1.0 PROJECT OVERVIEW

1.1 Introduction

NSTAR Electric Company d/b/a Eversource Energy proposes to construct, operate, and maintain an approximately 9-mile, 115-kilovolt ("kV") underground transmission line extending from Eversource's Sudbury Substation on Boston Post Road (Route 20) in Sudbury ("Sudbury Substation") to Hudson Light & Power Department's ("HLPD") substation at Forest Avenue in Hudson ("Hudson Substation") (the "New Line"). In order to accommodate the New Line, the Company and HLPD each will undertake modifications to their respective substations.[1] The New Line and related improvements to the Sudbury Substation comprise the Sudbury-Hudson Transmission Reliability Project (the "Project").

The Company submits this analysis (the "Analysis") to the Energy Facilities Siting Board (the "Siting Board"), which describes in detail the Project scope; the need for the Project; the evaluation of both transmission and non-transmission alternatives, routing alternatives and design options undertaken by the Company; as well as an assessment of environmental impacts and proposed mitigation, and a demonstration of the Project's consistency with applicable state policies in support of its petition pursuant to G.L. c. 164, § 69J ("Section 69J Petition") for approval to construct the Project.

Construction of the Project will serve the public interest by increasing the reliability of the regional electric transmission system. Consistent with the Siting Board's standards, the Project will provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. In addition, the Project will have other public benefits. The Project provides the opportunity to couple construction of the New Line with the development of a portion of the planned regional Mass Central Rail Trail ("MCRT"), a multi-use trail that will be managed by the Massachusetts Department of Conservation and Recreation ("DCR"). The proposed MCRT, traversing the state from west to east, would bring a number of advantages to its users, surrounding communities, and the Commonwealth as a whole. Developing an extensive shared-use trail increases and supports public health by providing an area for the general public to exercise via walking, running, and biking. The

[1] HLPD is not a co-petitioner with Eversource in this proceeding. Pursuant to an agreement between the Company and HLPD, the Eversource petition to the Siting Board is filed in conjunction with, and in support of, HLPD's plans to undertake the actual construction of three new 115-kV breakers at the Hudson Substation. The Company will not construct, own, operate or maintain any transmission facilities at Hudson Substation. The information provided regarding the Hudson Substation is for informational purposes only.

MCRT would also advance state-wide trail network connections, serving as a regional commuter trail. Regional trail connections are especially important today in Massachusetts, which is known for promoting initiatives and establishing goals for increasing the amount of commuters who bike and walk to work.

The Company's proposed route for the New Line and the locations of the Sudbury and Hudson Substations are shown on a United States Geological Survey "USGS" quadrangle base map (see Figure 1-1, Locus Map). Figure 1-2 shows the proposed New Line route on a 2013 MassGIS aerial photo. The New Line will pass primarily through the Towns of Sudbury and Hudson and will cross short sections of the Town of Stow and the City of Marlborough.

Concurrently with the Section 69J Petition, Eversource also has filed with the Department of Public Utilities ("DPU"): (1) a request for approval of the New Line pursuant to G.L. c. 164, § 72 ("Section 72 Petition"); and (2) a request for exemptions from the operation of the Town of Sudbury zoning bylaw for work proposed at Sudbury Substation pursuant to G.L. c. 40A, §3 ("Chapter 40 A, §3") ("Zoning Exemption Petition"). Section 72 requires a petitioner to seek approval from the DPU "for authority to construct and use or to continue to use as constructed or with altered construction a line for the transmission of electricity for distribution in some definite area." Under this statute, the DPU must determine that "such a line will or does serve the public convenience and is consistent with the public interest." Chapter 40A, § 3 authorizes the DPU to issue zoning exemptions for "[l]ands or structures" to be used by "public service corporations" if such zoning exemptions are required and "reasonably necessary for the convenience or welfare of the public."

Consistent with the requirements of G.L. c. 164, §§ 69H and 69J, the Project provides a solution that is designed to improve the reliability of the electric system by providing additional transmission line capacity that will relieve potential overload conditions on the existing transmission lines in the area over the long term, provides voltage support for the region, and prevents a potential voltage collapse that could impact over 400 megawatts ("MW") of load, while minimizing community and environmental impacts and costs.

The Analysis is presented in six sections. The remainder of this Introduction (Section 1) presents a general overview of the Project, briefly touching upon the subject matter discussed in each following Section. The following sections of this Analysis provide more detailed information to support the Project, specifically: a general discussion of the ISO New England Inc. ("ISO-NE") Greater Boston study process, which resulted in identifying the need for the Project (Section 2); a comparison of Project alternatives (Section 3); a description of the route selection process that was used to identify the Project, a Noticed Variation and a Noticed

Alternative Route (Section 4); a comparative analysis of the Project, the Noticed Variation and the Noticed Alternative Route, including impacts, cost, and reliability (Section 5); and an analysis of the Project's consistency with the health, environmental protection, resource use, and development policies of the Commonwealth of Massachusetts (Section 6).

1.2 Existing Transmission System and Project Need

In accordance with the rules of the North American Electric Reliability Corporation ("NERC"), the Northeast Power Coordinating Council ("NPCC," as delegated by NERC), and ISO-NE, the Company's transmission system must be planned and built to withstand certain operating contingencies while, at the same time, meet customer demand on the system. The Project is one of approximately 40 individual projects to emerge from an extended transmission system study process conducted by ISO-NE and its Greater Boston Working Group (the "Working Group") to identify and address reliability needs of the regional transmission system that serves northern Massachusetts and southern New Hampshire. ISO-NE convened the Working Group in 2008 to identify reliability-based transmission needs in the Greater Boston study area and develop transmission solutions to address each need. The study area, covering portions of four electric load zones, encompassed northeastern Massachusetts and southern New Hampshire, and included the City of Boston and its inner and outer suburbs to the north, west, and south. The Working Group identified needs throughout the study area and organized these needs by sub-area, as documented in the Greater Boston Area Updated Transmission Needs Assessment, dated January 30, 2015 ("Updated Needs Assessment"). Then, through an extensive stakeholder process, the Working Group identified and studied potential solutions to the various needs identified in the Updated Needs Assessment. In February 2015, ISO-NE made public its preferred solution to address these identified needs, which were a series of transmission projects, including the proposed Project. The Greater Boston Area Transmission Solutions Study, dated August 12, 2015 (the "Solutions Study"), details the development and comparison of alternative solutions and the performance of the preferred solution set of transmission projects.

Section 2 of the Analysis summarizes the results of the Greater Boston Area study process for the area northwest of downtown Boston, which the Working Group refers to as Subarea D (the Sudbury, Marlborough, and Northborough area), and which includes the municipalities of Sudbury, Framingham, Sherborn, Marlborough, Northborough, Westborough, Grafton, Hudson, Stow, Shrewsbury, Berlin, Millbury and Southborough. Due to the geographic size and extensive identified transmission reliability needs, Subarea D was divided into two subareas: the Sudbury Subarea and the Marlborough Subarea. The

proposed Project will address ISO-NE's determination of a need for additional transmission capacity within the Marlborough Subarea of Subarea D, which encompasses the municipalities of Berlin, Framingham, Grafton, Hudson, Marlborough, Northborough, Shrewsbury, Stow, Southborough and Westborough.

As described more fully in Section 2, the Updated Needs Assessment identified overloads in the Marlborough Subarea that cannot be resolved or mitigated by re-dispatching generation or through other operator action. These overloads can occur at pre-2013 and projected load levels under various generation dispatch conditions, and various operating contingencies. The Project will resolve potential thermal overloads and low voltage situations on the transmission system and voltage collapse that will avoid loss of over 400 MW of load; the loss of electric service to approximately 80,000 customers in the Marlborough Subarea. More recently, the Company verified the need for this Project using updated information, confirming that the existing transmission system currently does not have sufficient capacity to reliably serve the Marlborough Subarea at peak load conditions. The Updated Needs Assessment and the Company's own analysis demonstrate that there is an immediate need for additional capacity in this area to reliably serve electric customers. Addressing this issue is not discretionary; it is a requirement imposed by ISO-NE and NERC.

1.3 Project Alternatives

The Company evaluated a series of Project alternatives with the potential to meet the need identified in the Marlborough Subarea to determine the approach that best balances reliability, cost, and environmental impact. Section 3, Project Alternatives, contains the detailed analyses of the different alternatives to meet the identified need. These include: (1) a no-build alternative; (2) two transmission solutions (the Project and an alternative set of projects that would be constructed by New England Power Company d/b/a National Grid ("NEP"), and an upgrade to the 115-kV Line 455-507 to be constructed by Eversource (the "NEP Alternative"); and (3) non-transmission alternatives ("NTAs") such as new generation, energy efficiency, demand-response programs, or distributed generation.

Section 3 discusses ISO-NE's selection of the Project as the preferred transmission solution, and the Company's confirmation of this selection after a further evaluation of the two transmission alternatives based on updated cost information and environmental impacts. The Company also evaluated potential NTAs, but concluded that there was no practicable NTA, or combination of NTAs, that could resolve the need. NTAs sufficient to meet the need would require a combination of new generation with a contribution from energy efficiency and demand resources, would be at a higher cost to customers and would not be practically

feasible due to physical (land requirements) and logistical (extensive time to implement) difficulties and other requirements to implement. Accordingly, from cost, environmental impact, reliability, and constructability perspectives, the Company determined that construction of the proposed Project is the best approach to meet the identified need.

1.4 Preferred Route and Noticed Alternative Route

After determining that the Sudbury-Hudson Transmission Reliability Project was the superior alternative for meeting the identified need, Eversource undertook a thorough and objective analysis to identify the preferred route for the New Line between the Sudbury and Hudson Substations. Section 4 of this Analysis presents this routing analysis. The iterative route selection process entailed:

- Identifying a geographic study area;
- Identifying an array of initial route corridors and candidate routes, including design options;
- Evaluating developed and natural resource environment impacts, constructability, reliability, and cost of the candidate routes and designs;
- Seeking input and feedback from federal, state and municipal officials, residents/businesses, and other stakeholders; and
- Selecting the Project, a Noticed Variation and a Noticed Alternative Route based on the established evaluation criteria.

The Company's selection of the Project reflects a balancing of established environmental criteria, cost, and reliability. The preferred route for the New Line is an approximately 9-mile, underground route between the Sudbury and Hudson Substations primarily along an inactive railroad corridor ("Corridor" or "ROW") owned by the Massachusetts Bay Transportation Authority ("MBTA"). The New Line originates at the Sudbury Substation and travels northwest along the MBTA Corridor passing through short sections of Marlborough and Stow before entering Hudson, where it travels underground within public roadways for 1.3 miles after exiting the MBTA Corridor, terminating at the Hudson Substation as shown on Figures 1-1 and 1-2.

For the MBTA Corridor portion of the Project, the Company considered and evaluated using both an underground transmission line design and an overhead transmission line design. The Company determined that construction of the New Line underground along the MBTA Corridor will best balance minimization of impacts at a reasonable cost. The Company also

presents the results of its evaluation of the impacts and costs of the construction of an overhead transmission line along the same MBTA Corridor, as a Noticed Variation. While less costly than the underground design of the Project, the Noticed Variation would result in significantly greater permanent impacts.

The Noticed Alternative Route, which is approximately 10.3 miles long, is a geographically distinct route that could also be used to meet the identified need. Between the Sudbury and Hudson Substations, this route travels underground within public roadways for its entire length, including Boston Post Road/Route 20, Green Hill Road and Old Lancaster Road in Sudbury; State Road in Stow; and Main Street, Wilkins Street and Forest Avenue in Hudson. The Noticed Alternative Route was selected as the preferred roadway route after consideration of feedback from the municipalities and stakeholders. The route identified for the Project (and the Noticed Variation) and the Noticed Alternative Route are shown on Figure 1-3.

Construction of either the Project, the Noticed Variation, or the Noticed Alternative Route will require upgrades at the Sudbury Substation and Hudson Substation. These substations are shown on the locus map provided as Figure 1-1. The improvements at the Sudbury and Hudson Substations are described in Section 5. All improvements to the Sudbury Substation will be installed within the existing fence line of the substation. It is the Company's understanding that improvements to the Hudson Substation will require an expansion of the existing substation footprint.

Section 5 of the Analysis describes the methodology by which the Project will be constructed, assesses the potential for environmental impacts, and describes potential mitigation measures. It also provides a detailed comparison of the Project, the Noticed Variation, and the Noticed Alternative Route based on environmental factors, cost and reliability. Based on this comparison, the Company determined that, while each would offer comparable reliability, the Project is superior to the Noticed Alternative Route on balance of costs and potential for environmental impacts. Between the Project and the Noticed Variation, the Project would have fewer environmental impacts, while the Noticed Variation would be less expensive to construct.

1.5 Summary of Project Schedule and Cost

Assuming receipt of all necessary permits and approvals, construction of the Project is anticipated to commence in June of 2018. Current plans call for the Project to be energized by December of 2019. Construction is anticipated to occur over an approximate 18-month

period. Substation improvements at the Sudbury Substation will be timed to coincide with energization of the New Line.

The conceptual level cost estimate (-25%/+50%) for the Project is approximately $91.0 million (2018 dollars). This includes $84.3 million for construction of the proposed New Line and $6.7 million for the Sudbury Substation upgrades.

1.6 Project Benefits

The Sudbury-Hudson Transmission Reliability Project is part of an overall solution determined through the ISO-NE process to address critical reliability issues affecting the Greater Boston Area transmission system. The Project will have numerous public benefits, the primary of which will be to satisfy the transmission need determined by ISO-NE in the Marlborough Subarea. The Project also supports the Marlborough Subarea's economic growth, health, and demand for electricity. Use of the MBTA's existing transportation corridor for the New Line supports the development of necessary infrastructure in the area, while minimizing environmental impacts and facilitating the development of a new multi-use trail system for public use that will be managed by DCR. The trail will advance the planned regional MCRT, a shared-use path that would extend from downtown Sudbury, past New England farmland and forests, to the Assabet River Rail Trail in Hudson and Marlborough and the proposed continuation of the Bruce Freeman Rail Trail (Lowell to Sudbury). The new trail will extend public open space, promote regional connectivity and positive economic benefits, encourage exercise, and inspire environmental and historic appreciation by providing pedestrian and cycling rail trail users with access to the communities' many amenities, including recreational facilities, eateries, shops, and other businesses. Additionally, construction of the New Line, in conjunction with the trail, provides a unique opportunity to achieve cost efficiencies and environmental benefits by the repairing and repurposing of bridges and landscape features.

In addition to the savings provided by coupling the construction of the Project and the multi-use trail, the State and the host communities will receive additional benefits. The Company will provide annual payments to the MBTA for the use of the corridor. The municipalities of Sudbury, Marlborough, Stow and Hudson will also receive revenues from the taxes levied on the Company's investment in the Project.

1.7 Agency and Community Outreach

Eversource commits to continuing to work with federal, state and municipal officials, businesses and residents along the Project route and providing proactive and transparent communications throughout the life of the Project. The Company's extensive outreach efforts have been aimed at briefing all stakeholders on the need for the Project, consulting with stakeholders on the route selection, detailing the overall Project schedule, and explaining the permitting and siting processes, including opportunities for public input. The Company will continue outreach efforts during the licensing and permitting process and will take a hands-on, individualized approach to community outreach during the construction and restoration phases of the Project.

Key elements of the Company's outreach program are described below.

Website: A website for this Project is available at: https://www.eversource.com/Content/ct-g/about/major-projects-infrastructure/sudbury-to-hudson-project. The website provides basic Project information, maps, regular updates, and contact resources and will be kept up-to-date throughout the duration of the Project.

Project Hotline: The toll-free hotline number for the Project is 1-800-793-2202. This number is listed in all Project outreach materials, including fact sheets, mailings and the website and is provided at all community events. Eversource is committed to responding promptly to all inquiries.

Project E-mail: An e-mail address (TransmissionInfo@eversource.com) is designated for a timely response to property owner and other stakeholder questions, comments or concerns. This email address is listed in all Project outreach materials, including mailings, the website, and community events. Similar to the Project hotline, Eversource is committed to responding promptly to all inquiries.

Construction Community Outreach Plan: Eversource will execute a comprehensive community outreach plan to keep property owners, businesses, and municipal officials, including fire, police, and emergency personnel, up-to-date on planned construction activities. Prior to the start of construction in each area, dedicated field outreach personnel will notify municipal officials and perform door-to-door outreach to inform abutting property owners, residents, and businesses of planned construction start and work schedule. The Company will provide regular communications and work closely with both abutters and

municipal officials to minimize construction impacts throughout the construction duration. The outreach plan will also include:

- In-person pre-construction briefings with municipalities, abutting residences and businesses, and other stakeholder groups, as requested, to outline the overall construction process, key milestones, and expected timelines;
- Regular e-mail updates to municipal officials;
- Periodic letters or postcards to abutters and other stakeholders regarding advance notice of scheduled construction activities and/or milestone construction activities;
- Work area signage as appropriate; and
- Outreach staff available to meet with affected property owners prior to each major stage of construction.

Open Houses: The Company held Open Houses to provide the public with opportunities to interact with Project subject matter experts, ask questions, and share concerns. At the Open Houses, the Company provided information on the need for and benefits of the Project, described the siting process, explained the route selection process and provided detail on Project design and location, schedule and construction activities. The Open Houses were held in the Town of Hudson on March 15, 2016 and the Town of Sudbury on March 16, 2016. The Company mailed invitations to property owners within 300 feet of the proposed project, identified through town certified lists, and to municipal officials in Sudbury, Marlborough, Stow and Hudson. Newspaper advertisements for the Open Houses were also published in the Marlborough Enterprise, Hudson Sun, Metro West Daily News, and the Sudbury Town Crier.

Municipal and Stakeholder Briefings: The Company has met frequently with municipal officials and other stakeholders in Sudbury, Marlborough, Stow and Hudson. A summary list of many of the outreach meetings with the municipalities, special interest groups, regulatory agencies and other officials is provided in Table 1-1.

Table 1-1: Project Outreach Meetings

Date	Group	Topic
January 3, 2014	Sudbury Officials	Meeting to introduce Project
January 10, 2014	Hudson Officials	Meeting to introduce Project
December 3, 2014	Sudbury Officials	Meeting to introduce Project
December 10, 2014	Hudson Officials	Meeting to introduce Project
January 21, 2015	Sudbury and Hudson Department of Public Works ("DPW") and Engineering	Meeting to discuss routing options with Town officials
March 2, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
April 15, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
May 8, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
May 29, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
June 1, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
June 22, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
June 24, 2015	MBTA, DCR, Eversource and HLPD	Site visit to MBTA ROW in Sudbury, Hudson, Stow
July 10, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
July 31, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
October 1, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
October 23, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
November 12, 2015	Stow Officials	Meeting to discuss routing options
November 19, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
November 19, 2015	Sudbury and Hudson Officials	Meeting to discuss routing options
December 14, 2015	Marlborough Officials	Meeting to introduce Project and discuss routing options
December 17, 2015	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
January 14, 2016	MBTA, Eversource, HLPD	Meeting to discuss MBTA easement and location requirement of the line within the easement
January 21, 2016	Sudbury Town Officials	Meeting to discuss routing options

Table 1-1: Project Outreach Meetings (Cont'd.)

Date	Group	Topic
January 28, 2016	Hudson Town Officials	Meeting to discuss routing options
January 28, 2016	Stow Town Officials	Meeting to discuss routing options
February 2, 2016	Sudbury Board of Selectman Meeting	Meeting to introduce Project
February 4, 2016	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
February 22, 2016	Hudson Board of Selectman Meeting	Meeting to introduce Project
February 23, 2016	Stow Board of Selectman Meeting	Meeting to introduce Project
March 10, 2016	MBTA, Eversource, HLPD	Meeting to discuss activities on MBTA property - transmission design, license to enter, testing
March 14, 2016	Hudson Executive Administrator	Meeting to review Open House layout and Project poster boards
March 14, 2016	Hudson Light & Power, Senator James Eldridge and Representative Kate Hogan	Meeting to provide an update on the Siting Process (route evaluation through Project approval)
March 15, 2016	Eversource Hudson Open House	Open House to introduce Project to the public of Sudbury, Hudson, Stow, and Marlborough
March 16, 2016	Eversource Sudbury Open House	Open House to introduce Project to the public of Hudson, Sudbury, Stow, and Marlborough
April 5, 2016	Sudbury Town Manager Meeting	Meeting to provide route scoring analysis for in-road alternatives
April 19, 2016	Hudson Executive Assistant (Tom Moses) Meeting and DPW (Eric Ryder) Meeting	Meeting to provide the route scoring analysis for in-road alternatives and discuss next steps
April 20, 2016	Marlborough Office Administration (Morris Josephson) and DPW Commission (John Ghiloni) Meeting	Meeting to provide the route scoring analysis for in-road alternatives and discuss next steps
April 25, 2016	Stow Town Administrator (William Wrinquley and Working Group (Arnie Epstein) Meeting	Meeting to provide route scoring analysis for in-road alternatives and discuss next steps
May 4, 2016	Marlborough Mayor	Meeting to provide route scoring analysis for in-road alternatives and discuss next steps
May 13, 2016	Meeting with Sudbury DPW Director Bill Pace	Meeting to gather in road utility information for underground route scoring
May 18, 2016	Meeting with Marlborough Commissioner, Engineer and DPW	Meeting to discuss Project design alternatives and gather feedback from the town
May 18, 2016	Meeting with Stow DPW	Meeting to discuss Project design alternatives and gather feedback from the town
May 18, 2016	Meeting with Hudson DPW and Town Executive Administrator	Meeting to discuss Project design alternatives and gather feedback from the town
May 24, 2016	Conference call with MBTA	Meeting to discuss Project design alternatives and easement terms and conditions
August 15, 2016	Meeting with Department of Conservation and Recreation (DCR)	

Table 1-1: Project Outreach Meetings (Cont'd.)

Date	Group	Topic
August 15, 2016	Meeting with Executive Office of Energy & Environmental Affairs	Meeting to provide update on current Project direction
August 16, 2016	Meeting with Stow Town Manager and Stow Energy Group	Meeting to provide updated routing analysis for alternatives and discuss next steps
August 17, 2016	Meeting with Marlborough	Meeting to provide updated routing analysis for alternatives and discuss next steps
August 17, 2016	Meeting with Hudson	Meeting to provide updated routing analysis for alternatives and discuss next steps
August 17, 2016	Meeting with Sudbury	Meeting to provide updated routing analysis for alternatives and discuss next steps
August 25, 2016	Meeting with Protect Sudbury	Meeting to provide update on Project and hear feedback from organization representatives
September 6, 2016	Meeting with NHESP	Meeting to discuss the Project permitting strategy and design alternatives
October 24, 2016	Meeting with DCR	Meeting to discuss proposed design alternatives along MBTA ROW
October 26, 2016	Meeting with MBTA	Meeting to finalize easement terms and conditions
October 26, 2016	Meeting with Sudbury Board of Selectmen and public	Meeting to provide update on Project and discuss next steps
October 27, 2016	Meeting with Sudbury DPW	Meeting to gather in road utility information for underground route scoring
November 9, 2016	Meeting with Stow Board of Selectmen and public	Meeting to provide update on Project and discuss next steps
November 10, 2016	Meeting with MEPA	Discuss ENF document filing with MEPA
November 14, 2016	Meeting with Hudson Board of Selectmen and public	Meeting to provide update on Project and discuss next steps
November 22, 2016	Meeting with Protect Sudbury	Meeting to provide update on Project and hear feedback from organization representatives
January 12, 2017	Meeting with DCR	Meeting to discuss proposed Project along MBTA ROW
January 23, 2017	MassDOT Board of Directors and Fiscal and Management Control Board Meeting	Approval of Eversource easement on MBTA right-of-way
February 8, 2017	Meeting with MBTA and DCR	Meeting to discuss easement on MBTA right-of-way and next steps

1.8 Project Team

The Company has assembled an experienced team of planners, engineers, environmental scientists, attorneys, and project outreach specialists for the Project. The team's principal organizations are outlined below.

NSTAR Electric Company d/b/a Eversource Energy (Project Proponent)

NSTAR Electric Company is a Massachusetts corporation and a wholly-owned subsidiary of Eversource Energy, which operates New England's largest energy delivery system. The Company transmits and delivers electricity to approximately 1.2 million electric customers in Boston and 80 surrounding cities and towns in Massachusetts, covering an area of approximately 1,700 square miles.

VHB (Environmental Consultants)

VHB is an engineering and environmental consulting firm based in Watertown, Massachusetts. VHB's engineers, scientists, planners, and regulatory specialists have completed environmental assessment, modeling, licensing, and permitting for multiple large-scale energy infrastructure projects throughout the Northeast. VHB conducted the routing analysis and the assessment of environmental impacts for the Project and is providing local, state, and federal environmental permitting support.

Keegan Werlin LLP (Outside Counsel)

Keegan Werlin LLP, based in Boston, serves as regulatory counsel for the Project on siting, permitting, and licensing matters. The firm specializes in representing clients in all aspects of energy, environmental and regulatory processes. Keegan Werlin's attorneys include former utility regulators and attorneys from energy, environmental and resource management agencies. Attorneys in the firm have represented transmission companies and project developers in numerous applications to the Siting Board, Department and other permitting agencies for approval to construct electric transmission lines, bulk generating facilities and natural gas pipelines.

London Economics International, LLC

London Economics International, LLC ("LEI") is a global economic and financial consultancy specializing in energy and infrastructure. The firm combines a detailed understanding of specific network and commodity industries, such as electricity generation and distribution, with sophisticated analysis and a suite of proprietary quantitative models to produce reliable and comprehensible results. LEI has advised private sector clients, market institutions, and government on renewable and conventional energy policy initiatives, procurement, non-transmission alternative studies, market and tariff design, asset valuation, project development and risks evaluation, market power, and strategy in virtually all deregulated markets worldwide. LEI has assessed the feasibility and cost of non-transmission alternatives to the Project.

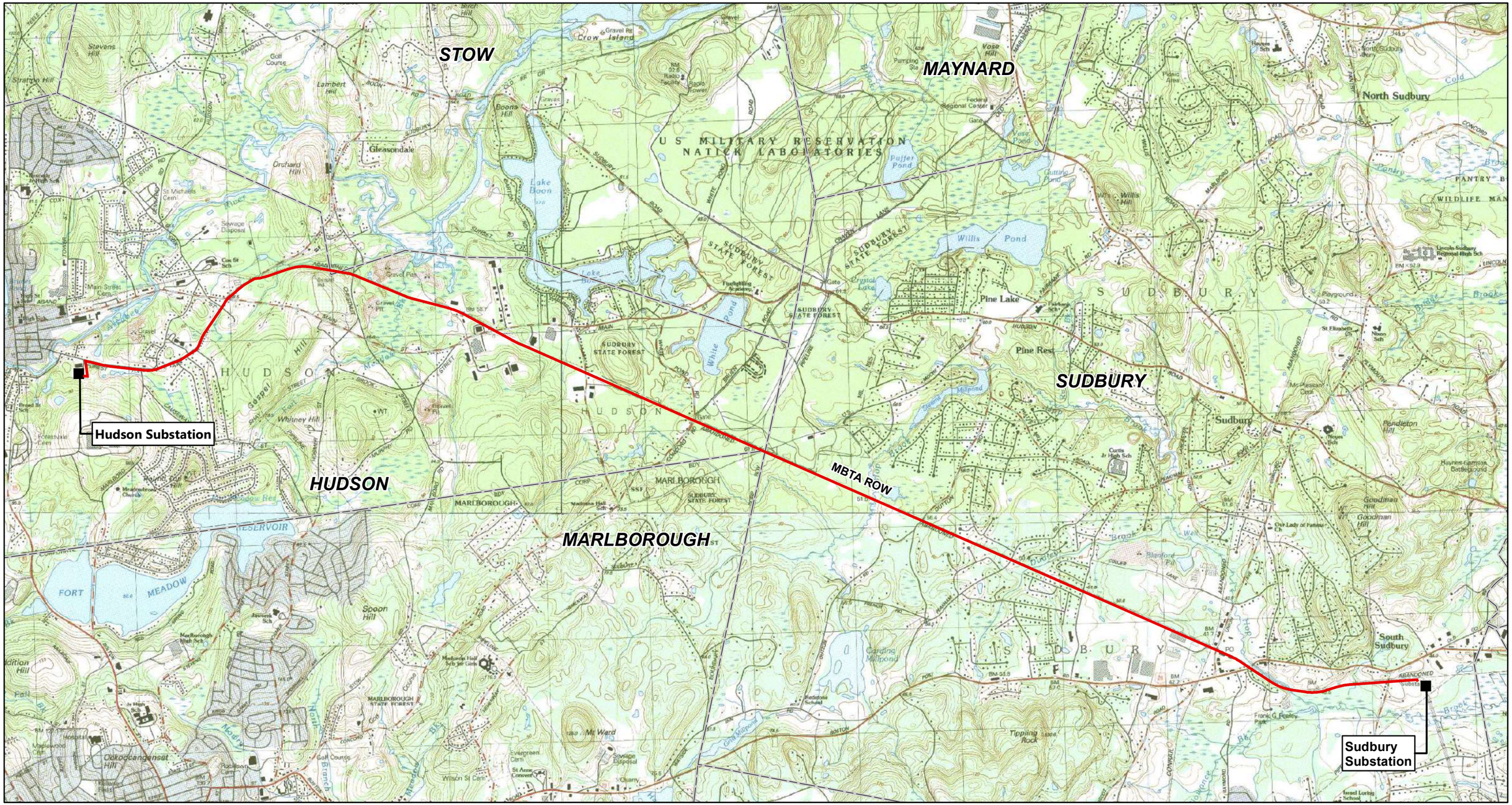
Exponent, Inc.

Exponent Inc., based in New York City, is a multidisciplinary organization of scientists, physicians, engineers, and business consultants that performs in-depth investigations including evaluation of complex human health and environmental issues. Exponent Inc. has been contracted to assess the effect of the Project on EMF levels at the edge of the ROW and Project vicinity. The analysis also addresses the potential health effects of exposure to EMF, and includes an assessment of Project compliance with exposure guidelines and regulatory guidance documents.

1.9 Conclusion

The Project will address critical reliability issues affecting the Greater Boston area transmission system. The Company seeks authority to construct the Project to fulfill its obligation to ensure the safe and reliable transmission of power. The Company will meet this objective through construction and operation of the Project. For the reasons described in greater detail in the subsequent sections of this Analysis, the Project conforms to the Siting Board's standards on need, alternatives, routing, and minimization of environmental impacts under G.L. c. 164, § 69J, and therefore should be approved by the Siting Board.

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section1\April2017\Figure 1-1 Locus Map.mxd 4/12/2017



Project

Substation Location

Municipal Boundary

Source:
MassGIS, VHB

4/12/2017

N

0 3,000 6,000 Feet

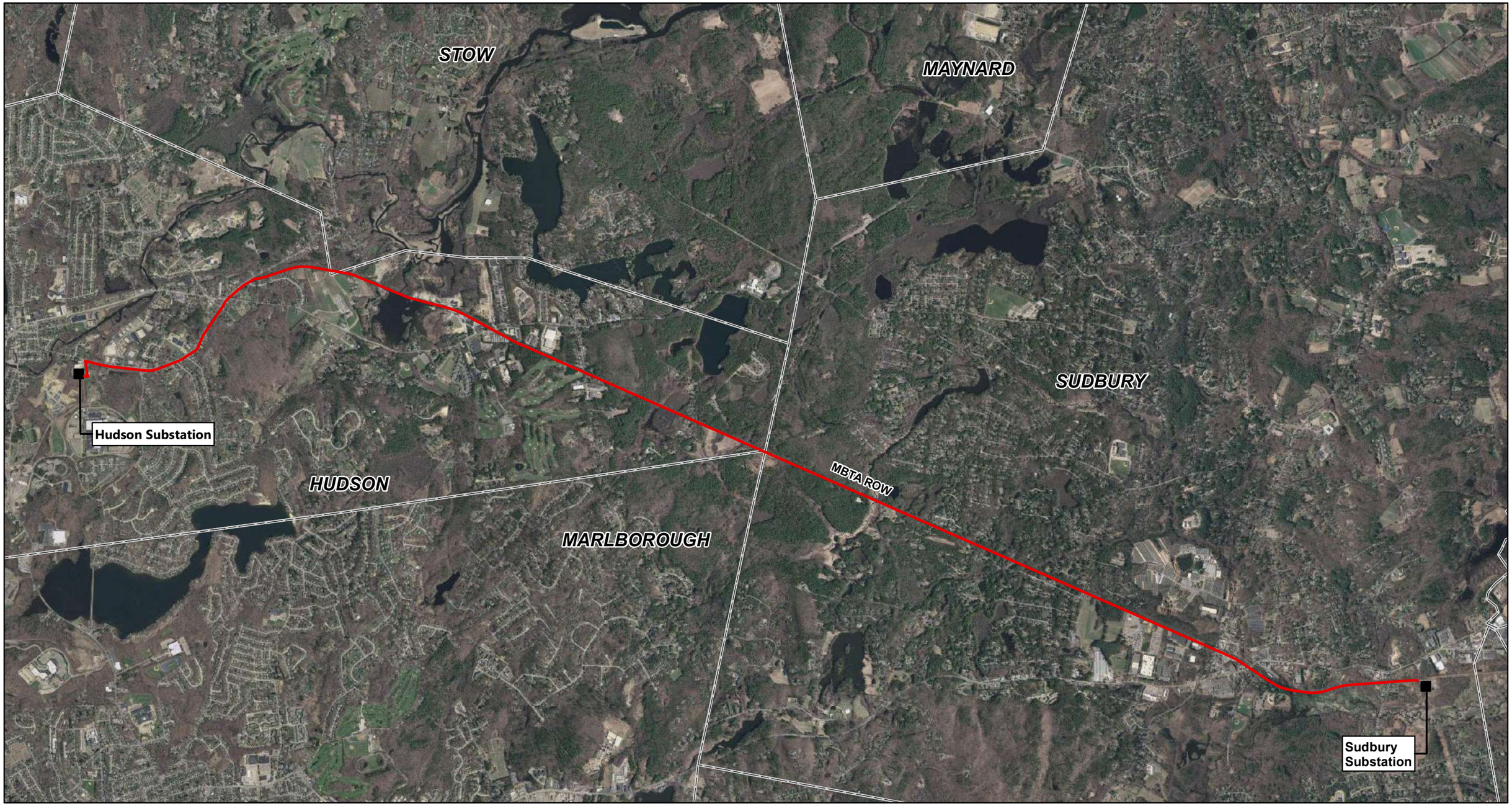
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 1-1: Locus Map (USGS)

vhb

\\WHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section1\April2017\Figure 1-2 Proposed New Line.mxd 4/12/2017



Project

Substation Location

Municipal Boundary

N

Source:
MassGIS, VHB

4/12/2017

0 3,000 6,000 Feet

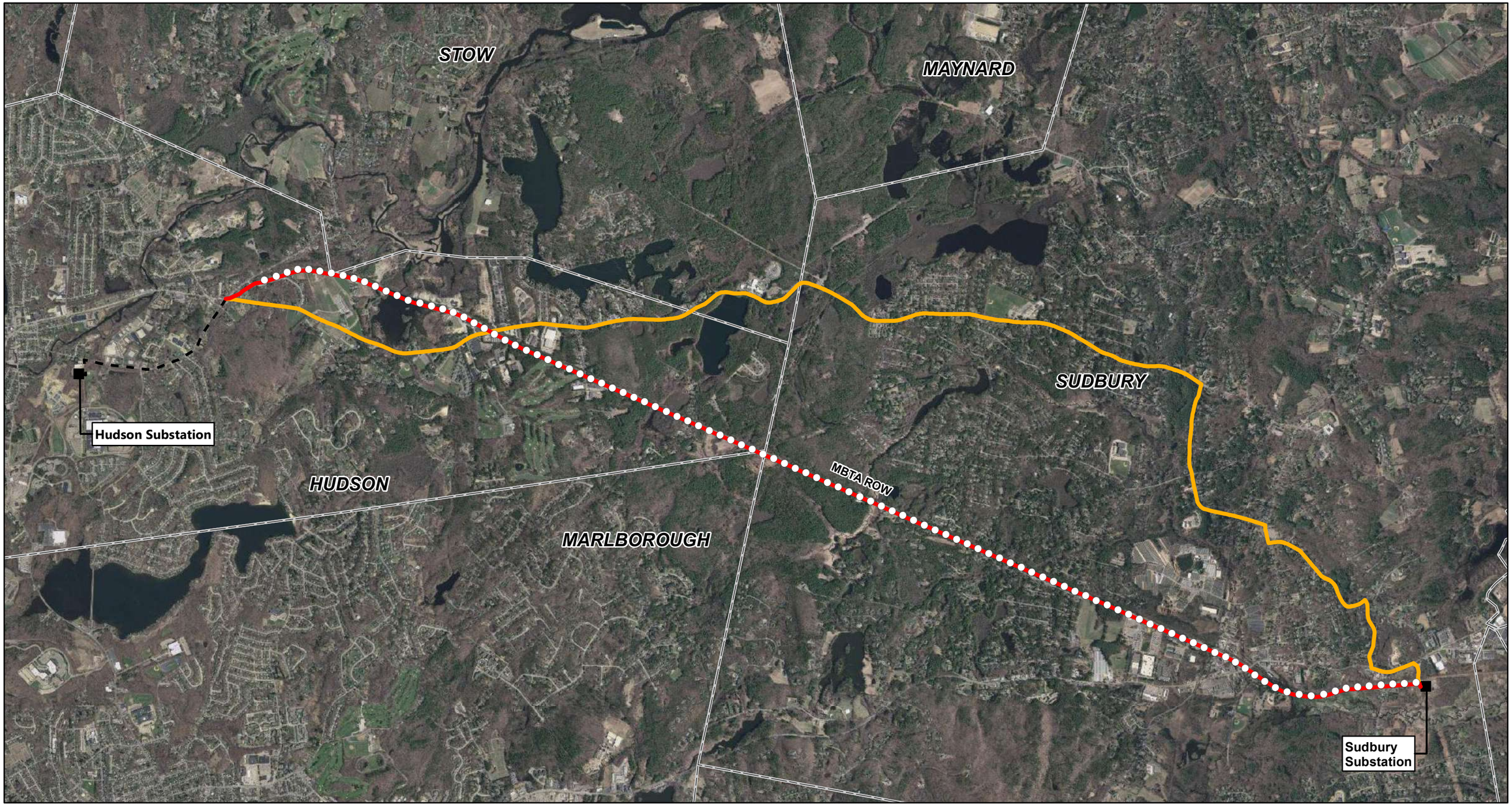
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 1-2: Locus Map (Aerial)

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section1\April2017\Figure 1-3 PetitionFigure.mxd



- Common Underground Segment
- Noticed Variation (OH in MBTA ROW)
- Project (UG)
- Noticed Alternative Route
- Substation Location
- Municipal Boundary

Source:
MassGIS, VHB

4/12/2017

N

0 3,000 6,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 1-3: Project, Noticed Variation, and Noticed Alternative Route

vhb

2.0 PROJECT NEED

2.1 Introduction

The New England transmission network or grid is the backbone of the regional electric system. It consists of a network of high-voltage transmission lines that transmit bulk power generated by various sources to substations that convert the power to a lower voltage for delivery to homes and businesses. The grid is designed to meet reliability standards and criteria developed by NERC, which sets the minimum standards for electric power transmission for all of North America, the NPCC and ISO-NE. The reliability standards and criteria established by the NPCC and ISO-NE expressly require transmission operators, including Eversource, to design and test their systems to withstand representative operating contingencies as specified in the criteria. If identified criteria violations are not addressed, transmission equipment could overload or voltage levels could be outside of acceptable operating ranges under certain system conditions. The impacts could result in equipment damage and wide-scale power outages.

Eversource's transmission system is an integral part of the bulk power system delivering electricity to customers in New England. If the Eversource transmission system does not have sufficient capability to serve forecasted load under the conditions outlined in the NERC, NPCC and ISO-NE reliability criteria, the Company must plan and implement system additions or upgrades to address the identified inadequacies. In this case, the Company is proposing to install a new 115-kV transmission line to alleviate thermal overload conditions, provide voltage support for the region and prevent voltage collapse that impacts over 400 MW of load identified in the Marlborough Subarea, which encompasses parts of the municipalities of Framingham, Marlborough, Northborough, Westborough, Grafton, Hudson, Stow, Shrewsbury, Berlin, and Southborough. As a result, the proposed upgrade serves the public interest by eliminating the potential for equipment damage and power outages under certain system conditions that could affect approximately 80,000 customers.

The Project is one of approximately 40 individual transmission projects to emerge from an extended transmission study process conducted by the ISO-NE led Working Group. The goal of the Working Group was to identify and address reliability needs of the transmission system that serves Greater Boston/Metro West and Southern New Hampshire, including transmission networks owned and operated by Eversource and NEP in the Sudbury, Marlborough and Northborough area (referred to as Subarea D). The Working Group completed its initial needs assessment and documented the results in the Greater Boston Area Transmission Needs Assessment dated July 8, 2010. This study was updated, ultimately

resulting in the issuance of the Updated Needs Assessment, provided as Appendix 2-1, and the selection of a set of transmission projects (including the Project), referred to as the Greater Boston-New Hampshire Solution, to address the identified needs.[2] The Updated Needs Assessment concluded that there are numerous thermal and voltage violations on various transmission lines in Subarea D, as depicted in Figure 2-1. Due to the geographic size and extensive identified transmission reliability needs, Subarea D was further broken down into two subareas: the Marlborough Subarea and the Sudbury Subarea. The focus of this Analysis is a solution for the needs in the Marlborough Subarea. As described more fully below and as documented in the Updated Needs Assessment, certain existing 69-kV and 115-kV lines serving the Marlborough Subarea would overload under various contingencies at existing peak load levels, which would lead to a voltage collapse and the consequent loss of service to over 400 MW of load (approximately 80,000 customers). Thus there is an immediate and substantial need to address reliability issues in Marlborough Subarea.

In addition to the process conducted by the Working Group to evaluate need, Eversource conducted its own confirming analysis using the 2016 Capacity, Energy, Loads, and Transmission ("CELT") report, including the updated energy efficiency and solar photovoltaics ("PV") forecast, to verify that the need for the Project remains. As described in detail in Section 2.6 below, the Eversource analysis verified that the transmission system's reliability is compromised and that the potential for line overloads, low voltage and voltage collapse persists. The Project is designed to resolve the identified transmission system reliability issues.

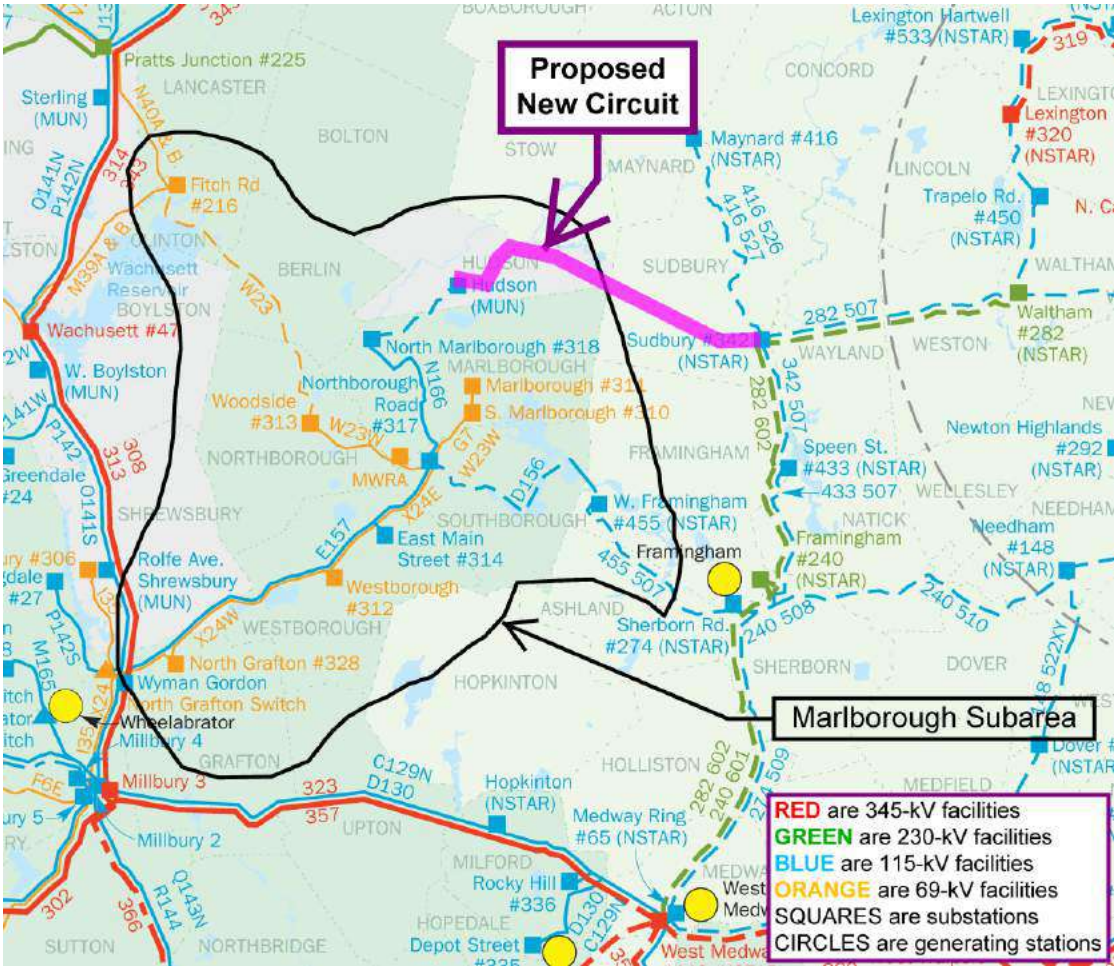
2.2 Description of Existing Area Transmission System

This Project is designed to address transmission reliability needs in the Marlborough Subarea, which is currently supplied by two 115-kV lines and three 69-kV lines as shown in Figure 2-1. The Subarea is fed from the southeast by Line 455-507 originating from Eversource's Sherborn Substation, and from the west by the 115-kV Line E-157W originating from NEP's Millbury Substation. The 69-kV feeds to the area consist of a NEP Line X-24W between Millbury Substation and Westborough Substation, Line N-40 from NEP's Pratts Junction Substation to NEP's Fitch Road Substation (where it becomes Line W-23 to NEP's Marlboro Substation), and Line M-39 between NEP's Wachusett Substation to NEP's Fitch Road Substation.

[2] The Updated Needs Assessment has been redacted for the public record in order to avoid disclosure of Critical Energy Infrastructure Information ("CEII"). An unredacted copy has been provided to the Siting Board under seal and subject to a Motion for Protective Treatment, and will be provided to eligible parties who have executed CEII Non-Disclosure Agreements.

The towns of Hudson and Stow are served by HLPD, which owns the Hudson Substation. The Hudson Substation is presently served by two 115-kV lines from NEP's Northborough Road Substation.

Figure 2-1: Geographical Depiction of Marlborough Subarea of Subarea D



2.3 Transmission Planning Standards

Eversource must adhere to reliability standards and criteria that are established under the purview of NERC, which has authority to ensure the reliability of transmission systems across most of North America. NERC oversees a number of regional councils, one of which is the NPCC, covering New York, New England and eastern Canada. Within the NPCC, New England is a "control area" subject to the supervision and control of ISO-NE. ISO-NE has responsibility for dispatching generation and for conducting the day-to-day operation of the integrated transmission system. ISO-NE operates the various transmission networks owned by electric utilities in New England as a single transmission system. The standards established by NERC, NPCC and ISO-NE have been developed to ensure that the electric power system serving New England, including Eversource's service territory, is designed, constructed and maintained to provide adequate and reliable electric power to the region. NERC establishes a general set of rules and criteria applicable to all geographic areas. NPCC establishes a set of rules and criteria that are particular to the northeast, and also encompass the more general NERC standards. In turn, ISO-NE develops standards and criteria that are specific to New England, but are also coordinated with the NPCC. The Company is required to comply with the following reliability and planning standards when planning its transmission system:

- NERC TPL-001-4 Transmission System Planning Performance Requirements;
- NPCC Regional Reliability Reference Directory # 1, "Design and Operation of the Bulk Power System";
- ISO-NE Planning Procedure 3, "Reliability Standards for the New England Area Pool Transmission Facilities"; and
- ISO-NE Planning Procedure 5-3, "Guidelines for Conducting and Evaluating Proposed Plan Application Analyses."

The Updated Needs Assessment was performed in accordance with the above listed standards. The Updated Needs Assessment evaluated the reliability performance of the transmission system serving the study area under 2018 and 2023 projected system conditions. The system was tested with all lines in and under N-1 and N-1-1 contingencies for a range of possible operating conditions. The testing identified the potential for transmission system overloads in various subareas including Subarea D. Unacceptable low voltage conditions were also noted in some subareas including Subarea D. The testing also identified high voltage conditions in several areas and several load pockets where under contingency conditions there would be the loss of approximately 300 MW of customer load.

2.4 ISO-NE Planning Process for the Greater Boston Area

Under the Federal Energy Regulatory Commission's regulatory authority, ISO-NE, an independent, not-for-profit corporation, is authorized to perform three critical, complex, interconnected roles for the New England region, which encompasses all of the six New England states: (i) grid operation: keeping electricity flowing over the region's high voltage transmission system; (ii) market administration: designing, running, and overseeing the billion-dollar markets where wholesale electricity is bought and sold; and (iii) power system planning: doing studies, analyses, and planning to make sure New England's electricity needs will be met now and into the future. Together, these three core responsibilities help protect the health of the region's economy and the well-being of its residents by ensuring the constant availability of competitively-priced wholesale electricity – today and for future generations.

In administering the regional system planning process, ISO-NE has a number of responsibilities relating to transmission resources. ISO-NE's primary functions in this area are to: (i) conduct periodic needs assessments on a system-wide or specific-area basis, as appropriate, and (ii) develop an annual regional transmission plan using a 10-year planning horizon.

Needs assessments are designed to identify future system needs on the regional transmission system, or within a subarea of the system, with consideration of available market solutions. Needs assessments examine various aspects of system performance and capability, identify the timing and details of system needs, and analyze whether pool transmission facilities ("PTFs") in the New England transmission system: (i) meet applicable reliability standards, (ii) have adequate transfer capability to support local, regional and inter-regional reliability; (iii) support the efficient operation of the wholesale electric markets; and (iv) are sufficient to integrate new resources and loads on an aggregate or regional basis. Needs assessments identify the location and nature of any potential problems with respect to PTFs and conditions that significantly affect the reliable and efficient operation of the PTFs, along with any critical time constraints for addressing the specific, identified needs and to facilitate the development of market responses and the pursuit of a regulated transmission solution.

The ISO-NE annual 10-year transmission plan is referred to as the Regional System Plan ("RSP"). The RSP is a compilation of the regional system planning process activities conducted by ISO-NE and stakeholders during a given year and presents the results and findings of the ongoing ISO-NE regional planning process. The RSP addresses system needs and deficiencies, as determined by ISO-NE through its periodic needs assessments, with

updates occurring on a going forward basis to: (i) account for changes in PTF system conditions; (ii) ensure reliability of the transmission system; (iii) comply with national and regional planning standards, criteria and procedures; and (iv) account for market performance and economic, environmental and other considerations. The Company's planning process is integrated with and coordinated by ISO-NE as part of its regional planning process and annual RSP.

For major transmission upgrades, the regional transmission planning process includes the following steps: (i) system needs are identified through a periodic needs assessment undertaken by ISO-NE; (ii) regulated transmission solutions are suggested to meet identified system needs; (iii) solution studies are prepared to identify the most cost-effective regulated transmission solution; (iv) proposed regulated transmission solutions are reviewed and approved by ISO-NE; and (v) a transmission cost allocation review is conducted.

The regional planning process is carried out by ISO-NE as part of an open and transparent process involving planning committees made up of various stakeholders and which include the New England Power Pool Reliability Committee, the Environmental Advisory Group and the Planning Advisory Committee (the "PAC"). Membership in the PAC includes market participants, public utility commissions, consumer advocates and Attorneys General, environmental regulators and other interested parties. The PAC provides input and feedback to ISO-NE regarding the regional system planning process including: (i) the development of the RSP; (ii) assumptions for studies performed; (iii) the results of needs assessments and solutions studies, and (iv) potential market responses to the needs identified by ISO-NE through a needs assessment. Based on input and feedback provided by the PAC, ISO-NE refers issues and concerns to the appropriate technical committees, including but not limited to, the Markets Committee, Reliability Committee and the Transmission Committee, for further investigation and consideration of potential changes to rules and procedures.

In 2008, the Working Group, led by ISO-NE, was formed to evaluate the performance of the Greater Boston System area transmission system under NERC Transmission Planning Standard TPL-001-4 to identify reliability-based transmission needs and develop transmission solutions to address each need. In July 2009, the Working Group completed its initial needs assessment and documented the results in the July 2010 Greater Boston Area Transmission Needs Assessment. This needs assessment was then updated in 2015 to account for significant system changes including revisions in assumptions for load growth, energy efficiency, generators no longer available to provide or maintain reliability (including "delists" and retirements), generator additions, and other factors that could affect the demands placed on the Greater Boston Area transmission system. The results were

documented in the Updated Needs Assessment (Appendix 2-1). Eversource's Project was identified through the Greater Boston Area transmission solution study process as the most cost-effective regulated transmission solution for the identified needs in the Marlborough Subarea.

2.5 Methodology for Analyzing System Reliability

2.5.1 Methodology

As part of the Updated Needs Assessment, the Working Group used load-flow analysis to assess the performance of the area transmission system under a series of defined contingency situations, including:

N-1 Contingencies

- Loss of one transmission circuit, transformer, generator, bus section or shunt device;
- Opening of a line section without a fault;
- Loss of two transmission components (circuit, transformer or generator) sharing a common circuit breaker; and
- Loss of two transmission circuits on a multiple circuit transmission tower.

N-1-1 Contingencies

- Loss of one major generating unit, transmission circuit or transformer followed by an N-1 contingency as defined above.

The primary goal of a load-flow analysis is to determine whether the occurrence of a single contingency (N-1), or one contingency followed by a second contingency (N-1-1), would load any transmission element beyond its long-time emergency ("LTE") or short-time

emergency ("STE") rating,[3] or would result in unacceptable voltage levels.[4] The loading capability of a given transmission element is a function of the element's heat-dissipation capability, and therefore, this analysis is also referred to as a thermal analysis. In addition, ISO-NE studies whether N-1 or N-1-1 contingencies could cause consequential load loss approaching or exceeding 300 MW of customer load in load pockets within the system.[5]

2.5.2 Load Levels Tested

The Updated Needs Assessment evaluated transmission system reliability over a near-term (five-year, to 2018) and a longer-term (ten-year, to 2023) planning horizon, and was based on information in the 2013 CELT Report, which was the most recent CELT Report available at the time the Updated Needs Assessment was performed. The study models reflected the summer peak 90/10[6] load conditions outlined in Table 2-1.[7]

Table 2-1: Summer Peak 90/10 Load Conditions Based on 2013 CELT Report

Year	New England Peak Load	Boston Peak Load
2018	32,615 MW	6,830 MW
2023	34,460 MW	7,210 MW

2.5.2.1 Passive and Active Demand Resource Assumptions

Demand resources ("DR"), resources that reduce end-use demand for electricity from the power system, fall into two general types: Active DR (activated only when needed) and Passive DR (designed to save electricity use at all times). Passive and Active DR were modeled as load

[3] Each transmission element on the system is rated to identify its thermal capability. Specifically, each element has a normal rating, LTE, and STE rating. The normal rating for a transmission element is the continuous operating limit for that element. The LTE rating is the 12-hour capability of the element, which assumes that any emergency loading affecting this line will last no more than 12 hours. Transmission elements may be operated above the normal rating (and below the LTE rating) within a 12-hour period to meet peak-loading conditions. After 12 hours, the line must operate at a normal or lower loading level or it must be taken out of service. Transmission elements may operate above their LTE rating (and below STE rating) for up to 15 minutes. The STE rating is the 15-minute capability of the element, meaning that the element could operate at this level for no more than 15 minutes and then would have to be operated at the LTE or a lower loading level.

[4] Transmission bus voltage levels outside of 0.95 and 1.05 per unit of normal voltage are generally considered unacceptable.

[5] Consequential load loss refers to the load that is no longer served by the transmission system as a result of transmission facilities being removed from service by a protection system operation designed to isolate the fault.

[6] The 90/10 forecasted load level is an extreme weather level and is the peak demand expected once every ten years. The 90/10 extreme peak load level has a 10% chance of being exceeded because of weather conditions.

[7] See Section 2.5 below for a summary of the Company's evaluation based on the more recent 2016 CELT report, which confirmed the need for the Project.

reductions, that is, the customer load that must be met by dispatching generation resources is reduced by the amount of load represented by DR. Passive DR included Passive DR that bid into and were ultimately selected in Forward Capacity Auction ("FCA") #7[8] conducted by ISO-NE as Forward Capacity Market ("FCM") resources. This "cleared" amount of Passive DR was combined with forecasted energy efficiency for the study year, as provided in the 2013 CELT Report. Active DR was also modeled at levels that cleared FCA #7. The Passive and Active DR values used for modeling are provided in Tables 3-6 and 3-7 of the Updated Needs Assessment (Appendix 2-1, pp. 31-32).

2.5.2.2 Generating Resources

Generation projects that cleared prior FCAs and have a corresponding FCM Capacity Supply Obligation as of FCA #7 were included in the study base case. These resources include, but are not limited to, the Footprint Power Project, 674 MW of new gas-fired combined-cycle generation to be located at Salem Harbor in Salem, Massachusetts. The existing Salem Harbor units 1 through 4, totaling approximately 747 MW, have retired and these units were removed from all base cases used in the study.

2.5.3 Generation Dispatch Scenarios

For each of two study years (2018 and 2023), the Updated Needs Assessment evaluated 37 generation dispatch cases representing a range of possible generation dispatch and availability conditions. The cases all have at least one major Boston RSP Subarea generating unit out of service as a base condition. The major Boston RSP Subarea generating units are listed below, together with their summer ratings.

- Mystic 7: 578 MW
- Mystic 8: 703 MW
- Mystic 9: 714 MW
- Kendall 4: 154 MW
- Salem Harbor 5/Footprint 1: 337 MW as qualified in FCA #7 ("Footprint 1")
- Salem Harbor 6/Footprint 2: 337 MW as qualified in FCA #7 ("Footprint 2")

The 37 generation dispatch cases are organized by surrounding interface transfer levels. One set is based on high transfers from northern New England to southern New England ("North-South transfers") along with high South Eastern Massachusetts/Rhode Island ("SEMA/RI")

[8] FCA #7 covered the capacity commitment period of 2016/2017. These were the most recently available FCA results at the time of the Updated Needs Assessment.

export levels; the second set is based on high North-South transfers with low SEMA/RI export levels; and the final set is based on low North-South transfers with high SEMA/RI export levels. A detailed description of the generation dispatch cases can be found in Table 3-5 of the Updated Needs Assessment (Appendix 2-1, p. 28).

The dispatch cases include both design cases and retirement sensitivity cases. Design cases include cases with either one or two major generating units out of service, as the Working Group recognized that the one generator-out-of-service cases might highlight different issues than the two generator-out-of-service cases. The one-unit-out design cases assumed Mystic 8 (345-kV), Mystic 9 (115-kV), Kendall, or one Footprint unit was out of service, while simultaneously modeling a range of stressed conditions on the North-South interface, the SEMA/RI interface or the East-West interface.

The two-unit-out cases assumed that two of the six units in the bulleted list above were out of service while simultaneously modeling a range of stressed conditions on the North-South interface or the SEMA/RI interface. A proposed solution must be developed for any design case where a thermal, voltage, short-circuit or stability issue arises that is outside of acceptable ranges defined within NERC, NPCC, ISO-NE or the respective company's design standards, procedures or criteria.

Sensitivity testing was performed to address concerns that older generating units in the Boston RSP Subarea could retire from service or be subject to extended shutdown (for example, for repair or repowering) during the 10-year planning horizon. The sensitivity cases all assumed the retirement of the 1975 vintage 578 MW Mystic 7 unit. Study cases included two major units (Mystic 8 and Mystic 9) out of service with relevant interface transfer levels within their respective defined limits. There is no requirement that a proposed solution be developed for a generator sensitivity case; however, the retirement sensitivity cases are used to examine the robustness of a proposed solution in light of potential future generator retirements.

2.6 Greater Boston Needs Assessments Results for Marlborough Subarea - Thermal Overloads and Low Voltage Leading to Voltage Collapse

The Updated Needs Assessment evaluated the reliability performance of the transmission system in the Marlborough Subarea for 2018 and 2023 projected system conditions and was performed in accordance with the reliability and planning standards and criteria and load levels referenced in Section 2.4 above. Consistent with the reliability criteria established by NERC, NPCC and ISO-NE, the Working Group assessed the ability of the local area transmission system to withstand single-contingency (N-1) and double-contingency (N-1-1) conditions given projections of peak load, generator availability and dispatch conditions.

As described above, the Marlborough Subarea includes 115-kV and 69-kV facilities that interconnect several Eversource, NEP and municipal substations. As explained in the Updated Needs Assessment, the transmission system was tested with all lines in and under N-1 and N-1-1 contingency conditions for a number of possible operating conditions with respect to interface transfer levels and generating unit availability conditions. The Updated Needs Assessment identified overloads on several 115-kV and 69-kV lines in the Marlborough Subarea that cannot be resolved or mitigated by re-dispatching generation or through other operator actions. Specifically, the Updated Needs Assessment identified potential overloads (with respect to the STE and LTE ratings)[9] on Eversource Lines 455-507 and 513-507 and NEP Lines E-157W, E-157, E-157E, W-23, W-23W, N-40, X-24W and X-24E, in the event of N-1 and N-1-1 contingencies, under the various system operating conditions tested, including current and forecasted system load levels. Although the N-1 contingency overloads are being rectified as separate projects by NEP (the W-23W Reconductoring Project and the X-24W/E-157W DCT Project),[10] the potential for thermal overloads under N-1-1 contingencies would remain. The following subsections summarize the remaining overloads for the design cases and retirement sensitivity cases with respect to Lines 455-507, 513-507, E-157W, E-157, E-157E, W-23, W-23W, N-40, X-24W and X-24E. Additional detail can be found in the Updated Needs Assessment, provided as Appendix 2-1 of this Analysis.

2.6.1 Design Case Overloads

The Updated Needs Assessment identified N-1 and N-1-1 thermal overloads on 69-kV and 115-kV lines in the Marlborough Subarea. As discussed above, while the N-1 overloads in Subarea D are being addressed by two NEP projects, thermal overloads under N-1-1 contingencies are not addressed by these or any other Greater Boston Projects identified in the Solutions Study. To verify that N-1-1 overloads will persist upon completion of these other projects, Eversource conducted an additional analysis of the system with all the other Greater Boston projects in-service except for the Sudbury-Hudson Transmission Reliability Project. The remaining N-1-1 overloads are shown in Table 2-2 below. These results confirm the original N-1-1 design case results from the Updated Needs Assessment. Detailed N-1-1 results, including relevant contingencies, are presented in Section 5.2.3 of the Updated Needs Assessment.

[9] According to ISO NE Planning Procedure 7 entitled "PP7 - Procedures for Determining and Implementing Transmission Facility Ratings in New England," emergency ratings, which exceed normal ratings, involve loss of life or loss of tensile strength in excess of design criteria. Consistent with ISO-NE Operating Procedure 19, the emergency ratings are calculated by using the following time durations: Winter LTE (W LTE) - 4 hours; Summer LTE (S LTE) - 12 hours; Winter STE (W STE) - 15 minutes; Summer STE (S STE) - 15 minutes.

[10] The W-23W and X-24W/E-157W Projects are scheduled to be completed in 2017.

Table 2-2: Summary of Design Cases Thermal Overloads

Subarea D Reference/Line #	2018	2023
(D-7) 455-507 West Framingham to Sherborn	N-1-1 LTE overloads > 132% N-1-1 STE overloads > 132%	N-1-1 LTE overloads > 137% N-1-1 STE overloads > 137%
(D-7) 513-507 West Framingham to Northborough Road	N-1-1 LTE overloads > 117% N-1-1 STE overloads > 117%	N-1-1 LTE overloads > 122% N-1-1 STE overloads > 122%
(D-2) E-157W Millbury to Centech	N-1-1 LTE overloads > 129% N-1-1 STE overloads > 121%	N-1-1 LTE overloads > 134% N-1-1 STE overloads > 126%
(D-2) E-157 Centech to East Main St.	N-1-1 LTE overloads > 123% N-1-1 STE overloads > 115%	N-1-1 LTE overloads > 127% N-1-1 STE overloads >119%
(D-2) E-157E East Main St. to Northborough Rd.	N-1-1 LTE overloads > 110%	N-1-1 LTE overloads > 113%
(D-1) W-23 Fitch Road to Woodside	N-1-1 LTE overloads > 176% N-1-1 STE overloads >168%	N-1-1 LTE overloads > 176% N-1-1 STE overloads > 168%
(D-3) W-23W Northborough Road to Woodside	N-1-1 LTE overloads > 178% N-1-1 STE overloads > 174%	N-1-1 LTE overloads > 178% N-1-1 STE overloads > 174%
(D-9) N-40 Fitch Road to Pratts Junction	N-1-1 LTE overloads > 108%	N-1-1 LTE overloads > 109% N-1-1 STE overloads > 101%
(D-4) X-24W Millbury to Westborough	N-1-1 LTE overloads > 178% N-1-1 STE overloads > 172%	N-1-1 LTE overloads > 179% N-1-1 STE overloads >173%
(D-4) X-24E Westborough to Northborough Rd.	N-1-1 LTE overloads > 126% N-1-1 STE overloads > 120%	N-1-1 LTE overloads > 127% N-1-1 STE overloads > 121%

The Updated Needs Assessment retirement sensitivity case results also identified numerous LTE and STE N-1-1 overloads in 2018 and 2023 on the above lines. The results are shown in Table 2-3 below.

Table 2-3: Summary of Retirement Cases Thermal Overloads

Subarea D Reference/Line #	2018	2023
(D-7) 455-507 West Framingham to Sherborn	N-1-1 LTE overloads > 122% N-1-1 STE overloads > 122%	N-1-1 LTE overloads > 128% N-1-1 STE overloads > 128%
(D-7) 513-507 West Framingham to Northborough Rd.	N-1-1 LTE overloads > 114% N-1-1 STE overloads > 114%	N-1-1 LTE overloads > 120% N-1-1 STE overloads > 120%
(D-2) E-157W Millbury to Centech	N-1-1 LTE overloads > 121% N-1-1 STE overloads > 113%	N-1-1 LTE overloads > 126% N-1-1 STE overloads > 118%
(D-2) E-157 Centech to East Main St.	N-1-1 LTE overloads > 121% N-1-1 STE overloads> 113%	N-1-1 LTE overloads > 126% N-1-1 STE overloads>118%
(D-2) E-157E East Main St. to Northborough Rd.	N-1-1 LTE overloads > 109%	N-1-1 LTE overloads > 113%
(D-1) W-23 Fitch Road to Woodside	N-1-1 LTE overloads > 173% N-1-1 STE overloads >165%	N-1-1 LTE overloads > 173% N-1-1 STE overloads > 165%
(D-3) W-23W Northborough Road to Woodside	N-1-1 LTE overloads > 174% N-1-1 STE overloads > 170%	N-1-1 LTE overloads > 174% N-1-1 STE overloads > 170%
(D-9) N-40 Fitch Road to Pratts Junction	N-1-1 LTE overloads > 105%	N-1-1 LTE overloads > 106%
(D-4) X-24W Millbury to Westborough	N-1-1 LTE overloads > 178% N-1-1 STE overloads > 172%	N-1-1 LTE overloads > 179% N-1-1 LTE overloads> 173%
(D-4) X-24E Westborough to Northborough Rd.	N-1-1 LTE overloads > 126% N-1-1 STE overloads > 120%	N-1-1 LTE overloads > 127% N-1-1 STE overloads > 121%

In addition, the potential for low voltage was also identified on many of the 69-kV buses in the area. Voltages at substations are typically required to be maintained between 0.95 per unit ("p.u.") and 1.05 p.u. Voltage collapse is defined in the ISO-NE Transmission Planning Guide as the "situation which results in a progressive decrease of voltage to unacceptable low levels, levels at which power transfers become infeasible. Voltage collapse usually leads to a black-out." As shown in Table 2-4, under certain contingencies in the Marlborough Subarea, voltages well below 0.95 p.u. would occur, indicating a significant risk of voltage collapse that would result in over 400 MW of load lost in 2023, affecting the Marlborough Subarea.

Table 2-4: Summary of Design Cases Low Voltage Results

Substation Name, Location	2018 Voltage (p.u.)	2023 Voltage (p.u.)
Woodside, Northborough	.74	.73
Northborough Road, Southborough	.70	.69
MWRA, Southborough	.71	.70
S. Marlboro, Marlborough	.70	.69
Marlboro, Marlborough	.70	.68
North Grafton, Grafton	.80	.79
Westborough, Westborough	.73	.71

Table 2-5 below shows the forecasted extreme summer peak loads in MW at the stations serving the municipalities impacted by the voltage collapse based on the 2013 CELT Report, minus the energy efficiency ("EE") forecast and passive DR. An N-1-1 event resulting in voltage collapse would result in loss of service to the area served from these substations.

Table 2-5: Forecasted Summer Peak Loads (MW)
(minus EE forecast and passive DR)

Station, Location	2018 (MW)	2023 (MW)
West Framingham, Framingham	50	52
Northborough Road, Southborough	60	61
South Marlboro, Marlborough	30	31
Marlboro, Marlborough	44	45
North Marlboro, Marlborough	30	31
Hudson, Hudson	74	76
East Main Street, Westborough	61	63
Westborough, Westborough	49	50
North Grafton, Grafton	29	29
Woodside, Northborough	35	36
Centech, Shrewsbury	22	23
Total	487	502

Eversource conducted additional analysis using the 2016 CELT Report (as discussed in Section 2.7), including the updated energy efficiency and solar PV forecast, to verify that the need for the Project remains. The analysis verified that the Project is still needed to resolve the line overloads, low voltage and voltage collapse needs.

2.6.2 Year of Need

The Updated Needs Assessment determined the year of need for each transmission element that was found to be exposed to potential overloads under contingency conditions. Additionally, the specific reliability violations for each element that could be overloaded are summarized by study year and categorized as either design or retirement sensitivity violations. The year-of-need assessment was based on evaluation of the year and load level at which elements first fail to meet criteria under N-1 or N-1-1 contingency conditions. The year of need is based on the Boston RSP Subarea loads. The assessment found that the lines addressed by the Project first fail to meet reliability requirements under N-1-1 conditions prior to 2013. Thus, the Updated Needs Assessment demonstrates that there is an immediate need for transmission system upgrades in the Marlborough Subarea in order to continue to reliably serve customers.

2.7 Eversource Updated Project Needs Analysis

To confirm that the need for the Project remains, Eversource conducted an analysis for the year 2023 using the 2016 CELT Report, including the updated energy efficiency and solar PV forecast ("EV Updated Analysis"). The 2016 CELT Report incorporates the results of FCA # 10.[11] The EV Updated Analysis verified that the Project is still needed to resolve the line overloads, low voltage and voltage collapse issues that were identified in the Updated Needs Assessment. The study models reflected the summer peak 90/10 load conditions outlined in Table 2-6.

Table 2-6: Summer Peak 90/10 Load Conditions Based on 2016 CELT Report

Year	New England Peak Load	Boston Peak Load
2023	33,777 MW	7,094 MW

[11] FCA #10 covers the capacity commitment period for 2019-2020.

The EV Updated Analysis utilized the results of the most recently available FCA, FCA #10. Table 2-7 below shows the generators with contract supply obligation ("CSO") in FCA #10 but not in FCA #7, totaling 22 MW. Table 2-8 below shows the difference between generators cleared in FCA #7 and FCA #10, totaling -6.5 MW.[12]

The major Greater Boston area generating units total 2,780 MW (refer to Table 2-1 of Appendix 2-1). The 22 MW generation addition amounts to 0.79% of that total.

The 2023 Boston RSP Subarea load is 7,094 MW. The addition of this generation is just 0.31% of the total 2023 load. Thus, the addition of this generation does not have an impact on Subarea D or the need for the Project.

Table 2-7: Additional Generators in FCA #10 in NEMA with Supply Obligations

Generator	From FCA #10 (MW)
Amesbury	2.31
Ipswich Wind II	0.15
Leominster – South St.	1.41
True North	2.59
LSRHS	0.42
M Street Jet	44.43[13]
MAT-2 (MATEP Combined Cycle)	13.85
Subtotal (MW)	22.0[14]

[12] Data obtained from http://www.iso-ne.com/static-assets/documents/2016/02/fca_10_obligations xlsx and http://www.iso-ne.com/static-assets/documents/markets/othrmkts_data/fcm/cal_results/ccp17/fca17/fca_7_results xlsx

[13] Although the M Street Jet did not have a CSO in FCA 7, it was inadvertently modeled in the 2015 Needs Assessment at its qualified capacity ("QC") of 43.16 MW because it had an obligation in FCA #6.

[14] Only the difference between QCs of the M Street Jet unit (44.43 MW – 43.16 MW= 1.27 MW) in the two FCAs is included in the sub-total in Table 1 above.

Table 2-8: Difference in Qualified Capacities of Generators Between FCA #7 and FCA #10

Generator	FCA #7 (MW)	FCA #10 (MW)	Difference (MW)
Resco Saugus	32.28	30.11	-2.17
Mystic 7	577.59	570.80	-6.79
MATEP (Diesel)	18.91	17.12	-1.79
West Medway Jet 2	41.90	39.85	-2.05
Kendall Ct	154.30	153.53	-0.76
Framingham Jet 1	10.89	10.15	-0.75
Ipswich Diesels	10.24	9.50	-0.75
Covanta Haverhill Landfill Gas Engine	1.38	1.24	-0.14
Necco Cogeneration Facility	5.00	4.87	-0.13
Railroad Street Revere Pv	0.22	0.25	0.02
Ipswich Wind Farm 1	0.13	0.15	0.02
Wheelabrator North Andover	29.52	29.72	0.20
Ogden-Martin 1	38.90	39.55	0.65
Framingham Jet 2	11.00	10.72	-0.29
Mystic Jet	7.40	8.59	1.19
Waters River Jet 2	30.51	31.75	1.24
Mystic 9	702.53	709.68	7.14
Mystic 8	690.92	703.32	12.41
Methuen Hydro	0.02	0	-0.02
MATEP (Combined Cycle)	43.25	42.52	-0.73
Total Difference in Generation (MW)			**-6.5**

The changes in generation and associated impact to Subarea D reflected in the above tables are insignificant and hence, do not affect the need for the Project.

The EV Updated Analysis was conducted with all the other Greater Boston – New Hampshire Solution Projects in service except for the Project. The remaining N-1-1 overloads are shown in Table 2-9 below.

Table 2-9: Summary of 2016 CELT Cases Thermal Overloads

Subarea D Reference/Line #	2023
(D-2) E-157W Millbury to Centech	N-1-1 LTE overloads > 105%
D-1) W-23 Fitch Road to Woodside	N-1-1 LTE overloads > 146% N-1-1 STE overloads > 138%
(D-3) W-23W Northborough Road - Woodside	N-1-1 LTE overloads > 132% N-1-1 STE overloads > 128%
(D-4) X-24W Millbury to Westborough	N-1-1 LTE overloads > 170% N-1-1 STE overloads > 164%
(D-4) X-24E Westborough to Northborough Road	N-1-1 LTE overloads > 121% N-1-1 STE overloads > 115%

The EV Updated Analysis also included an N-1-1 voltage analysis. The low voltage results, which confirm the low voltage issues in the Marlborough Subarea identified in the Updated Needs Assessment, are shown in Table 2-10.

Table 2-10: Summary of 2016 CELT Cases Low Voltage Results (p.u.)

Substation Name, Location	2023
Woodside, Northborough	.80
Northborough Road (69kV), Southborough	.77
Northborough Road (115kV), Southborough	.75
MWRA, Southborough	.78
North Grafton, Grafton	.86
Westborough, Westborough	.80
West Framingham, Framingham	.75
Hudson, Hudson	.74
East Main St., Westborough	.78
North Marlboro, Marlborough	.75
South Marlboro, Marlborough	.76
Marlboro, Marlborough	.76

Table 2-11 below shows the forecasted extreme summer peak loads in MW at the stations serving the municipalities impacted by the voltage collapse based on the 2016 CELT Report, minus the EE forecast, PV forecast and passive demand response. Without the Project, an N-1-1 event resulting in voltage collapse would result in loss of service to the area served from these substations. The loss of load could potentially disconnect 419 MW of load in 2023. Such an outage could affect approximately 80,000 customers in the Marlborough Subarea.

Table 2-11: Forecasted Summer Peak Loads (MW) based on 2016 CELT (minus EE forecast, passive DR and PV forecast)

Station, Location	2023 (MW)
West Framingham, Framingham	49
Northborough Road, Southborough	41
South Marlboro, Marlborough	26
Marlboro, Marlborough	59
North Marlboro, Marlborough	25
Hudson, Hudson	62
East Main Street, Westborough	32
Westborough, Westborough	50
North Grafton, Grafton	29
Woodside, Northborough	29
Centech, Shrewsbury	17
Total	419

2.8 Summary of Project Need

The need for the Project is based upon conditions studied and analyses performed by ISO-NE and the Working Group, with the results published in the Updated Needs Assessment. As described above, the Updated Needs Assessment presents an evaluation of Subarea D which includes transmission facilities that interconnect substations in the Sudbury, Marlborough and Northborough area (Figure 2-1) and determined that a large portion of the Marlborough Subarea could not be reliably served in the event of N-1-1 contingencies. Specifically, the Working Group identified reliability issues in the Marlborough Subarea including potential thermal overloads and low voltage situations on the transmission system and high level loss of load due to area voltage collapse. The need for the Project is immediate as the potential for low voltage, voltage collapse and thermal overloads occur at pre-2013 load levels. The Company's recent analysis utilizing the current 2016 CELT Report confirmed the need for the Project. The loss of load could potentially disconnect 419 MW of load in 2023. Such an outage could affect approximately 80,000 customers in the Marlborough Subarea.

With the identified needs described above as a starting point, Eversource undertook an analysis of Project Alternatives to address the overload consequences and increase reliability, as fully described in Section 3.

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3.0 PROJECT ALTERNATIVES

3.1 Introduction

This Section describes the processes used to identify and evaluate alternative means of addressing the identified electric system reliability need in the Marlborough Subarea. Any viable alternative solution must address the needs outlined in Section 2, specifically, to resolve thermal overloads on the 115-kV and 69-kV lines, rectify the low-voltage violations on the transmission system, and eliminate the exposure of a loss of electric service for customers in the Marlborough Subarea. In its review of potential solutions, the Company evaluated a "No-Build Alternative," two transmission alternatives, and non-transmission alternatives such as incremental energy efficiency, demand response, energy storage and new generation.

After completing the 2010 Greater Boston Area Transmission Needs Assessment, the Working Group conducted a solution study to identify solutions to address the various needs. The alternatives analysis for the Marlborough Subarea was presented to the Planning Advisory Committee ("PAC") in January, 2012 in a presentation entitled Greater Boston Study Needs Assessment/Solutions Study Status Update (Appendix 3-1, at 21) as part of the work performed to select the Greater Boston Solutions. The Greater Boston Preferred Solution, presented to the PAC in March, 2012, identified the selection of a new, 115-kV transmission line between the Sudbury and Hudson Substations as the preferred solution to address the needs in the Marlborough Subarea (Appendix 3-2 at 27). After the Updated Needs Assessment was issued in January, 2015, the Working Group then conducted a transmission solution study analysis based on the Updated Needs Assessment. This resulted in the August 12, 2015 issuance of the Greater Boston Area Transmission Solutions Study ("Solutions Study"), provided in Appendix 3-3.[15] Once again, a new, 115-kV transmission line between the Sudbury and Hudson Substations was selected as the preferred solution to address the Marlborough Subarea needs (Appendix 3-3 at 63, 107).[16] The Updated Needs

[15] Appendices 3-1, 3-2, and 3-3 have been redacted for the public record in order to avoid disclosure of Critical Energy Infrastructure Information ("CEII"). Unredacted copies have been provided to the Siting Board under seal and subject to a Motion for Protective Treatment and will be provided to eligible parties who execute a CEII Non-Disclosure Agreement.

[16] The New Line between the Sudbury and Hudson Substations could either be constructed underground or primarily overhead. Although the Working Group conducted its modeling based on an overhead design, the Company has confirmed that underground construction provides an equally beneficial solution to the needs. As discussed in Sections 4 and 5 below, the Company determined that underground construction will best balance minimization of impacts at a reasonable cost and accordingly selected that as its preferred route for the New Line.

Assessment and the Solutions Study together provide the necessary evaluations and determinations required under the NERC TPL standard.

The Company's further evaluation of project alternatives confirmed that the Project is the best alternative to meet the identified need, with minimal impact to the environment, with a greater degree of reliability, and at the lowest cost possible.

3.2 No Build Alternative

Under the No-Build Alternative, no improvements would be made to the existing electric supply system serving Eversource and NEP customers in the Marlborough Subarea to address the identified needs. The Company would not pursue any new facilities or resources to address the area deficiencies, but instead would continue to rely upon the existing system configuration. This approach was dismissed from further consideration because it would not address the identified transmission reliability needs, which exist at current load levels; it would not correct the violations of national (NERC) and regional (NPCC and ISO-NE) reliability standards; and the region would continue to be at risk for voltage collapse resulting in loss of more than 400 MW of load.

3.3 Transmission Alternatives

The ISO-NE led Working Group evaluated two transmission alternatives to address the needs in the Marlborough Subarea as part of the Greater Boston Solution Study, the proposed Project and the NEP Alternative. The proposed Project, including the improvements at the Hudson Substation,[17] is superior to the NEP Alternative. Both alternatives are described in greater detail below.

3.3.1 Transmission Alternative 1 – Preferred Transmission Alternative

The preferred transmission alternative, which includes the Project, would involve the construction of the New Line from Sudbury Substation to the Hudson Substation (approximately 9.0 miles.).[18] In addition to the New Line, the Company would also undertake improvements at the Sudbury Substation including the addition of two new 115-kV breakers and a 115-kV shunt reactor. Further, HLPD would install three new 115-kV

[17] Although the Hudson Substation upgrades are not part of the Project for which the Company is seeking approval, the work is a component of the Transmission Alternative 1 solution.

[18] The Project also includes the refurbishment of NEP's X-24 69 kV line from Millbury – Northborough Road, which was completed by NEP in 2015 and consisted of replacing structures and line hardware.

breakers at Hudson Substation to support the New Line, and make other related modifications, including reconfiguring the existing transmission lines to a ring bus design.

Figure 3-1 provides an overview of the New Line component of the preferred transmission alternative.

The estimated conceptual level (-25%/+50%) cost (in 2018 dollars) of the Eversource portion of Transmission Alternative 1 is approximately $91.0 million. The total estimated Transmission Alternative 1 cost is approximately $96.0 million, including the New Line and upgrades to both the Sudbury and Hudson Substations.[19, 20]

3.3.2 Transmission Alternative 2

Transmission Alternative 2 is the NEP Alternative, which consists of a set of projects detailed in the document entitled, "National Grid's Alternative to the Construction of Eversource's Proposed Sudbury – Hudson Line," attached as Appendix 3-4).[21] This alternative would include the following components: (1) converting NEP Line X-24 from 69-kV to 115-kV from NEP's Millbury #5 Substation in Millbury, to NEP's Northborough Road Substation in Southborough (14.5 miles); (2) reconductoring the 115-kV Line 455-507 from Eversource's West Framingham Substation to Eversource's Sherborn Substation (5.75 miles; including upgrades to West Framingham Substation and Sherborn Substation); and (3) reconductoring NEP's 115-kV Line E-157W from NEP's Millbury #2 Substation to Shrewsbury Electric and Cable Operations' ("SELCO") Centech Substation (5.8 miles).[22]

To complete the voltage conversion of the recently refurbished NEP Line X-24 from 69-kV to 115-kV, some 69-kV equipment at five substations would need to be upgraded to 115-kV as follows:

- Millbury #2 Substation (115-kV) – Relocate the existing V-174 Line and add a position for the X-24 Line, which would now terminate at Millbury #2.

[19] The cost estimate set forth in the Solutions Study and PAC presentations (Appendices 3-1, 3-2. and 3-3) was based on overhead construction of the New Line.

[20] Although the Hudson Substation upgrades are not part of the Project, the Company has included the cost for this work in order to compare alternative solutions to meet the identified need.

[21] Appendix 3-4 has been redacted for the public record in order to avoid disclosure of Critical Energy Infrastructure Information ("CEII"). Unredacted copies have been provided to the Siting Board under seal and subject to a Motion for Protective Treatment and will be provided to eligible parties who execute a CEII Non-Disclosure Agreement.

[22] Line X-24 and Line E-157W are co-located within the same ROW for approximately 2.8 miles between Centech Substation and the Millbury Substations.

- Millbury #5 Substation – Remove the 69-kV X24W Line and change the relay settings.
- North Grafton Substation – Redesign the substation for 115-kV.
- Westborough Substation – Upgrade all 69-kV equipment to 115-kV.
- Northborough Rd Substation – Expand the existing 115-kV yard and relocate Line X-24 to it.

Figure 3-2 provides an overview map of Transmission Alternative 2, the NEP Alternative. The conceptual level (-25%/+50%) cost of Alternative 2, as updated by NEP for Eversource in August 2016, is approximately $103.1 million. In addition, the Eversource component of Alternative 2 (reconductoring the 115-kV Line 455-507 from the West Framingham Substation to the Sherborn Substation and upgrading those stations) would cost an estimated $13.0 million. Thus, the total conceptual level cost estimate of Alternative 2 is approximately $116.1 million.

3.3.3 Transmission Alternatives Comparison

A comparison of Transmission Alternative 1 and Transmission Alternative 2 is presented below.

3.3.3.1 Cost

The total estimated cost of the Transmission Alternative 1 is approximately $96.0 million. The total estimated cost of Transmission Alternative 2 is approximately $116.1 million, roughly $20.1 million more than Transmission Alternative 1. Accordingly, Transmission Alternative 1 is the superior transmission alternative based on cost.

In addition to being the lower cost alternative to Transmission Alternative 2 and having less environmental impact than Transmission Alternative 2 (as discussed below), Transmission Alternative 1 provides an important community and financial benefit to the Commonwealth and the local municipalities through the Company's partnership with DCR to advance the proposed Mass Central Rail Trail, saving Commonwealth funds to construct the multi-use trail.

3.3.3.2 Reliability

Both transmission alternatives would meet the identified need. However, Transmission Alternative 1 provides an additional local reliability benefit to a population of approximately 27,000 (in the towns of Hudson and Stow) that are served by HLPD, the Town of Hudson's

municipal electric department. HLPD's Hudson Substation is currently served by two radial transmission lines on common towers. Transmission Alternative 1 would bring a third, geographically separate transmission line into Hudson Substation as well as the Marlborough Subarea. It would allow the Hudson Substation to remain in service following the loss of a double-circuit tower (N-1 contingency) carrying the two existing transmission lines between the Northborough Road and Hudson Substations. Additionally, the proposed reconfiguration to a ring bus design at Hudson Substation, with alternating transmission line and load power transformers, would provide additional reliability to the Hudson Substation as compared to the existing radial system, which would remain in place with Transmission Alternative 2. Also, the X-24 Line shares a ROW with the E-157W Line for some of its length. Transmission Alternative 1 would provide a new transmission source into the area on a new ROW, further diversifying the supply for the Marlborough Subarea and preventing the loss of two of the 115-kV sources of supply into the area under the extreme contingency of loss of all lines within a ROW. Finally, the X-24 Line provides a back up to SELCO's electric system. If the line is modified to 115-kV as part of the NEP Alternative, SELCO could lose a source of emergency back-up.

To summarize, the Project is superior to the NEP Alternative in its ability to bring greater reliability to the Marlborough Subarea. Additionally, it provides an important local reliability benefit to the towns of Hudson and Stow and, unlike Transmission Alternative 2, does not adversely affect a backup supply to SELCO.

3.3.3.3 Environmental Impacts

Transmission Alternative 1 would be approximately 9.0 miles in length, with upgrades at two existing substation facilities, while Transmission Alternative 2 would involve 26.1 miles of transmission line work, as well as proposed upgrades at seven substations.

Table 3-1 presents a desktop analysis of key environmental elements for both transmission alternatives.

As shown in Table 3-1, Transmission Alternative 1 has less potential environmental impacts for ten of the thirteen environmental parameters that were compared. As compared to Transmission Alternative 1, Transmission Alternative 2 would result in construction along approximately 17.1 more miles; cross 56 more roadways/highways; impact approximately 134 more residential properties; cross 30 more waterbodies; traverse 82.3 more acres of mapped Massachusetts Department of Environmental Protection ("MassDEP") wetlands; and potentially impact 0.8 more miles of cultural resource areas, and 21 more cultural resource points, as identified in the Massachusetts Historical Commission ("MHC") Historic Inventory.

In addition, Transmission Alternative 2 would be located within 5.6 acres of an Area of Critical Environmental Concern, 70.9 acres of watersheds of Outstanding Resource Waters, and traverse 4.9 miles of Environmental Justice Areas. Transmission Alternative 1 does not cross any Area of Critical Environmental Concern, Outstanding Resource Water Crossings or Environmental Justice Areas.

While Transmission Alternative 1 would result in significantly more tree clearing and traverse approximately 6.8 more acres of mapped Natural Heritage and Endangered Species Program ("NHESP") Priority and Estimated Habitat for state-listed rare species and is adjacent to approximately 0.8 more miles of conservation lands than Transmission Alternative 2, it makes use of an existing, inactive MBTA ROW and the impacts from Transmission Alternative 1 would be similar to those associated with the construction and operation of the planned multi-use MCRT proposed by DCR to benefit the community. As a result, assuming the rail trail would be constructed in any event, the incremental impact of the construction of Transmission Alternative 1 is significantly less.

Based on this comparison, the Company concluded that Transmission Alternative 1is superior to Transmission Alternative 2 with regard to the potential for environmental impact.

Table 3-1: Transmission Alternatives Potential Environmental Impact Comparison Summary

	Transmission Alternative 1	Transmission Alternative 2
Municipalities	Sudbury, Marlborough, Stow, Hudson	Millbury, Grafton, Shrewsbury, Westborough, Southborough, Framingham, Sherborn
Total Miles	9.0	26.1
Number Highway/Road Crossings	10	66
Residential (total parcels adjacent to ROW limits)[23]	156	290
Number of Water Body Crossings	11	41
MassDEP Wetlands in ROW (acres)	7.3	89.6
NHESP Priority/Estimated Habitat in ROW (acres)	13.2	6.4
Area of Critical Environmental Concern in ROW(acres)	0	5.6
Mapped Outstanding Resource Water Areas (acres)	0	70.9
Tree Clearing (acres)	26.7	0
Adjacent Conservation Land (miles)	3.7	2.9
Cultural Resource (MHC Point)[24]	23	44
Cultural Resource (MHC Areas; miles)[25]	1.7	2.5
Environmental Justice Areas Crossed (miles)	0	4.9

3.3.3.4 Conclusion on Transmission Alternatives

As described in the previous sections, Transmission Alternative 1 is the transmission solution that best meets the identified need and reflects a balancing of established environmental criteria, cost, and reliability. Transmission Alternative 1 is $20.1 million less costly than Transmission Alternative 2, offers a more robust solution that provides an additional local reliability benefit and a geographically separate transmission line to the Marlborough Subarea, and balances potential environmental impacts with community benefits. The community also benefits by advancing the vision of DCR for the proposed MCRT multi-use path, saving Commonwealth funds to construct the multi-use trail project and reducing the overall cumulative environmental impact.

[23] Residential Land Uses along each route include the number of parcels immediately adjacent, as per the MassGIS Datalayer (Level 3 Assessor's Parcel Mapping, June 2016).

[24] MHC Points identify the locations of buildings, burial grounds, structures, and objects (e.g., statues, monuments, walls) as per the MassGIS Datalayer (MHC Historic Inventory, July 2016).

[25] MHC Areas identify protected areas and districts as per the MassGIS Datalayer (MHC Historic Inventory, July 2016).

3.4 Description and Assessment of Non-Transmission Alternatives

The Company engaged London Economics International ("LEI") to assess the feasibility and costs of using a non-transmission alternative ("NTA") in lieu of the Project. LEI's assumptions, methodology, and findings are discussed briefly below, and are detailed in a report titled, "Analysis of Non-Transmission Alternatives to the Sudbury-Hudson Project: Identification of Feasible NTA Technologies and Levelized Costs" (the "LEI Report"). The LEI Report is attached as Appendix 3-5.

As input to the LEI Report, the Company identified the specific necessary energy injections and their locations within the transmission system that would be needed in order to mitigate contingency transmission overloads absent construction of the Project. Using this information, LEI assessed the ability of various non-transmission technologies to address contingency conditions at each location. LEI identified several NTA technologies that hypothetically could meet the technical requirements (capacity, availability, and response time) to defer construction of the Project. LEI also considered a number of practical limitations to developing NTAs at the specified locations, including the necessary development time, land availability, and existence of accommodating infrastructure.

Finally, LEI evaluated the likely costs of several possible NTAs under different scenarios. For the cost analysis, LEI identified the gross and net levelized cost of entry ("LCOE") for each NTA technology, and used this information to calculate the annual cost to ratepayers of deferring construction of the Project using these technologies. LEI determined that the total net direct cost to ratepayers of the least cost, hypothetical NTA solution would be approximately $23 million annually (the estimated levelized annual revenue requirement), under reasonable assumptions regarding future revenues from the ISO-NE energy and capacity markets, as well as from the sale of renewable energy credits ("RECs"). In comparison, the estimated levelized annual revenue requirement for the Project is approximately $11.8 million**.** In addition to the increased cost of an NTA solution, implementation would likely be infeasible due to the myriad of practical challenges identified in the LEI report.

3.4.1 Methodology

The Company conducted an analysis to determine the amount of energy injection required (in terms of MW) and location of those energy requirements (new resources) to address thermal overloads in the Marlborough Subarea if construction of the Project were to be deferred. This assessment considered the reliability needs for the projected 2023 transmission system serving the Greater Boston study area under N-1 and N-1-1 contingency conditions. The analysis identified the specific capacity of resources and their specific locations within the transmission

system that would be needed to mitigate transmission overloads seen on the 2023 transmission system absent construction of the Project.

The analysis was conducted using the PowerGEM Transmission Analysis and Reliability Assessment ("TARA") application - the same analytical tool used in the Solutions Study. TARA has the ability to optimize the dispatch of a multitude of generating resources across a defined area to mitigate transmission overloads that are the consequence of single contingency (N-1) or multiple contingency (N-1-1) events.

The optimization process attempts to identify the minimum level of resources required to address identified overloads. TARA first finds a helpful location to place a resource and then continues to increase the dispatch level of the resource until either the maximum output is reached, or additional increases are no longer helpful. The software then proceeds to the next most helpful location and continues the process until all overloads have been mitigated and/or all possible helpful locations have been used. The Company's analysis showed that the minimum level of resources necessary to resolve the transmission overloads and low voltage problems addressed by the Project would consist of 237 MW (at 69-kV) at Northborough Road Substation, and 27 MW (at 69-kV) at Woodside Substation.

3.4.2 Feasibility and Practicality Assessment

The initial step in LEI's analysis was to assess the feasibility and practicality of NTAs at each location by considering a broad range of possible NTA technologies, including:

- Combined-cycle gas turbines;
- Simple cycle gas turbines (dual-fuel jet engines, aeroderivative combustion turbines, and large frame combustion turbines);
- Utility-scale solar, with and without storage;
- Distribution-scale solar with and without storage;
- Slow and fast-discharge battery storage;
- Active demand response; and
- Passive demand response (energy efficiency).

LEI then evaluated each technology to determine which are technically feasible to meet the identified need. A technically feasible NTA technology is defined as one that is independently capable of providing energy to meet the energy injection requirements, performance, and

response time at a particular location. In the evaluation, LEI considered NTA technologies independently, as well as in combination, to meet the need.

First, LEI considered the size (i.e., capability) of the NTA required at each location, and evaluated whether different NTA technologies were suitable given the size of the injection required relative to the minimum (and maximum) capacity of each NTA technology. For example, a conventional combined-cycle facility with a minimum size of over 250 MW would not be suitable for Woodside Substation, which has a much smaller NTA requirement. Additionally, for active and passive demand response technologies, LEI considered whether sufficient peak load exists at each location to make either technology a technically feasible NTA. At both locations, LEI determined that a demand response solution was not technically feasible because even large reductions in peak loads at both substations would be insufficient to resolve the reliability needs that the Project is designed to address.

Then, LEI considered whether a specific technology has the operating characteristics (performance and response time) needed to respond to contingency conditions at a specific location. If a resource is to be used to respond to an N-1-1 contingency, it must be able to provide energy within 30 minutes of the occurrence of the first contingency. The resource must then continue to operate until the failed transmission system element is repaired or until loads sufficiently drop – at a minimum, 12 hours. For example, solar photovoltaic ("PV") technologies are not dispatchable unless paired with energy storage, and thus solar PV alone is not a technically feasible solution.

At the conclusion of this analysis, LEI identified one or more technically feasible NTA technologies for each location. LEI next considered whether practical challenges would prevent NTAs from being developed at the necessary locations. These challenges include the necessary development time, land requirements and infrastructure requirements.

Development Time

Since the need for the Project is pre-2013, in order to provide a reliability benefit comparable to the Project, any NTA would need to enter service by 2019 (the planned in-service year of the Project). Additionally, the NTA would likely need to be developed by a third party, as electric distribution companies are generally prohibited from direct ownership of generation assets under the Commonwealth's deregulation of the electric utility industry (Electric Utility Restructuring Act of 1997). To date, no generation project of sufficient size has been proposed by any generation developer at the necessary locations. Development of a generation project would include, among others things, identification of an appropriate site, completion of permitting and siting processes, completion of interconnection studies with ISO-NE,

compliance with environmental regulations, securing an available fuel supply and contracting with equipment suppliers and construction vendors. All of these requirements make it impractical to develop a generation project within the same time frame as the Project.

Land Requirements

The NTAs under consideration would need to be developed in the vicinity of Northborough Road and Woodside Substations and would require appropriate parcels of land in these areas. Each technology has different land requirements. For example, the availability of a large amount of unencumbered land is a prerequisite for developing a large installation of solar PV and energy storage and, as a practical matter, land compatible with industrial uses would be necessary for a gas-fired generator. The areas surrounding the substations are primarily residential areas and suburban settings, and it is highly unlikely that there are appropriate parcels of land that would be compatible with either a solar facility of sufficient size or a gas-fired generation facility.

Accommodating Infrastructure

As there are no interstate natural gas pipelines in close proximity to the identified NTA sites, a gas supply lateral to the closest pipeline would need to be constructed for any new gas-fired generation. In addition, a combined-cycle generation facility would require access to water for cooling. Dual fuel generators might also require a backup supply (such as a storage tank for fuel oil onsite), which could increase the costs and further complicate the permitting process. Finally, any generation technology (i.e., solar PV or natural gas-fired) could require additional transmission upgrades in order to interconnect with the transmission network at the specified locations.

3.4.3 Development of Least-Cost NTAs

While noting the significant practical challenges associated with development of all of the technically feasible NTA technologies, LEI assembled a set of least-cost NTAs for each location, based on the generic gross and net LCOE for each technology.[26] For each technology deemed technically feasible at a specific location, LEI multiplied the net LCOE for that technology by the capacity requirement at that location, adjusted for the performance (i.e.,

[26] While the LCOE estimates reflect projected costs and revenues that are specific to the New England region, they are "generic" in the sense the costs do not reflect site-specific challenges (such as land constraints or gas supply) that could increase installation costs at any particular site. The LCOE estimates are consistent with those used in NTA analyses for other Greater Boston projects.

expected availability) of that technology. The technology with the lowest resultant direct cost to ratepayers was then selected as the least-cost technology for that location. LEI then aggregated the total costs associated with the identified least-cost, technically feasible NTA technologies across both locations in order to determine a total direct cost to customers of an NTA solution.

Because future market revenues are inherently uncertain, LEI calculated the net LCOE for each technology under four scenarios with varying assumptions about capacity market and REC market revenues, as described in Appendix 3-5. The least-cost mix of technically feasible NTA technologies may vary depending on the assumption made on future market revenues. LEI concluded that the least cost NTA technologies would include gas-fired generation at the two locations. The minimum direct cost to ratepayers for an NTA to defer construction of the Project would be $23 million annually (for a solution with a 249 MW combined-cycle gas turbine facility and a 32 MW aeroderivative peaking facility). In comparison, the annual cost to ratepayers (levelized revenue requirement) for the Project is approximately $11.8 million.

Given the Commonwealth's commitment to clean energy and reduced greenhouse gas emissions, LEI also considered whether solar and energy storage could provide a cost effective alternative in lieu of gas-fired generation. However, LEI's analysis showed that such a project would be significantly more expensive than an NTA solution based on conventional fossil-fueled generation.

For example, even if the Company were to pursue a solar-based solution, an extremely large amount of utility-scale solar, combined with energy storage, would likely be necessary to displace the aeroderivative peaking facility at Woodside Substation. A facility of this size would be significantly larger than any proposed solar facility within the Commonwealth, and likely impossible within the vicinity of Woodside Substation, where existing land uses are primarily suburban and residential.[27] It would be similarly infeasible to use solar and energy storage to meet the much larger resource need at Northborough Road.

3.4.4 Non-Transmission Alternatives Analysis Conclusion

The practical challenges to development of generation in the Project area make technically feasible NTAs inferior alternatives to the Project. LEI's analysis shows that while these NTAs hypothetically could meet the identified need, they would be unprecedented in scope, costly,

[27] As of 11/25/2016, the largest proposed solar facility within Massachusetts in the ISO-NE Interconnection Queue is approximately 10 MW.

and difficult to implement, particularly with an in-service date comparable to that of the Project. The higher cost to customers of the least cost NTA to the Project, combined with the physical and logistical difficulties of implementing such a solution in a timely fashion, makes an NTA a substantially less desirable solution to the identified need than the Project. Additionally, no NTA is capable of providing the additional transmission supply source and increased level of reliability to HLPD customers that the Project is able to provide. Overall, the Project better meets the goal of providing a robust, secure and reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost.

3.5 Conclusion On Project Alternatives

The Company's analyses demonstrate that Transmission Alternative 1 will best address the need and improve reliability to the Marlborough Subarea. Relative to other transmission and non-transmission alternatives studied, Transmission Alternative 1will best address the thermal overloads, low voltage and potential loss of more than 400 MW of load needs identified in the Updated Needs Assessment, with the least environmental and construction impacts and at the lowest cost.

Therefore, a new 115-kV transmission line between Sudbury Substation and Hudson Substation was the solution carried forward to undergo the routing analysis presented in Section 4 of this Analysis.

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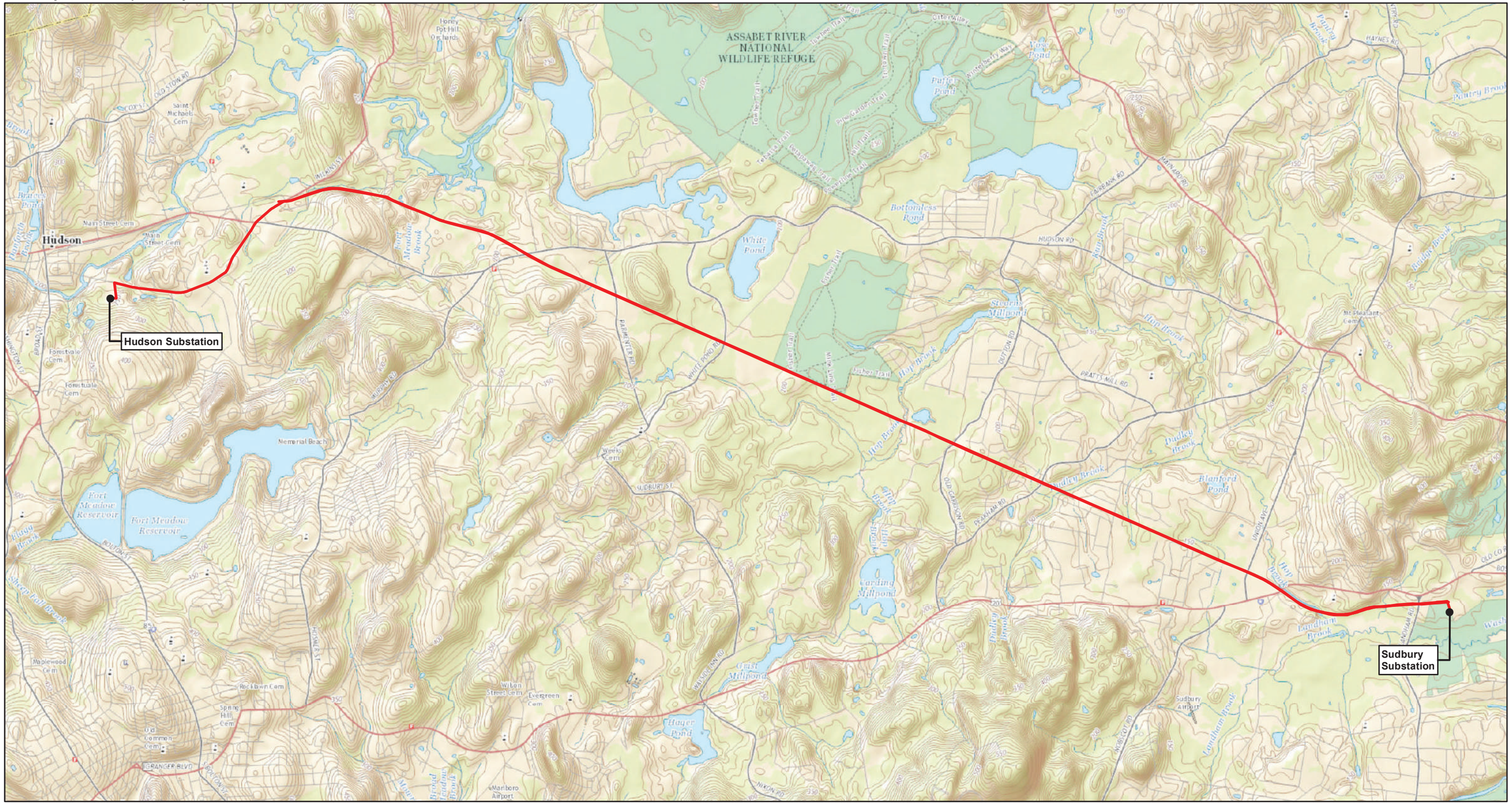


EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 3-1: Transmission Alternative 1

N

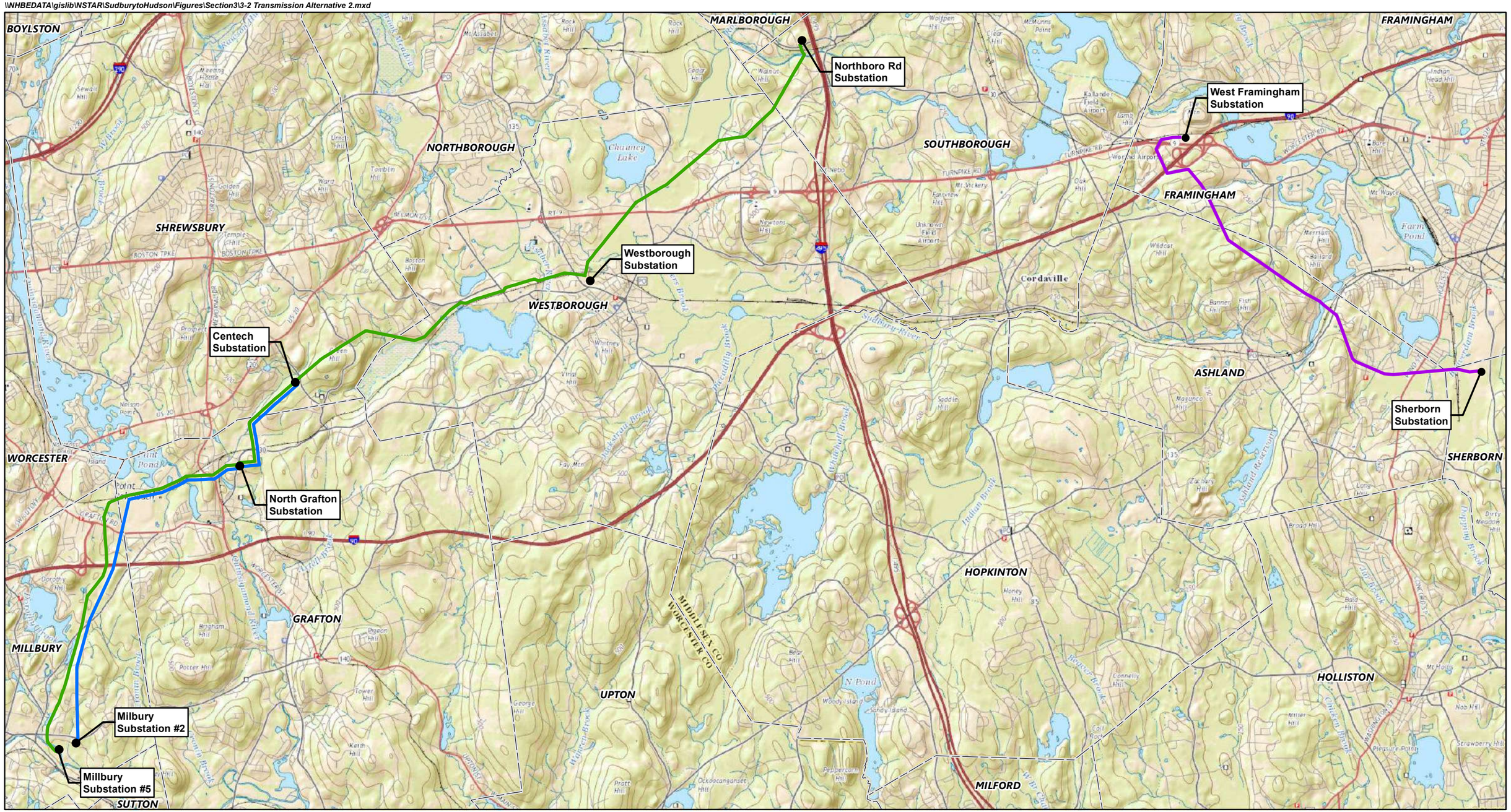
Source:
MassGIS, VHB

4/12/2017

0 3,000 6,000 Feet

vhb

\\WHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section3\3-2 Transmission Alternative 2.mxd



NEP's X-24 Line (X-24E and X-24W) from Millbury #5 Substation to Northborough Rd #317 Substation (Southborough)

NEP's E-157W line from Millbury #2 Substation to Shrewsbury Municipal's Centech Substation

Eversource's Line 455-507 from West Framingham Substation to Sherborn Substation

Municipal Boundary

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 3-2: Transmission Alternative 2

N

Source:
MassGIS, VHB

4/12/2017

0 6,000 12,000 Feet

vhb

4.0 ROUTING ANALYSIS

4.1 Introduction and Overview

As presented in Section 3, the Company's proposed solution to address the electrical system need identified in Section 2 involves the construction of a new 115-kV transmission line between the existing Eversource Sudbury Substation and HLPD's existing Hudson Substation, with associated modifications at each substation. This Section describes the process by which the Company identified and evaluated possible routes which lead to a determination of the preferred route for the Project and a Noticed Alternative Route. This Section also describes the Company's evaluation of design variations considered, resulting in the identification of a Noticed Variation for the New Line.

4.1.1 Siting Board Standard of Review

The Siting Board has a statutory mandate to implement the policies of G.L. c. 164, §§ 69J-69Q to provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost (G.L. c. 164, §§ 69H, 69J). Further, Section 69J requires the Siting Board to review alternatives to planned projects, including "other site locations." In implementing this statutory mandate, the Siting Board requires a petitioner to demonstrate that it has considered a reasonable range of practical project and siting alternatives and that the proposed facilities are sited at locations that minimize costs and environmental impacts while ensuring supply reliability. New England Power Company d/b/a National Grid, EFSB 12-1/D.P.U. 12-46/12-47, at 41 (2014) ("NEP/IRP"); New England Power Company d/b/a National Grid and Western Massachusetts Electric Company, 18 DOMSB 323, at 336 (2012) ("Hampden County"); NSTAR Electric Company, EFSB 10-2/D.P.U. 10-131/10-132, at 4 (2012) ("Lower SEMA").

To do so, an applicant must satisfy a two-pronged test and demonstrate that it has: (1) developed and applied a reasonable set of criteria to identify and evaluate alternative routes in a manner that ensures that no routes were overlooked or eliminated that, on balance, are clearly superior to the proposed route; and (2) identified at least two noticed sites or routes with some measure of geographic diversity. (NEP/IRP, at 41; Hampden County, at 366; Lower SEMA, at 53-54).

The following subsections describe the route selection process developed by the Company in accordance with the above-cited requirements.

4.1.2 Routing Analysis Overview

The Company's methodology for siting new electric transmission lines, referred to as a "routing analysis," is developed as an adaptive and iterative approach to identify and evaluate possible routes for the proposed new transmission line in accordance with requirements described above. The routing analysis identified the route for the Project as the option that best balances minimization of environmental impacts (including developed and natural environment impacts and constructability constraints), reliability, and cost. The analysis also identified a Noticed Variation to the Project as well as a Noticed Alternative Route that provides a geographically distinct alternative to the Project, while also striking a balance of the aforementioned factors.

In initiating the routing analysis, the Company first established routing objectives (described in more detail in the following subsections). The routing analysis methodology presented herein uses previously established approaches for evaluating electric transmission routing options and is a standard process implemented by the Company and historically accepted by the DPU.

For this case, the Company also studied three different design variations to the physical configuration of the proposed new line to supplement the standard evaluation of potential alternative route options. Specifically, the Company considered a primarily overhead transmission line design and a primarily underground transmission line design along the inactive railroad corridor owned by the MBTA (sometimes referred to herein as MBTA ROW), where some of the possible routes are located. Given that design variations along the MBTA ROW pose different potential impacts to developed and natural environmental features and have varying associated costs, the Company included these design variations in the following routing analysis.

4.1.3 Routing Analysis Objectives

The objective of the Company's routing analysis was to identify a cost-effective and technically feasible design that achieved the required transmission system reliability improvements by interconnecting the specified substations. Additional consideration was given to the potential impacts the candidate solutions may have on the developed and natural environment. These objectives included:

- Comply with all applicable statutory requirements, regulations, and state and federal siting agency policies
- Achieve a reliable, operable, and cost-effective solution
- Maximize the reasonable, practical, and feasible use of existing linear corridors (e.g., transmission line, highway, railroad, or pipeline ROWs)
- Minimize/avoid the need to acquire property rights
- Maximize the potential for direct routing options over circuitous routes

4.1.4 Routing Analysis Methodology

Consistent with the Company's standard methodology, the routing analysis for the new line consisted of the following steps, discussed in more detail in subsequent sections:

- **Identification of Project Study Area**: Focused the routing analysis within the region of the existing Sudbury and Hudson Substations.
- **Development of Universe of Routes**: Identified numerous routing options, including utilization of existing linear corridors within the Project Study Area to develop a set of potential routes.
- **Identification of Candidate Routes**: Identified and described the viable routes from the Universe of Routes and associated design variations (collectively referred to herein as "Candidate Routes") that met the need for the Project and were consistent with the objectives of the Company's routing analysis.
- **Environmental Analysis**: Compared the potential for environmental (developed and natural) impacts and constructability constraints along the Candidate Routes.
- **Cost Analysis**: Compared the estimated costs for the Candidate Routes.
- **Reliability Analysis**: Compared the reliability of the Candidate Routes.
- **Selection of Routes**: Evaluated the results of the above analyses and identified the Company's preferred Project, a Noticed Variation and a Noticed Alternative Route that best balance reliability, minimization of environmental impacts, constructability constraints, and cost.

4.1.5 Summary of Public Input

Company representatives met with federal, State, and municipal officials, residents/business owners, and other stakeholders to discuss the Universe of Routes under consideration for the new line and to obtain input on these routing options. This process began in January 2014 and, as of the date of this filing, has included more than 48 meetings (see Section 1 for a detailed list of the meetings). The following table summarizes the meetings and the input provided by the stakeholders that played a significant role in the development and content of the routing analysis. While the Company received valuable input at all meetings, the focus of Table 4-1 is to identify how stakeholder input helped shape the Company's routing analysis.[28]

[28] This table is an overview and does not provide details regarding all items discussed at the meetings listed. In addition, this table may have omitted additional meetings where some of the same routing related topics were discussed and/or conveyed to the Company.

Table 4-1: Stakeholder Input Used to Develop/Supplement Routing Analysis

Date	Participants	Input Received	Modifications Made to Analysis
January 21, 2015	Sudbury and Hudson DPW and Engineering	• Feedback on public streets being considered for routes	• Used information to screen routes and added some additional streets for consideration as potential routes
December 14, 2015	Marlborough City Officials	• Potential for traffic congestion should be a key factor in the analysis	• Increased weight of traffic criterion
January 21, 2016	Sudbury Town Officials	• Potential visual impacts from routes/design options should be a key factor in the analysis • Potential for traffic congestion should be a key factor in the analysis • Potential for impacts to historic districts and scenic roadways should be a key factor in the analysis • Company should consider roadway options that are entirely along Route 20 in Sudbury • Company should avoid historic town center	• Increased weight of tree clearing criterion; expanded visual impact assessment for the Project • Increased weight of traffic criterion • Began researching local historic resources (not identified by MHC), added scenic roadways criterion • Added two more routes along Route 20 to the Universe of Routes for consideration
March 15 and 16, 2016	Eversource Hudson and Sudbury Open Houses	• The following should be key factors in routing analysis: o Impacts to natural resources; o Potential visual impacts to abutters from tree clearing along MBTA ROW; and o Number of abutters affected along each route; o The Company should consider including a roadway route as the Preferred Route	• Increased weight of natural environmental criteria, including tree clearing • Increased weight of land uses abutting route criteria
April 5, 2016	Sudbury Town Manager Meeting	• Historic resources are important and need to be weighted appropriately • Reiterated that scenic roads are important	• Increased weight of historic resources • Increased weight of scenic roads
April 19, 2016	Hudson Executive Assistant Meeting and DPW Meeting	• The placement of potential routes within aquifer protection zones should be considered in the routing analysis • Asked whether the Project could be a combination of overhead and underground within the MBTA ROW due to concerns that an underground design could impact groundwater flow within the Town's water supply protection district	• Expanded analysis of potential to impact public water supply • Considered potential to include a hybrid overhead and underground design option on MBTA ROW
August 25, 2016	Protect Sudbury	Requested the Company to: • Give greater weight to natural environmental factors • Add length adjacent to conservation areas into the routing analysis • Add potential impacts to public water supplies as a routing factor	• Increased weight for natural environment criteria • Added abutting conservation lands length to routing analysis • Added public water supplies to routing analysis
August 30, 2016	Northeast Logistics Systems, LLC (email)	• Proposed additional routing options	• Added these proposed routes to Universe of Routes for consideration
August 30, 2016	Hudson Historical Society (phone)	• Identified locally important historic resources	• Added sites to environmental analysis
September 14, 2016	Sudbury Historical Commission and Sudbury Historic District Commission (email)	• Identified locally important historic resources	• Confirmed that all sites were already included in analysis
October 7, 2016	Protect Sudbury (email)	• Proposed additional routing options	• Added the proposed routes to the Universe of Routes for consideration

4.2 Identification of Project Study Area

Following the establishment of the routing objectives, the Company reviewed the region between the existing Sudbury and Hudson Substations and demarcated a geographic "Project Study Area," as depicted in Figure 4-1, within which to concentrate the investigation of potential routes. Within this Project Study Area, the Company looked for existing linear corridors (e.g., existing rail, gas, and electric ROWs and public roadway corridors) that appeared to be feasible to facilitate construction of a new line and could provide a reasonably direct route between the two substations.

The majority of the Project Study Area is located within the municipalities of Sudbury, Wayland, Framingham, Marlborough, Hudson, and Stow. The northern edge of the Project Study Area is generally defined by Route 27. The center of the Project Study Area between the two substations is defined by the inactive MBTA ROW, which runs in an east-west direction. The southern boundary of the Project Study Area is generally defined by Route 20.

Much of the center of the Project Study Area consists of federal, municipal, and private open space areas including conservation, recreational, agricultural, and water protection supply areas. Major bodies of water in the area include Wash Brook, Dudley Brook, Hop Brook, Willis Lake, Puffers Pond, Taylor Brook, White Pond, Fort Meadow Brook, Lake Boon and the Assabet River.

In general, the eastern end of the Project Study Area in Sudbury and the western end in Hudson and Marlborough are more developed areas with primarily residential uses, but with some commercial areas and occasional industrial uses. In Sudbury and Marlborough, commercial/industrial land uses are concentrated along Boston Post Road/Route 20. In Hudson, commercial/industrial land uses are concentrated along Main Street/Route 62.

4.3 Route Selection

This section describes the process the Company used to identify the Project, Noticed Variation and Noticed Alternative Route. Briefly, the Company initially identified a Universe of Routes within the Project Study Area based on the routing analysis objectives described in Section 4.1.3. Next, a screening assessment of the Universe of Routes was completed, which eliminated any routes that did not fully meet the routing objectives. Following the screening process, the remaining routes were developed into complete and distinct Candidate Routes for further investigation and scoring under a number of criteria. Cost estimates were also developed, and the reliability of each Candidate Route was

assessed. The outcome of the routing analysis was the identification of the routes that best balance minimization of environmental impacts, constructability constraints, reliability, and cost. Each of these steps in the routing analysis is discussed more fully below.

4.3.1 Identification of Universe of Routes

Using the routing objectives identified in Section 4.1.3, and in conjunction with public input described in Section 4.1.5, the Company reviewed USGS maps, MassGIS data, and aerial photography; and completed field reconnaissance to identify the Universe of Routes, that could support a new line between the two substations, including the utilization of existing linear corridors. The Company also received suggested routes for the new line from stakeholders such as town officials, Northeast Logistics, LLC ("NELS"), and the citizens group, Protect Sudbury. These route options were incorporated into the Universe of Routes that were considered for the new line and are shown on Figure 4-2.

4.3.2 Screening Methodology

The Universe of Routes identified by the Company, and with input from stakeholders, consisted of twenty-one different route options that were initially screened. The initial screening process included reviewing publicly available data to consider existing abutting land uses and the presence of natural resources such as wetlands, waterways, and rare species habitat. In addition, traffic experts conducted field investigations to confirm general traffic patterns and volumes as applicable to the route. The Company also reviewed the routes for constructability constraints, such as difficult bends or existing underground utility congestion. Real estate personnel reviewed existing ownership and easement details along existing electric or gas transmission ROWs. The Company also considered other information received from various meetings with municipal staff members, stakeholder groups, and from the two public Open Houses. Route options were eliminated from further consideration if they were found to be unsuitable for transmission line development.

By means of the screening process, the Company determined that nine of these routes were inappropriate for further consideration as Candidate Routes and the remaining twelve routes were advanced as Candidate Routes for more detailed evaluation. Five of the twelve Candidate Routes had associated design variations. Out of the nine routes eliminated, six had been suggested by stakeholders. The following section provides an overview of the routes that were eliminated, with an explanation.

4.3.2.1 Summary of Eliminated Routes

As previously stated, the Company initially identified a Universe of Routes for consideration and review. Subsequently, stakeholders suggested additional routes for consideration and review. The Company included these routes into the Universe of Routes. Based on the screening process described above, the Company eliminated several routes from this Universe of Routes, as depicted in Figure 4-3. A summary of the eliminated routes is provided in Table 4-2 below.

Table 4-2: Routes Eliminated During Screening

Route Name	Description	Distance (miles)	Explanation for Elimination
Route 1	Electric Transmission ROW	28.8	• Existing transmission corridors from substations extend away from each other, resulting in a long circuitous route.
Route 2 / NELS ROW C	Gas Transmission ROW	11.9	• Several sections of the gas easement are not wide enough to feasibly collocate either an overhead or underground transmission line. • Gas pipeline easement is not owned in fee along its entire length and use of it would require acquiring rights from many underlying private landowners.
Route 3	Goodman Hill Road to Rt. 27 to Rt. 117 to Rt. 62	13.5	• Long circuitous route that traverses through historic Sudbury town center. Sudbury officials requested that Eversource avoid historic town center. • Goodman Hill Road has two existing underground transmission lines located within it. Installation of a third underground transmission line within this roadway would create operational issues for both the proposed and existing lines.
Route 4	Goodman Hill to Hudson	10.1	• Passes through historic Sudbury town center and Sudbury officials requested that Eversource avoid historic town center. • Goodman Hill Road has two existing underground transmission lines located within it. Installation of a third underground transmission line within this roadway would create operational issues for both the proposed and existing lines.
NELS Street A / Protect Sudbury Alternate 4	Rt. 20 to Wayside Inn Rd. to Sudbury St. to Parmenter St. to Main St.	11.09	• Similar, but inferior, to Eversource Candidate Route 7. • Approximately 0.25 miles longer to use Parmenter Street rather than to use Goodale and Chestnut Streets, with no benefit. • Abuts 58 more residences and 21 more businesses than a route along Goodale and Chestnut Streets. • Passes historic Wayside Inn.
NELS Street B	Rt. 20 to Wayside Inn Rd. to Dutton Rd. to Hudson Rd. to Main St.	12.93	• Similar, but inferior to, Eversource Candidate Route 6. • Approximately 1.8 miles longer to use Dutton Road versus Horse Pond Road. • Abuts 23 more residences and 10 more businesses.
NELS Street C	Rt. 20 to Rt. 85	11.35	• Similar, but inferior to, Eversource Candidate Routes 7 and 8. • Approximately 0.25 miles longer than any similar Eversource route. • Long circuitous route located along two major commuter roadways (Route 20 and Route 85).
NELS ROW A / Protect Sudbury Alternate 1	Rt. 20 to Gas Transmission ROW	9 96	• Several sections of the gas easement are not wide enough to feasibly collocate either an overhead or underground transmission line. • Gas pipeline easement is not owned in fee along its entire length and use of it would require acquiring rights from many underlying landowners.
NELS ROW B / Protect Sudbury Alternate 5	Rt. 20 – Gas Transmission ROW	11.36	• Gas pipeline easement is not owned in fee along its entire length and use of it would require acquiring rights from many underlying landowners. • Several sections of the gas easement are not wide enough to feasibly collocate either an overhead or underground transmission line. • Would require acquisition of land subject to Article 97 of the Amendments to the Constitution of the Commonwealth in connection with the "conservation of land" held or owned by the Commonwealth for natural resource purposes (4 parcels along the route).

1 The lengths listed here do not match the lengths provided by NELS in its report. The NELS route lengths did not appear to include installation from the roadways to the substations. NELS Street C did not appear to extend past the Intel property to the Hudson substation, and NELS ROW C did not appear to include the distance along Forest Avenue from the pipeline to the Hudson Substation.

2 Residential and business counts were based on available MassGIS parcel data and were not field verified.

4.3.3 Identification of Candidate Routes

Following the elimination of some routes from the Universe of Routes during the screening process, the Company advanced twelve Candidate Routes for more detailed analysis and ranking, as described below and presented in Figure 4-4. Table 4-3 provides an overview of the length, roads crossings, and other features along each route. Full descriptions of each route are presented in Appendix 4-1. A brief summary of the Candidate Routes is presented below.

MBTA/Roadway Candidate Routes

Candidate Routes 1, 2, and 3 would primarily travel from the Sudbury Substation along the inactive MBTA ROW, with shorter sections at the west end traveling underground in various public roadways to the Hudson Substation (Figures 4-5, 4-6, and 4-7). Specifically:

- *Candidate Route 1* would leave the MBTA ROW at Chestnut Street and traverse down Lewis Street to Main Street, where it would then travel west to Forest Avenue to connect to the Hudson Substation.
- *Candidate Route 2* would leave the MBTA ROW at Wilkins Street, and travel southwest on Wilkins Street to continue onto Forest Avenue to the Hudson Substation.
- *Candidate Route 3* would leave the MBTA ROW at Cox Street, and would follow Mackin Street and Woodrow Street southwest to Forest Avenue to connect to the Hudson Substation.

For Candidate Routes 1, 2, and 3, the Company evaluated three different transmission line design variations for the portion along the MBTA ROW: (1) an all overhead design in the MBTA ROW, denoted with the letter "A," (2) an all underground design, denoted with the letter "B," and (3) a combination overhead and underground design (the "hybrid option"), denoted with the letter "C." The hybrid design would travel underground from the Sudbury Substation to a point just west of the Charter Oak Country Club near Parmenter Road in Hudson, then continue overhead along the MBTA ROW to Chestnut Street (Route 1) or to a point just east of the residences along Orchard Drive near Ferjulian's orchards (Routes 2 and 3) before transitioning back underground for the remainder of the route. All three Candidate Routes transition underground into public roadways in Hudson, once the routes leave the MBTA ROW.

Candidate Routes 9 and 10 would begin at the Sudbury Substation and travel within the MBTA ROW for a short distance, then transition underground in Sudbury into public roadways and continue into Stow and Hudson for the remainder of their length:

- *Candidate Route 9* would leave the MBTA ROW at the intersection of Route 20 and Station Road in Sudbury, where it would travel within the roadway along Station Road, then follow Union Avenue and Old Lancaster Road north to Hudson Road, where the route would turn west and follow Hudson Road (which becomes Sudbury Road in Stow and Main Street in Hudson) and Forest Avenue in Hudson to reach the Hudson Substation.
- *Candidate Route 10* would leave the MBTA ROW at Horse Pond Road in Sudbury, and would travel north within the roadway along Horse Pond Road, Pratts Mill Road, and Dutton Road to reach Hudson Road, at which point the route would turn west and follow the same roads as Candidate Route 9 to arrive at the Hudson Substation.

For Candidate Routes 9 and 10, the Company evaluated two design variations along the MBTA ROW: overhead ("A") and underground ("B"), presented in Figures 4-13 and 4-14.

Public Roadway Candidate Routes (All Underground)

The Company also evaluated seven routes that would travel entirely in public roadways (Candidate Routes 4, 5, 5A, 6, 7, 8, and 11). Candidate Routes 4 through 8 are presented in Figures 4-8 through 4-12 and Candidate Route 11 is presented in Figure 4-15. All of these routes would exit the Sudbury Substation via the existing driveway and travel west on Route 20 for various distances:

- *Candidate Route 4* would turn north on Concord Road and Old Lancaster Road to reach Hudson Road, at which point the route would turn west to follow Hudson Road (which becomes Sudbury Road in Stow and Main Street in Hudson) and Forest Avenue to arrive at the Hudson Substation.
- *Candidate Route 5* would turn north onto Union Avenue to the intersection with Old Lancaster Road, at which point the route would follow the same roads as Candidate Route 4 to reach the Hudson Substation.
- *Candidate Route 5A* would turn west off of Route 20 at Station Road, then turn north at Union Avenue to follow the same roads as Candidate Route 5 for the remainder of the route.
- *Candidate Route 6* would turn north onto Horse Pond Road, and follow Pratts Mill Road and Dutton Road to reach Hudson Road, at which point it would turn west to follow Hudson Road (which becomes Sudbury Road in Stow and Main Street in Hudson) and Forest Avenue to arrive at the Hudson Substation.

- *Candidate Route 7* would stay on Route 20 into Marlborough, then turn north onto the western branch of Wayside Inn Road and follow Sudbury Street, Concord Road, and Goodale Street/Chestnut Street in Hudson to Main Street, at which point the route would turn west to follow Main Street and Forest Avenue to the Hudson Substation.
- *Candidate Route 8* would stay on Route 20 into Marlborough and turn north on Hosmer Street, following Hosmer, Causeway into Hudson, and Marlboro Streets to reach Forest Avenue, at which point the route would turn west to reach the Hudson Substation.
- *Candidate Route 11* would turn north from Route 20 onto Green Hill Road in Sudbury, then follow Old Lancaster Road northwest to Hudson Road, where the route would turn west and follow Hudson Road (which becomes Sudbury Road in Stow and Main Street in Hudson) and Forest Avenue to arrive at the Hudson Substation.

Table 4-3: Candidate Route Summary

	Candidate Route	Route Length (miles)	Towns	Length in Each Town (miles)	Streets in Each Town	Major Waterbody Crossings in Each Town	Landmarks and Major Conservation Areas in Each Town
MBTA ROW/Roadway	**MBTA-Chestnut** **1A (OH)** **1B (UG)** **1C (Hybrid)**	9.33	Sudbury	4.27	Streets Crossed by ROW: Landham Rd, Rt 20/Boston Post Rd, Union Ave, Horse Pond Rd, Peakham Rd, Dutton Rd	Hop Brook, Dudley Brook	Great Meadows National Wildlife Refuge, The Coolidge, Wash Brook, Mill Village Shopping Center, Meadow Walk/Raytheon, Stone Farm, Hopbrook Marsh Conservation Land, Memorial Forest, Assabet River National Wildlife Refuge
			Marlborough	0.02	None	--	Desert Conservation Area
			Hudson	5.04	Streets Crossed by ROW: White Pond Rd, Parmenter Rd, Main St Streets Traveled: Chestnut St, Lewis St, Main St, Forest Ave	Fort Meadow Brook	Assabet River National Wildlife Refuge, Marlborough-Sudbury State Forest, Charter Oak Country Club, Extra Space Storage, Ferjulian's Farm/Orchards, Forest Avenue Elementary School
	MBTA-Wilkins **2A (OH)** **2B (UG)** **2C (Hybrid)**	9.00	Sudbury	4.27	Streets Crossed by ROW: Landham Rd, Rt 20/Boston Post Rd, Union Ave, Horse Pond Rd, Peakham Rd, Dutton Rd	Hop Brook, Dudley Brook	Same as 1A/1B/1C
			Marlborough	0.02	None	--	Same as 1A/1B/1C
			Hudson	4.63	Streets Crossed by ROW: White Pond Rd, Parmenter Rd, Main St, Chestnut St Streets Traveled: Wilkins St, Forest Ave	Fort Meadow Brook	Same as 1A/1B/1C, plus Assabet River Rail Trail parking lot
			Stow	0.08	None	--	Small portion of Ferjulian's Farm/Orchards
	MBTA-Woodrow **3A (OH)** **3B (UG)** **3C (Hybrid)**	9.19	Sudbury	4.27	Streets Crossed by ROW: Landham Rd, Rt 20/Boston Post Rd, Union Ave, Horse Pond Rd, Peakham Rd, Dutton Rd	Hop Brook, Dudley Brook	Same as 1A/1B/1C
			Marlborough	0.02	None	--	Same as 1A/1B/1C
			Hudson	4.82	Streets Crossed by ROW: White Pond Rd, Parmenter Rd, Main St, Chestnut St, Wilkins St Streets Traveled: Cox St, Mackin St, Woodrow St, Forest Ave	Fort Meadow Brook	Same as 2A/2B/2C, plus Joseph L. Mulready School
			Stow	0.08	None	--	Same as 2A/2B/2C
	MBTA-Station-Union-Hudson **9A (OH)** **9B (UG)**	10.71	Sudbury	5.86	Streets Crossed by ROW: Landham Rd Streets Traveled: Station Rd, Union Ave, Concord Rd, Hudson Rd	Hop Brook, Run Brook	Great Meadows National Wildlife Refuge, The Coolidge, Wash Brook, Mill Village Shopping Center, Cavicchio Greenhouses, Sudbury Department of Public Works, Gray Reservation, Haskell Field, Marlborough-Sudbury State Forest, Assabet River National Wildlife Refuge
			Stow	0.75	Streets Traveled: Sudbury Rd	--	Marlborough-Sudbury State Forest, Massachusetts Firefighting Academy
			Hudson	4.10	Streets Traveled: Main St, Forest Ave	Fort Meadow Brook	Marlborough-Sudbury State Forest, Lake Boone, Extra Space Storage, Hudson Fire Department, Sauta Fields, Ferjulian's Farm/Orchards, Forest Avenue Elementary School
	MBTA-Horse Pond-Hudson **10A (OH)** **10B (UG)**	10.48	Sudbury	5.64	Streets Crossed by ROW: Landham Rd, Union Ave Streets Traveled: Horse Pond Rd, Pratts Mill Rd, Dutton Rd, Hudson Rd	Hop Brook, Dudley Brook	Great Meadows National Wildlife Refuge, The Coolidge, Wash Brook, Mill Village Shopping Center, Meadow Walk/Raytheon, Stone Farm, Ephraim Curtis Middle School, Stearns Mill Pond, Haskell Field, Marlborough Sudbury State Forest, Assabet River National Wildlife Refuge
			Stow	0.75	Streets Traveled: Sudbury Rd	--	Same as 9A/9B
			Hudson	4.10	Streets Traveled: Main St, Forest Ave	Fort Meadow Brook	Same as 9A/9B
Roadway Only (all UG)	**4 (Rt 20- Concord-Hudson)**	10.47	Sudbury	5.63	Streets Traveled: Rt 20/Boston Post Rd, Concord Rd, Old Lancaster Rd, Hudson Rd	Run Brook	The Coolidge, Mill Village Shopping Center, Goodnow Municipal Library, Wadsworth Cemetery, Sudbury Department of Public Works, Gray Reservation, Haskell Field, Marlborough-Sudbury State Forest, Assabet River National Wildlife Refuge
			Stow	0.75	Streets Traveled: Sudbury Rd	--	Same as 9A/9B
			Hudson	4.10	Streets Traveled: Main St, Forest Ave	Fort Meadow Brook	Same as 9A/9B
	5 (Rt 20-Union-Hudson)	10.92	Sudbury	6.08	Streets Traveled: Rt 20/Boston Post Rd, Union Ave, Old Lancaster Rd, Hudson Rd	Hop Brook, Run Brook	The Coolidge, Mill Village Shopping Center, Mill Village Shopping Center, Rugged Bear Plaza, Sudbury Police Department, Sudbury Crossing, U.S. Post Office, Cavicchio Greenhouses, Sudbury Department of Public Works, Gray Reservation, Haskell Field, Marlborough-Sudbury State Forest, Assabet River National Wildlife Refuge
			Stow	0.75	Streets Traveled: Sudbury Rd	--	Same as 9A/9B
			Hudson	4.10	Streets Traveled: Main St, Forest Ave	Fort Meadow Brook	Same as 9A/9B
	5A/Protect Sudbury Alternate 3 (Rt 20-Station-Union-Hudson)	10.75	Sudbury	5.90	Streets Traveled: Rt 20/Boston Post Rd, Station Rd, Union Ave, Old Lancaster Rd, Hudson Rd	Hop Brook, Run Brook	The Coolidge, Mill Village Shopping Center, Mill Village Shopping Center, Cavicchio Greenhouses, Sudbury Department of Public Works, Gray Reservation, Haskell Field, Marlborough-Sudbury State Forest, Assabet River National Wildlife Refuge
			Stow	0.75	Streets Traveled: Sudbury Rd	--	Same as 9A/9B
			Hudson	4.10	Streets Traveled: Main St, Forest Ave	Fort Meadow Brook	Same as 9A/9B

Table 4-3: Candidate Route Summary (continued)

	Candidate Route	Route Length (miles)	Towns	Length in Each Town (miles)	Streets in Each Town	Major Waterbody Crossings in Each Town	Landmarks and Major Conservation Areas in Each Town
Roadway Only (all UG)	**6 (Rt 20-Horse Pond-Hudson)**	11.11	Sudbury	6.26	Streets Traveled: Rt 20/Boston Post Rd, Horse Pond Rd, Pratts Mill Rd, Dutton Rd, Hudson Rd	Hop Brook, Dudley Brook	The Coolidge, Mill Village Shopping Center, Mill Village Shopping Center, Rugged Bear Plaza, Sudbury Police Department, Sudbury Crossing, Sudbury Plaza, Meadow Walk/Raytheon, Sudbury Fire Department, JP Bartlett Greenhouses, Massachusetts State Police Crime Laboratory, Stone Farm, Ephraim Curtis Middle School, Stearns Mill Pond, Haskell Field, Marlborough-Sudbury State Forest, Assabet River National Wildlife Refuge
			Stow	0.75	Streets Traveled: Sudbury Rd	–	Same as 9A/9B
			Hudson	4.10	Streets Traveled: Main St, Forest Ave	Fort Meadow Brook	Same as 9A/9B
	7 (Rt 20-Sudbury-Main)	10.85	Sudbury	4.61	Streets Traveled: Rt 20/Boston Post Rd	Hop Brook	The Coolidge, Mill Village Shopping Center, Mill Village Shopping Center, Rugged Bear Plaza, Sudbury Police Department, Sudbury Crossing, Sudbury Plaza, Meadow Walk/Raytheon, Sudbury Fire Department, JP Bartlett Greenhouses, Wayside Plaza, Grist Mill Pond
			Framingham	0.04	Streets Traveled: Rt 20/Boston Post Rd	–	–
			Marlborough	2.75	Streets Traveled: Rt 20/Boston Post Rd E, Wayside Inn Rd, Sudbury St, Concord Rd, Goodale St,	–	–
			Hudson	3.45	Streets Traveled: Chestnut St, Main St, Forest Ave	Fort Meadow Brook	Charter Oak Country Club, Ferjulian's Farm/Orchards, Forest Avenue Elementary School
	8 (Rt 20-Hosmer-Causeway)	11.10	Sudbury	4.61	Streets Traveled: Rt 20/Boston Post Rd	Hop Brook	Same as 7
			Framingham	0.04	Streets Traveled: Rt 20/Boston Post Rd		–
			Marlborough	4.51	Streets Traveled: Rt 20/Boston Post Rd E, E Main St, Hosmer St, Causeway St	Broad Meadow Brook, Mowry Brook	Hager Pond, Raytheon, Staples, Home Depot, Target, Marlboro Square Shopping Center, Marlborough Fire Department, Ghiloni Park, Firefly's, Jaworek Elementary School, Fort Meadow Lake/Memorial Beach
			Hudson	1.94	Streets Traveled: Causeway St, Marlboro St, Forest Ave	Fort Meadow Brook	–
	11/Protect Sudbury Alternate 2 (Rt 20-Green Hill-Hudson)	10.29	Sudbury	5.46	Streets Traveled: Rt 20/Boston Post Rd, Green Hill Rd, Old Lancaster Rd (east), Concord Rd, Old Lancaster Rd (west), Hudson Rd	Run Brook	The Coolidge, Sudbury Department of Public Works, Gray Reservation, Haskell Field, Marlborough-Sudbury State Forest, Assabet River National Wildlife Refuge
			Stow	0.75	Streets Traveled: Sudbury Rd	–	Same as 9A/9B
			Hudson	4.09	Streets Traveled: Main St, Forest Ave	Fort Meadow Brook	Same as 9A/9B

4.4 Analysis of Candidate Routes

As one part of the process to identify the best routes, the Company conducted an environmental scoring analysis for each of the twelve Candidate Routes. The environmental scoring analysis includes seventeen individual criteria that compare the relative levels of potential environmental (developed and natural) impacts and constructability constraints along each of the potential Candidate Routes.

The other two steps of the process to identify the best routes include a cost analysis and a reliability analysis.

Section 4.4 presents details regarding the environmental scoring analysis completed for the Candidate Routes. Sections 4.5 and 4.6 present the cost analysis and the reliability analysis completed for the Candidate Routes, respectively.

4.4.1 Criteria and Weight Assessment

The Company evaluated the Candidate Routes using a set of 17 criteria to compare each Candidate Route. The criteria were developed to reflect the defined routing objectives, public feedback, and environmental and constructability factors. The scoring criteria include the following subcategories:

- **Developed Environment Criteria** compare existing conditions of, and potential impacts to, the developed environment and surrounding population.
- **Natural Environment Criteria** compare existing conditions of, and potential impacts to, the natural environment.
- **Constructability Criteria** compare route location and design factors that may add complexity to construction.

The Company assigned the individual criteria weights based upon an assessment of the potential for temporary and permanent impacts and to reflect public feedback. The weighting scale ranges from 1 to 5, with 1 being the lowest weight and 5 being the highest weight that could be applied to a particular environmental criterion.

The 17 criteria identified by the Company to evaluate and compare each Candidate Route are outlined in Section 4.3.3.

4.4.2 Criteria Evaluation Methods

After identifying the environmental criteria and assigning weights, the Company completed a scoring evaluation for each Candidate Route. The Company scored, weighted, and ranked each Candidate Route to reflect its ease of constructability and its potential for impacts to the developed and natural environment. After gathering data for each Candidate Route, the Company assessed each criterion and identified the Candidate Route that had the largest number for that criterion. All other routes/designs were then compared against this number to arrive at a "ratio score" for each Candidate Route on a scale of 0 to 1. For example, if Candidate Route X had 5 trees to be removed, Candidate Route Y had 10 trees, and Candidate Route Z had 15 trees, the ratio scores would be calculated as shown in the following table.

Candidate Route	Number of Trees	Ratio Score
Candidate Route X	5	5 ÷ 15 = **0.33**
Candidate Route Y	10	10 ÷ 15 = **0.66**
Candidate Route Z	15	15 ÷ 15 = **1.00**

The lowest ratio score would equate to the lowest potential for impact. For each criterion, the ratio score was then multiplied by its assigned weight to produce a weighted score that magnified the criterion by its relative importance.

The ratio and weighted scores for each criterion were added to arrive at "total ratio scores" and "total weighted scores." The total weighted scores were then sorted in order from low to high, to identify a given Candidate Route's "rank." The lowest weighted score would equate to the lowest potential for impact with emphasis on certain criterion as previously described in this section. The ranks developed in this routing analysis are based on the total weighted scores.

4.4.3 Developed Environment, Natural Environment and Constructability Criteria Description

Developed Environment Criteria

Developed Environment Criteria compare existing conditions of, and potential impacts to, the developed environment and surrounding population. The seven Developed Environment Criteria included in the scoring analysis are:

- Residential Land Uses
- Sensitive Receptors
- Potential for Traffic Congestion
- Commercial/Industrial Land Uses
- Scenic Roadways
- Cultural Resources
- Potential to Encounter Subsurface Contamination

Land uses (residential, commercial/industrial, and conservation) in the vicinity of the Candidate Routes are shown in Figure 4-16. Cultural resources are shown in Figure 4-17.

Residential Land Uses

Residential land uses along each Candidate Route could be subject to temporary traffic disruption, street closings, construction noise, and/or other temporary impacts due to project construction, as well as visual impacts from the permanent removal of trees along the route. Residential land uses were scored as the number of residences directly abutting the property boundary of the MBTA ROW or public roadway easement along each Candidate Route. The number of residences was determined using ArcGIS and by using available property assessment data from MassGIS and local online databases. The number of single and multi-family residential units was confirmed by using Google and Bing 2015-2016 aerial and street imagery and/or by field verification. The ratio score for this category was calculated by dividing the total number of residential units determined for each Candidate Route by the highest number of residential units among all the Candidate Routes. This criterion was assigned a weight of 5.

Sensitive Receptors

Sensitive receptor land uses include hospitals, elder care facilities, schools, horse farms, cemeteries, daycares, district courts, nursing homes, police stations, fire stations, and religious facilities. Sensitive receptors along each Candidate Route could be subject to temporary traffic disruption, street closings, construction noise, and/or other temporary impacts due to project construction, as well as visual impacts from the permanent removal of trees. The number of sensitive receptors includes the number of parcels directly abutting each Candidate Route with a land use type identified as sensitive to the above temporary or permanent impacts. The number of sensitive receptors was evaluated using available property assessment data from MassGIS and local online databases, Google and Bing 2015-2016 aerial and street imagery, and field verification. The ratio score was calculated by dividing the total number of sensitive receptor units for each Candidate Route by the highest number of sensitive receptor units found among all the Candidate Routes. This criterion was assigned a weight of 5.

Potential for Traffic Congestion

The installation of a new transmission line within public roadways could result in temporary increased traffic density and congestion, traffic disruption, street closings, construction noise, and/or other temporary impacts due to project construction. The potential for traffic congestion was determined by VHB transportation consultants using a multi-criteria analysis to assess existing traffic conditions and the potential for impacts. A traffic score was developed for each Candidate Route. The traffic analysis considered factors such as existing traffic volumes, roadway widths, number of travel lanes, and the availability of reasonable detours. Available traffic information was obtained from municipal departments or through available public documents for proposed or ongoing projects in the area. Field reconnaissance verified the existing conditions, including confirming roadway measurements and 15-minute midday (9 a.m. to 4 p.m.) traffic counts. An overall score was calculated for each Candidate Route to provide a comparison of traffic-related impacts along each Candidate Route. The ratio score was calculated by dividing the total sum of traffic scores determined for each Candidate Route by the highest traffic score found among all the Candidate Routes. This criterion was assigned a weight of 5.

Commercial/Industrial Land Uses

Commercial/industrial land uses along each Candidate Route could be affected by temporary traffic disruption, street closings, construction noise, and/or other temporary impacts due to project construction, as well as by the permanent removal of trees along the MBTA ROW. Commercial/industrial land uses were derived from the number of commercial/industrial units that directly abut the property boundary of each Candidate Route. Commercial/industrial land uses were evaluated using ArcGIS, available property assessment data, and local online databases to determine the number of commercial/industrial units that directly abut each Candidate Route. Identified commercial/industrial units were confirmed using Google and Bing 2015-2016 aerial and street imagery and by field verification. The ratio score was calculated by dividing the total number of commercial/industrial units determined for each Candidate Route by the highest number of commercial/industrial units among all the Candidate Routes. This criterion was assigned a weight of 4.

Scenic Roadways

Massachusetts G.L. c. 40, § 15C allows municipalities to designate scenic roadways in order to protect the trees, stone walls and other features along these roads. Sudbury, Hudson, and Marlborough have designated scenic roadways in each of their municipalities; Stow has not identified any to date. Potential impacts to scenic roadways, both temporary and permanent, could potentially result from the installation of the project within public roadways and construction along roadway crossings of the MBTA ROW. The potential impacts to scenic roadways were derived from the total length of the designated scenic roadways along the

centerline of each Candidate Route. The length of scenic roadways was determined using ArcGIS and town records. Routes along the MBTA ROW were assessed by calculating the width of limits of work where the MBTA ROW intersected with scenic roadways. Routes along public roadways were assessed by calculating the length of the route within the designated scenic roadways. The ratio score was calculated by dividing the total length of scenic roadways determined for each Candidate Route by the greatest length of scenic roadways among the routes. This criterion was assigned a weight of 4.

Cultural Resources

Cultural resources could potentially be affected by construction impacts such as earth movement, traffic disruption, street closings, and noise, as well as by the permanent removal of trees and the placement of transmission facilities in or near cultural resources. For purposes of this analysis, cultural resources include historic and archaeological resources identified by the MHC. Historic resources include MHC Inventory Points (individual properties) and MHC Inventory Areas (identified by MHC as "Historic Districts" and "Inventoried Areas") that have been inventoried by MHC, listed on the National Register of Historic Places, and/or the State Register of Historic Places.

Commonwealth Heritage Group, Inc. ("CHG") assessed archeological resources documented in the MHC Inventory of the Historic and Archeological Assets of the Commonwealth and, from that reference, identified sites within a quarter-mile radius along each Candidate Route. The quarter-mile radius used to evaluate archaeological sites is a standard used by CHG for Eversource projects, which MHC has accepted as sufficient in past submissions.

Historic resources were evaluated by VHB using GIS data from MHC's Massachusetts Cultural Resource Information System. Based on feedback obtained from stakeholders, additional unregistered local cultural resources were identified through coordination with local Historic Commissions and Societies, research of locally regulated historic areas or sites, available site mapping from municipal and historical society records, and other publicly available documentation.

The number of cultural resources was derived from the total number of historic and archaeological sites and the number of parcels within historic districts or areas along each Candidate Route. MHC Inventory Points were tallied within parcels that were directly adjacent to the property boundary of the MBTA ROW or public roadways along each Candidate Route. MHC Inventory Areas were quantified by tallying parcels within each area that are directly adjacent to the property boundary of the MBTA ROW or public roadway along each Candidate Route, excluding parcels that also contained historic sites, to avoid double counting. Qualifying archaeological sites were those that are located within a quarter-mile of the centerline of each

Candidate Route. The ratio score was calculated by dividing the total number cultural resources determined for each Candidate Route by the highest number of cultural resources found among all the Candidate Routes. This criterion was assigned a weight of 2.

Potential to Encounter Subsurface Contamination

Subsurface contamination could add complexities to construction. The potential to encounter subsurface contamination was derived from the number of sites on or adjacent to each Candidate Route where a documented release of oil and/or hazardous materials occurred, or where past land uses potentially resulting in contamination have been documented in the MassDEP Bureau of Waste Site Cleanup online database, pursuant to the Massachusetts Contingency Plan ("MCP") (310 CMR 40.0000). This criterion was evaluated using the MADEP Bureau of Waste Site Cleanup online database and observations of current land use. The ratio score was calculated by dividing the total number of documented sites determined for each Candidate Route by the highest number of documented sites found among all the Candidate Routes. This criterion was assigned a weight of 1.

Natural Environment Criteria

Natural environment criteria compare existing conditions of, and potential impacts to, the natural environment. The following assumptions were used to calculate potential impacts to the natural environment criteria for each Candidate Route. Along the MBTA ROW, the limit of work for an overhead transmission line design included a clearing corridor along the full width of the ROW (approximately 80 feet wide); the limit of work for an underground transmission line design included a 30-foot-wide clearing corridor, with expanded areas of clearing at manhole locations measuring approximately 40 to 50 feet wide and 50 feet long.[29] Underground installation within public roadways was assumed to require a 4-foot-wide trench, with 10-foot by 30-foot manholes every 1700 feet. Both the trench and the manholes are assumed to be within the paved limits of the roadway and would not require tree clearing. The six natural environment criteria included in the scoring analysis are:

- Tree Clearing
- Wetland Resource Areas
- State-listed Rare Species Habitat
- Public Water Supplies
- Conservation Land Uses
- Public Shade Trees

[29] According to the Expanded Environmental Notification Form submitted by DCR for the proposed Mass Central Rail Trail, the multi-use trail would require clearing of a 19-foot-wide corridor.

Natural resources (wetlands, rare species habitats, and public water supplies) in the area are shown in Figure 4-18.

Tree Clearing

To accommodate the construction and safe operation of the line, tree clearing would be required. The criterion score for tree clearing was derived from the total acreage of tree clearing required within the estimated limits of work along each Candidate Route. Underground installation within public roadways was assumed to require no tree clearing for scoring purposes; however, final design could require selective tree removal and/or minor trimming to facilitate construction. Any vegetation removal would be conducted in accordance with the Company's approved Vegetation Management Plan, DCR's Trail Guidelines and Best Practices Manual where applicable, and all applicable state and local laws, bylaws, and regulations. Tree clearing areas were evaluated on ArcGIS using tree canopy coverage data derived from digitized tree canopy at full leaf-out using Google Earth 2016 aerial imagery and aerial photogrammetric mapping by Eastern Topographic, Inc. (based on aerial photographs taken on February 22, 2013), and augmented by an on-the-ground survey performed by VHB during 2015. The ratio score was calculated by dividing the total acreage of tree clearing determined for each Candidate Route by the highest number of acres to be cleared among all the Candidate Routes. This criterion was assigned a weight of 5.

Wetland Resource Areas

Transmission line construction could directly affect wetland resource areas. This criterion score was derived from the total combined area of all state and local jurisdictional wetland resources present within the estimated limits of work along each Candidate Route. Wetland resource areas applicable to the routing analysis, as defined in the Massachusetts Wetland Protection Act regulations (310 CMR 10.00), include the following:

- Bordering Vegetated Wetland ("BVW")
- 100-foot Buffer Zone to BVW/Bank
- Bordering Land Subject to Flooding ("BLSF")
- 200-foot Riverfront Area
- Vernal Pools

Applicable wetland resource areas defined by local wetland bylaw regulations for Sudbury and Stow include the following:[30]

[30] At the time of filing, the Town of Hudson does not have a local wetland bylaw.

Stow
- 100-foot Buffer Zone to BLSF
- 100-foot Buffer Zone to intermittent streams

Sudbury
- 100-foot Adjacent Upland Resource Area ("AURA") to BLSF
- 100-foot AURA to intermittent streams
- Potential Vernal Pools
- 100-foot AURA to Potential Vernal Pools

Wetland resource areas were identified using a combination of field delineation and utilizing ArcGIS with the most current data available. Potential impacts to perennial streams were assumed to be accounted for within riverfront areas. There were no Areas of Critical Environmental Concern ("ACECs") or Outstanding Resource Waters ("ORWs") present along any of the Candidate Routes. The ratio score was calculated by dividing the total acreage of wetland resource areas determined for each Candidate Route by the highest acreage of wetland resource areas among all the Candidate Routes. This criterion was assigned a weight of 5.

State-listed Rare Species Habitat

Transmission line construction could potentially impact protected habitats for state-listed rare species. Areas of protected habitat for state-listed species were determined from the areas of Priority or Estimated Habitat, as defined by the NHESP, present within limits of work along each Candidate Route. Areas of rare species habitat were confirmed utilizing ArcGIS and applying MassGIS mapping of NHESP Priority and Estimated Habitat areas. Underground installation within public roadways was assumed to have no impacts on state-listed habitat. The ratio score for each Candidate Route was calculated by dividing the total acreage of NHESP Priority and Estimated Habitat determined for each Candidate Route by the highest measured acreage among all the Candidate Routes. This criterion was assigned a weight of 5.

Public Water Supply

During the public Open Houses and in stakeholder meetings, members of the public voiced concern over the fact that many of the proposed Candidate Routes are located through portions of designated Wellhead Protection Areas for municipal wells within Hudson and Sudbury and requested that public water supply zones be considered as a routing evaluation criteria. Public water supply areas considered in this routing analysis included the boundaries of aquifers, Zone I and Zone II Water Supply Protection Areas, and locally identified water supply protection districts. These resources were identified using available data layers from MassGIS and zoning maps from the City of Marlborough and the Towns of Hudson, Stow, and Sudbury. The precise

length of each route that passed through a public water supply resource area was calculated using ArcGIS. The ratio score was calculated by dividing the total linear mileage of public water supply resources along each Candidate Route by the highest measured mileage among all the Candidate Routes. This criterion was assigned a weight of 3.

Conservation Land Use

The installation of an overhead or underground transmission line could potentially result in impacts to conservation lands abutting the Candidate Route. Conservation lands were defined as those properties that were primarily protected for conservation purposes, as identified in available MassGIS data, including but not limited to town forests, state forests, federal wildlife refuges, and privately-held forest lands. Recreational uses such as golf courses or ball fields were not included in this criterion. Underground installation within public roadways was assumed to have no impact on adjacent conservation lands. The length of each Candidate Route that abutted conservation land was derived using ArcGIS. The ratio score was calculated by dividing the total linear mileage of abutting conservation lands along each Candidate Route by the highest measured mileage among all the Candidate Routes. This criterion was assigned a weight of 3.

Public Shade Trees

According to G.L. c. 87, § 1, public shade trees are defined as "all trees within a public way or on the boundaries thereof." For the purposes of this analysis, shade trees included all such trees that have a diameter at breast height of at least 2 inches and that are present within limits of work and within the limits of the roadway easement (including areas outside existing pavement or sidewalks) along each Candidate Route. Underground installation within public roadways was assumed to require no tree clearing for scoring purposes; however, final design of such an installation could require selective tree removal and/or minor trimming to facilitate construction access. Any vegetation removal would be completed in accordance with the Company's approved Vegetation Management Plan, DCR's Trail Guidelines and Best Practices Manual where applicable, and all applicable state and local laws, bylaws, and regulations. The number and location of public shade trees was determined through field survey and desktop assessment of aerial imagery. The ratio score was calculated by dividing the total number of shade trees determined for each Candidate Route by the highest number of shade trees among the routes/designs. This criterion was assigned a weight of 1.

Constructability Criteria

Constructability criteria compared route location and design factors that may add complexity to the Project. The four constructability criteria included in the scoring analysis are:

- Trenchless Crossings
- Existing Utility Density
- Length of Route
- Hard Angles

Trenchless Crossings

Trenchless crossings are methods of underground transmission line installation where the traditional open-cut trench method is infeasible (e.g., at crossings of water bodies or under highways and railroads) so alternative methods such as jack-and-bore or horizontal directional drilling are required. The Company determined the estimated number of trenchless crossings that would be required for each Candidate Route. This criterion was evaluated along the MBTA ROW from the Sudbury Substation to Wilkins Street (Hudson) based on a preliminary underground design. Trenchless crossings outside of this area were assessed by project engineers to determine potential locations where crossings of water bodies, railroads, or roadway under- or overpasses could require trenchless crossing methods. The ratio score was calculated by dividing the total number of trenchless crossings determined for each Candidate Route by the highest number of trenchless crossings found among all the Candidate Routes. This criterion was assigned a weight of 3.

Existing Utility Density

The number of existing utilities in the roadway determines the available below-grade space to physically accommodate an underground transmission line. All of the Candidate Routes evaluated were determined to be feasible for construction; however, for public roadway routes, increased utility density could hamper the construction process and increase construction duration and attendant traffic disruption and noise impacts. The score for existing utility density was derived from the number of existing underground utilities and available space below grade to physically install a cable and manhole system. Existing utility density was determined using ArcGIS and subsurface utility maps from municipalities and other utility owners, and compared existing utilities against road width in order to identify route segments as high, moderate, and low for utility density. Underground utility maps were developed by a combined effort of aerial photogrammetric mapping by Eastern Topographic, Inc. (based on aerial photographs taken on February 22, 2013), and an on-the-ground survey performed by VHB in 2015 and 2016. The length of moderate/high segments was totaled for each Candidate Route and divided by the total route length to generate a "utility density score." The ratio score was calculated by dividing the utility density score for each Candidate Route by the highest score found among all the Candidate Routes. This criterion was assigned a weight of 3.

Route Length

The length of a route could result in a shorter construction duration and less overall disruption. Route length was defined as total length of each Candidate Route from the Sudbury Substation to the Hudson Substation. Route length was determined utilizing ArcGIS. The ratio score was calculated by dividing the total mileage determined for each Candidate Route by the highest mileage found among all the Candidate Routes. This criterion was assigned a weight of 1.

Hard Angles

For underground transmission line installation, hard angles produce bends in the cable that can increase construction difficulty and risk of cable damage. Although hard angles can complicate construction, all of the routes were determined to be technically feasible. The scoring for hard angles was determined from the number of turns required in the underground portion of a route that were greater than 30 degrees. Hard angles were evaluated using GIS mapping of each Candidate Route. The ratio score was calculated by dividing the total number of hard angles for each Candidate Route by the highest number of hard angles found among Candidate Routes. This criterion was assigned a weight of 1.

A summary of the routing analysis criteria and associated weights are below in Table 4-4.

Table 4-4: Routing Analysis Criteria Weights Summary

	Criterion	Assigned Weight
Natural Environment	Public Shade Trees	1
	Tree Clearing Area	5
	Wetland Resource Areas	5
	Public Water Supplies	3
	State-Listed Rare Species Habitat	5
	Conservation Land Use	3
Developed Environment	Residential Land Use	5
	Commercial/Industrial Land Use	4
	Sensitive Receptors	5
	Cultural Resources	2
	Scenic Roadways	4
	Potential for Traffic Congestion	5
	Potential to Encounter Subsurface Contamination	1
Constructability	Route Length	1
	Trenchless Crossings	3
	Utility Density	3
	Hard Angles	1

4.4.4 Environmental Analysis Results

This section presents the results of the environmental scoring analysis completed for each Candidate Route.

4.4.4.1 Environmental Analysis Results Summary

Table 4-5 provides an overview of all raw data, total ratio scores and total weighted scores for each Candidate Route.

Table 4-5: Scoring Matrix

Candidate Routes/ Design Options	Scoring Criteria: Developed Environment Criteria: Residential Land Uses: Total Housing Units	Residential Land Uses: Single-Family Units	Residential Land Uses: Multi-Family Units	Commercial/ Industrial Uses (Total Building Units)	Sensitive Receptors (Total Parcels)	Cultural Resources	Scenic Roadways (miles)	Potential for Traffic Congestion	Potential to Encounter Subsurface Contamination	Natural Environment Criteria: Public Shade Trees	Tree Clearing (acres)	Wetland Resource Areas (acres)	Public Water Supplies (miles)	Conservation Lands (miles)	State-Listed Rare Species Habitat (acres)	Constructability Criteria: Route Length: Feet	Route Length: Miles	Trenchless Crossings	Existing Utility Density	Hard Angles (> 30°)	Total Environmental/ Constructability Score	
Option 1A: MBTA ROW (OH) to Chestnut	334	170	164	91	3	88	1 33	0.83	9	35	64.27	30 96	6.49	3.82	12 90	49,254	9 33	2	0.24	3		
Ratio Score	0.10			0.21	0 13	0 35	0 25	0.33	0.31	0.74	0.88	0.80	0.83	0.996	1.00	0.84		0 13	0.25	0.33	**8.49**	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.51**			**0.85**	**0.63**	**0.70**	**1.01**	**1.67**	**0.31**	**0.74**	**4.40**	**4.00**	**2.48**	**2.99**	**5.00**	**0.84**		**0.40**	**0.75**	**0.33**	**27.61**	**Weighted Score**
Option 1B: MBTA ROW (UG) to Chestnut	334	170	164	91	3	88	1 27	0.83	9	11	24.90	11.76	6.49	3.82	5.09	49,254	9 33	2	0.24	3		
Ratio Score	0.10			0.21	0 13	0 35	0 24	0.33	0.31	0.23	0.34	0.30	0.83	0.996	0.39	0.84		0 13	0.25	0.33	**6.33**	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.51**			**0.85**	**0.63**	**0.70**	**0 96**	**1.67**	**0.31**	**0.23**	**1.71**	**1.52**	**2.48**	**2.99**	**1.97**	**0.84**		**0.40**	**0.75**	**0.33**	**18.85**	**Weighted Score**
Option 1C: MBTA ROW Hybrid to Chestnut	334	170	164	91	3	88	1 28	0.83	9	11	10.00	15 58	6.49	3.82	5.09	49,254	9 33	2	0.24	3		
Ratio Score	0.10			0.21	0 13	0 35	0 24	0.33	0.31	0.23	0.14	0.40	0.83	0.996	0.39	0.84		0 13	0.25	0.33	**6.74**	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.51**			**0.85**	**0.63**	**0.70**	**0 97**	**1.67**	**0.31**	**0.23**	**0.69**	**2.01**	**2.48**	**2.99**	**1.97**	**0.84**		**0.40**	**0.75**	**0.33**	**18.34**	**Weighted Score**
Option 2A: MBTA ROW (OH) to Wilkins	320	156	164	91	3	80	0.44	0.66	9	47	70.05	35.81	6.49	3.82	12 90	47,552	9.01	1	0.14	3		
Ratio Score	0.10			0.21	0 13	0 32	0.08	0.27	0.31	1.00	0.96	0.93	0.83	0.996	1.00	0.81		0.07	0.15	0.33	**8.48**	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.48**			**0.85**	**0.63**	**0.63**	**0 33**	**1.34**	**0.31**	**1.00**	**4.80**	**4.63**	**2.48**	**2.99**	**5.00**	**0.81**		**0 20**	**0.45**	**0.33**	**27.26**	**Weighted Score**
Option 2B: MBTA ROW (UG) to Wilkins	320	156	164	91	3	80	0 37	0.66	9	12	26.71	13 53	6.49	3.82	5.09	47,552	9.01	1	0.14	3		
Ratio Score	0.10			0.21	0 13	0 32	0.07	0.27	0.31	0.26	0.37	0.35	0.83	0.996	0.39	0.81		0.07	0.15	0.33	**5.95**	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.48**			**0.85**	**0.63**	**0.63**	**0 28**	**1.34**	**0.31**	**0.26**	**1.83**	**1.75**	**2.48**	**2.99**	**1.97**	**0.81**		**0 20**	**0.45**	**0.33**	**17.60**	**Weighted Score**
Option 2C: MBTA ROW Hybrid to Wilkins	320	156	164	91	3	80	0 39	0.66	9	20	34.50	19 30	6.49	3.82	5.09	47,552	9.01	1	0.14	3		
Ratio Score	0.10			0.21	0 13	0 32	0.07	0.27	0.31	0.43	0.47	0.50	0.83	0.996	0.39	0.81		0.07	0.15	0.33	**6.86**	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.48**			**0.85**	**0.63**	**0.63**	**0 30**	**1.34**	**0.31**	**0.43**	**2.36**	**2.49**	**2.48**	**2.99**	**1.97**	**0.81**		**0 20**	**0.45**	**0.33**	**19.06**	**Weighted Score**
Option 3A: MBTA ROW (OH) to Woodrow	324	162	162	94	3	74	0.44	0.73	9	47	72.97	38.69	6.49	3.84	12 90	48,548	9 19	0	0.12	1		
Ratio Score	0.10			0.22	0 13	0 29	0.08	0.29	0.31	1.00	1.00	1.00	0.83	1.000	1.00	0.83		0.00	0.13	0.11	**8.32**	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.49**			**0.88**	**0.63**	**0 58**	**0 33**	**1.46**	**0.31**	**1.00**	**5.00**	**5.00**	**2.48**	**3.00**	**5.00**	**0.83**		**0.00**	**0.38**	**0.11**	**27.49**	**Weighted Score**
Option 3B: MBTA ROW (UG) to Woodrow	324	162	162	94	3	74	0 37	0.73	9	12	27.88	14 53	6.49	3.84	5.09	48,548	9 19	1	0.12	1		
Ratio Score	0.10			0.22	0 13	0 29	0.07	0.29	0.31	0.26	0.38	0.38	0.83	1.000	0.39	0.83		0.07	0.13	0.11	**5.78**	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.49**			**0.88**	**0.63**	**0 58**	**0 28**	**1.46**	**0.31**	**0.26**	**1.91**	**1.88**	**2.48**	**3.00**	**1.97**	**0.83**		**0 20**	**0.38**	**0.11**	**17.66**	**Weighted Score**
Option 3C: MBTA ROW Hybrid to Woodrow	324	162	162	94	3	74	0 39	0.73	9	20	35.67	20 29	6.49	3.84	5.09	48,548	9 19	1	0.12	1		
Ratio Score	0.10			0.22	0 13	0 29	0.07	0.29	0.31	0.43	0.49	0.52	0.83	1.000	0.39	0.83		0.07	0.13	0.11	**6.70**	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.49**			**0.88**	**0.63**	**0 58**	**0 30**	**1.46**	**0.31**	**0.43**	**2.44**	**2.62**	**2.48**	**3.00**	**1.97**	**0.83**		**0 20**	**0.38**	**0.11**	**19.12**	**Weighted Score**

Table 4-5: Scoring Matrix (continued)

Candidate Routes/ Design Options	Scoring Criteria: Developed Environment Criteria: Residential Land Uses: Total Housing Units	Single Family Units	Multi-Family Units	Commercial/ Industrial Uses (Total Building Units)	Sensitive Receptors (Total Parcels)	Cultural Resources	Scenic Roadways (miles)	Potential for Traffic Congestion	Potential to Encounter Subsurface Contamination	Natural Environment Criteria: Public Shade Trees	Tree Clearing (acres)	Wetland Resource Areas (acres)	Public Water Supplies (miles)	Conservation Lands (miles)	State-Listed Rare Species Habitat (acres)	Constructability Criteria: Route Length: Feet	Miles	Trenchless Crossings	Existing Utility Density	Hard Angles (> 30°)	Total Environmental/ Constructability Score	
Option 4: Route 20 to Concord to Hudson	590	359	231	137	15	134	5.27	2.09	14	0	0	0 99	7.20	0	0	55,215	10.46	10	0.94	2		
Ratio Score	0.18			0 32	0.63	0 53	1.00	0.84	0.48	0.00	0.00	0.03	0.92	0.00	0.00	0.94		0.67	0.98	0 22	7.73	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.89**			**1 29**	**3.13**	**1.06**	**4.00**	**4 20**	**0.48**	**0.00**	**0.00**	**0 13**	**2.75**	**0.00**	**0.00**	**0.94**		**2.00**	**2.94**	**0 22**	**24.04**	**Weighted Score**
Option 5: Route 20 to Union to Hudson	569	335	234	229	14	145	4.44	2 19	21	0	0	1 23	7.67	0	0	57,698	10 93	12	0.94	6		
Ratio Score	0.17			0 54	0.58	0 57	0.84	0.88	0.72	0.00	0.00	0.03	0.98	0.00	0.00	0.98		0.80	0.98	0.67	8.76	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.86**			**2 15**	**2.92**	**1 15**	**3.36**	**4.42**	**0.72**	**0.00**	**0.00**	**0 16**	**2.93**	**0.00**	**0.00**	**0.98**		**2.40**	**2.95**	**0.67**	**25.68**	**Weighted Score**
Option 5A: Route 20 to Station to Union to Hudson	567	333	234	164	12	124	4.44	2 17	16	0	0	1 30	7.49	0	0	56,747	10.75	12	0.94	7		
Ratio Score	0.17			0 38	0.50	0.49	0.84	0.88	0.55	0.00	0.00	0.03	0.96	0.00	0.00	0.97		0.80	0.98	0.78	8 33	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.86**			**1 54**	**2.50**	**0 98**	**3.36**	**4 38**	**0.55**	**0.00**	**0.00**	**0 17**	**2.87**	**0.00**	**0.00**	**0.97**		**2.40**	**2.95**	**0.78**	**24.30**	**Weighted Score**
Option 6: Route 20 to Horse Pond to Hudson	614	368	246	231	13	143	3.82	2.42	22	0	0	1 22	7.84	0	0	58,595	11 10	9	0.94	7		
Ratio Score	0.19			0 54	0.54	0 57	0.72	0 97	0.76	0.00	0.00	0.03	1.00	0.00	0.00	1.00		0.60	0.99	0.78	8.69	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.93**			**2 17**	**2.71**	**1 13**	**2.90**	**4 87**	**0.76**	**0.00**	**0.00**	**0 16**	**3.00**	**0.00**	**0.00**	**1.00**		**1.80**	**2.96**	**0.78**	**25.16**	**Weighted Score**
Option 7: Route 20-Sudbury-Main	673	321	352	215	13	218	4.77	2.48	17	0	0	1 37	4.90	0	0	57,300	10.85	15	0.96	9		
Ratio Score	0.20			0 50	0.54	0.86	0.91	1.00	0.59	0.00	0.00	0.04	0.63	0.00	0.00	0.98		1.00	1.00	1.00	9 24	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**1.02**			**2.02**	**2.71**	**1.72**	**3.62**	**5.00**	**0.59**	**0.00**	**0.00**	**0 18**	**1.88**	**0.00**	**0.00**	**0.98**		**3.00**	**3.00**	**1.00**	**26.71**	**Weighted Score**
Option 8: Route 20-Hosmer-Causeway	3304	316	2988	426	24	253	2.00	2.46	29	0	0	1 37	4.05	0	0	58,631	11 10	15	0.94	7		
Ratio Score	1.00			1.00	1.00	1.00	0.38	0 99	1.00	0.00	0.00	0.04	0.52	0.00	0.00	1.00		1.00	0.98	0.78	10.68	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**5.00**			**4.00**	**5.00**	**2.00**	**1.52**	**4 96**	**1.00**	**0.00**	**0.00**	**0 18**	**1.55**	**0.00**	**0.00**	**1.00**		**3.00**	**2.95**	**0.78**	**32.93**	**Weighted Score**
Option 9A: MBTA (OH) to Station to Union to Hudson	552	322	230	127	11	108	4.44	1 94	14	11	9.71	8 34	7.47	0.51	1.12	56,525	10.71	10	0.82	5		
Ratio Score	0.17			0 30	0.46	0.43	0.84	0.78	0.48	0 23	0.13	0 22	0.95	0.133	0.09	0.96		0.67	0.86	0 56	8 25	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.84**			**1 19**	**2.29**	**0 85**	**3.36**	**3 91**	**0.48**	**0 23**	**0.67**	**1.08**	**2.86**	**0.40**	**0.43**	**0.96**		**2.00**	**2.57**	**0 56**	**24.69**	**Weighted Score**
Option 9B: MBTA (UG) to Station to Union to Hudson	552	322	230	127	11	108	4.44	1 94	14	8	3.90	4.40	7.47	0.51	0.57	56,525	10.71	10	0.82	5		
Ratio Score	0.17			0 30	0.46	0.43	0.84	0.78	0.48	0 17	0.05	0 11	0.95	0.133	0.04	0.96		0.67	0.86	0 56	7 97	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.84**			**1 19**	**2.29**	**0 85**	**3.36**	**3 91**	**0.48**	**0 17**	**0.27**	**0 57**	**2.86**	**0.40**	**0.22**	**0.96**		**2.00**	**2.57**	**0 56**	**23.51**	**Weighted Score**
Option 10A: MBTA (OH) to Horse Pond to Hudson	566	334	232	105	8	104	3.82	1.89	13	11	19.92	12.92	7.26	0.68	1.12	55,343	10.48	6	0.73	5		
Ratio Score	0.17			0 25	0.33	0.41	0.72	0.76	0.45	0 23	0.27	0 33	0.93	0.176	0.09	0.94		0.40	0.76	0 56	7.79	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.86**			**0 99**	**1.67**	**0 82**	**2.90**	**3 80**	**0.45**	**0 23**	**1.36**	**1.67**	**2.78**	**0.53**	**0.43**	**0.94**		**1.20**	**2.29**	**0 56**	**23.48**	**Weighted Score**
Option 10B: MBTA (UG) to Horse Pond to Hudson	566	334	232	105	8	101	3.82	1.89	13	8	7.85	5.78	7.26	0.68	0.57	55,343	10.48	6	0.73	5		
Ratio Score	0.17			0 25	0.33	0.40	0.72	0.76	0.45	0 17	0.11	0 15	0.93	0.176	0.04	0.94		0.40	0.76	0 56	7 32	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.86**			**0 99**	**1.67**	**0 81**	**2.90**	**3 80**	**0.45**	**0 17**	**0.54**	**0.75**	**2.78**	**0.53**	**0.22**	**0.94**		**1.20**	**2.29**	**0 56**	**21.43**	**Weighted Score**
Option 11: Route 20-Greenhill-Hudson	581	350	231	62	10	57	4.34	2 10	13	0	0	0 97	6.63	0	0	54,361	10 30	10	0.94	8		
Ratio Score	0.18			0 15	0.42	0 23	0.82	0.84	0.45	0.00	0.00	0.03	0.85	0.00	0.00	0.93		0.67	0.98	0.89	7.41	Ratio Score
Weight	5			4	5	2	4	5	1	1	5	5	3	3	5	1		3	3	1		
Weighted Score	**0.88**			**0 58**	**2.08**	**0.45**	**3.29**	**4 22**	**0.45**	**0.00**	**0.00**	**0 13**	**2.54**	**0.00**	**0.00**	**0.93**		**2.00**	**2.94**	**0 89**	**21.37**	**Weighted Score**

Table 4-6 presents a summary of the Candidate Routes ranked by total weighted environmental score. The lowest total weighted score equates to the lowest potential for impact, with the emphasis on certain criteria as previously described in this section.

Table 4-6: Environmental Rank by Total Weighted Scores

Candidate Route	Route Length (miles)	Total Weighted Score	Rank
Option 2B: MBTA ROW (UG) to Wilkins	9.01	19.37	1
Option 3B: MBTA ROW (UG) to Woodrow	9.19	19.44	2
Option 1C: MBTA ROW Hybrid to Chestnut	9.33	20.22	3
Option 1B: MBTA ROW (UG) to Chestnut	9.33	20.76	4
Option 2C: MBTA ROW Hybrid to Wilkins	9.01	20.83	5
Option 3C: MBTA ROW Hybrid to Woodrow	9.19	20.91	6
Option 11: Route 20 to Greenhill to Hudson	10.30	25.41	7
Option 4: Route 20 to Concord to Hudson	10.46	25.49	8
Option 10B: MBTA (UG) to Horse Pond to Hudson	10.48	25.94	9
Option 8: Route 20-Hosmer-Causeway	11.10	26.07	10
Option 5A: Route 20 to Station to Union to Hudson	10.75	26.45	11
Option 6: Route 20 to Horse Pond to Hudson	11.10	27.91	12
Option 5: Route 20 to Union to Hudson	10.93	27.94	13
Option 10A: MBTA (OH) to Horse Pond to Hudson	10.48	27.99	14
Option 9B: MBTA (UG) to Station to Union to Hudson	10.71	28.09	15
Option 2A: MBTA ROW (OH) to Wilkins	9.01	29.03	16
Option 3A: MBTA ROW (OH) to Woodrow	9.19	29.27	17
Option 9A: MBTA (OH) to Station to Union to Hudson	10.71	29.43	18
Option 1A: MBTA ROW (OH) to Chestnut	9.33	29.52	19
Option 7: Route 20-Sudbury-Main	10.85	29.68	20

As shown in Tables 4-5 and 4-6, Candidate Route 2B (MBTA ROW (UG) to Wilkins) has the lowest weighted environmental score and would result in the lowest potential for impact of all the Candidate Routes evaluated. The Candidate Route located entirely within public roadways with the lowest weighted environmental score is Candidate Route 11 (Route 20 to Green Hill Road to Hudson). This route is a geographically distinct routing alternative to Candidate Route 2B.

The following sections provide more detailed comparisons and observations of the environmental analysis results.

4.4.4.2 Environmental Criteria Overview Tables

Tables 4-7 through 4-9 provide an overview of how each Candidate Route scores with respect to the three distinct subcategories of the environmental criteria: the developed environment, the natural environment, and constructability. The Candidate Route that has the lowest and highest potential for impact in each category is highlighted in green (lowest) and red (highest), respectively.

As shown in these tables, Candidate Route 11 (Route 20 to Green Hill Road to Hudson) has a lower potential for impacts to the natural environment criteria, but has a higher potential for impacts to the developed environment criteria than Candidate Route 2B (MBTA ROW (UG) to Wilkins). However, of the public roadway Candidate Routes considered, Candidate Route 11 has the lowest potential for impact to the developed environment.

The potential for impacts to the developed environment increases for those Candidate Routes with longer distances along Route 20 (Options 4, 5, 5A, 6, 7 and 8). Route 20 (also known as Boston Post Road) is a major commuter roadway, serving drivers within the western suburbs of Boston. Route 20 has high volumes of daily weekday traffic with over 1000 vehicles per hour observed during midday time periods and is classified by the Massachusetts Department of Transportation ("MassDOT") as an "urban principal arterial" roadway. Based on discussions with MassDOT, construction along this corridor could include the following limitations:

- Limited weekday work hours to avoid peak traffic hours
- Limited weekend work hours
- No options to detour traffic off Route 20 and on to local roads (will not be allowed by MassDOT)
- Use of cranes may be restricted to weekends only
- Night work may be required with work hours potentially from 9 p.m. to 5 a.m.
- Significant roadway restoration and/or upgrade requirements (typically more extensive than those required on local roadways)

All of these considerations identified by MassDOT could result in the potential for longer construction duration and for higher project costs for those Candidate Routes located for longer distances along Route 20.

Table 4-7: Overview of Developed Environment Scores

		Developed Environment	
Candidate Route		**Weighted Score**	**Rank**
MBTA ROW/Roadway	**1A: MBTA ROW (OH) to Chestnut**	7.75	6
	1B: MBTA ROW (UG) to Chestnut	7.70	5
	1C: MBTA ROW (Hybrid) to Chestnut	12.66	9
	2A: MBTA ROW (OH) to Wilkins	6.56	2
	2B: MBTA ROW (UG) to Wilkins	6.52	1
	2C: MBTA ROW (Hybrid) to Wilkins	11.48	7
	3A: MBTA ROW (OH) to Woodrow	6.73	4
	3B: MBTA ROW (UG) to Woodrow	6.68	3
	3C: MBTA ROW (Hybrid) to Woodrow	11.64	8
	9A: MBTA (OH) to Station to Union to Hudson	14.92	13.5
	9B: MBTA (UG) to Station to Union to Hudson	14.92	13.5
	10A: MBTA (OH) to Horse Pond to Hudson	14.00	12
	10B: MBTA (UG) to Horse Pond to Hudson	13.98	11
Public Roadway	**4: Route 20 to Concord Road to Hudson**	16.51	16
	5: Route 20 to Union to Hudson	17.85	18
	5A: Route 20 to Station to Union to Hudson	16.33	15
	6: Route 20 to Horse Pond to Hudson	18.23	19
	7: Route 20 to Sudbury to Main	19.65	20
	8: Route 20 to Hosmer to Causeway	16.62	17
	11: Route 20 to Green Hill to Hudson	13.81	10

Table 4-8: Overview of Natural Environment Scores

		Natural Environment	
Candidate Route		Weighted Score	Rank
MBTA ROW/Roadway	1A: MBTA ROW (OH) to Chestnut	19.97	18
	1B: MBTA ROW (UG) to Chestnut	11.31	13
	1C: MBTA ROW (Hybrid) to Chestnut	10.78	12
	2A: MBTA ROW (OH) to Wilkins	21.24	19
	2B: MBTA ROW (UG) to Wilkins	11.69	14
	2C: MBTA ROW (Hybrid) to Wilkins	13.12	16
	3A: MBTA ROW (OH) to Woodrow	21.84	20
	3B: MBTA ROW (UG) to Woodrow	11.91	15
	3C: MBTA ROW (Hybrid) to Woodrow	13.35	17
	9A: MBTA (OH) to Station to Union to Hudson	5.95	10
	9B: MBTA (UG) to Station to Union to Hudson	4.46	8
	10A: MBTA (OH) to Horse Pond to Hudson	7.21	11
	10B: MBTA (UG) to Horse Pond to Hudson	5.03	9
Public Roadway	4: Route 20 to Concord Road to Hudson	2.83	4
	5: Route 20 to Union to Hudson	3.15	6
	5A: Route 20 to Station to Union to Hudson	3.07	5
	6: Route 20 to Horse Pond to Hudson	3.16	7
	7: Route 20 to Sudbury to Main	1.77	2
	8: Route 20 to Hosmer to Causeway	1.48	1
	11: Route 20 to Green Hill to Hudson	2.69	3

Table 4-9: Overview of Constructability Scores

	Candidate Route	Constructability	
		Weighted Score	Rank
MBTA ROW/Roadway	1A: MBTA ROW (OH) to Chestnut	2.32	8
	1B: MBTA ROW (UG) to Chestnut	2.32	8
	1C: MBTA ROW (Hybrid) to Chestnut	2.32	8
	2A: MBTA ROW (OH) to Wilkins	1.79	5
	2B: MBTA ROW (UG) to Wilkins	1.79	5
	2C: MBTA ROW (Hybrid) to Wilkins	1.79	5
	3A: MBTA ROW (OH) to Woodrow	1.32	1
	3B: MBTA ROW (UG) to Woodrow	1.52	2.5
	3C: MBTA ROW (Hybrid) to Woodrow	1.52	2.5
	9A: MBTA (OH) to Station to Union to Hudson	6.09	12.5
	9B: MBTA (UG) to Station to Union to Hudson	6.09	12.5
	10A: MBTA (OH) to Horse Pond to Hudson	4.99	10.5
	10B: MBTA (UG) to Horse Pond to Hudson	4.99	10.5
Public Roadway	4: Route 20 to Concord Road to Hudson	6.11	14
	5: Route 20 to Union to Hudson	7.00	17
	5A: Route 20 to Station to Union to Hudson	7.09	18
	6: Route 20 to Horse Pond to Hudson	6.53	15
	7: Route 20 to Sudbury to Main	7.98	20
	8: Route 20 to Hosmer to Causeway	7.72	19
	11: Route 20 to Green Hill to Hudson	6.76	16

4.5 Cost Analysis

The Company evaluated the conceptual (-25%/+50%) total cost estimates for each Candidate Route in order to rank the various Candidate Routes.

Many factors could affect the actual cost of a transmission line project, including cost and availability of materials and equipment, labor, the presence of contaminated soils, and the potential for work hour restrictions imposed by the local community or other entities. For an underground line, subsurface conditions such as the type and depth of soil and rock that must be excavated in order to place the duct bank could also significantly affect project cost.

A summary of the conceptual cost estimates is provided below in Table 4-10. As shown in the table, Candidate Routes with overhead designs and those located along the MBTA ROW

would generally result in lower costs to construct compared to those located underground in public roadways.

Candidate Route 3A (MBTA ROW (OH) to Woodrow) has the lowest cost overall. The next lowest-cost Candidate Route that provided a geographically distinct routing alternative by following public roadways is Candidate Route 11 (Route 20 to Green Hill to Hudson).

Table 4-10: Candidate Route Conceptual Cost Estimates (+25%/-50%)

Candidate Route	Total (millions)[1]	Rank	Percent more than lowest cost option
3A: MBTA ROW (OH) to Woodrow	$43.3	1	0%
2A: MBTA ROW (OH) to Wilkins	$44.2	2	2%
1A: MBTA ROW (OH) to Chestnut	$50.5	3	17%
2C: MBTA ROW Hybrid to Wilkins	$83.5	4	93%
3C: MBTA ROW Hybrid to Woodrow	$85.4	5	97%
1C: MBTA ROW Hybrid to Chestnut	$88.1	6	103%
2B: MBTA ROW (UG) to Wilkins	$91.0	7	110%
3B: MBTA ROW (UG) to Woodrow	$94.5	8	118%
1B: MBTA ROW (UG) to Chestnut	$95.4	9	120%
10A: MBTA (OH) to Horse Pond to Hudson	$95.9	10	121%
9A: MBTA (OH) to Station to Union to Hudson	$106.1	11	145%
10B: MBTA (UG) to Horse Pond to Hudson	$109.4	12	153%
11: Route 20 to Green Hill to Hudson	$110.4	13	155%
4: Route 20 to Concord to Hudson	$113.7	14	163%
9B: MBTA (UG) to Station to Union to Hudson	$114.5	15	164%
5A: Route 20 to Station to Union to Hudson	$118.1	16	173%
5: Route 20 to Union to Hudson	$119.7	17	176%
6: Route 20 to Horse Pond to Hudson	$120.2	18	177%
7: Route 20-Sudbury-Main	$127.0	19	193%
8: Route 20-Hosmer-Causeway	$132.9	20	207%

1 Totals are based on estimates of required costs for transmission line design; substation upgrades to Sudbury; land acquisition; survey; environmental compliance; environmental mitigation; regulatory compliance; legal support; construction management; public outreach; risks; and other potential extraneous costs.

4.6 Reliability Analysis

The Company considered whether there was a difference in the Candidate Routes with regard to reliability. Increased length of a transmission system, in theory, could introduce additional exposure to potential faults. However, all of the Candidate Routes have relatively small

differences in length such that the Company did not consider the length of the routes would result in any substantial difference in their level of risk. While an underground line may be less susceptible to weather-induced outages, an overhead line takes much less time to repair in the event of an outage (days rather than weeks). However, both underground and overhead transmission technologies are both inherently reliable. Accordingly, reliability was not a determining factor when comparing Candidate Routes.

4.7 Selection of Project, Noticed Variation and Noticed Alternative Route

Table 4-11 provides a comprehensive summary of all Candidate Routes and their relative rankings with respect to the natural environment, developed environment, constructability, overall environmental score and cost.

Table 4-11: Ranking Summary of Candidate Routes

Candidate Route	Developed Environment	Natural Environment	Constructability	Total Environmental	Cost
1A: MBTA ROW (OH) to Chestnut	6	18	8	20	3
1B: MBTA ROW (UG) to Chestnut	5	13	8	3	9
1C: MBTA ROW (Hybrid) to Chestnut	9	12	8	8	7
2A: MBTA ROW (OH) to Wilkins	2	19	5	18	2
2B: MBTA ROW (UG) to Wilkins	1	14	5	1	6
2C: MBTA ROW (Hybrid) to Wilkins	7	16	5	11	4
3A: MBTA ROW (OH) to Woodrow	4	20	1	19	1
3B: MBTA ROW (UG) to Woodrow	3	15	2.5	2	8
3C: MBTA ROW (Hybrid) to Woodrow	8	17	2.5	13	5
4: Route 20 to Concord to Hudson	13.5	10	12.5	14	14
5: Route 20 to Union to Hudson	13.5	8	12.5	7	17
5A: Route 20 to Station to Union to Hudson	12	11	10.5	10	16
6: Route 20 to Horse Pond to Hudson	11	9	10.5	5	18
7: Route 20 to Sudbury to Main	16	4	14	6	19
8: Route 20 to Hosmer to Causeway	18	6	17	16	20
9A: MBTA (OH) to Station to Union to Hudson	15	5	18	12	11
9B: MBTA (UG) to Station to Union to Hudson	19	7	15	15	15
10A: MBTA (OH) to Horse Pond to Hudson	**20**	2	20	17	10
10B: MBTA (UG) to Horse Pond to Hudson	17	1	19	9	12
11: Route 20 to Green Hill to Hudson	10	3	16	4	13

The Company balanced considerations of impacts and costs in selecting the Project. Candidate Route 2B (MBTA ROW (UG) to Wilkins) has the lowest overall environmental score and was chosen as the Project. Candidate Route 2A (MBTA ROW (OH) to Wilkins) has a significantly lower cost than Candidate Route 2B, but also significantly greater environmental impacts.[31] Accordingly, the Company designated Candidate Route 2A as a Noticed Variation to the Project and advanced it for further analysis in Section 5.

[31] Candidate Route 3A is the lowest cost alternative; however, the cost differential between Candidate Routes 2A and 3A is approximately 2%, as presented on Table 4-10.

In considering a geographically distinct routing alternative, Candidate Route 11 (Route 20 to Green Hill to Hudson), a stakeholder-identified route, was identified as the all-roadway route that would result in the lowest potential for environmental impacts as well as the lowest cost. The Company therefore selected Candidate Route 11 as the Noticed Alternative Route.

The Project, Noticed Variation and Noticed Alternative Route are shown in Figure 1-3.

4.8 Conclusion

In accordance with the standard of review, the Company objectively and comprehensively developed and assessed a wide array of potential routes and design variations within the bounds of the Project Study Area. At the conclusion of this process, the Company identified a preferred Project, Noticed Variation and Noticed Alternative Route that best balance environmental impacts, costs, and reliability and enable the Company to meet the identified need.

A more detailed examination and comparison of the Project, Noticed Variation, and Noticed Alternative Route is presented in Section 5 of this Analysis.

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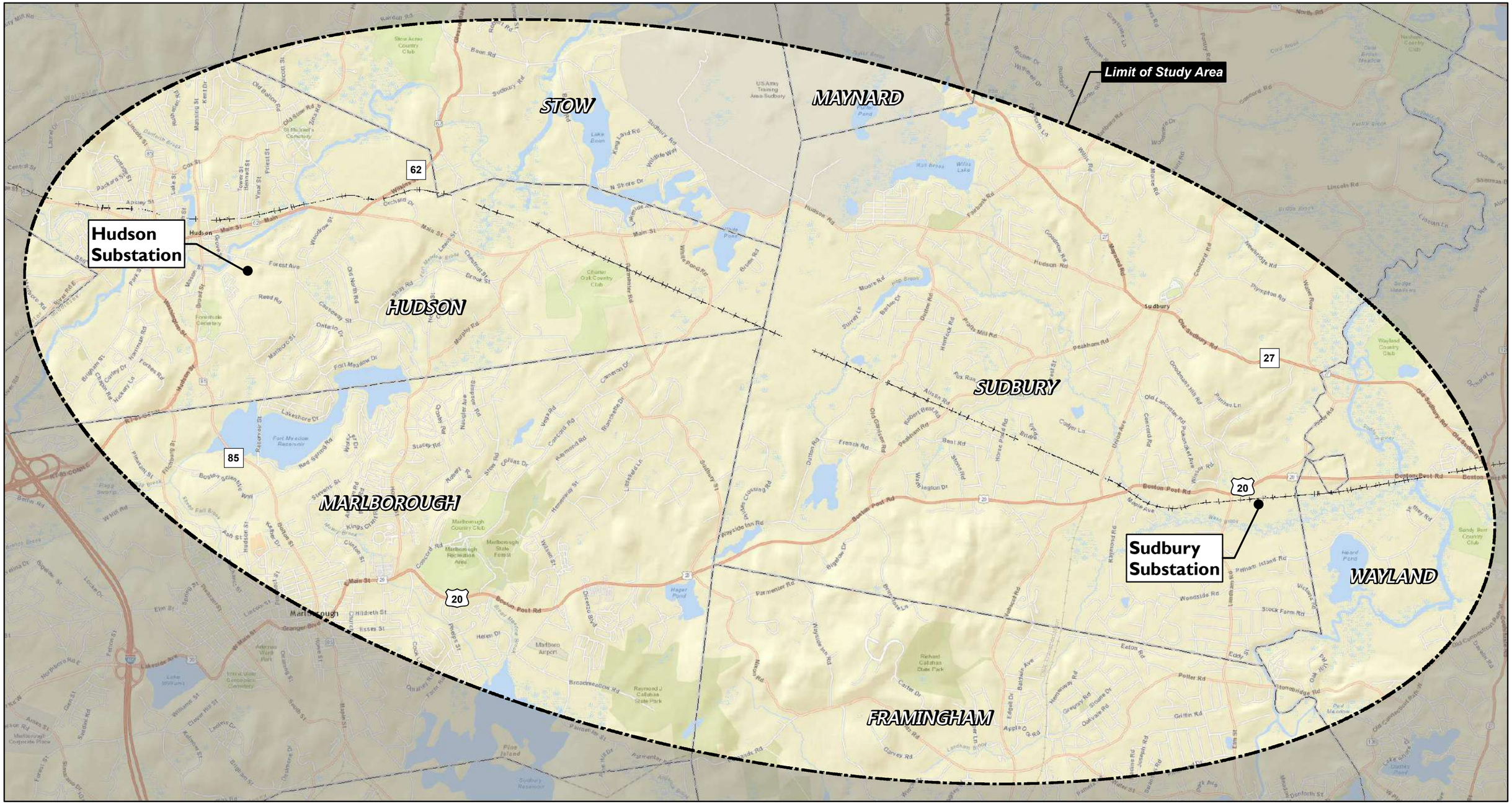

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Sudbury-Hudson Transmission Reliability Project

Figure 4-1: Project Study Area

vhb

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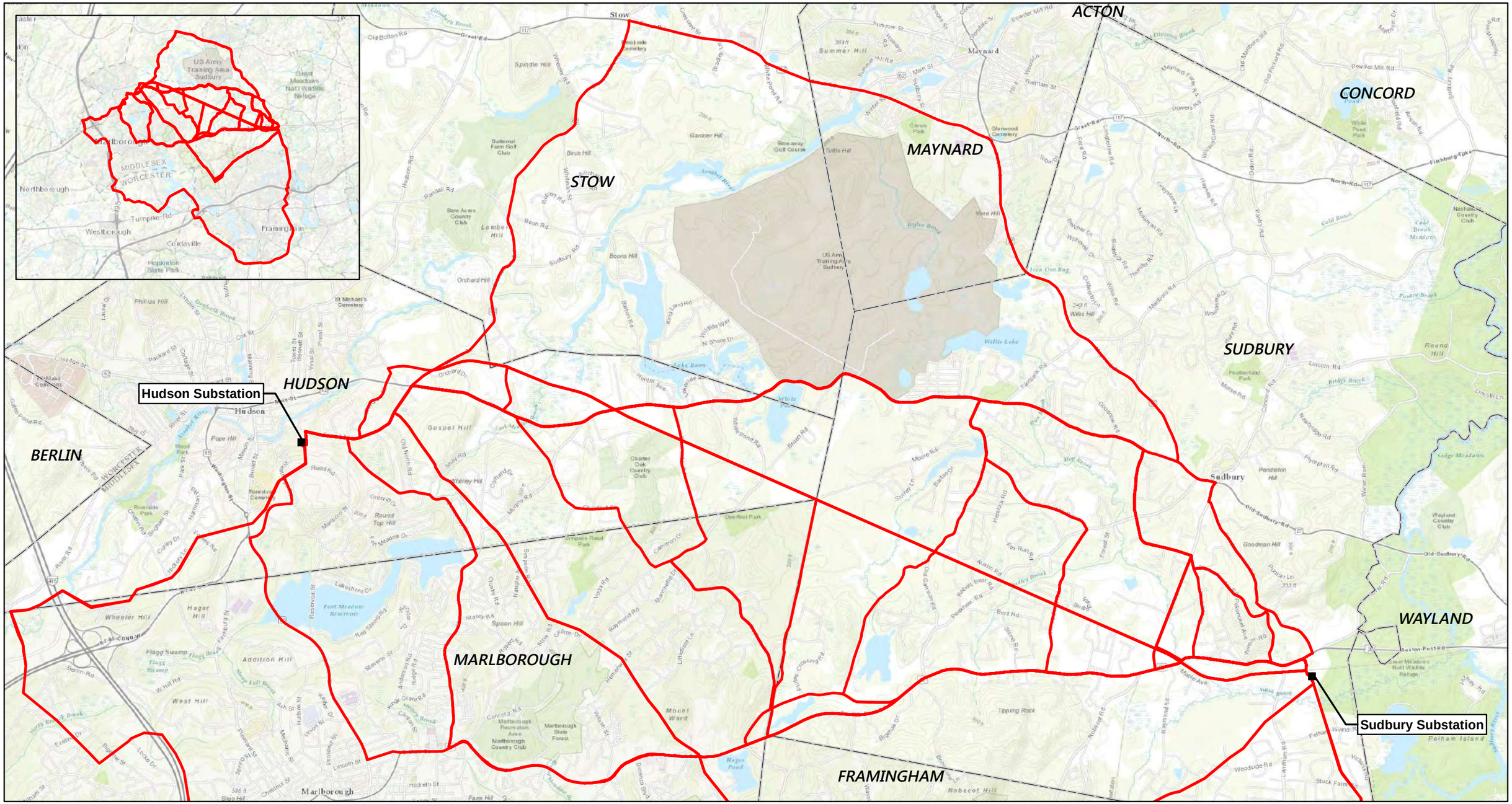


Potential Route

Municipal Boundary

N

0 4,000 8,000 Feet

Source:
MassGIS, VHB

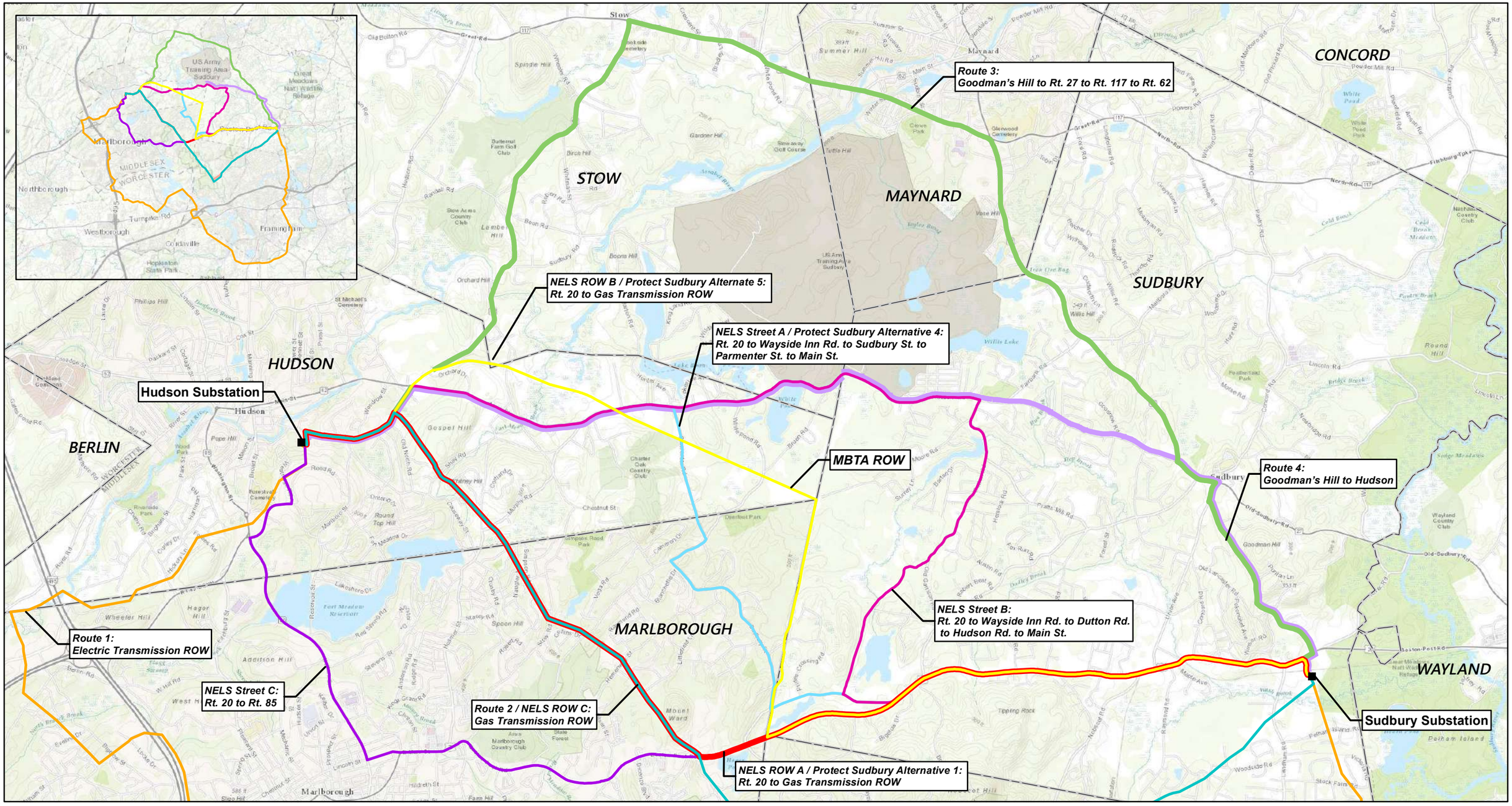
4/12/2017

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-2: Universe of Routes

vhb



Routes Eliminated During Screening

- Route 1: Electric Transmission ROW
- Route 2 / NELS ROW C: Gas Transmission ROW
- Route 3: Goodman's Hill to Rt. 27 to Rt. 117 to Rt. 62
- Route 4: Goodman's Hill to Hudson
- NELS Street A / Protect Sudbury Alternative 4: Rt. 20 to Wayside Inn Rd. to Sudbury St. to Parmenter St. to Main St.
- NELS Street B: Rt. 20 to Wayside Inn Rd. to Dutton Rd. to Hudson Rd. to
- NELS Street C: Rt. 20 to Rt. 85
- NELS ROW A / Protect Sudbury Alternative 1: Rt. 20 to Gas Transmission ROW
- NELS ROW B / Protect Sudbury Alternate 5: Rt. 20 to Gas Transmission ROW

NOTE: Not to scale. Alignments shown are for graphical purposes only. Lines that appear immediately adjacent to each other should be assumed to follow the same alignment.

Source:
MassGIS, VHB

4/12/2017

N

0 4,000 8,000 Feet

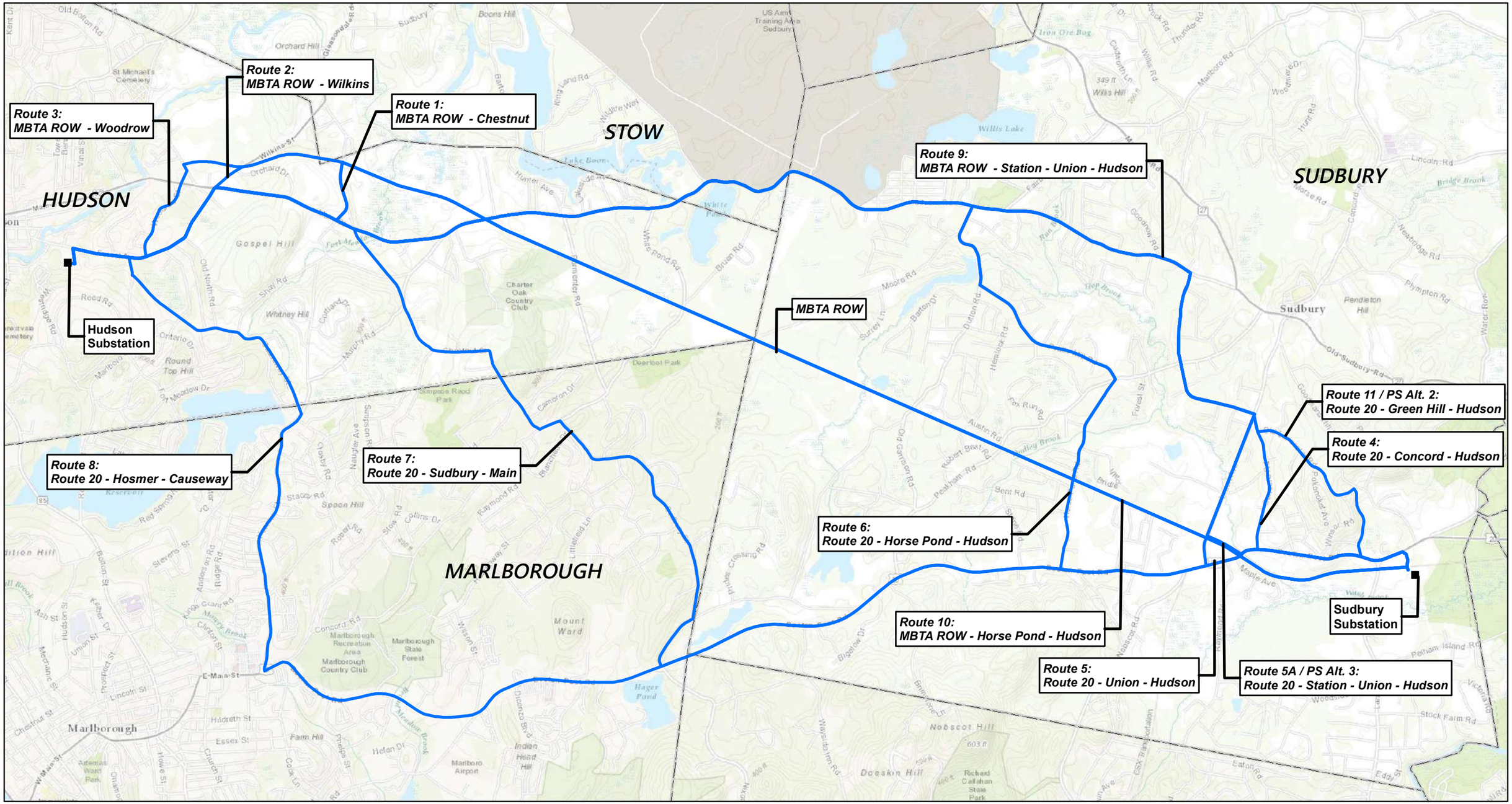
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-3: Eliminated Routes

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\March_2017\4-4_Candidate_Route_Overview.mxd Date: 4/12/2017



Candidate Route

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-4: Candidate Route Overview Map

N

0 3,000 6,000 Feet

Source:
MassGIS, VHB

4/12/2017

NOTE: Not to scale. Alignments shown are for graphical purposes only.
Lines that appear immediately adjacent to each other should be assumed to follow the same alignment.

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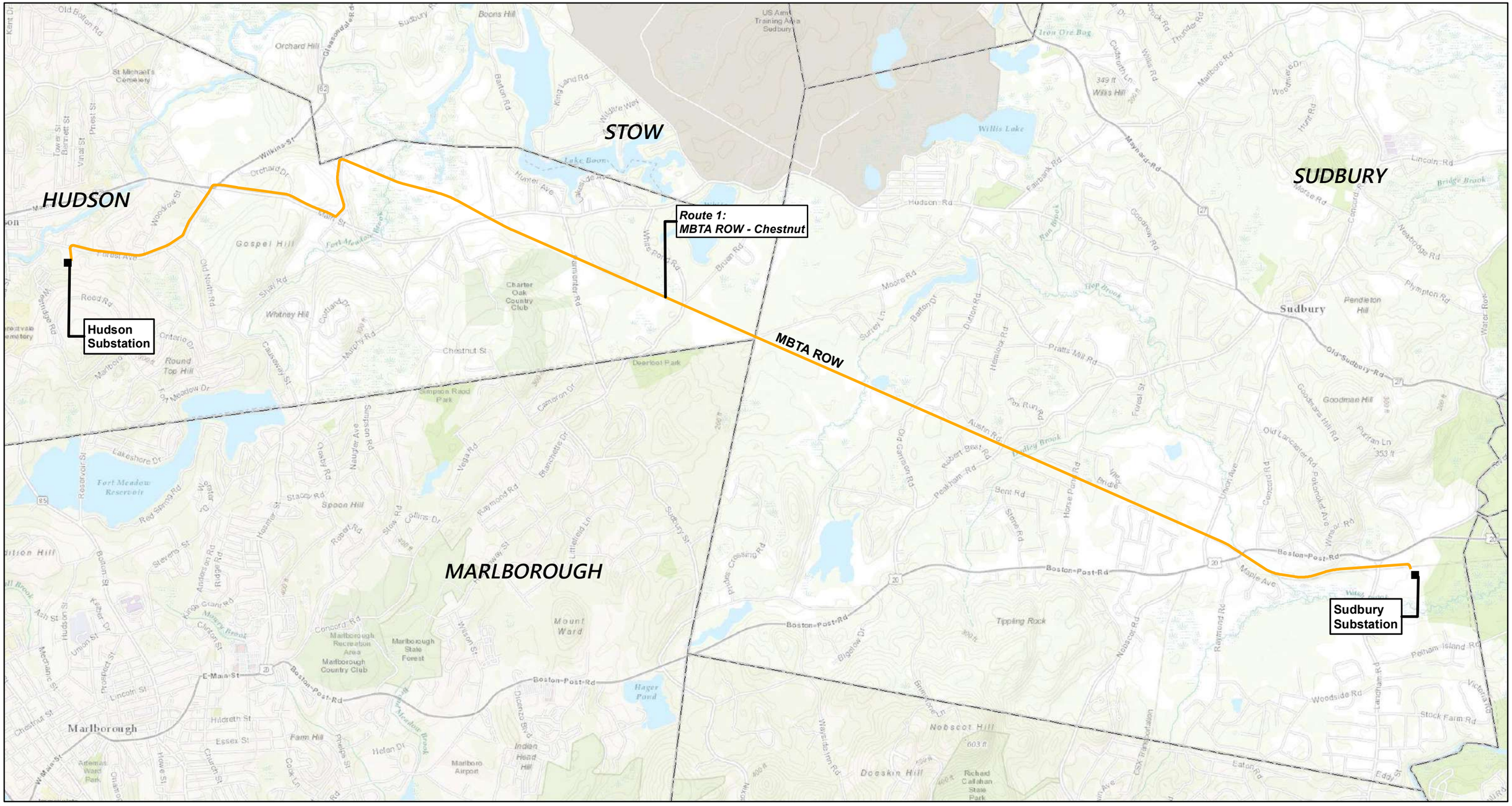

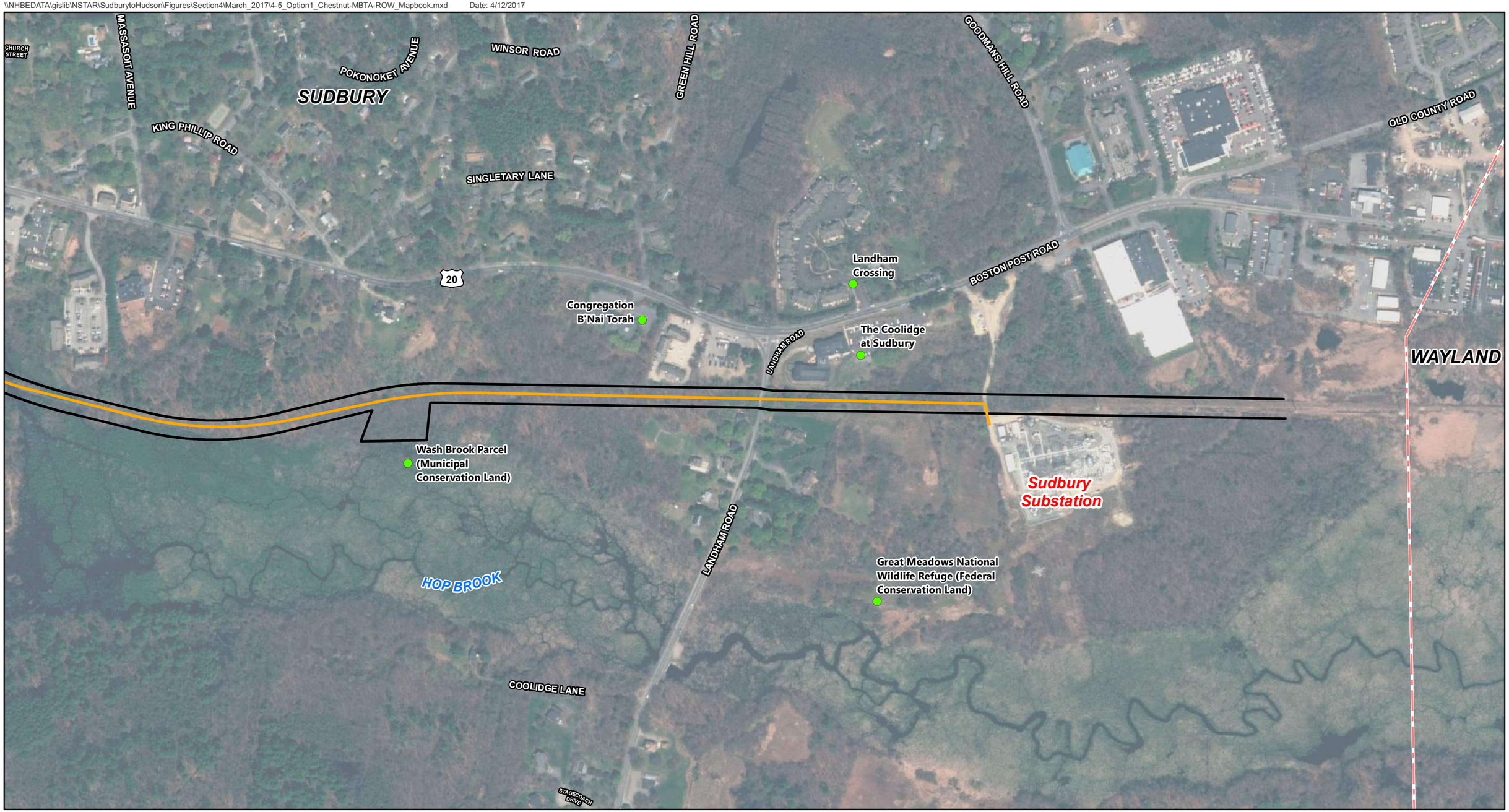

Route 1: MBTA ROW - Chestnut [9.3 miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

N

Source: MassGIS, VHB

4/12/2017

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-5: Candidate Route 1 MBTA ROW - Chestnut

vhb

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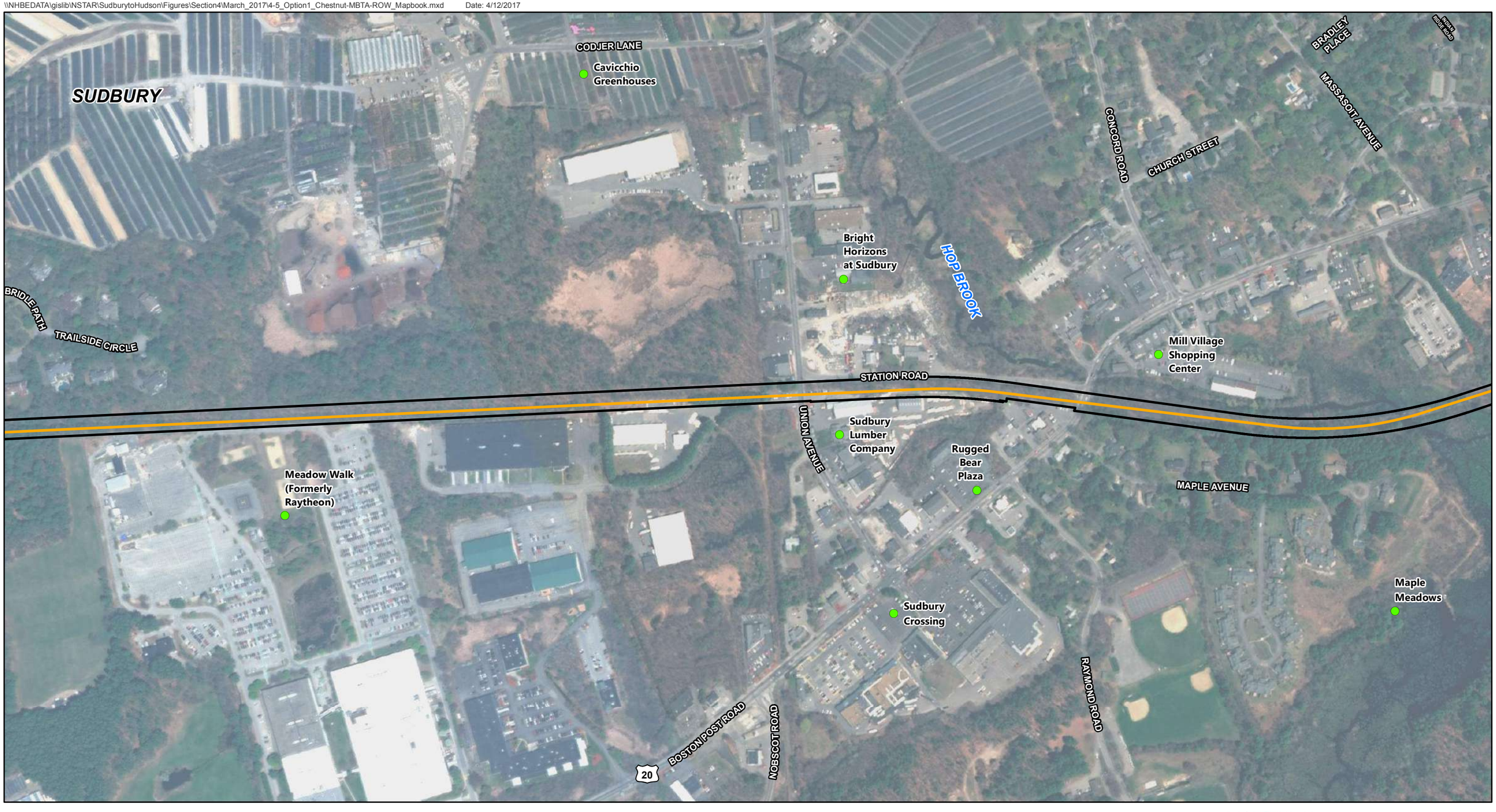

Route 1: MBTA ROW - Chestnut [9.3 miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-5: Candidate Route 1 MBTA ROW - Chestnut

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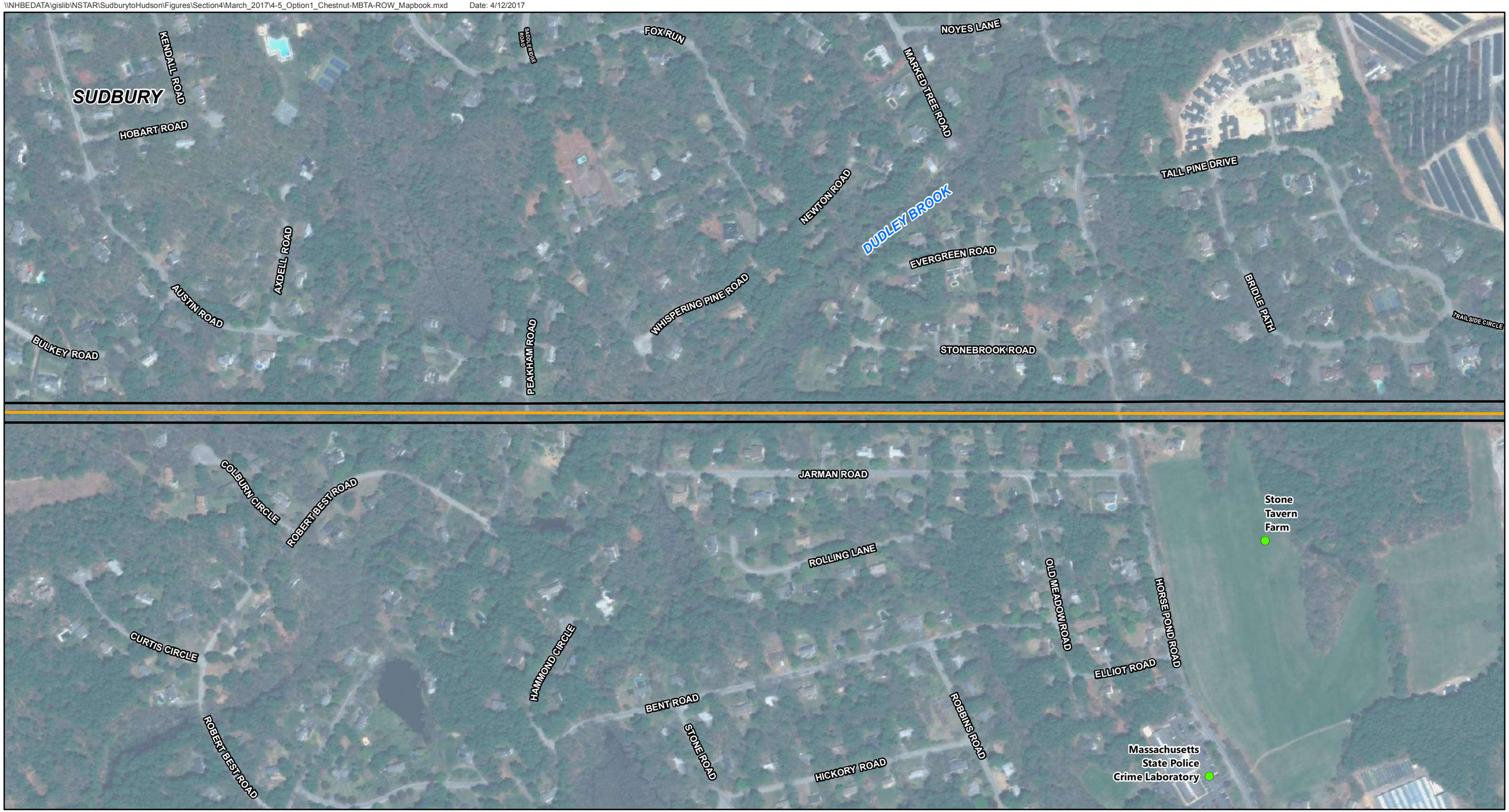
\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\March_2017\4-5_Option1_Chestnut-MBTA-ROW_Mapbook.mxd Date: 4/12/2017



Route 1: MBTA ROW - Chestnut [9.3 miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

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N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-5: Candidate Route 1 MBTA ROW - Chestnut

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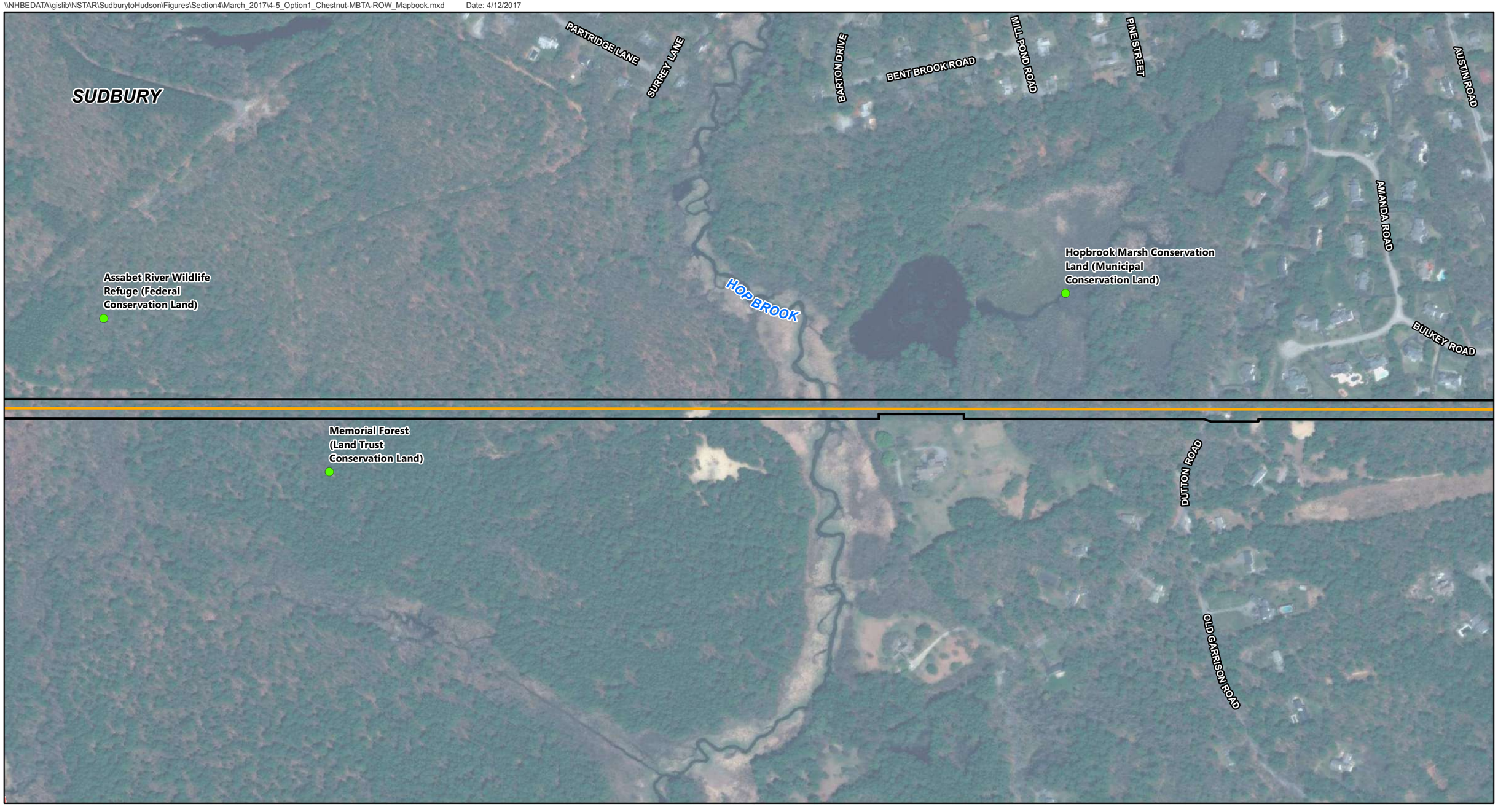
vhb



Route 1: MBTA ROW - Chestnut [9.3 miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

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N

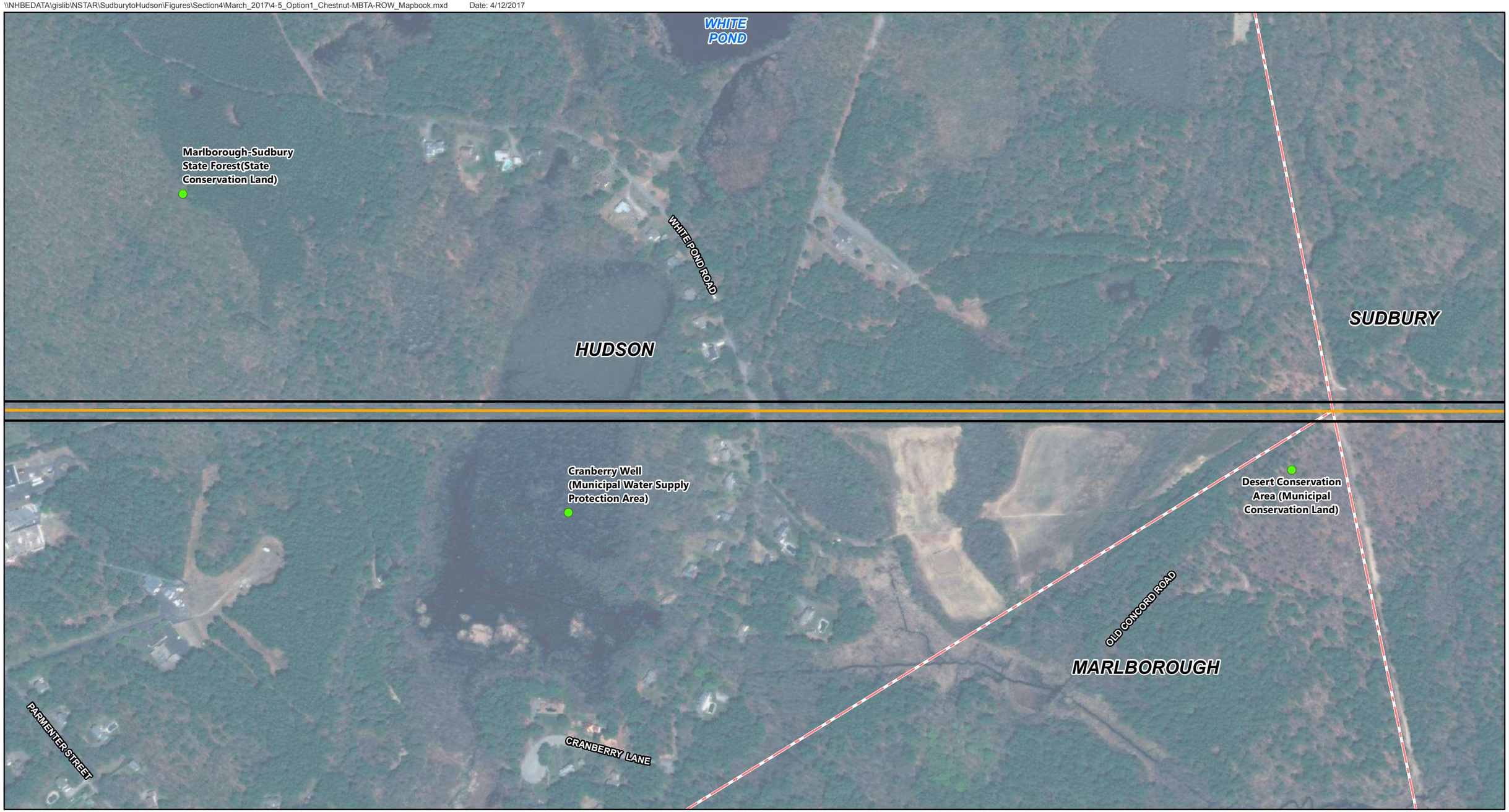
0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-5: Candidate Route 1 MBTA ROW - Chestnut

vhb



Route 1: MBTA ROW - Chestnut [9.3 miles]
MBTA ROW Boundary
Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

N

Source: MassGIS, VHB

4/12/2017

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-5: Candidate Route 1 MBTA ROW - Chestnut

vhb

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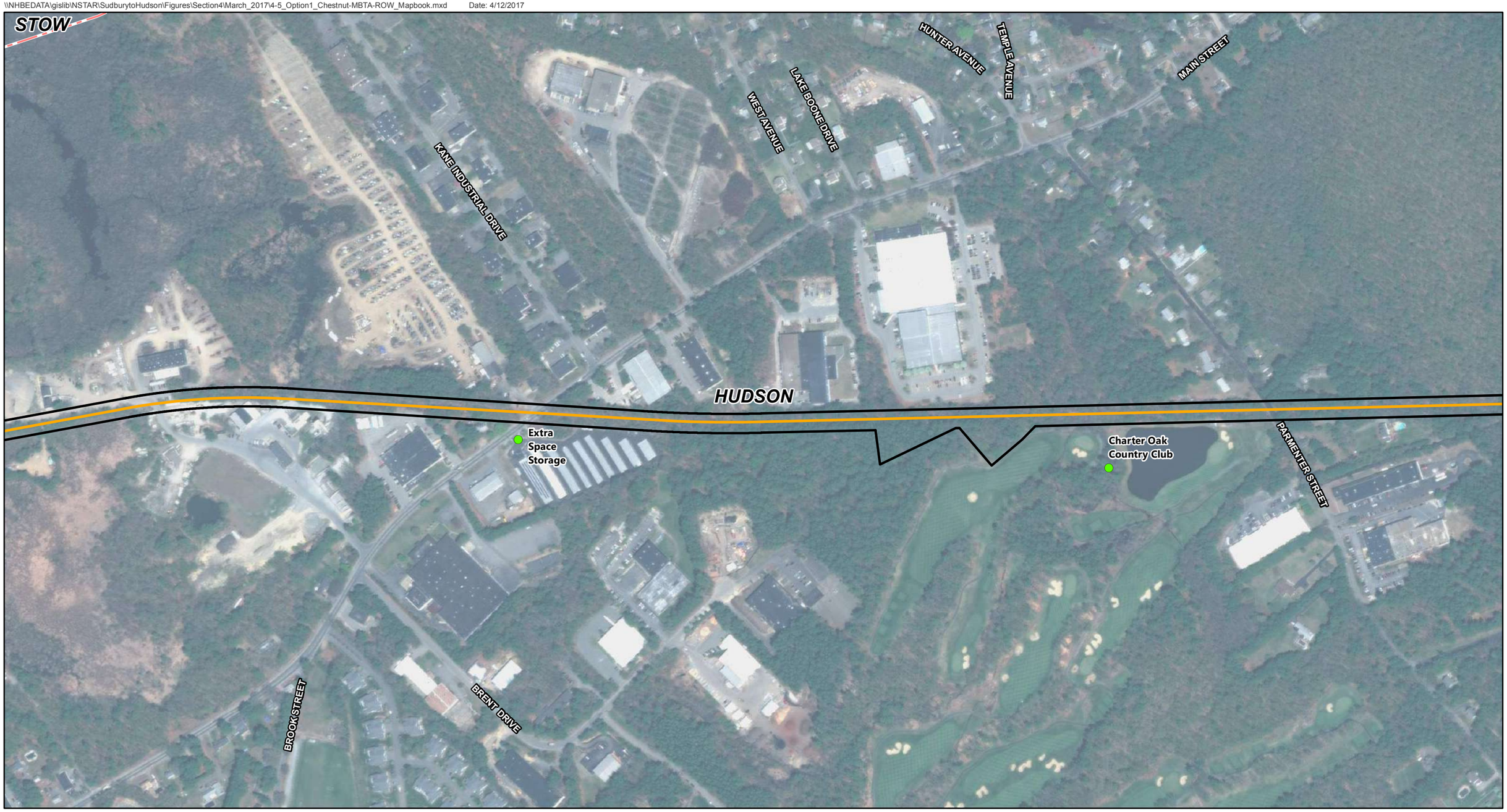

Route 1: MBTA ROW - Chestnut [9.3 miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

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N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-5: Candidate Route 1 MBTA ROW - Chestnut

vhb

Route 1: MBTA ROW - Chestnut [9.3 miles]
MBTA ROW Boundary
Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-5: Candidate Route 1
MBTA ROW - Chestnut**

vhb

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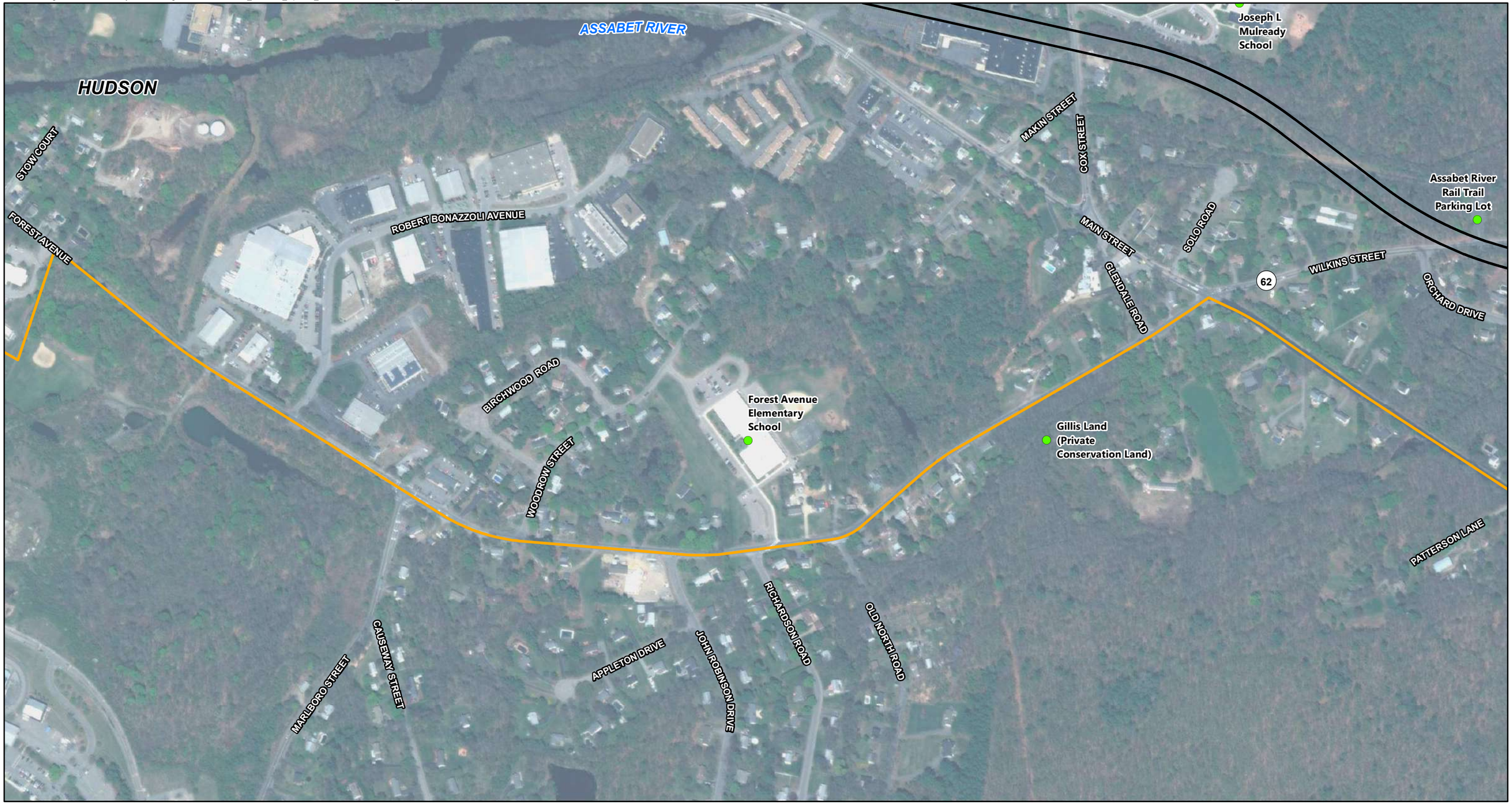

Route 1: MBTA ROW - Chestnut [9.3 miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-5: Candidate Route 1 MBTA ROW - Chestnut

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vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\March_2017\4-5_Option1_Chestnut-MBTA-ROW_Mapbook.mxd Date: 4/12/2017

Route 1: MBTA ROW - Chestnut [9.3 miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

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N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-5: Candidate Route 1 MBTA ROW - Chestnut

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vhb

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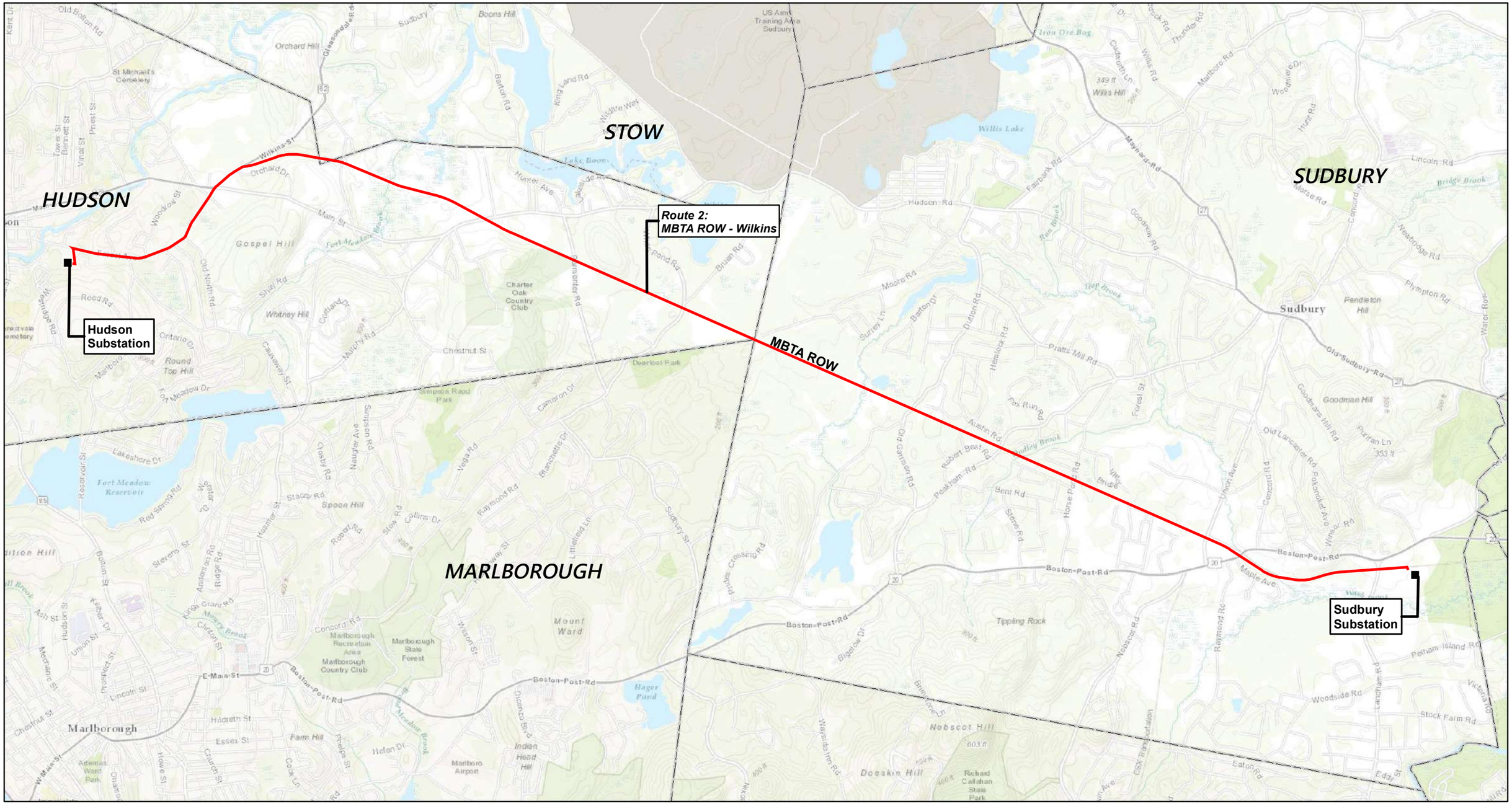

Route 2: MBTA ROW - Wilkins [9.0 Miles]

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/13/2017

N

0 3,000 6,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-6: Candidate Route 2
MBTA ROW - Wilkins**

vhb

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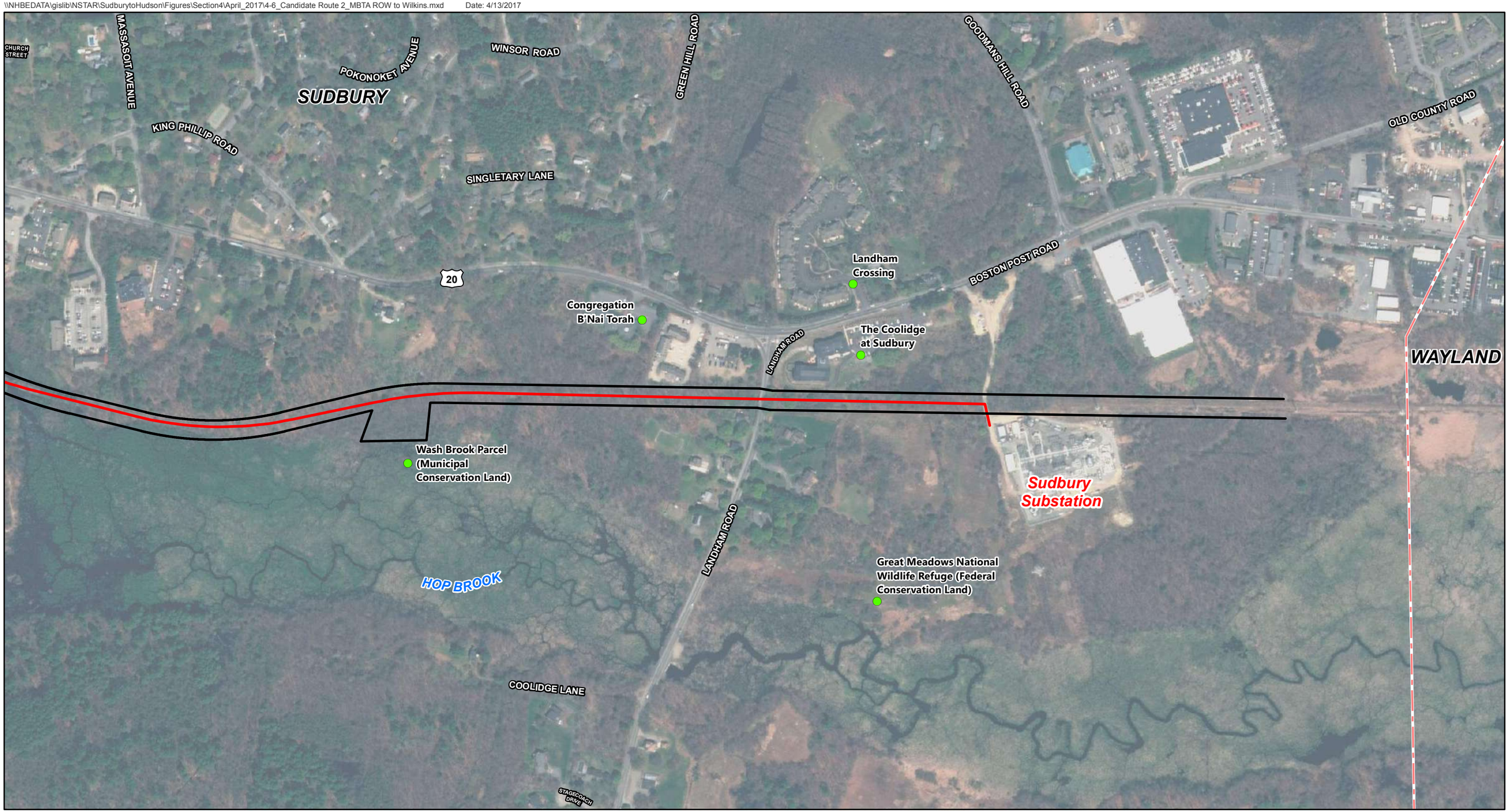

Route 2: MBTA ROW - Wilkins [9.0 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-6: Candidate Route 2 MBTA ROW - Wilkins

Sheet 1 of 9

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\April_2017\4-6_Candidate Route 2_MBTA ROW to Wilkins.mxd Date: 4/13/2017

Route 2: MBTA ROW - Wilkins [9.0 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-6: Candidate Route 2 MBTA ROW - Wilkins

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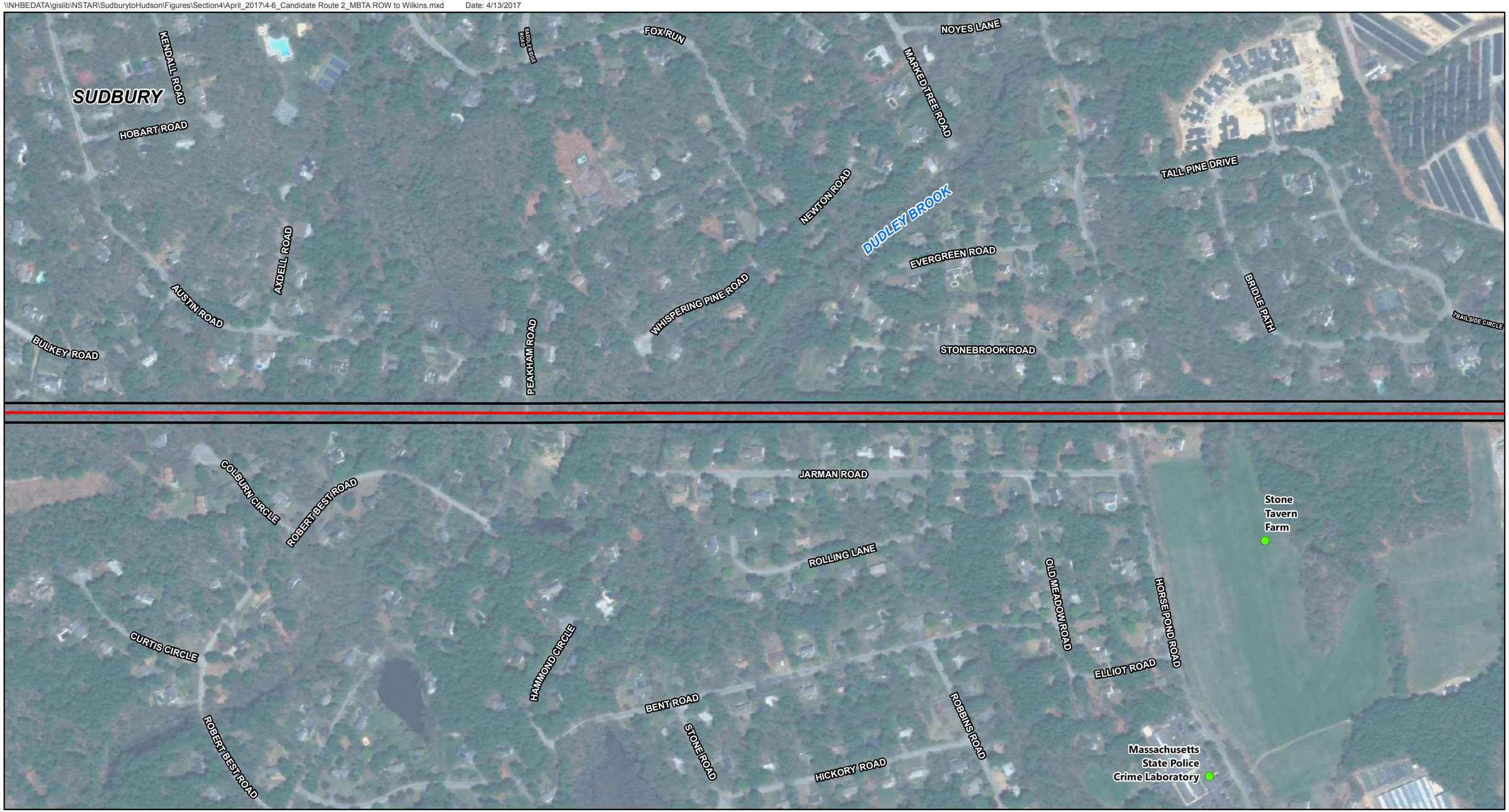


Route 2: MBTA ROW - Wilkins [9.0 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

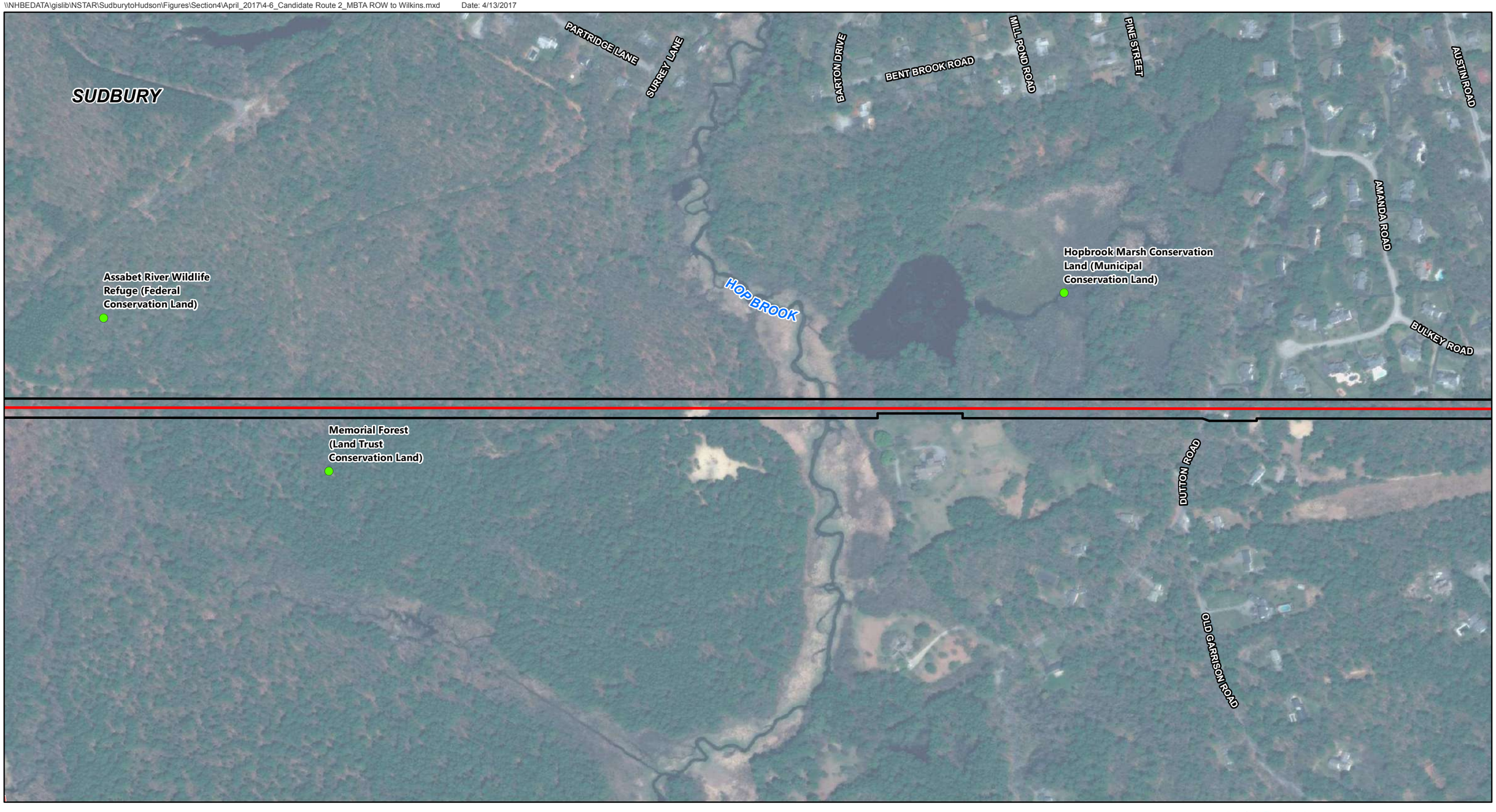
Sudbury-Hudson Transmission Reliability Project

Figure 4-6: Candidate Route 2 MBTA ROW - Wilkins

Sheet 3 of 9

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\April_2017\4-6_Candidate Route 2_MBTA ROW to Wilkins.mxd Date: 4/13/2017



Route 2: MBTA ROW - Wilkins [9.0 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-6: Candidate Route 2 MBTA ROW - Wilkins

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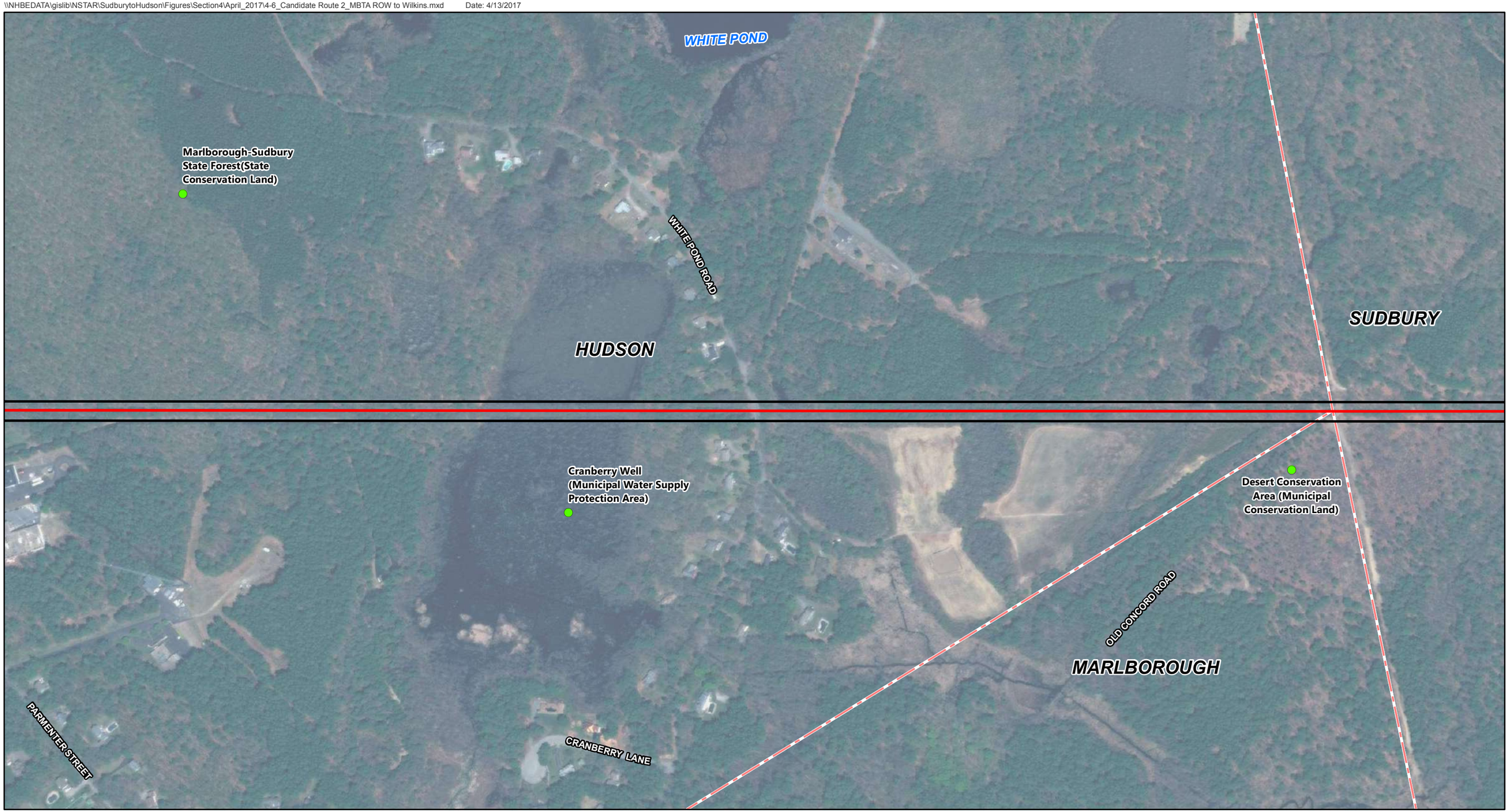

Route 2: MBTA ROW - Wilkins [9.0 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

N

Source: MassGIS, VHB

4/13/2017

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-6: Candidate Route 2 MBTA ROW - Wilkins

Sheet 5 of 9

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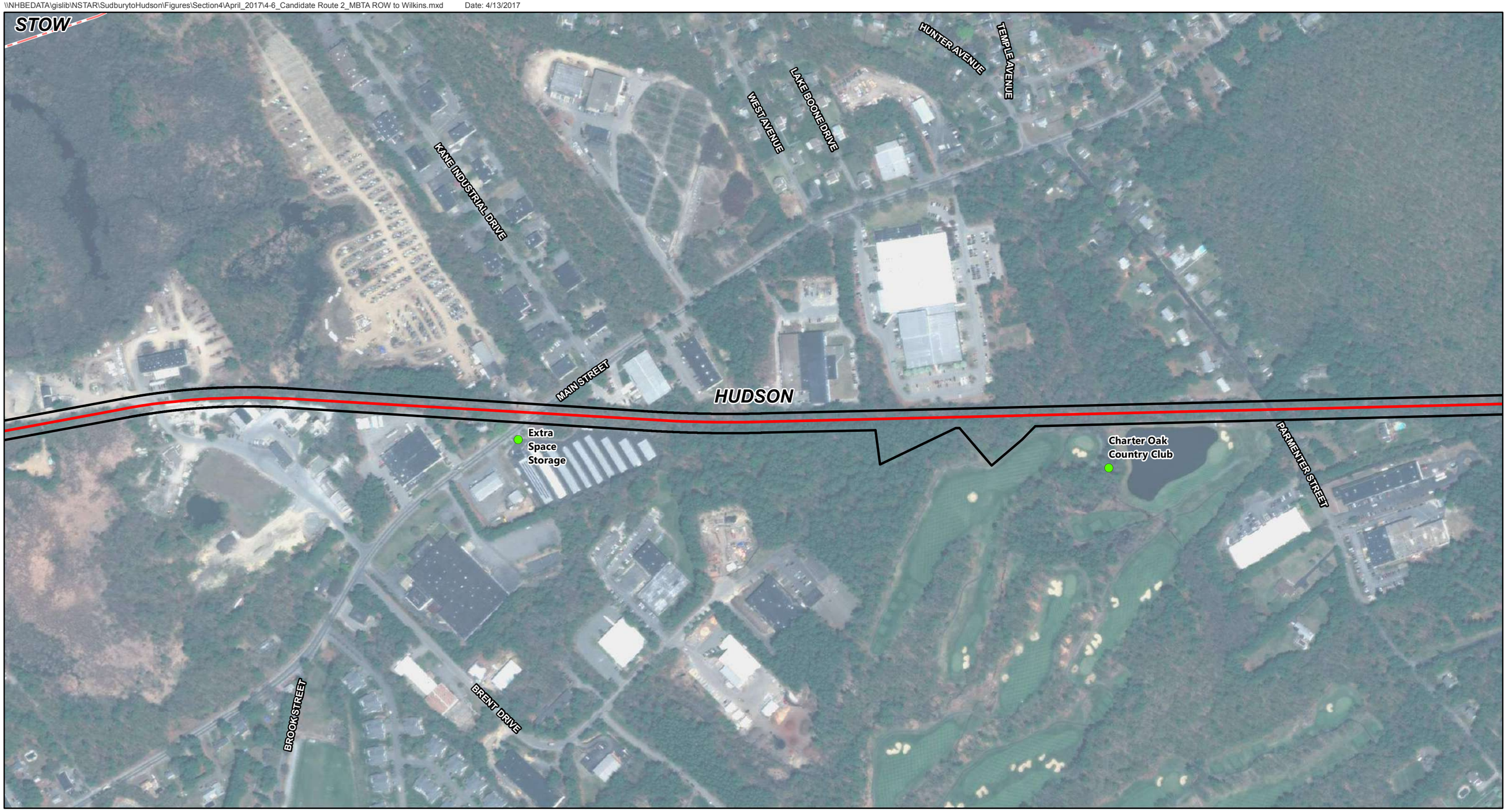

Route 2: MBTA ROW - Wilkins [9.0 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-6: Candidate Route 2 MBTA ROW - Wilkins

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vhb

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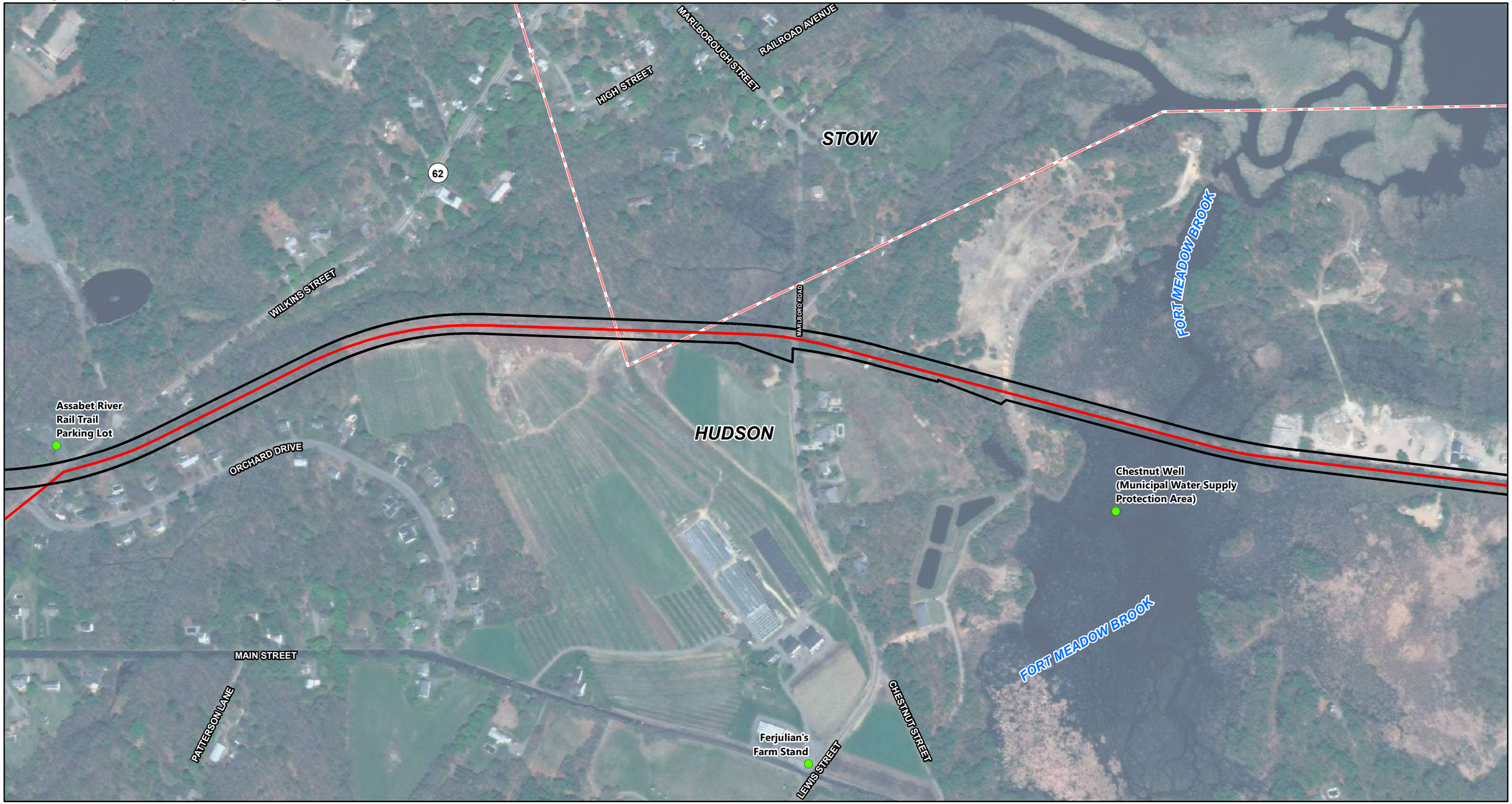

Route 2: MBTA ROW - Wilkins [9.0 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-6: Candidate Route 2
MBTA ROW - Wilkins**

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vhb

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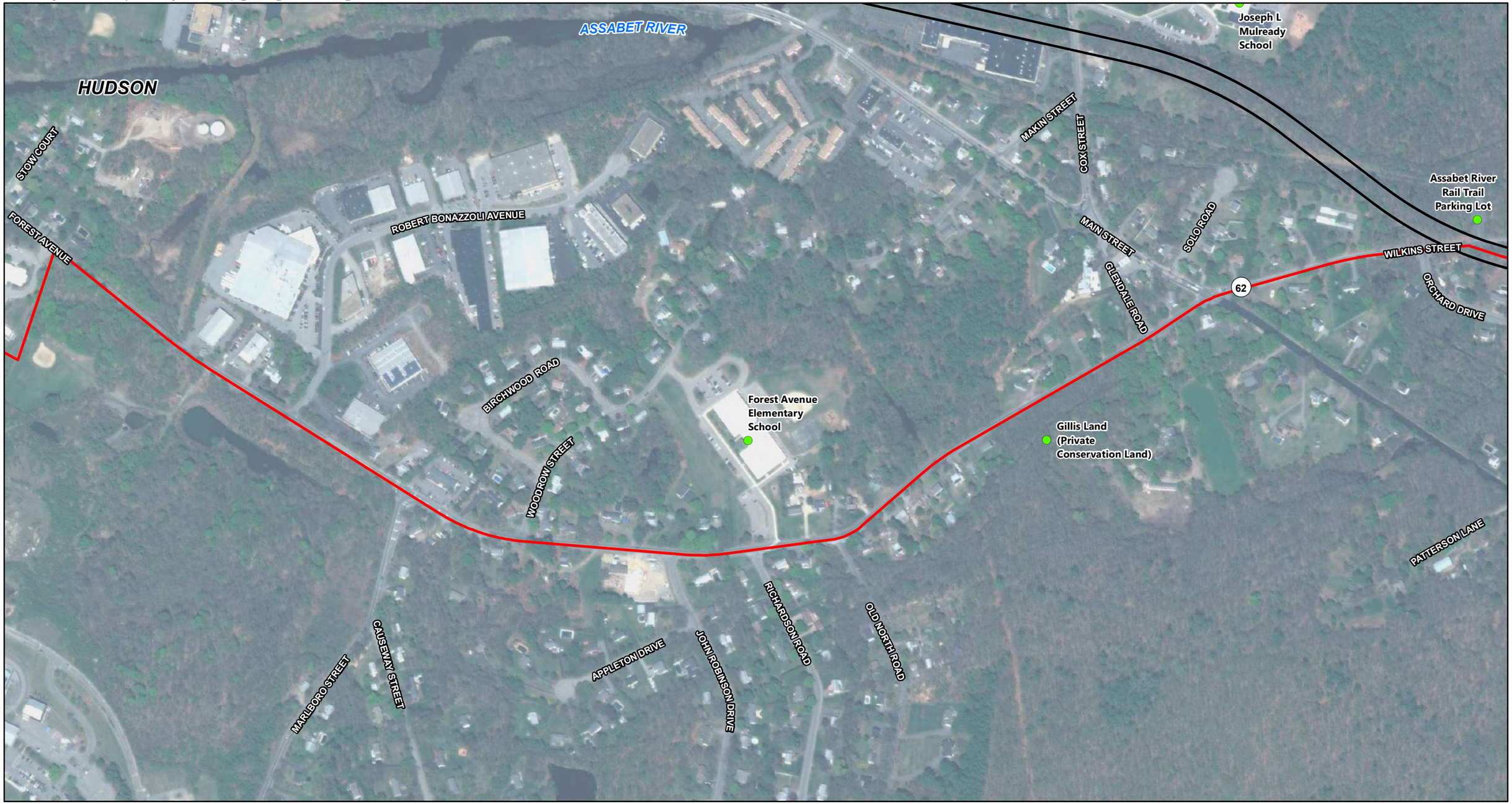

Route 2: MBTA ROW - Wilkins [9.0 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/13/2017

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-6: Candidate Route 2 MBTA ROW - Wilkins

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vhb

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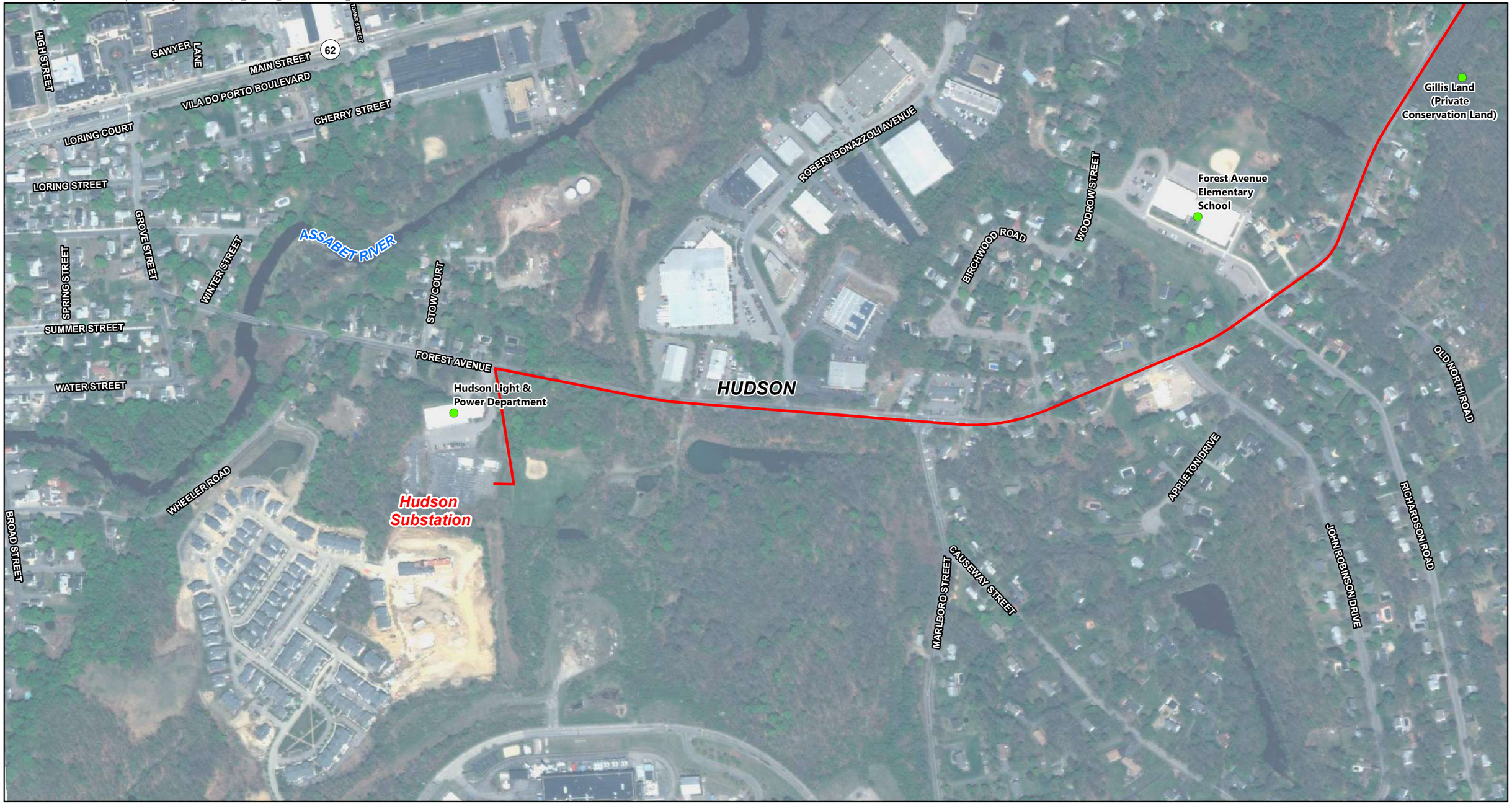

Route 2: MBTA ROW - Wilkins [9.0 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-6: Candidate Route 2 MBTA ROW - Wilkins

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vhb

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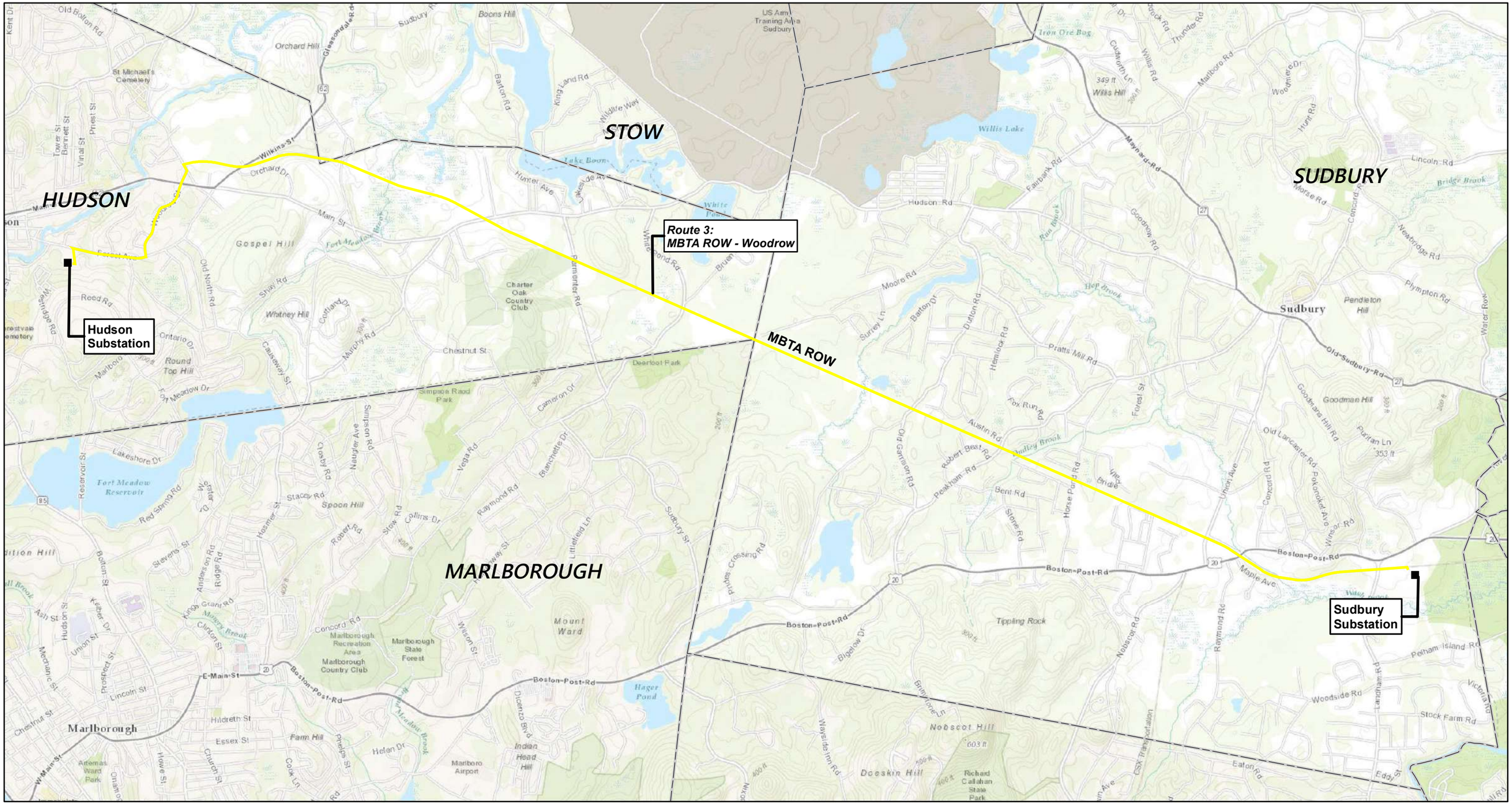


Route 3: MBTA ROW - Woodrow [9.2 Miles]

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/13/2017

N

0 3,000 6,000 Feet

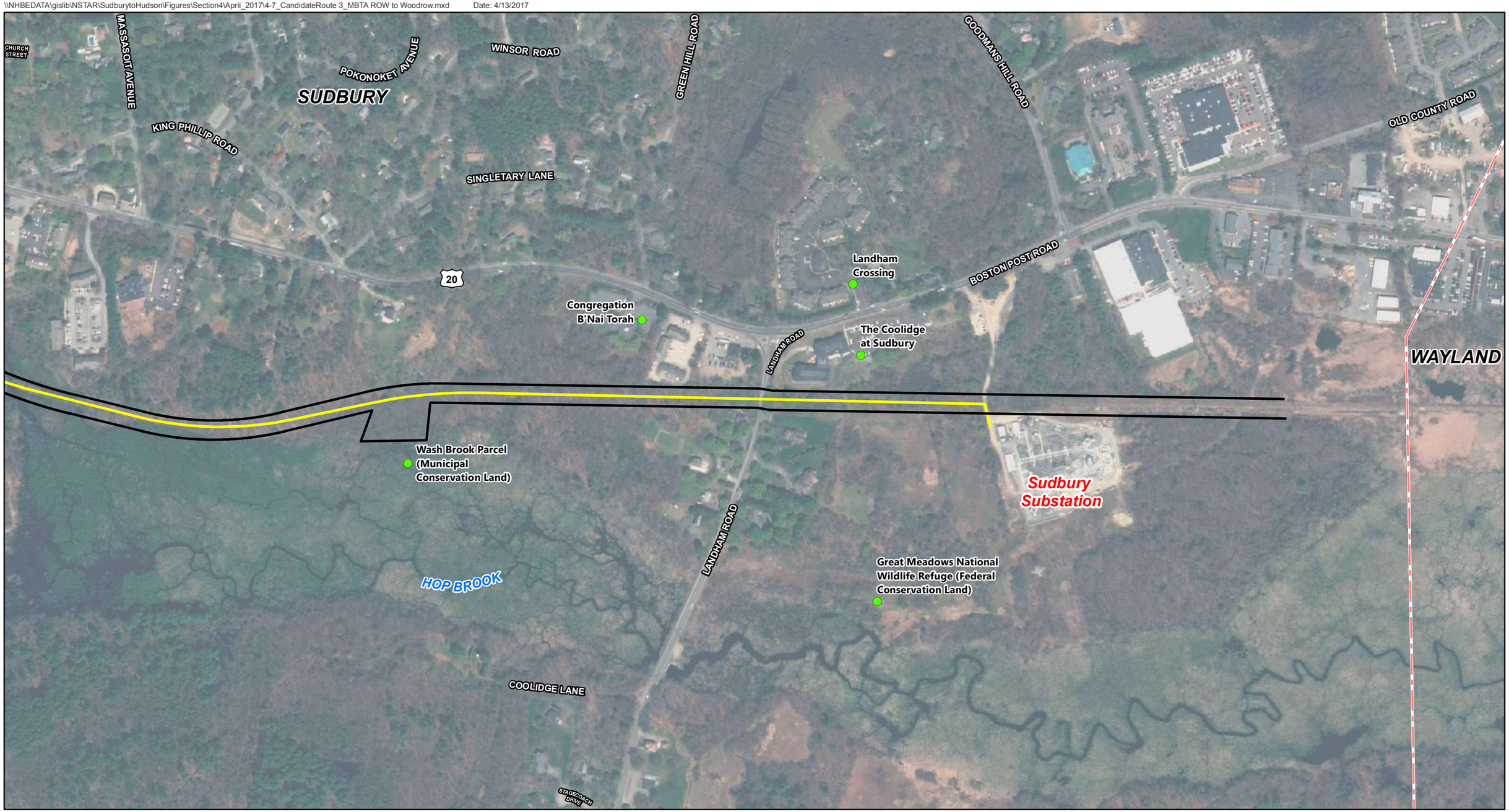
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-7: Candidate Route 3
MBTA ROW - Woodrow**

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\April_2017\4-7_CandidateRoute 3_MBTA ROW to Woodrow.mxd Date: 4/13/2017



Route 3: MBTA ROW - Woodrow [9.2 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

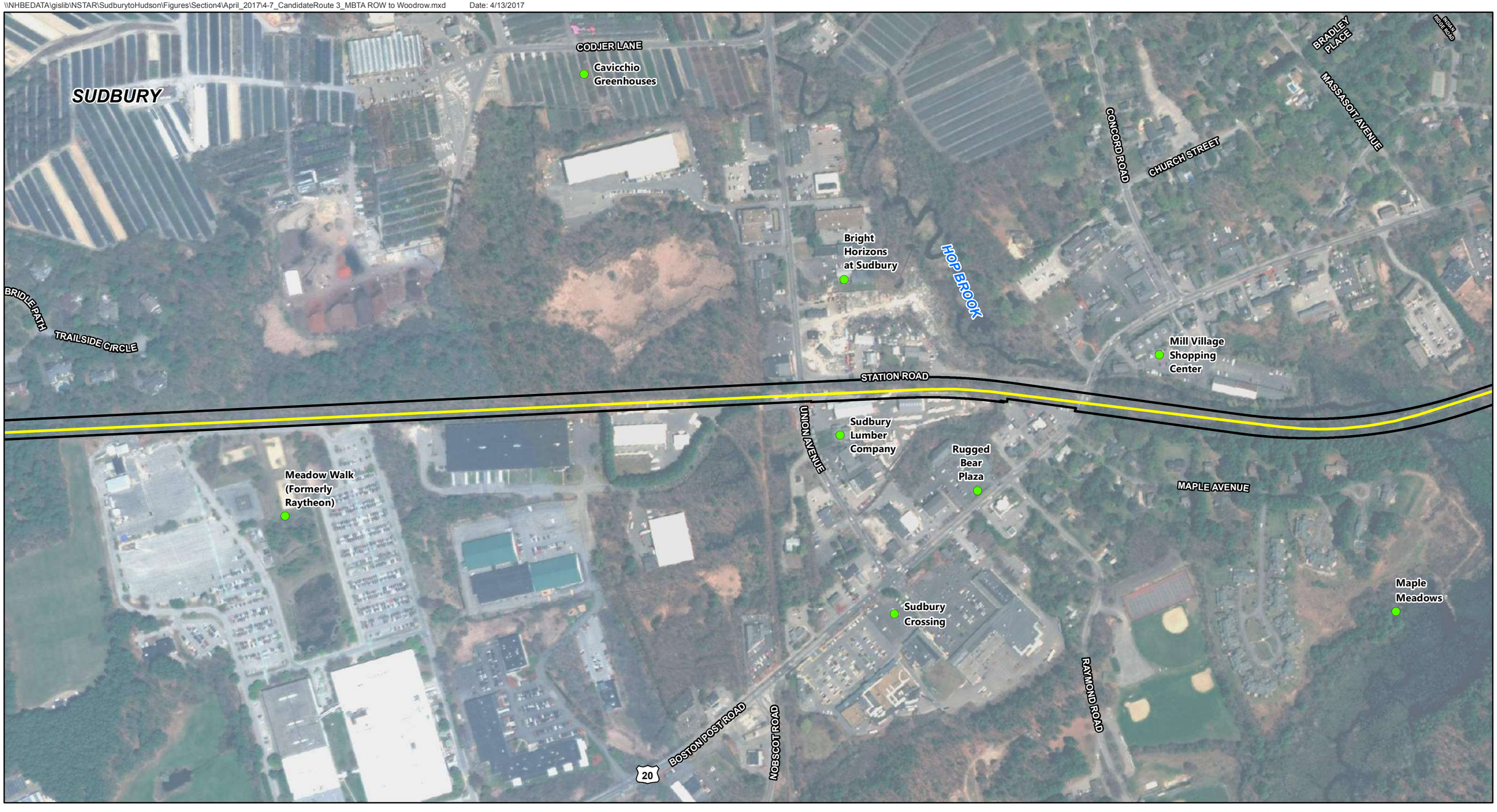
Sudbury-Hudson Transmission Reliability Project

Figure 4-7: Candidate Route 3 MBTA ROW - Woodrow

Sheet 1 of 9

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\April_2017\4-7_CandidateRoute 3_MBTA ROW to Woodrow.mxd Date: 4/13/2017



Route 3: MBTA ROW - Woodrow [9.2 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-7: Candidate Route 3 MBTA ROW - Woodrow

Sheet 2 of 9

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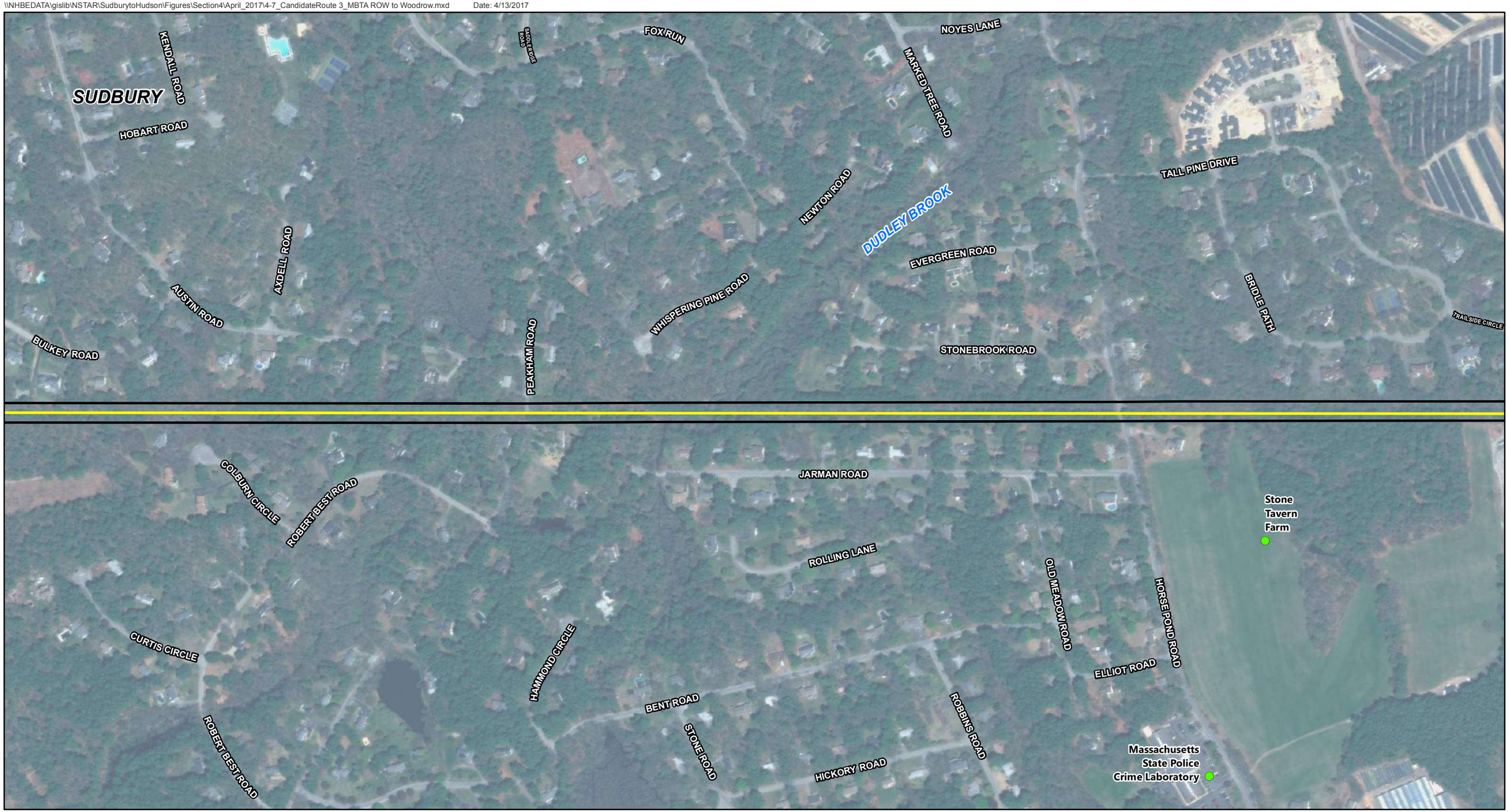

Route 3: MBTA ROW - Woodrow [9.2 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-7: Candidate Route 3 MBTA ROW - Woodrow

Sheet 3 of 9

vhb

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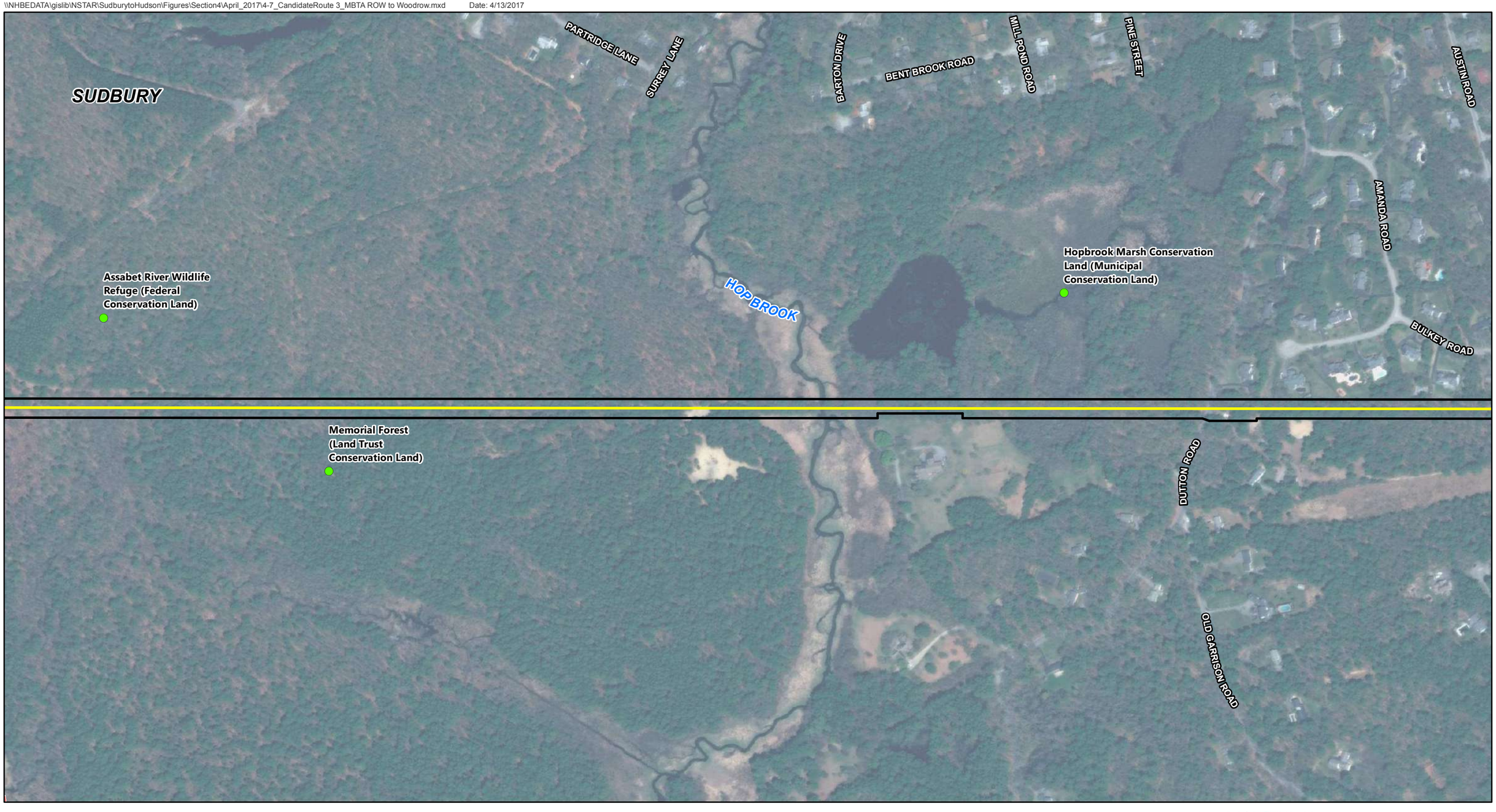

Route 3: MBTA ROW - Woodrow [9.2 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-7: Candidate Route 3 MBTA ROW - Woodrow

Sheet 4 of 9

vhb

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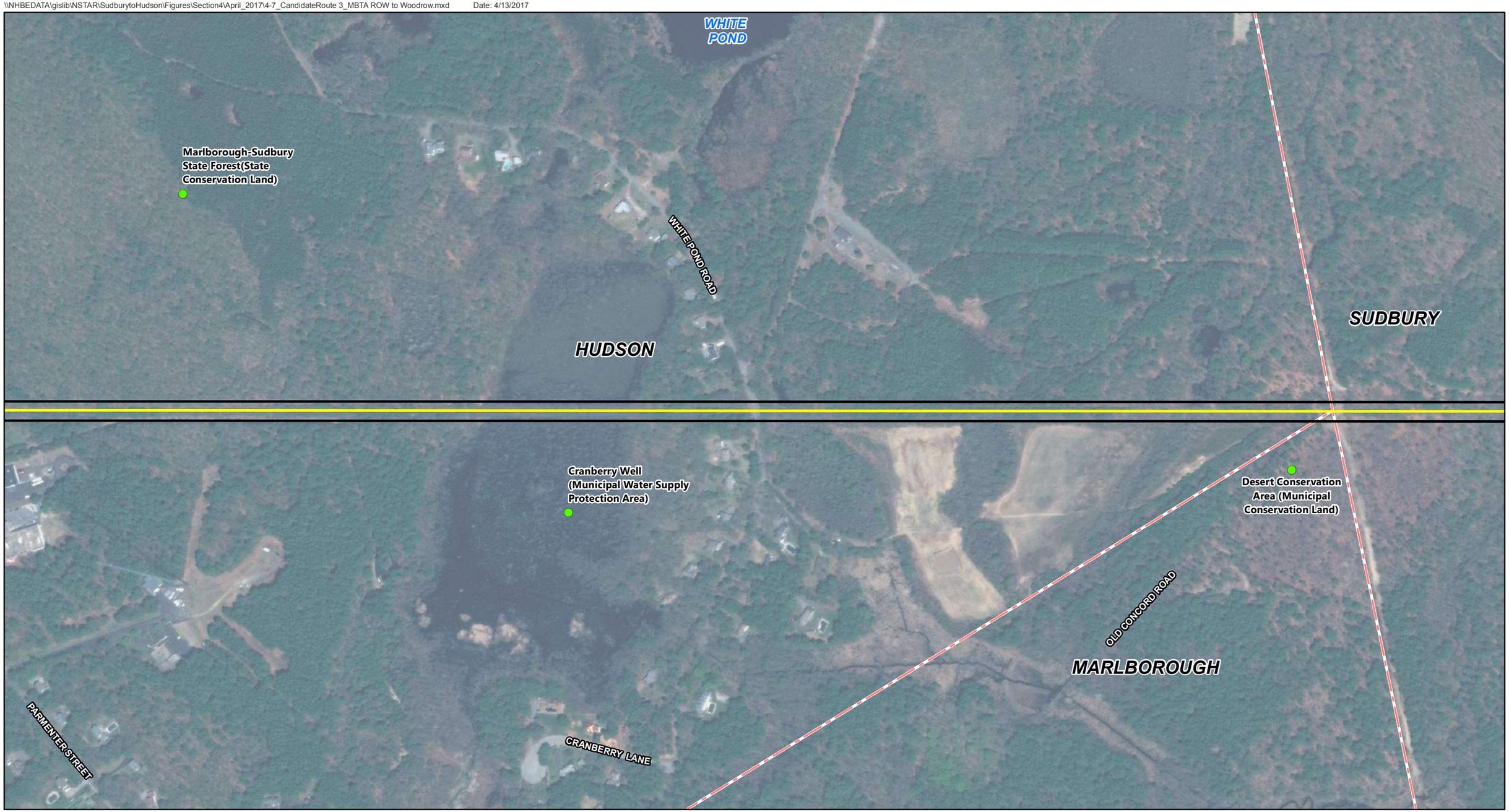

Route 3: MBTA ROW - Woodrow [9.2 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

N

Source: MassGIS, VHB

4/13/2017

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-7: Candidate Route 3 MBTA ROW - Woodrow

Sheet 5 of 9

vhb

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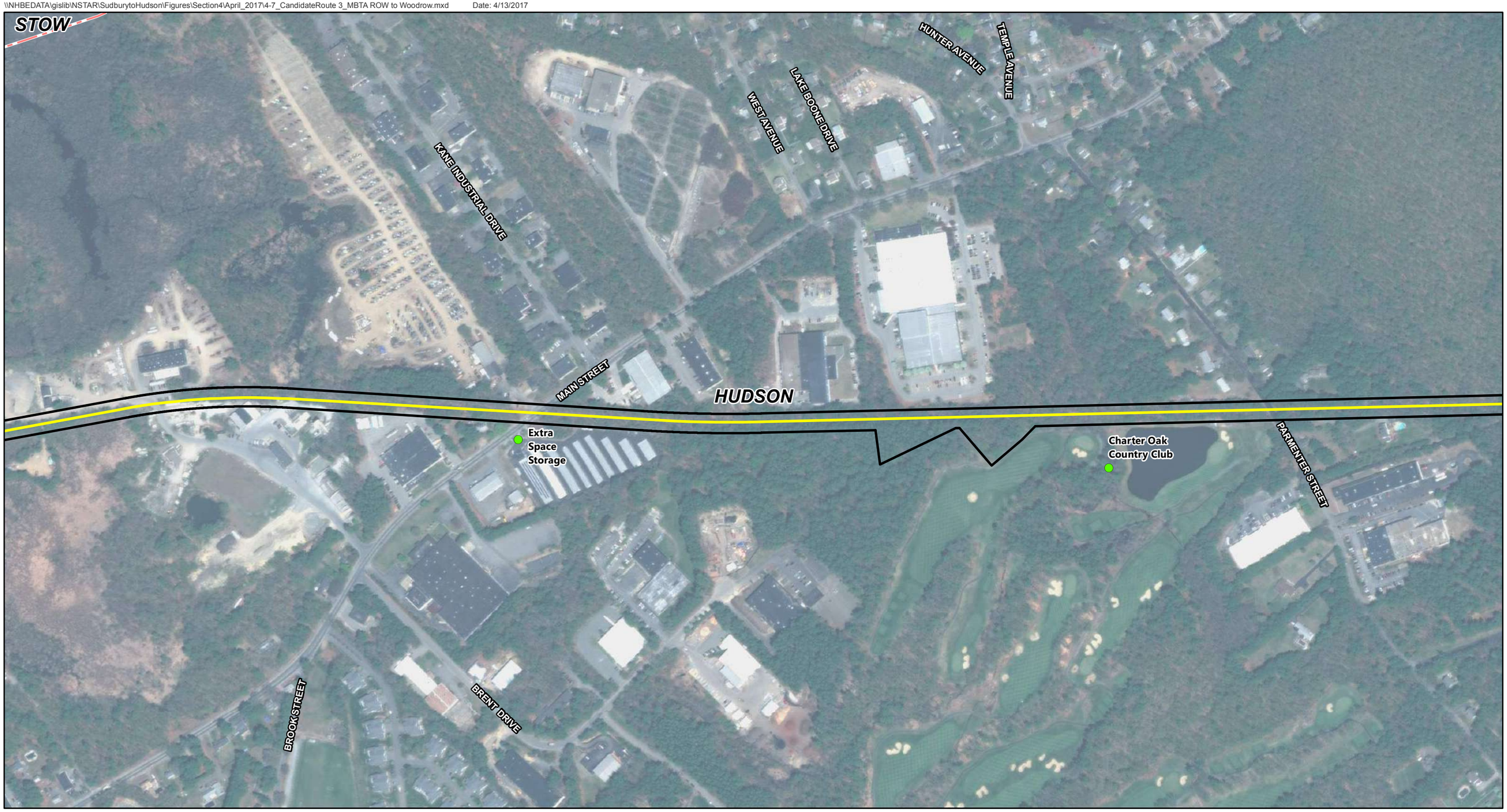

Route 3: MBTA ROW - Woodrow [9.2 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-7: Candidate Route 3 MBTA ROW - Woodrow

Sheet 6 of 9

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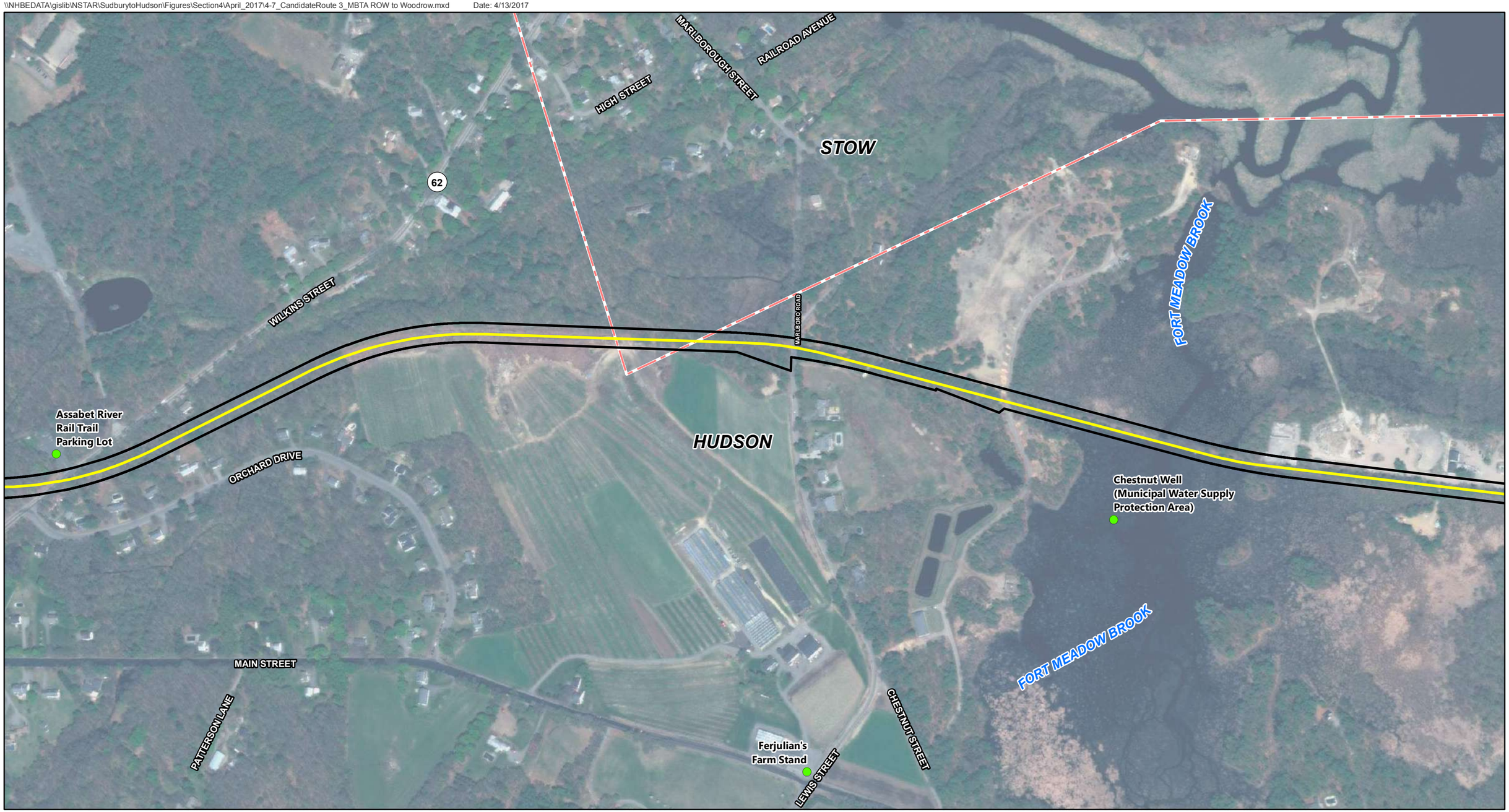

Route 3: MBTA ROW - Woodrow [9.2 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/13/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-7: Candidate Route 3
MBTA ROW - Woodrow**

Sheet 7 of 9

vhb

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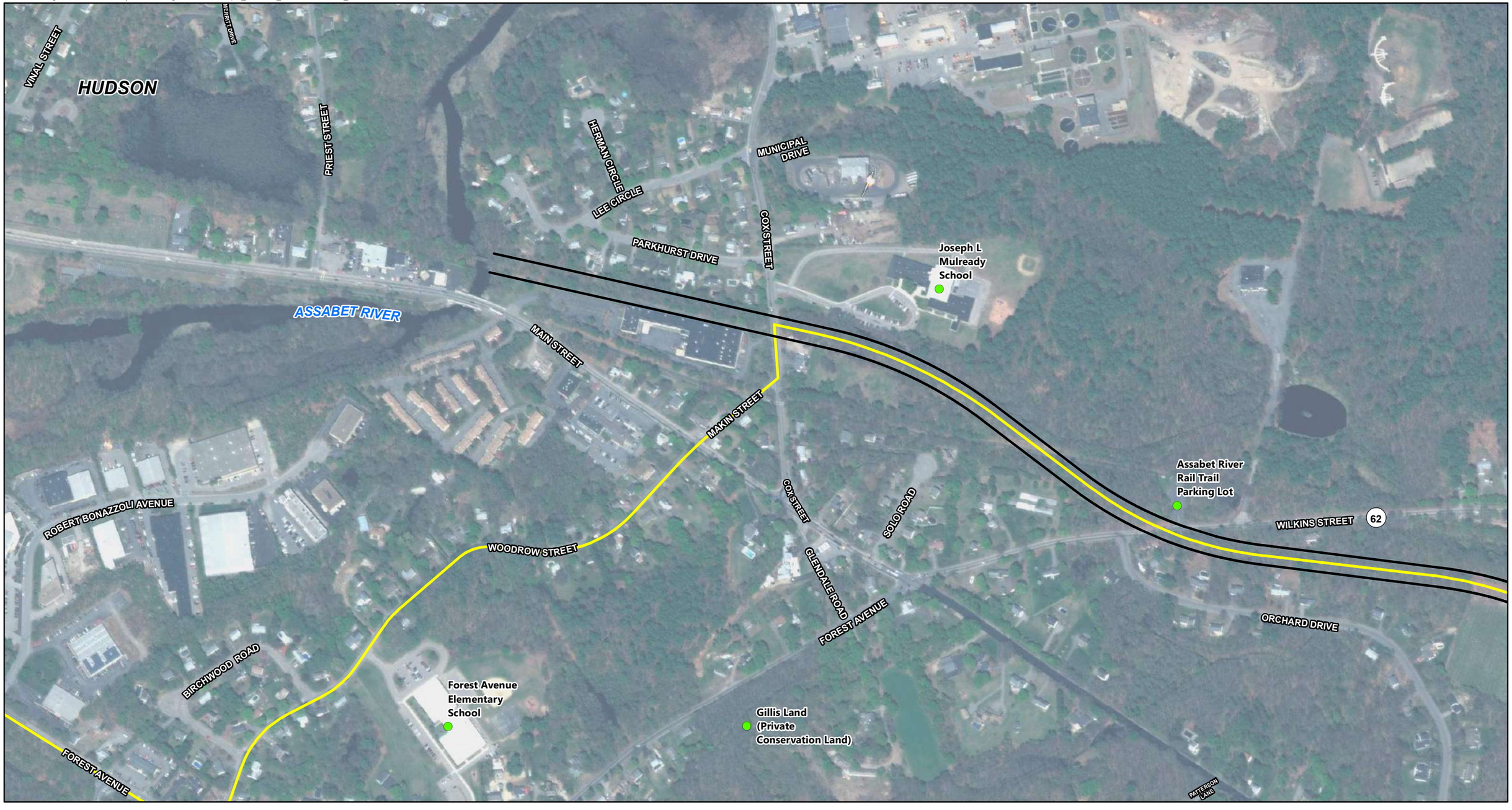

Route 3: MBTA ROW - Woodrow [9.2 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-7: Candidate Route 3 MBTA ROW - Woodrow

Sheet 8 of 9

vhb

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Route 3: MBTA ROW - Woodrow [9.2 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/13/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-7: Candidate Route 3 MBTA ROW - Woodrow

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vhb

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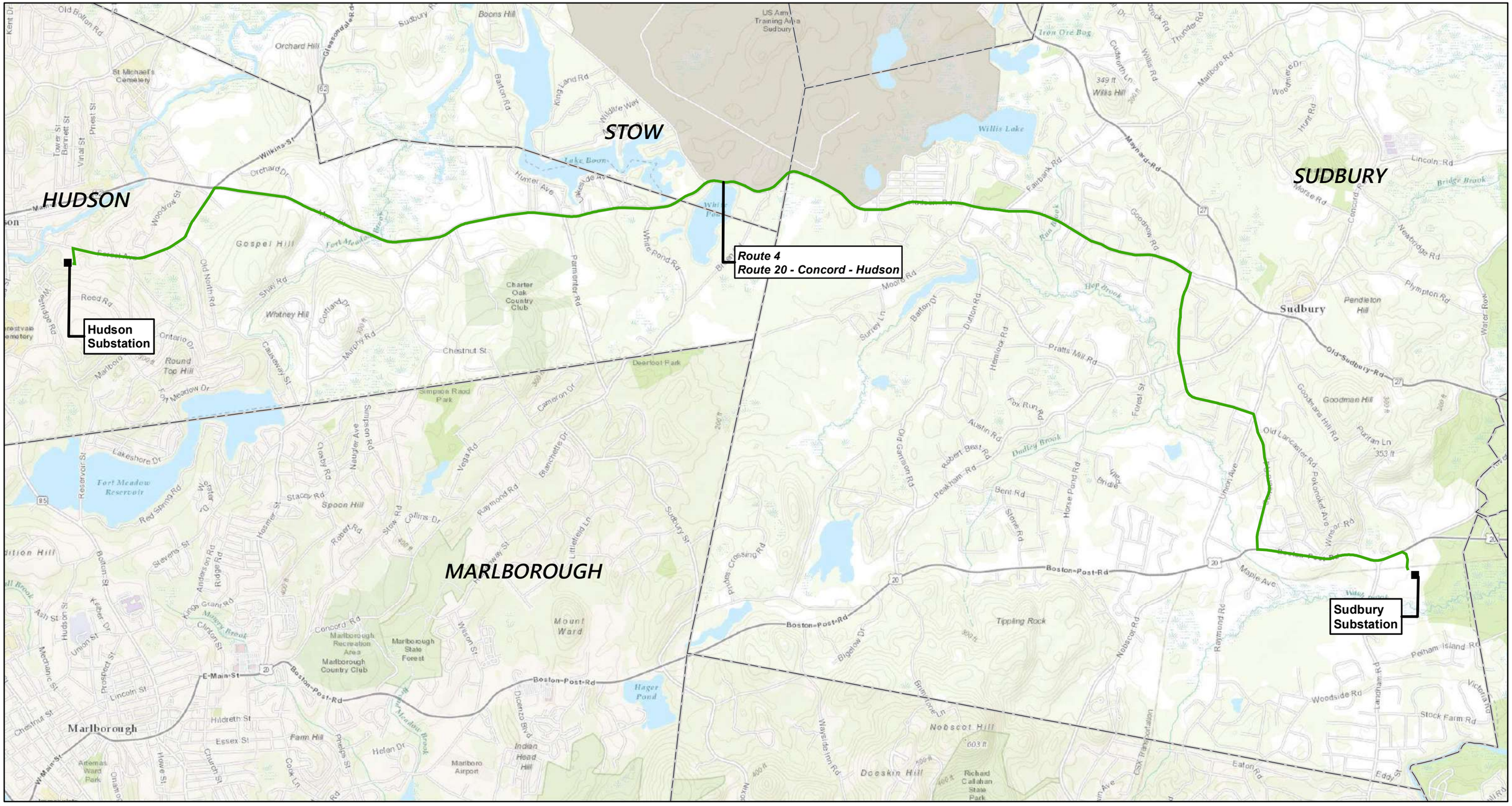

Route 4: Route 20 - Concord - Hudson [10.5 Miles]

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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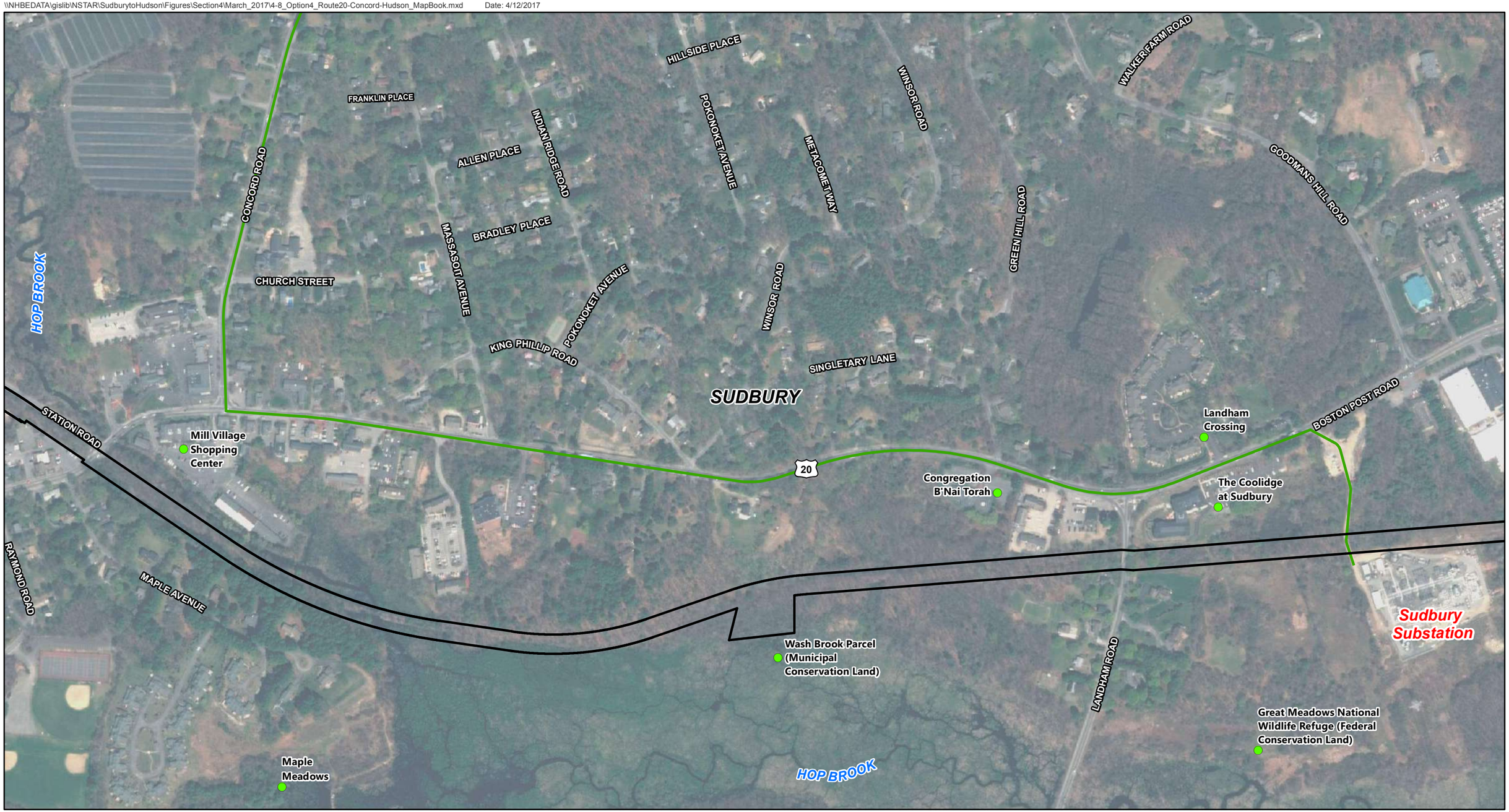
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-8: Candidate Route 4
Route 20 - Concord - Hudson**

vhb



Route 4: Route 20 - Concord - Hudson [10.5 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-8: Candidate Route 4 Route 20 - Concord - Hudson

Sheet 1 of 9

vhb

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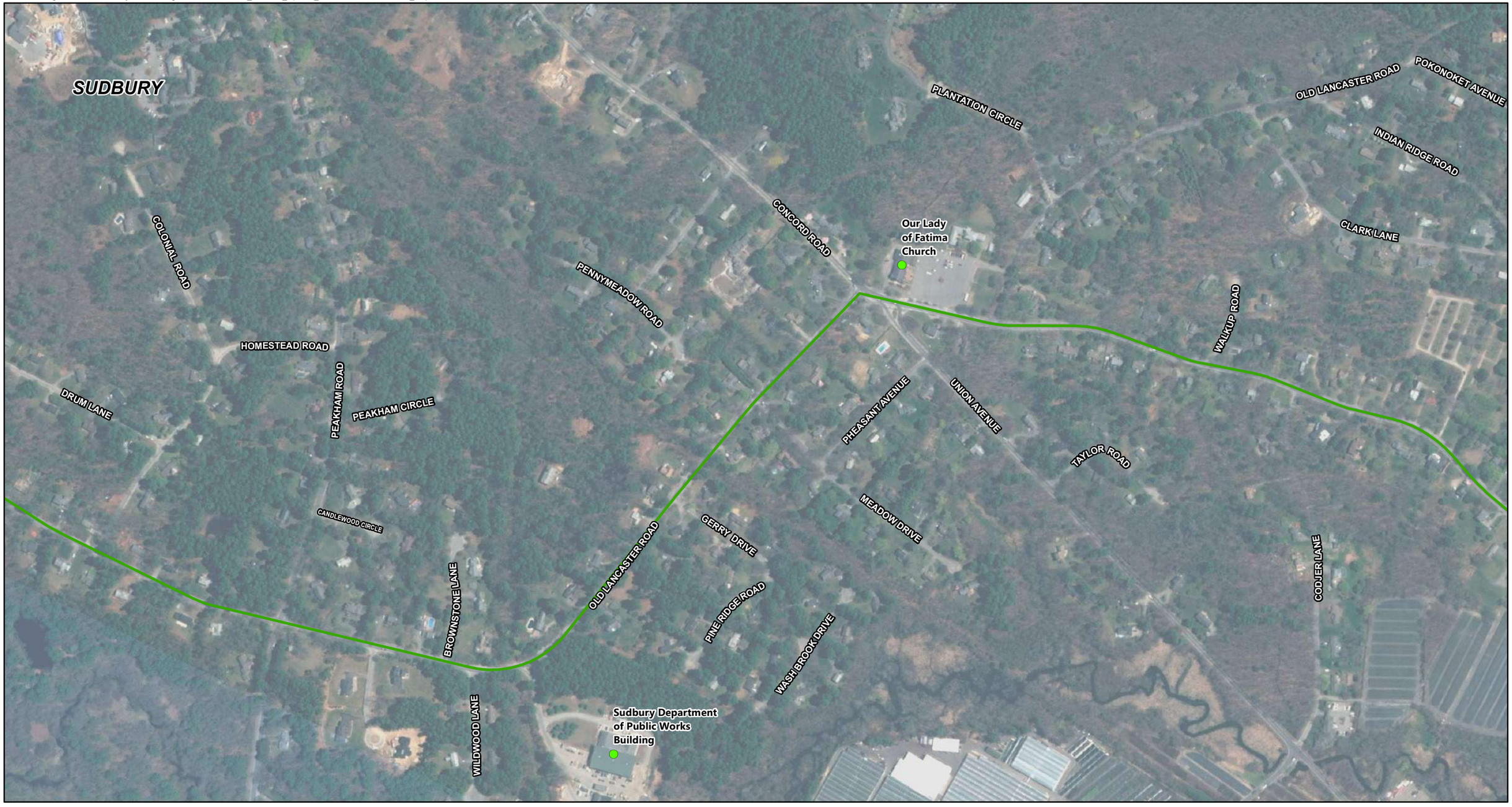

Route 4: Route 20 - Concord - Hudson [10.5 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-8: Candidate Route 4 Route 20 - Concord - Hudson

Sheet 2 of 9

vhb

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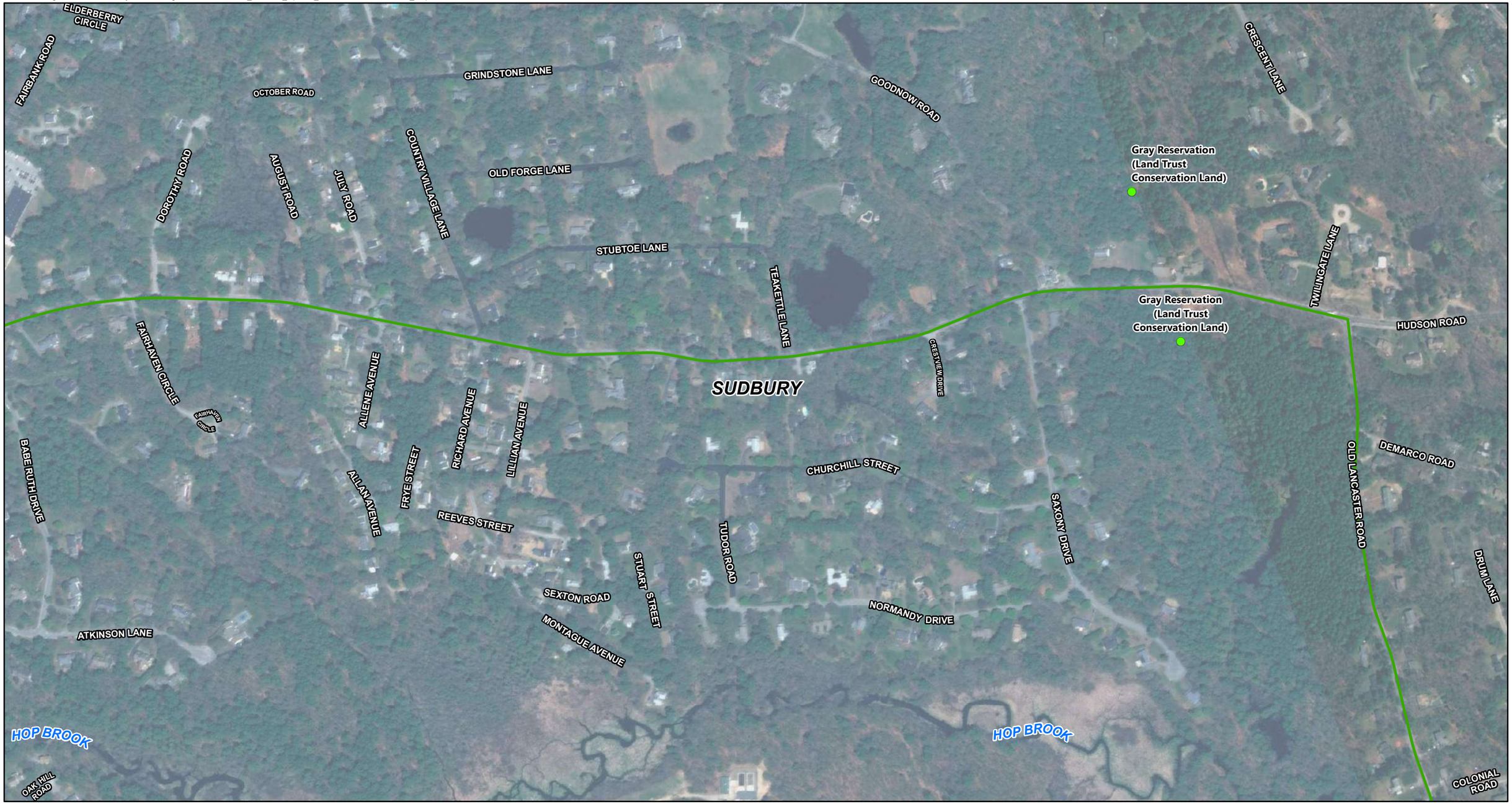

Route 4: Route 20 - Concord - Hudson [10.5 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

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0 400 800 Feet

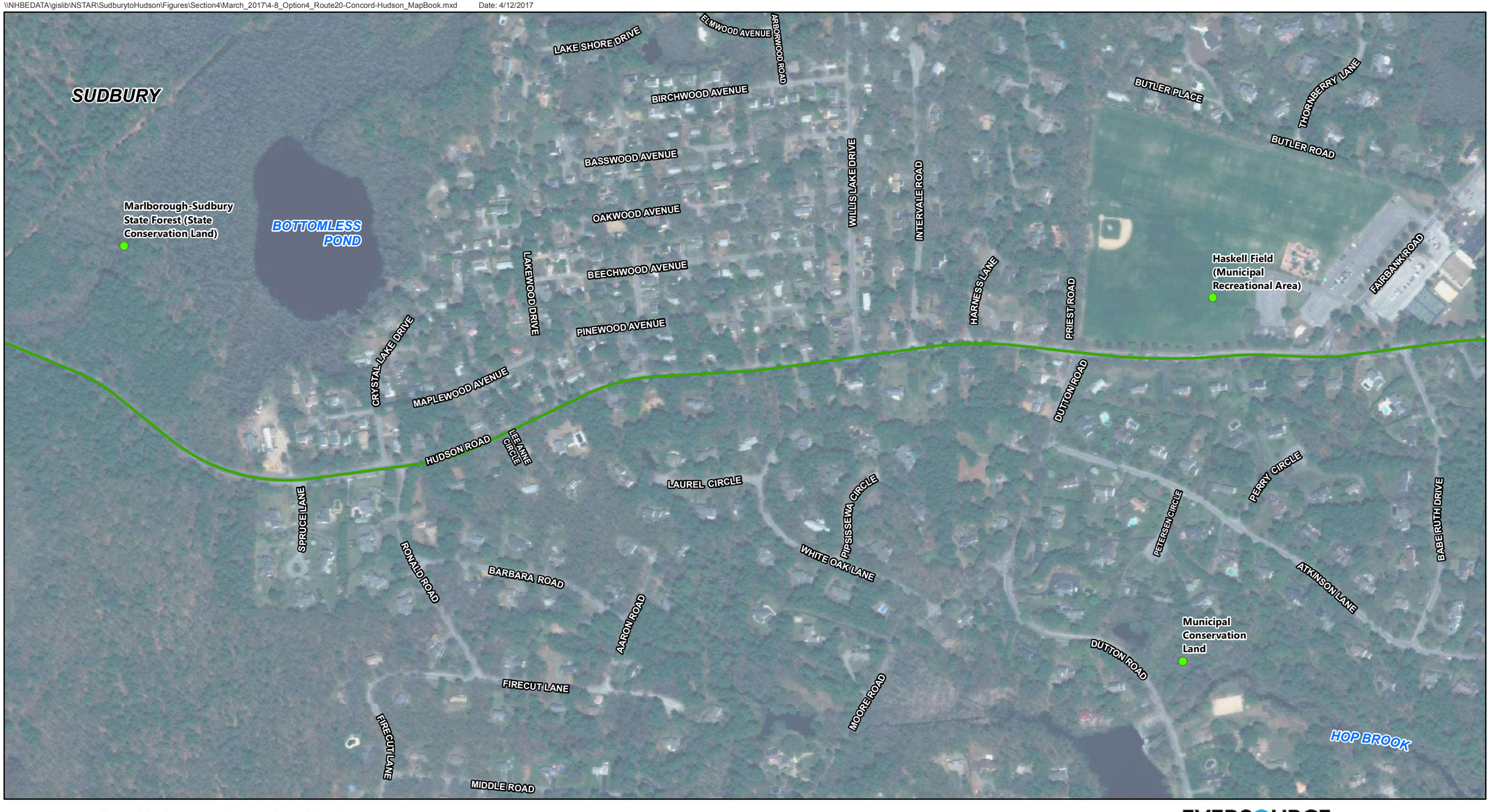
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-8: Candidate Route 4
Route 20 - Concord - Hudson

Sheet 3 of 9

vhb



Route 4: Route 20 - Concord - Hudson [10.5 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-8: Candidate Route 4 Route 20 - Concord - Hudson

Sheet 4 of 9

vhb

Route 4: Route 20 - Concord - Hudson [10.5 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-8: Candidate Route 4 Route 20 - Concord - Hudson

Sheet 5 of 9

vhb

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Route 4: Route 20 - Concord - Hudson [10.5 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-8: Candidate Route 4 Route 20 - Concord - Hudson

Sheet 6 of 9

vhb

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Route 4: Route 20 - Concord - Hudson [10.5 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

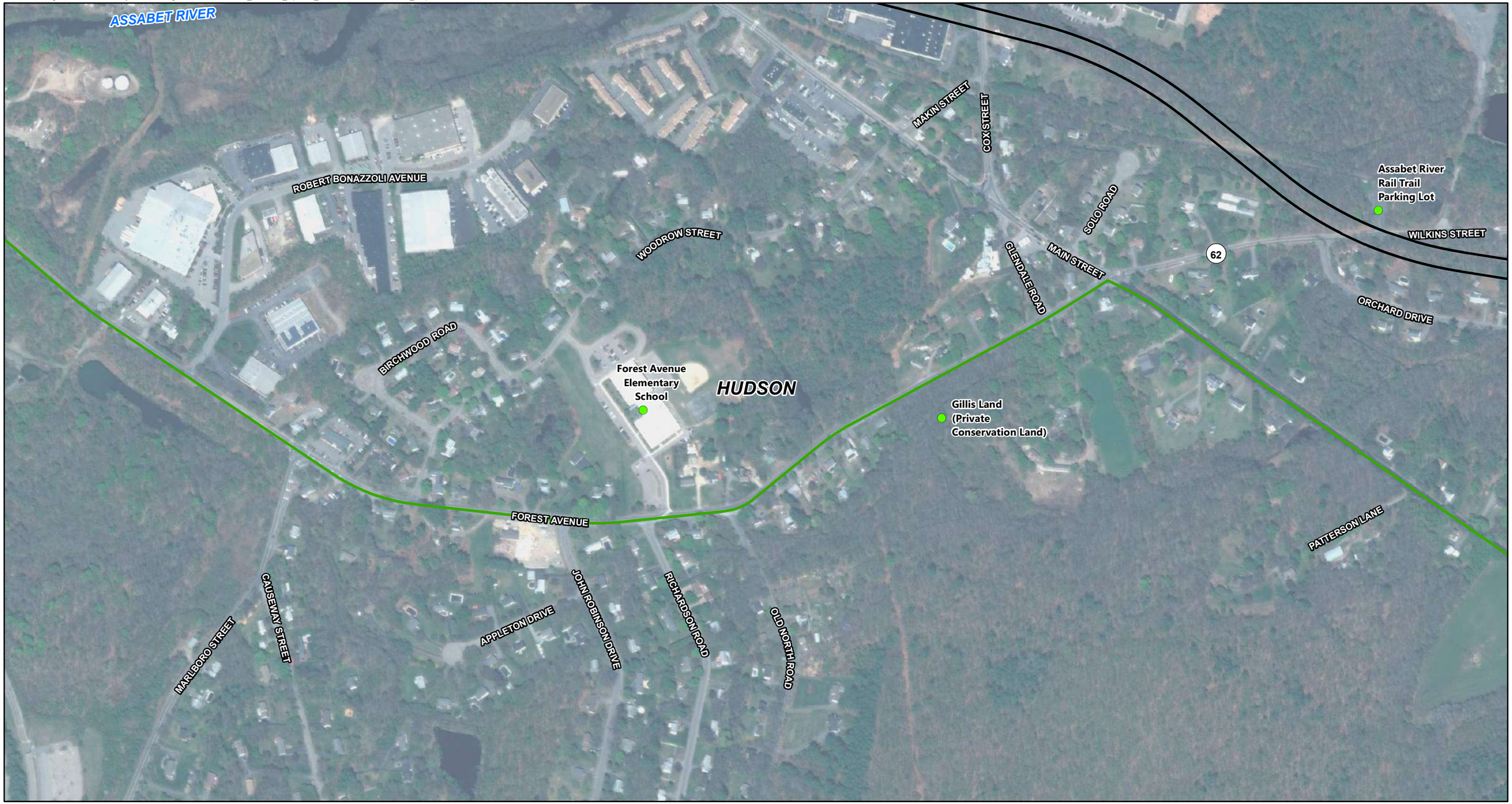
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-8: Candidate Route 4
Route 20 - Concord - Hudson**

Sheet 7 of 9

vhb



Route 4: Route 20 - Concord - Hudson [10.5 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-8: Candidate Route 4
Route 20 - Concord - Hudson

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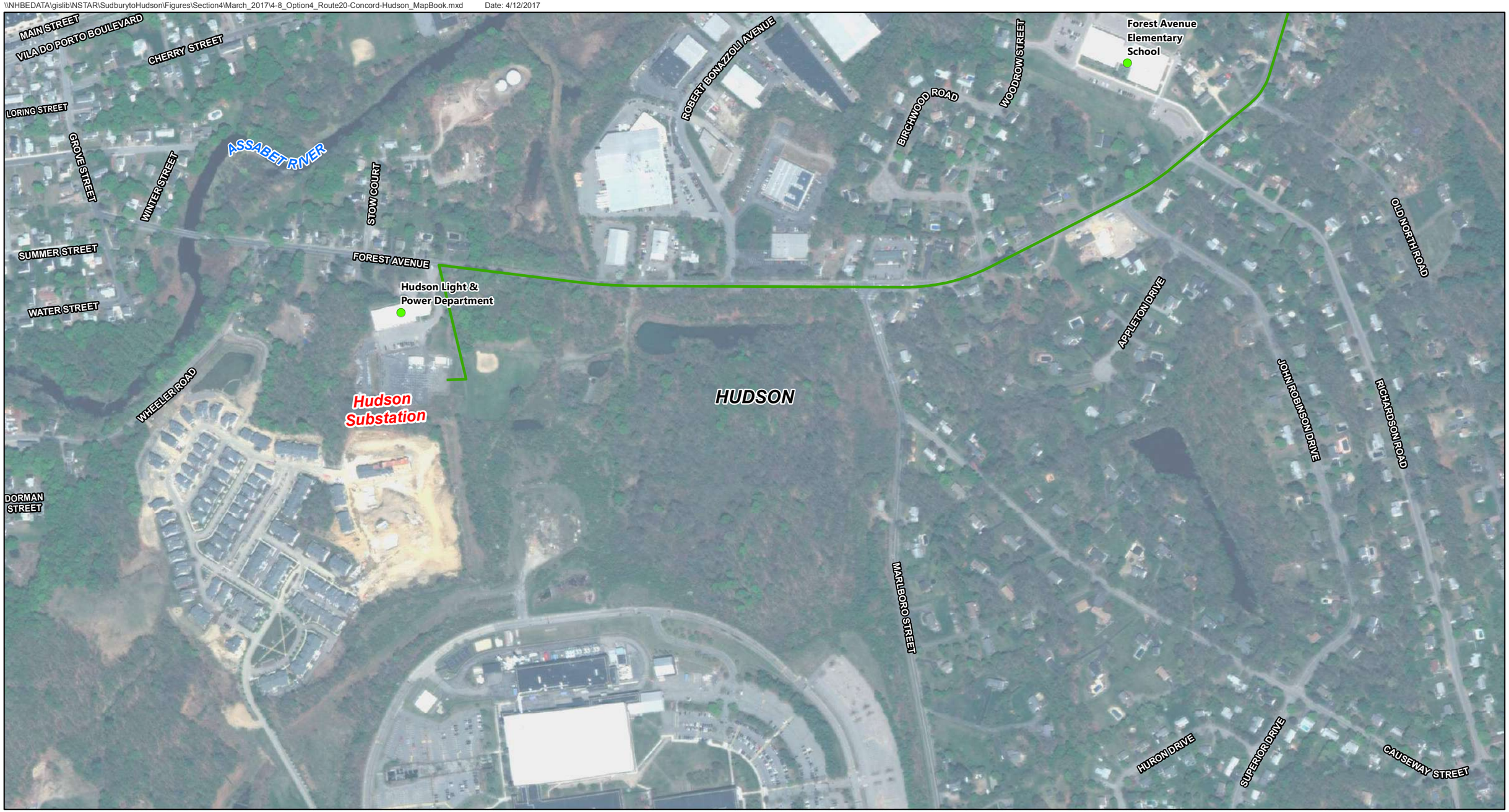

Route 4: Route 20 - Concord - Hudson [10.5 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-8: Candidate Route 4
Route 20 - Concord - Hudson

Sheet 9 of 9

vhb

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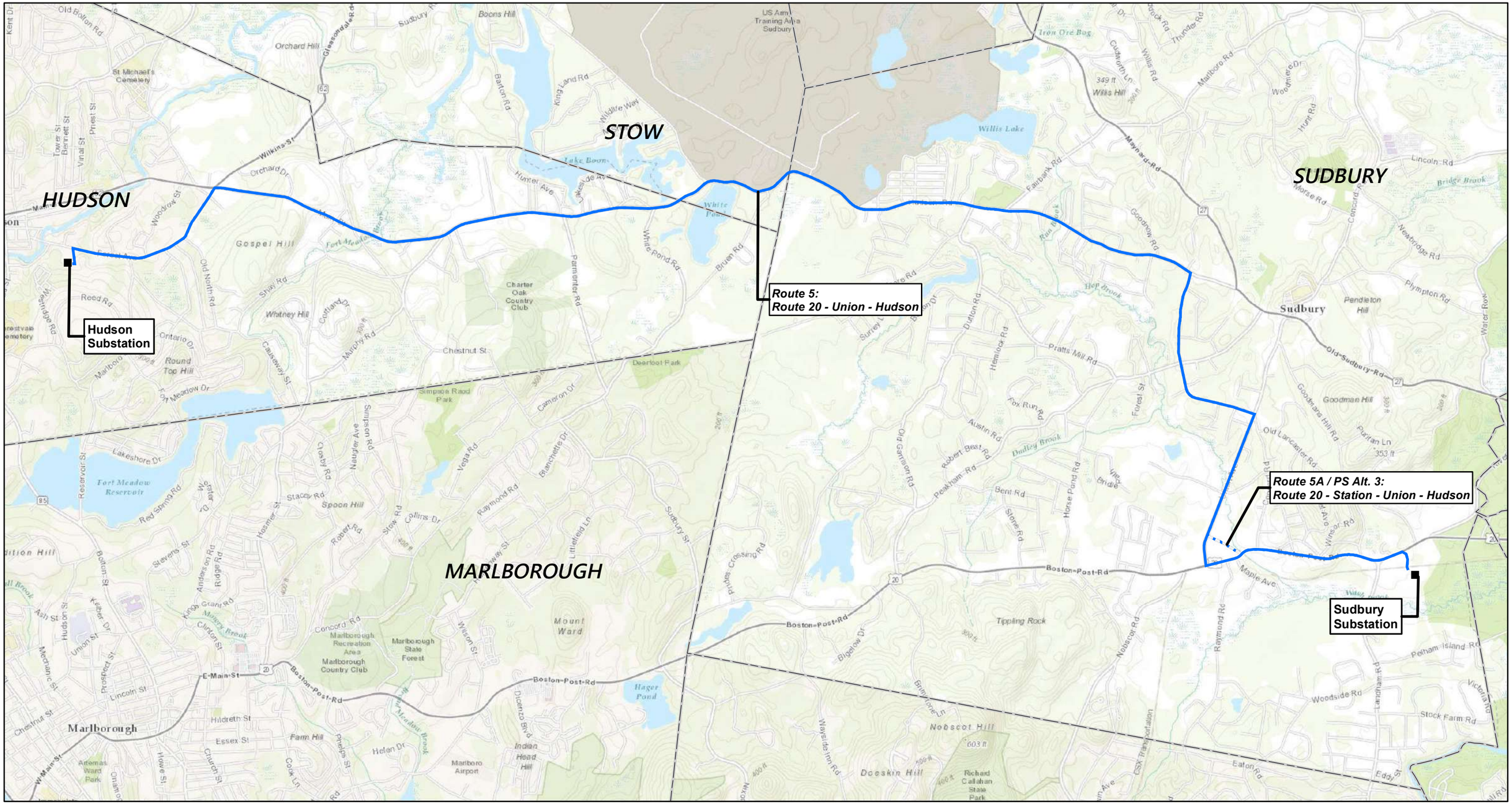
HUDSON
STOW
SUDBURY
MARLBOROUGH
Marlborough
Sudbury
Route 5:
Route 20 - Union - Hudson
Hudson Substation
Route 5A / PS Alt. 3:
Route 20 - Station - Union - Hudson
Sudbury Substation
Willis Lake
Lake Boon
Fort Meadow Reservoir
Hager Pond
Mount Ward
Tippling Rock
Nobscot Hill
Dooskin Hill
Gospel Hill
Whitney Hill
Round Top Hill
Spoon Hill
Indian Head Hill
Pendleton Hill
Goodman Hill
Boston Post Rd
Main St
Wayside Inn Rd
Old Sudbury Rd
Marlboro Airport
Charter Oak Country Club
Marlborough Recreation Area
Marlborough Country Club
Marlborough State Forest
Simpson Road Park
Dearfoot Park
Artemas Ward Park
Richard Callahan State Park
US Army Training Area Sudbury
St Michael's Cemetery
Iron Ore Bog
Wilkins St
Orchard Dr
Boons Hill
King Land Rd
Wildlife Way
Hunter Ave
Lakeside Ave
White Pond Rd
Bruen Rd
Barton Rd
Parmenter Rd
Fairbank Rd
Maynard Rd
Goodnow Rd
Run Brook
Hop Brook
Dutton Rd
Hemlock Rd
Pratts Mill Rd
Austin Rd
Fox Run Rd
Dudley Brook
Robert Best Rd
Peakham Rd
Old Garrison Rd
Bent Rd
Stone Rd
Horse Pond Rd
Bigelow Dr
Nobscot Rd
Raymond Rd
Maple Ave
Wilson Rd
Old Lancaster Rd
Goodmans Hill Rd
Puritan Ln
Lincoln Rd
Bridge Brook
Concord Rd
Worse Rd
Hunt Rd
Marlboro Rd
Willis Rd
Cudworth Ln
Thunder Rd
Woodmere Dr
Newbridge Rd
Plympton Rd
Water Row
Peters Crossing Rd
Brimstone Ln
Eaton Rd
Pelham Island Rd
Woodside Rd
Landham Rd
Victoria Rd
Stock Farm Rd
Eddy St
Maple Ave
Winsor Rd
Reed Rd
Ontario Dr
Meadow Dr
Lakeshore Dr
Reservoir St
Red Spring Rd
Stacey Rd
Robert Rd
Stow Rd
Collins Dr
Raymond Rd
Vega Rd
Blanchette Dr
Littlefield Ln
Sudbury St
Closby Rd
Naujeley Ave
Sunrise Rd
Foster Dr
Hosmer St
Stevens St
Andersen Rd
Ridge Rd
Bolton St
Ash St
Hudson St
Union St
Keiser Dr
King Grant Rd
Clinton St
Mechanic St
Prospect St
Lincoln St
Chestnut St
Hildreth St
Essex St
Farm Hill
Phelps St
Helen Dr
Howe St
Church St
Cook Ln
Cameron Dr
Chestnut St
Old North Rd
Shay Rd
Cortland Dr
Murphy Rd
Causeway St
Meadow Brook
Dicenzo Blvd
Brook Rd
Old Bolton Rd
Glassondale Rd
Priest St
Viral St
Bennett St
Tower St
Woodrow St
Fort Meadow Brook
Mulberry Brook
Stony Brook
Iron Ore Brook
Dudley Brook
Run Brook
Hop Brook
Bridge Brook
Mill Brook
Pendleton Hill
Goodmans Hill
Nobscot Hill
Dooskin Hill
Tippling Rock
Mount Ward
Boons Hill
Orchard Hill
Gospel Hill
Whitney Hill
Round Top Hill
Spoon Hill
Indian Head Hill
Farm

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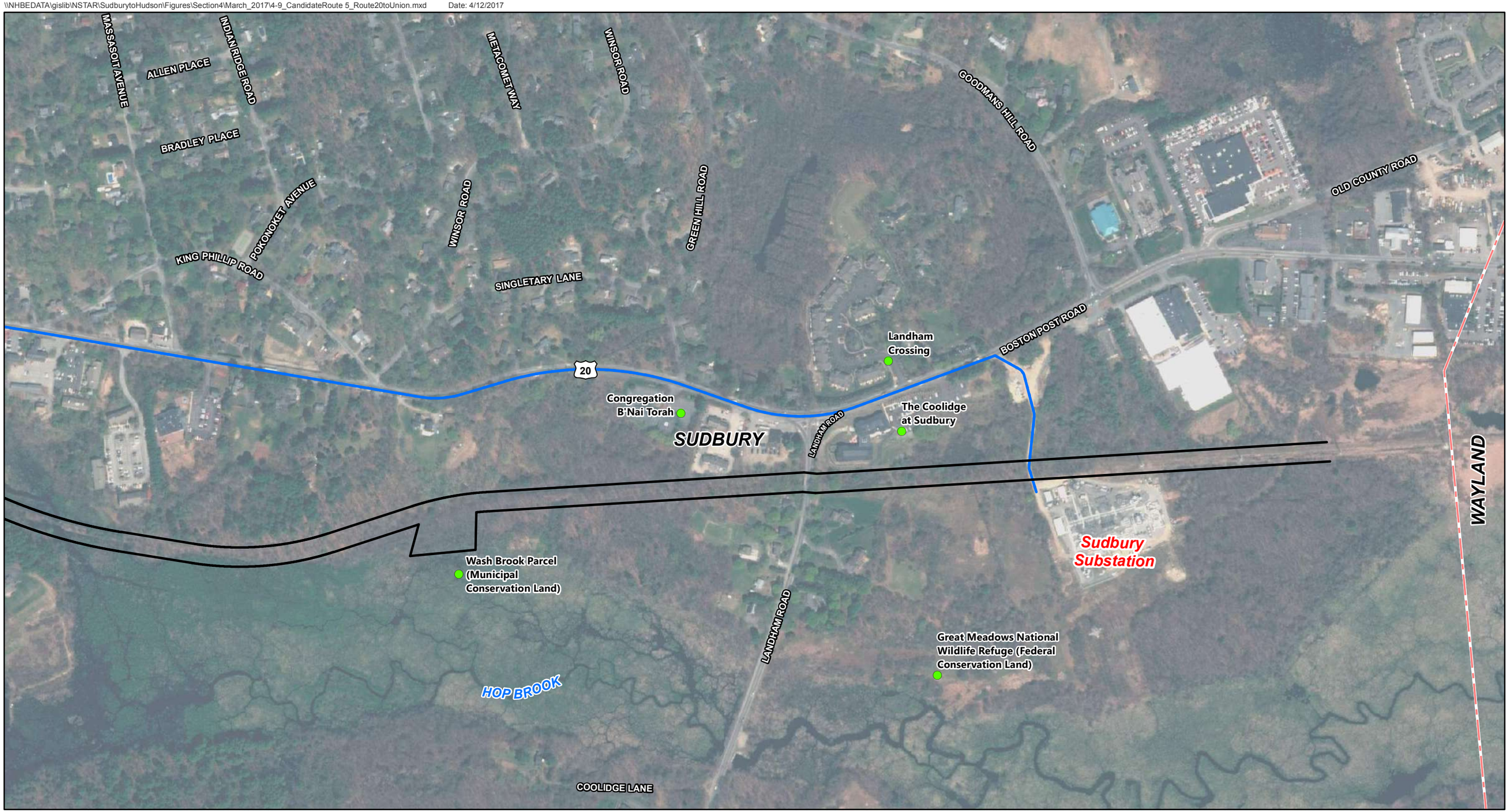

Route 5: Route 20 to Union - Hudson [10.9 Miles]

Route 5A / PS Alt. 3: Route 20 - Station - Union - Hudson [10.7 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-9: Candidate Route 5: Route 20 - Union - Hudson and Candidate Route 5A: Route 20 - Station - Union - Hudson

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\March_2017\4-9_CandidateRoute 5_Route20toUnion.mxd Date: 4/12/2017

Route 5: Route 20 to Union - Hudson [10.9 Miles]

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MBTA ROW Boundary

Landmark

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4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-9: Candidate Route 5: Route 20 - Union - Hudson and Candidate Route 5A: Route 20 - Station - Union - Hudson

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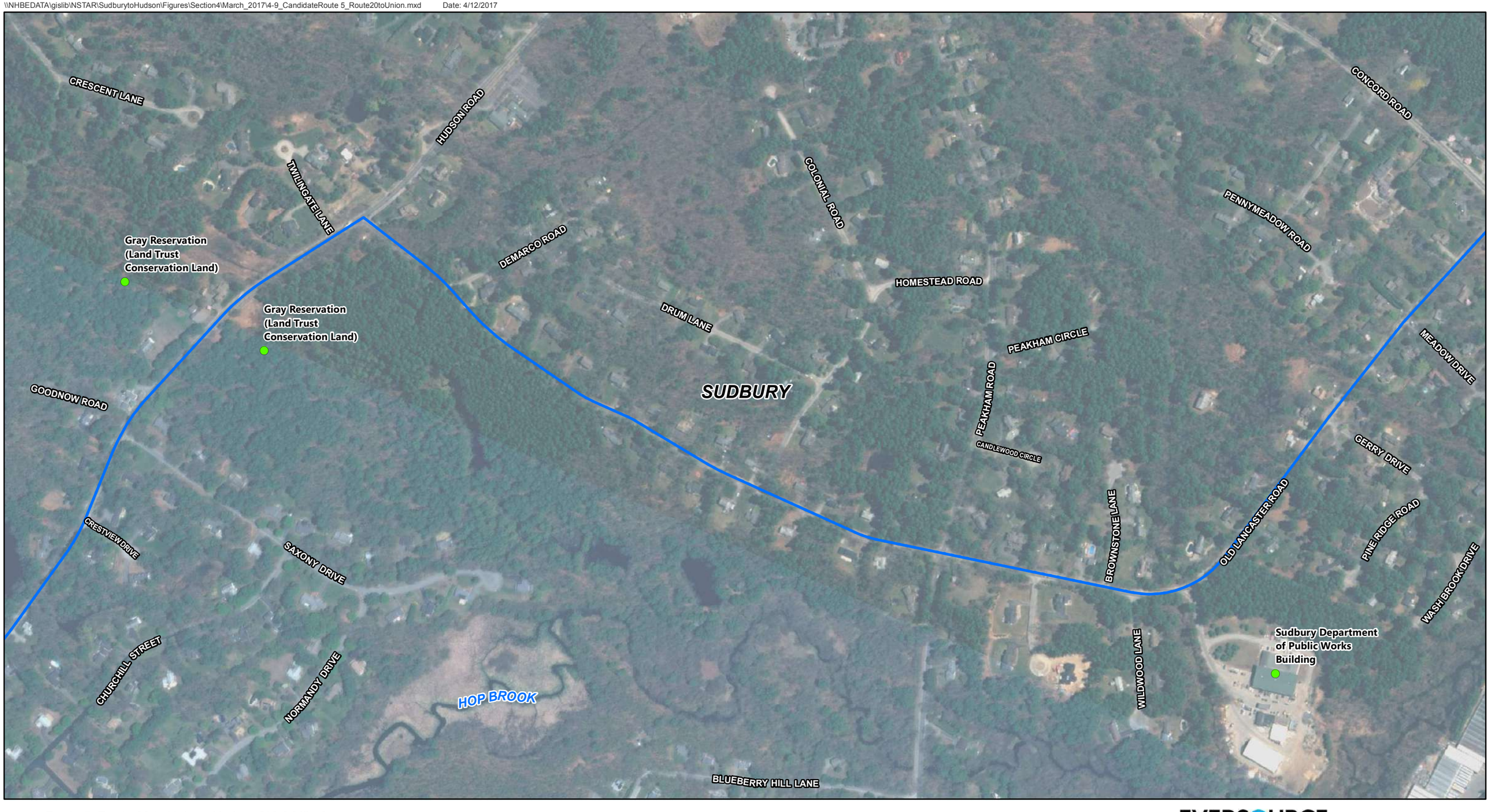

Route 5: Route 20 to Union - Hudson [10.9 Miles]

Route 5A / PS Alt. 3: Route 20 - Station - Union - Hudson [10.7 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-9: Candidate Route 5: Route 20 - Union - Hudson and Candidate Route 5A: Route 20 - Station - Union - Hudson

vhb

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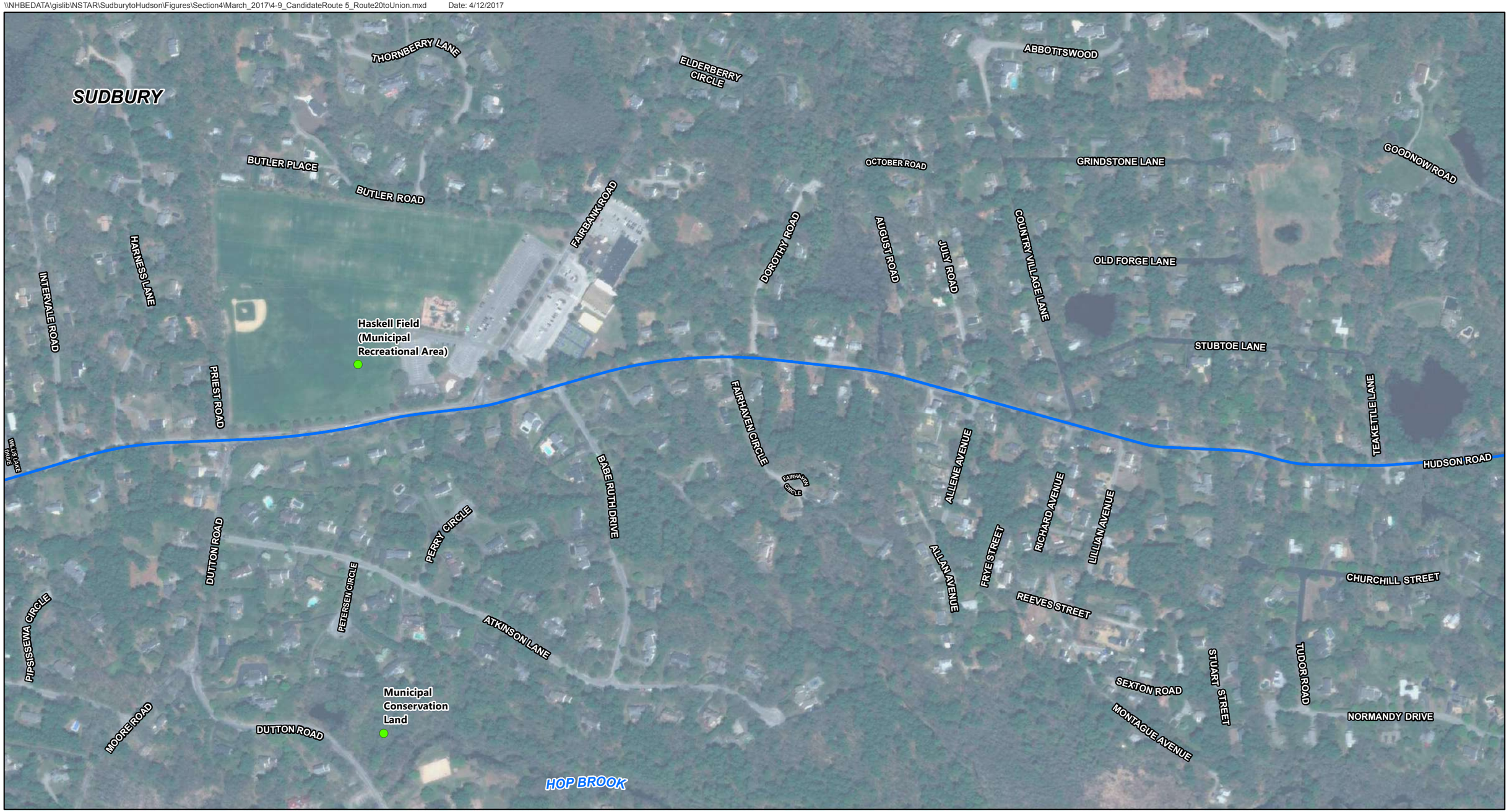

Route 5: Route 20 to Union - Hudson [10.9 Miles]

Route 5A / PS Alt. 3: Route 20 - Station - Union - Hudson [10.7 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-9: Candidate Route 5: Route 20 - Union - Hudson and Candidate Route 5A: Route 20 - Station - Union - Hudson

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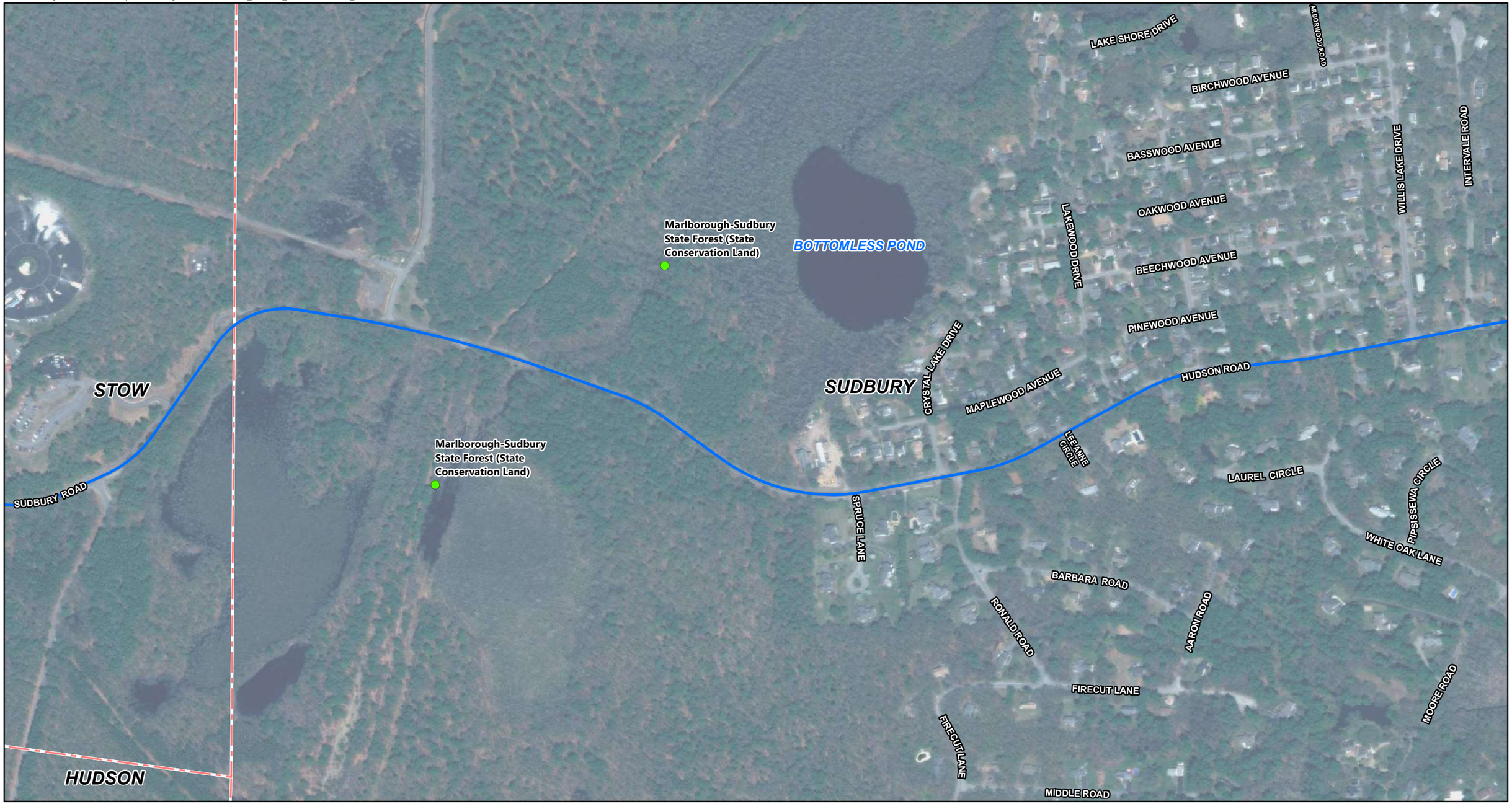

Route 5: Route 20 to Union - Hudson [10.9 Miles]

Route 5A / PS Alt. 3: Route 20 - Station - Union - Hudson [10.7 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-9: Candidate Route 5: Route 20 - Union - Hudson and Candidate Route 5A: Route 20 - Station - Union - Hudson

Sheet 5 of 9

vhb

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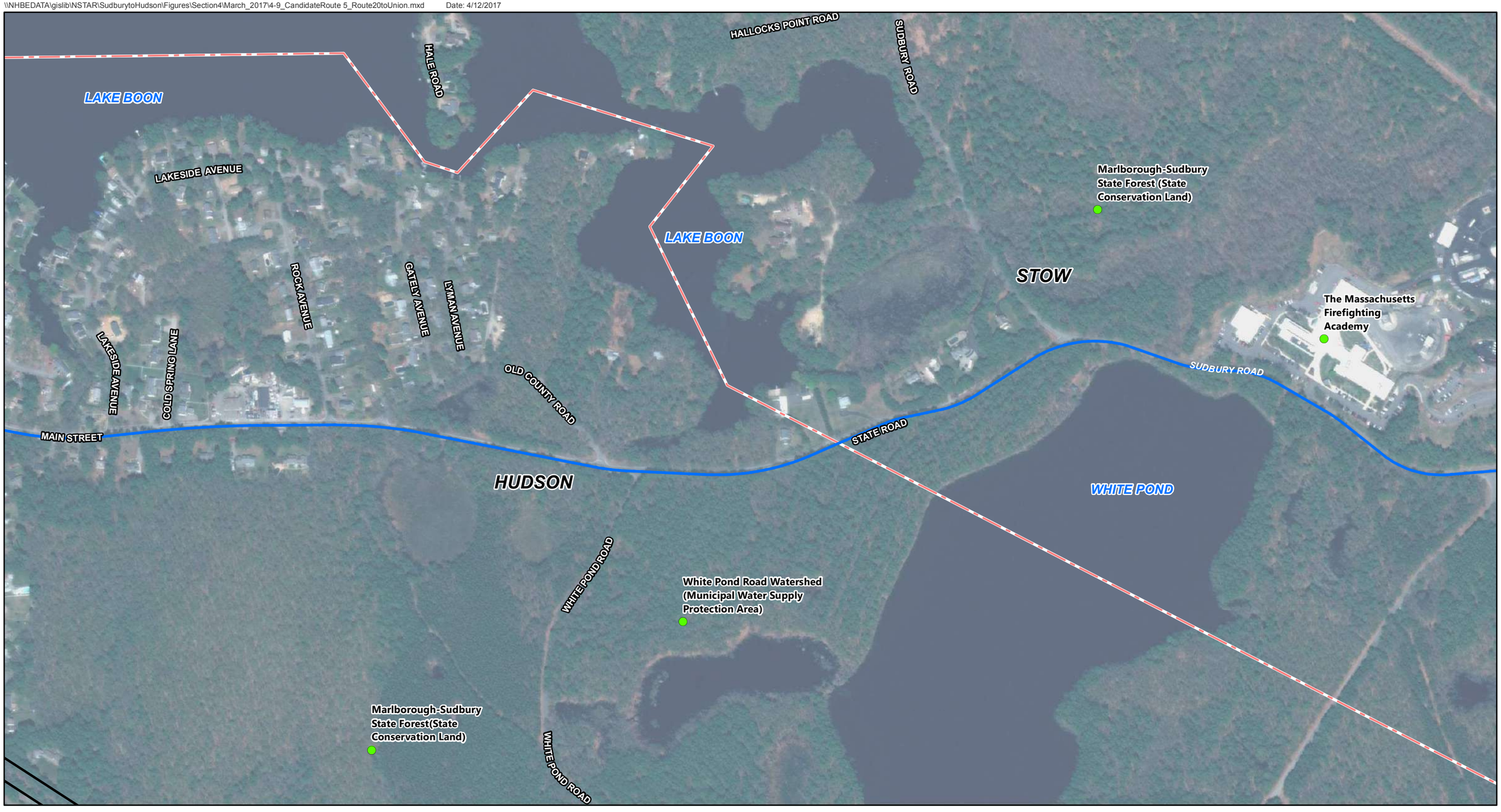

Route 5: Route 20 to Union - Hudson [10.9 Miles]

Route 5A / PS Alt. 3: Route 20 - Station - Union - Hudson [10.7 Miles]

MBTA ROW Boundary

Landmark

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MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-9: Candidate Route 5: Route 20 - Union - Hudson and Candidate Route 5A: Route 20 - Station - Union - Hudson

vhb

Sheet 6 of 9

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Route 5: Route 20 to Union - Hudson [10.9 Miles]

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MBTA ROW Boundary

Landmark

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-9: Candidate Route 5: Route 20 - Union - Hudson and Candidate Route 5A: Route 20 - Station - Union - Hudson

vhb

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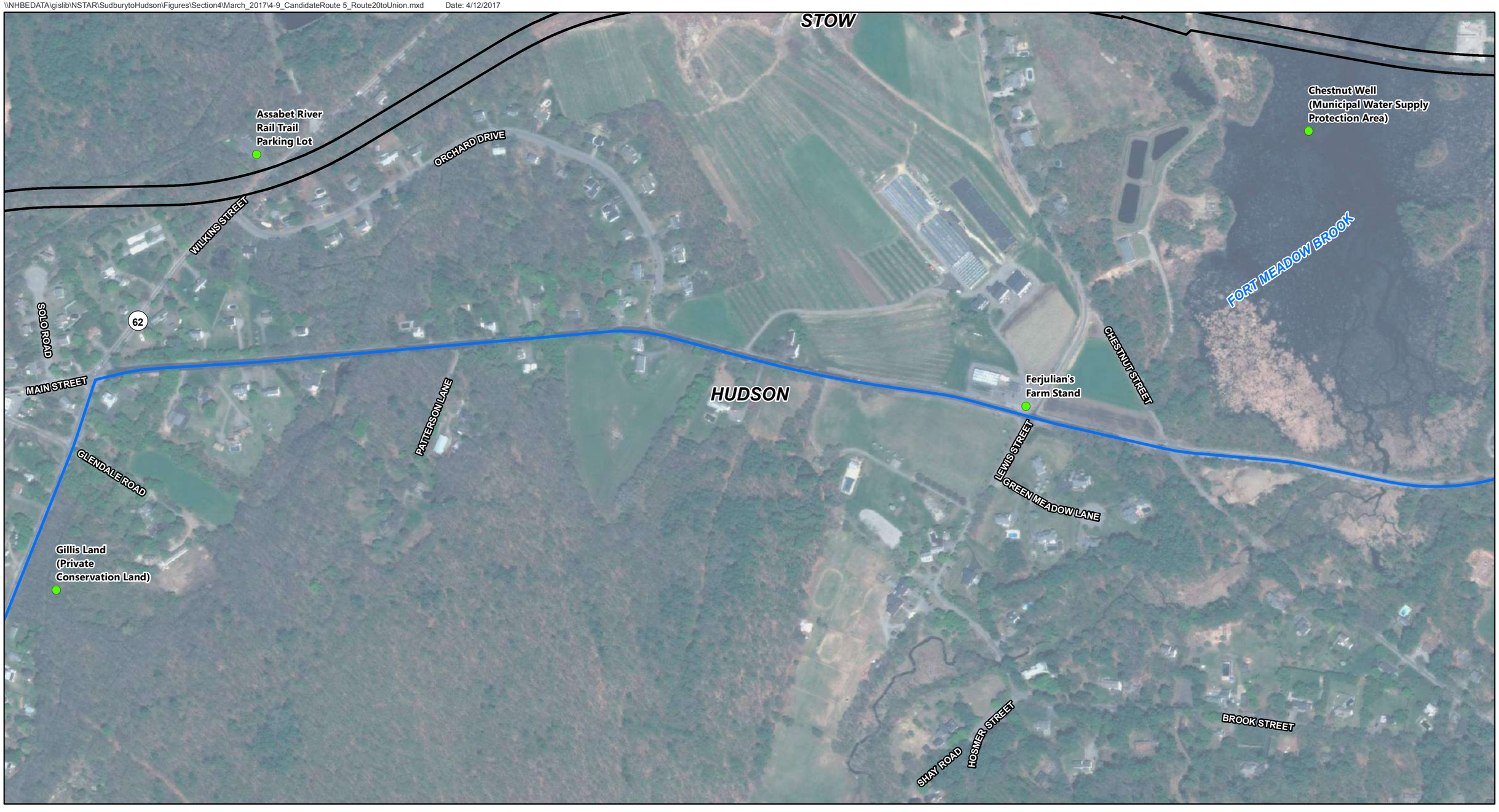


Route 5: Route 20 to Union - Hudson [10.9 Miles]

Route 5A / PS Alt. 3: Route 20 - Station - Union - Hudson [10.7 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

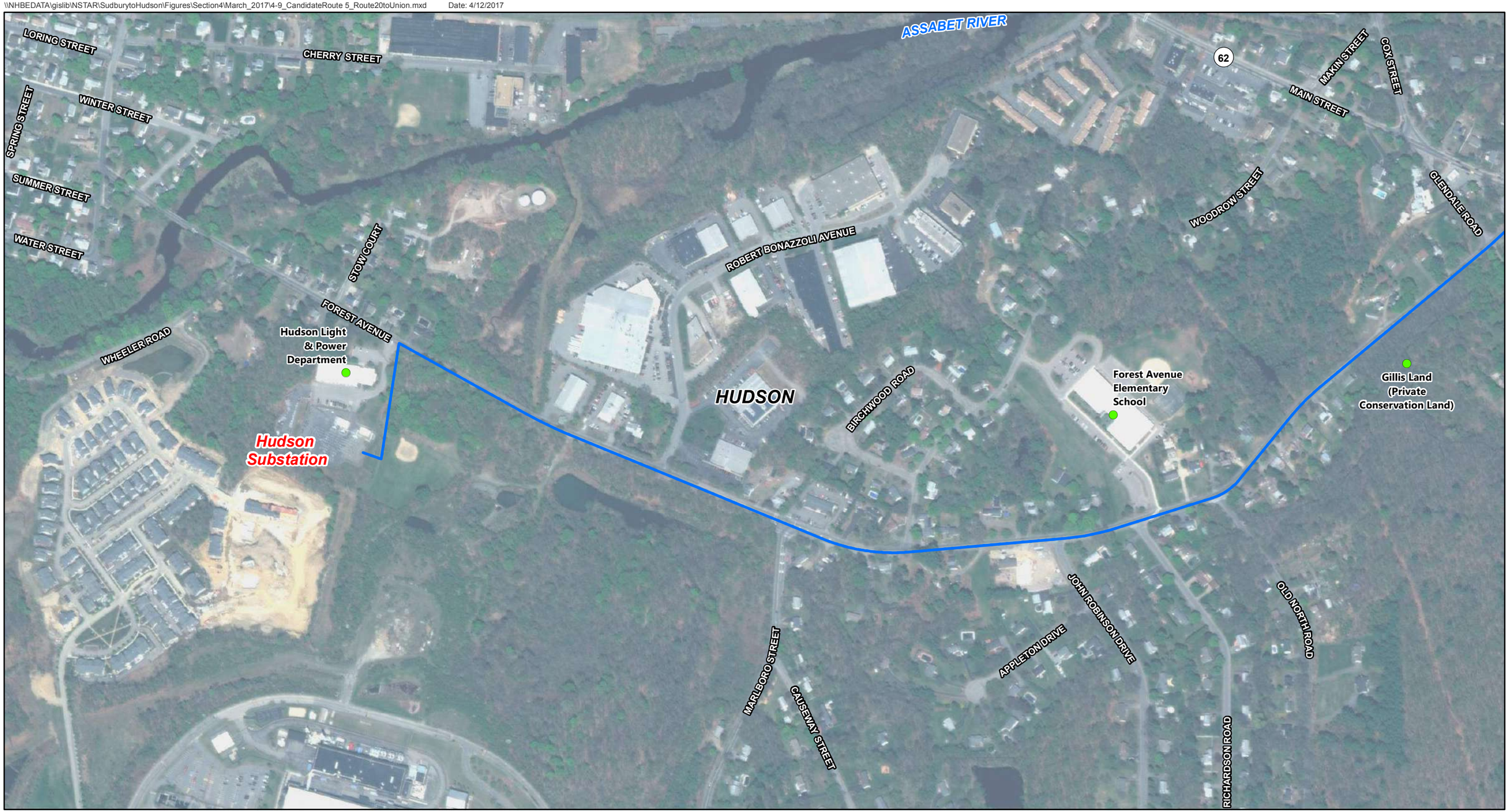
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-9: Candidate Route 5: Route 20 - Union - Hudson and Candidate Route 5A: Route 20 - Station - Union - Hudson

vhb

Sheet 8 of 9



Route 5: Route 20 to Union - Hudson [10.9 Miles]

Route 5A / PS Alt. 3: Route 20 - Station - Union - Hudson [10.7 Miles]

MBTA ROW Boundary

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-9: Candidate Route 5: Route 20 - Union - Hudson and Candidate Route 5A: Route 20 - Station - Union - Hudson

vhb

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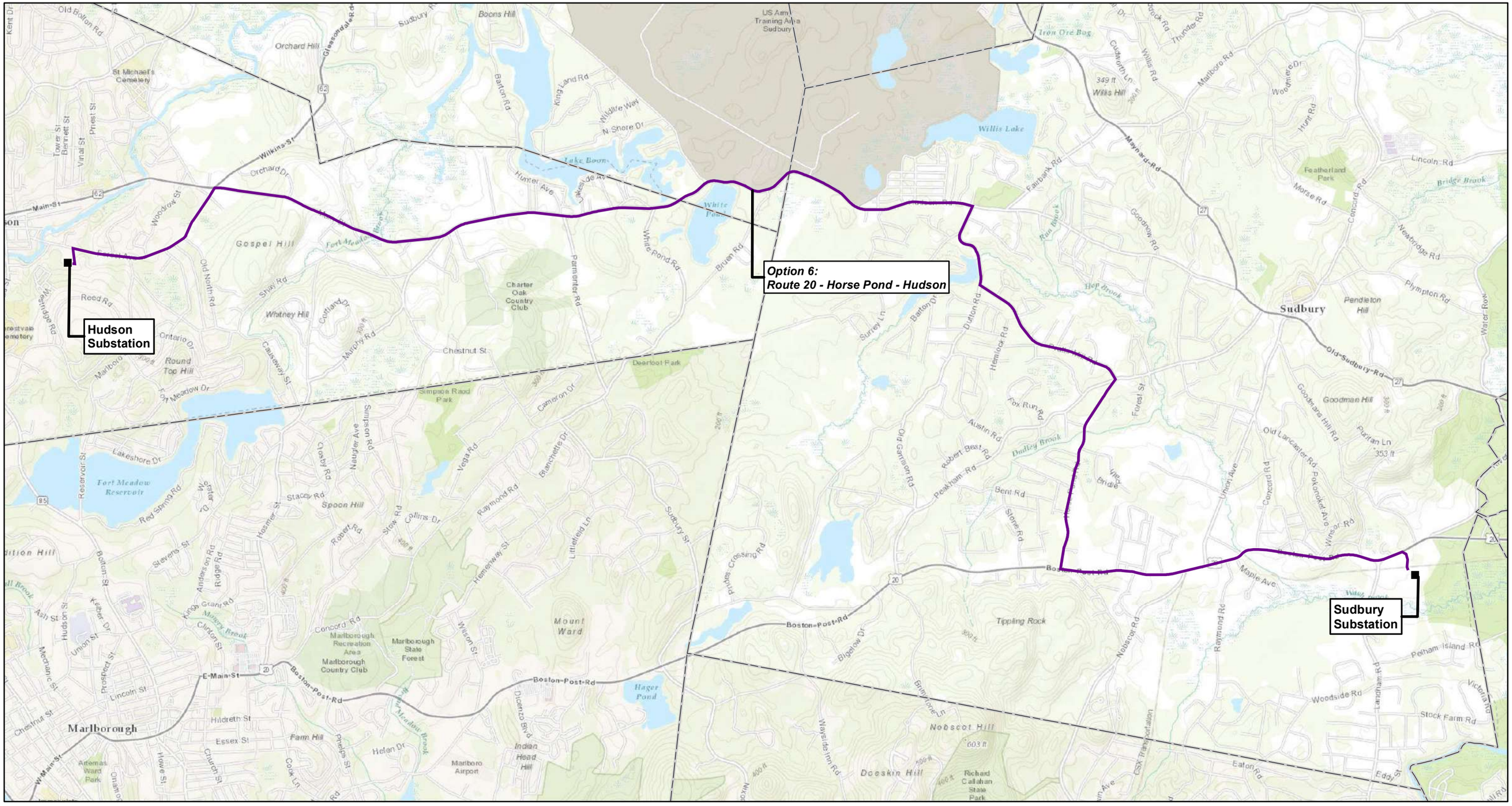

Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 3,000 6,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson

vhb

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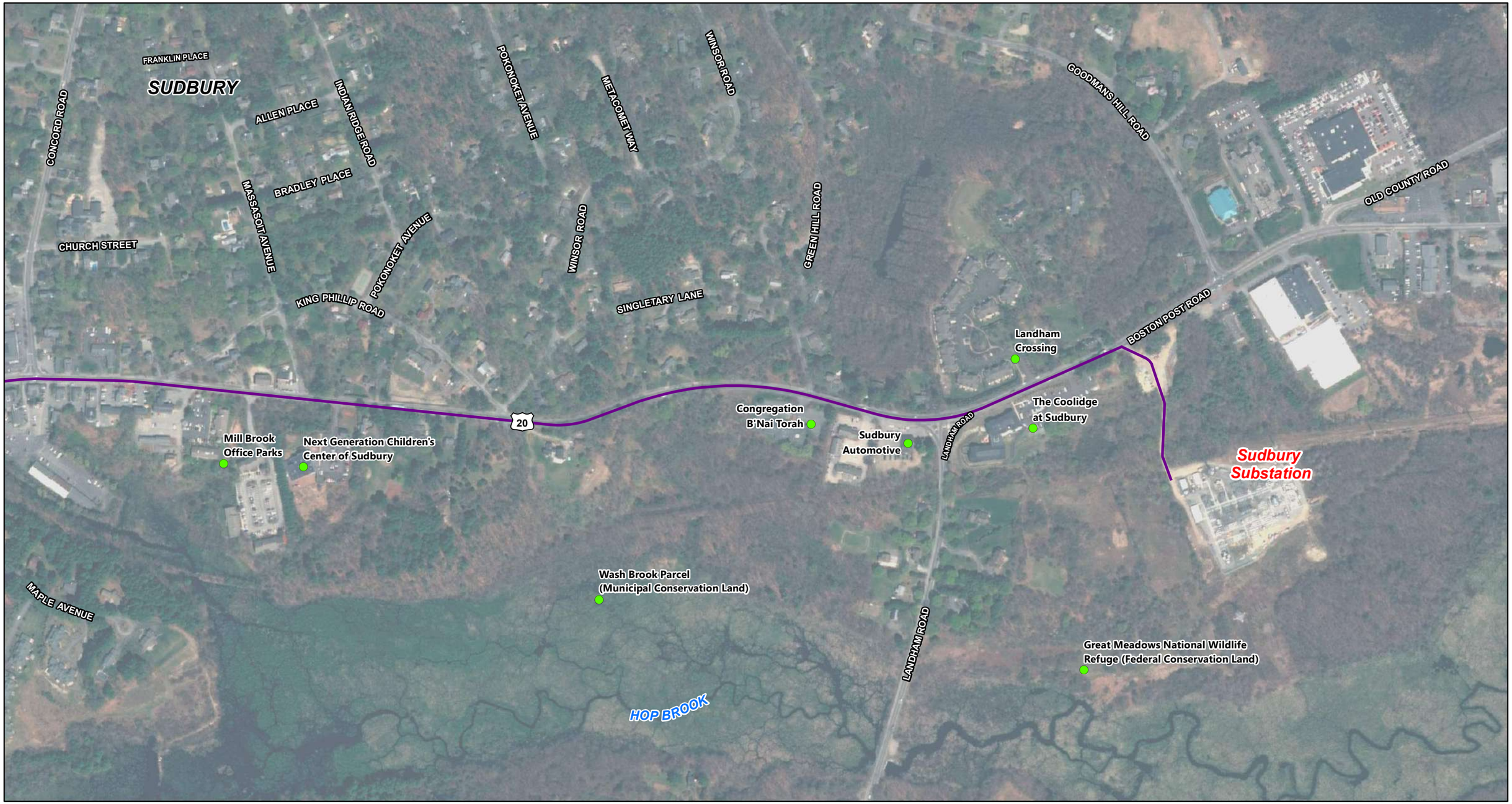

Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson

Sheet 1 of 9

vhb

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Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson

Sheet 2 of 9

vhb

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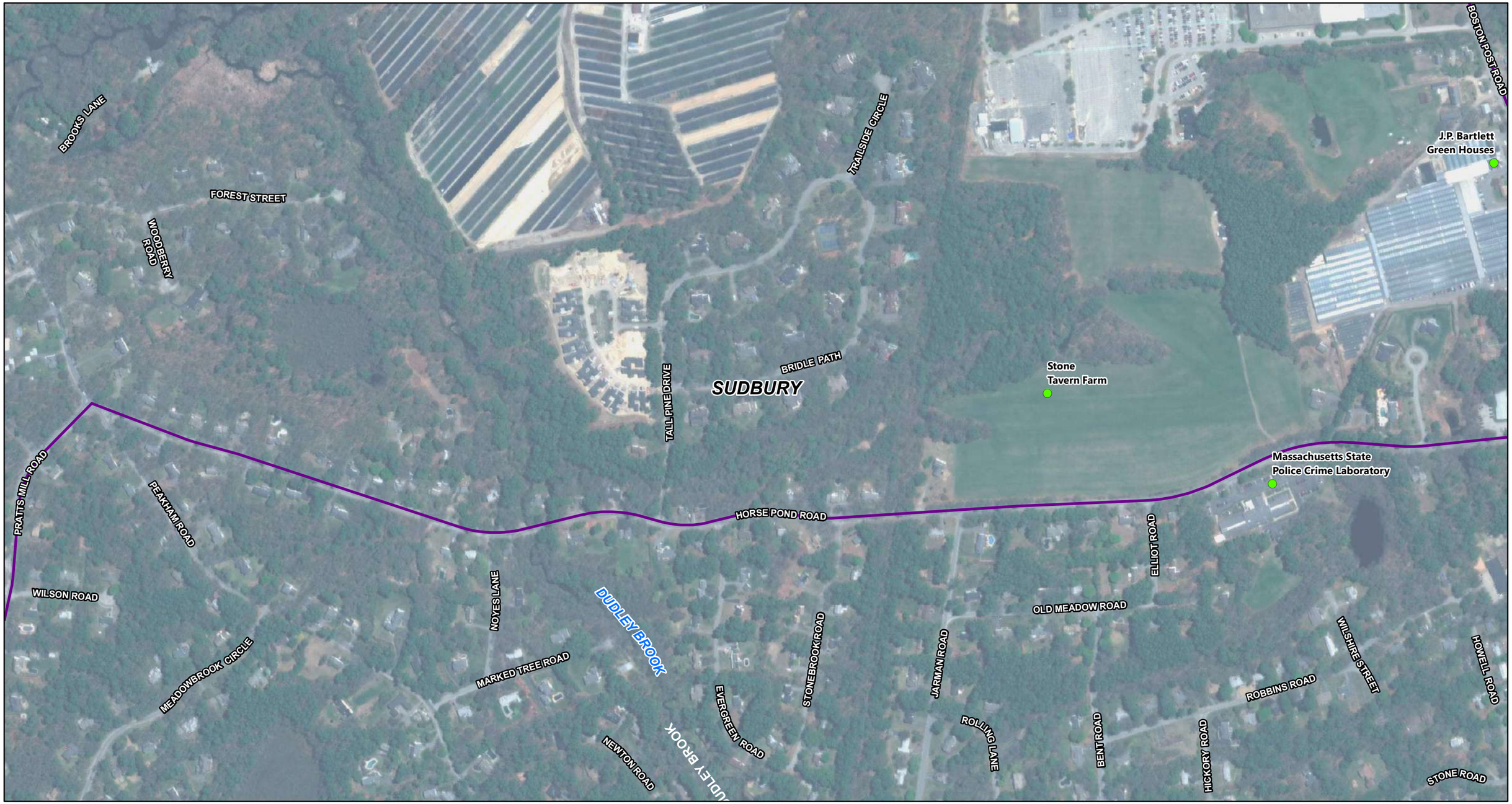

Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson

Sheet 3 of 9

vhb

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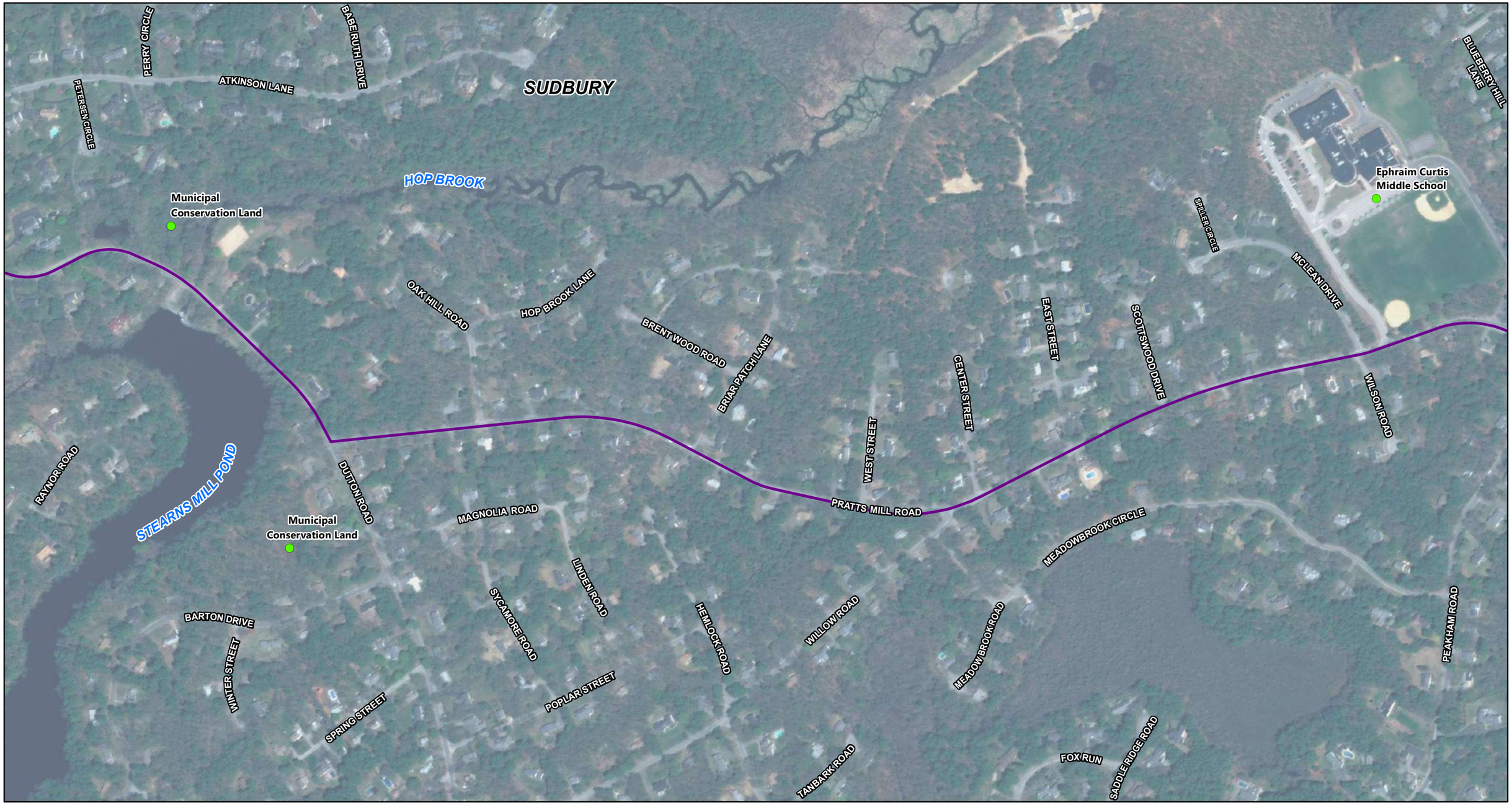

Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson

Sheet 4 of 9

vhb

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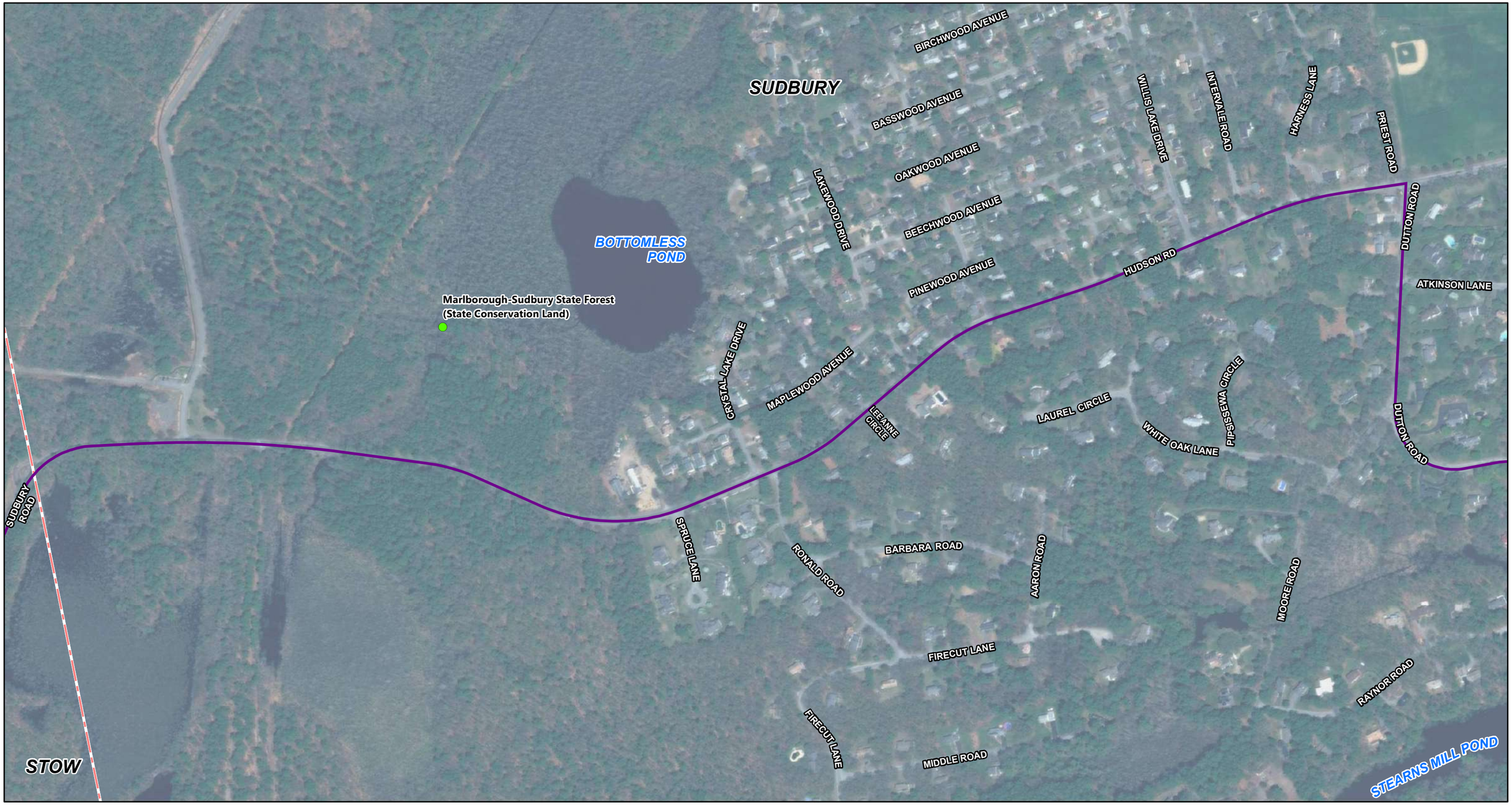

Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson

Sheet 5 of 9

vhb

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Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson**

Sheet 6 of 9

vhb

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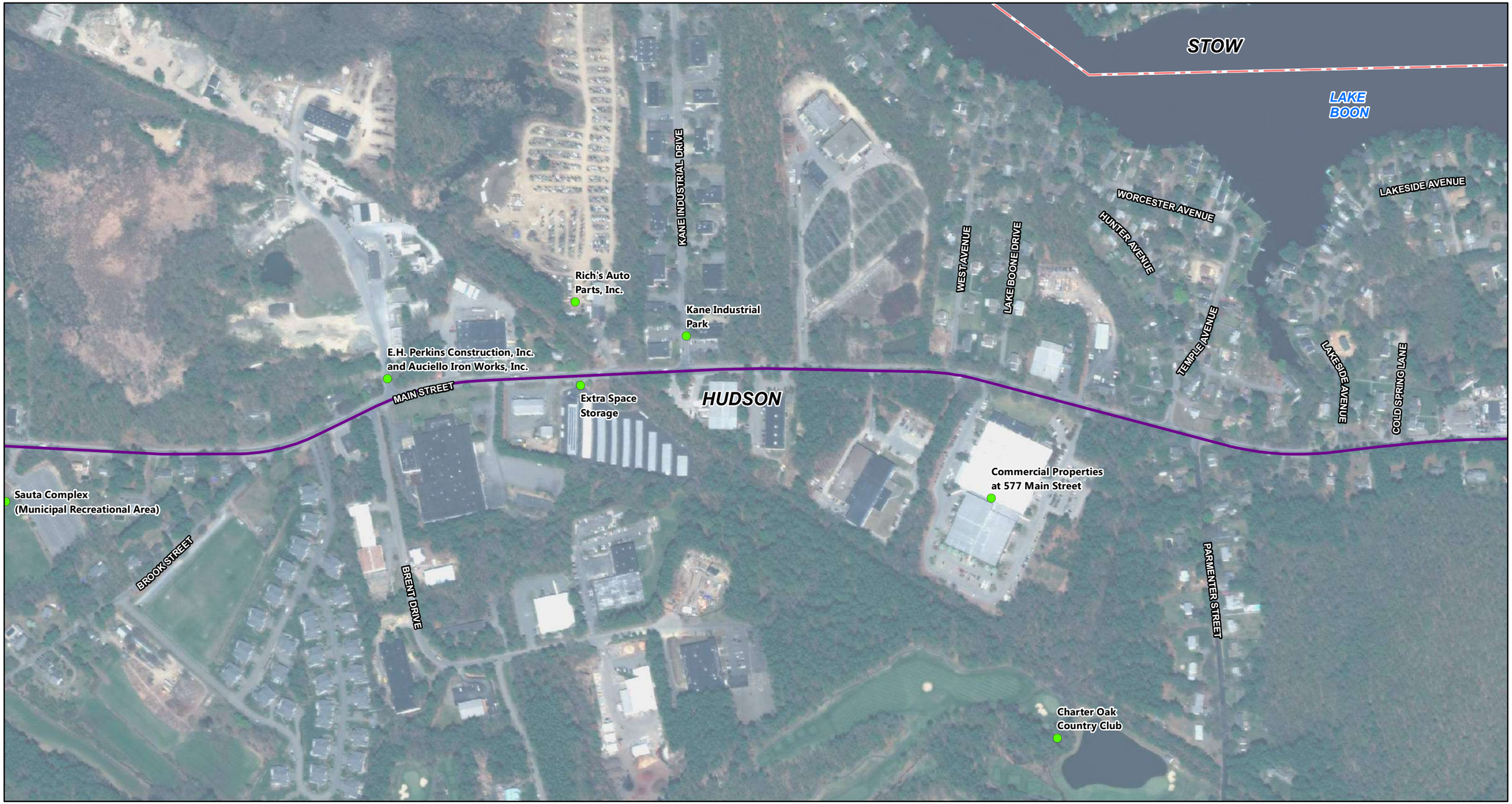

Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson

Sheet 7 of 9

vhb

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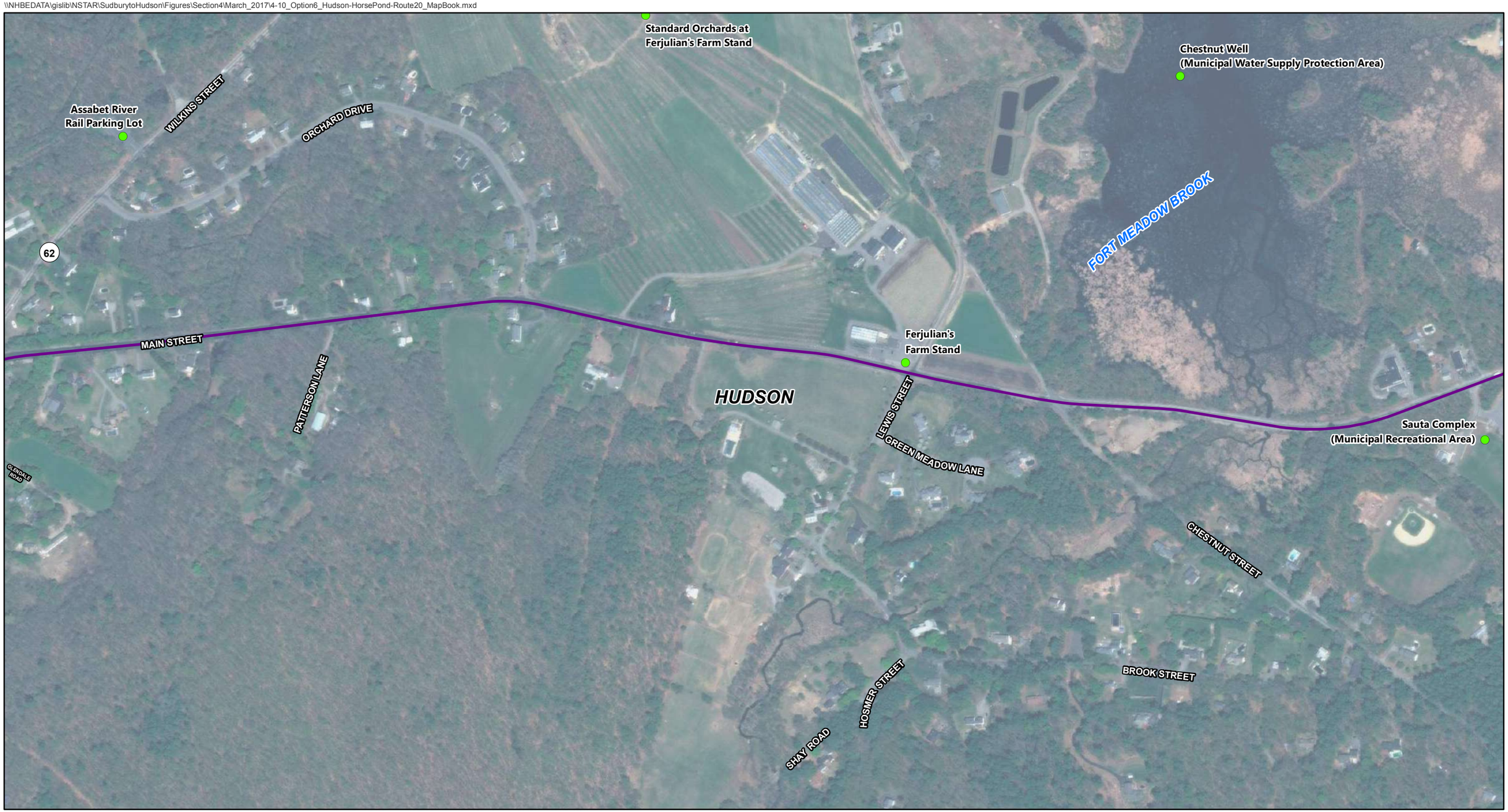

Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson**

Sheet 8 of 9

vhb

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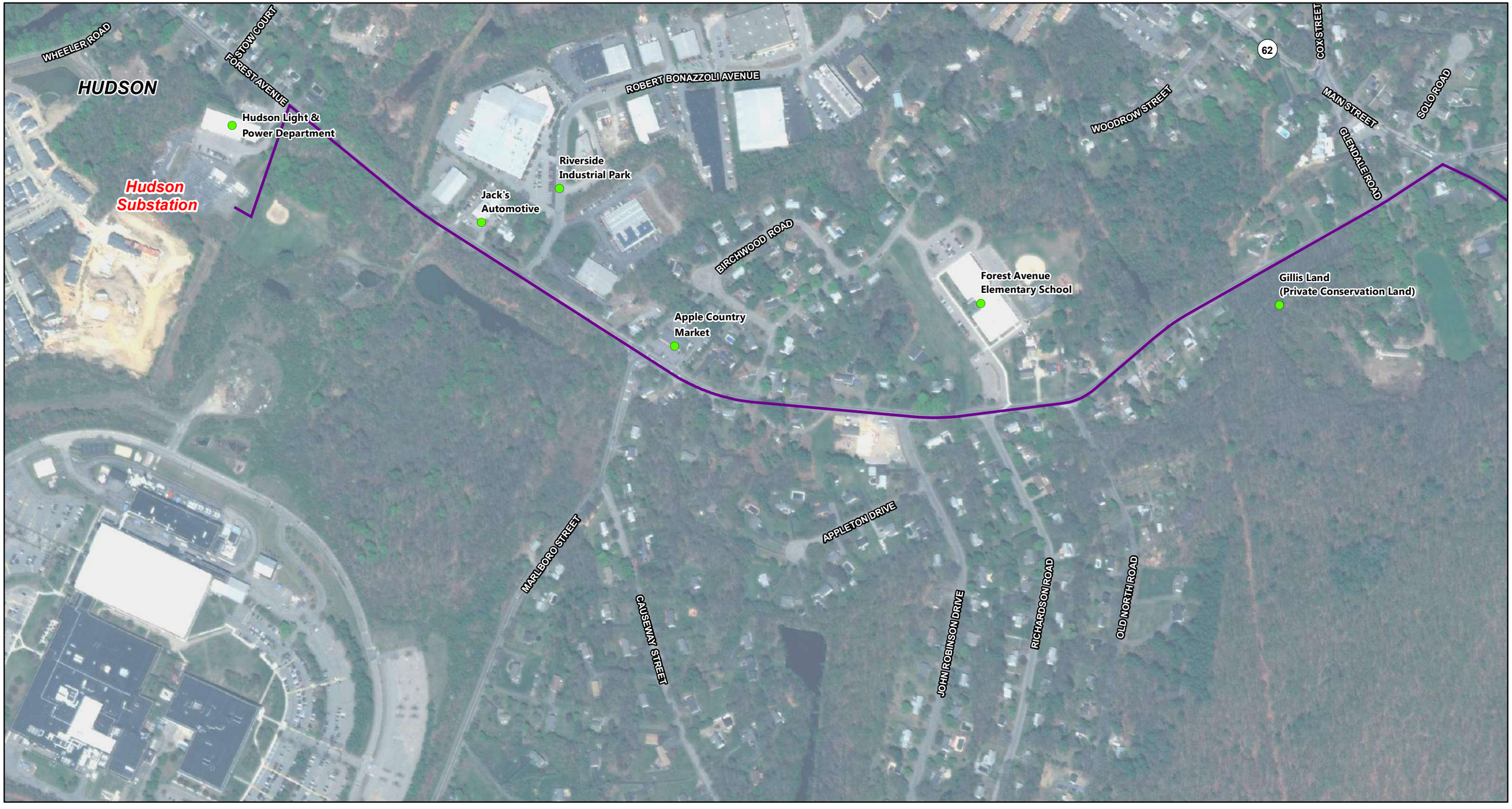

Route 6: Route 20 - Horse Pond - Hudson [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-10: Candidate Route 6
Route 20 - Horse Pond - Hudson

Sheet 9 of 9

vhb

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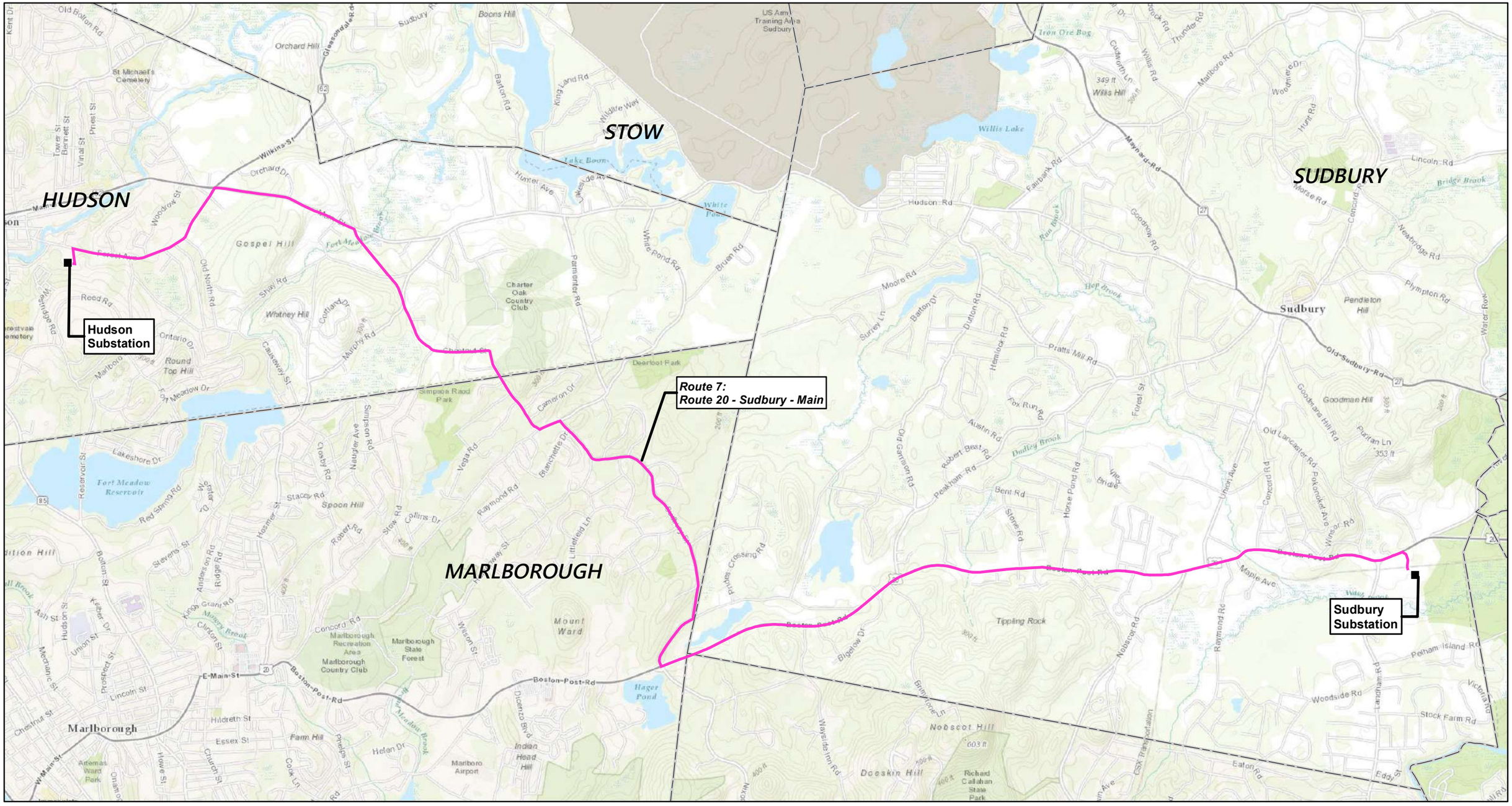

Route 7: Route 20 - Sudbury - Main [10.8 Miles]

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

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0 3,000 6,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-11: Candidate Route 7 Route 20 - Sudbury - Main

vhb

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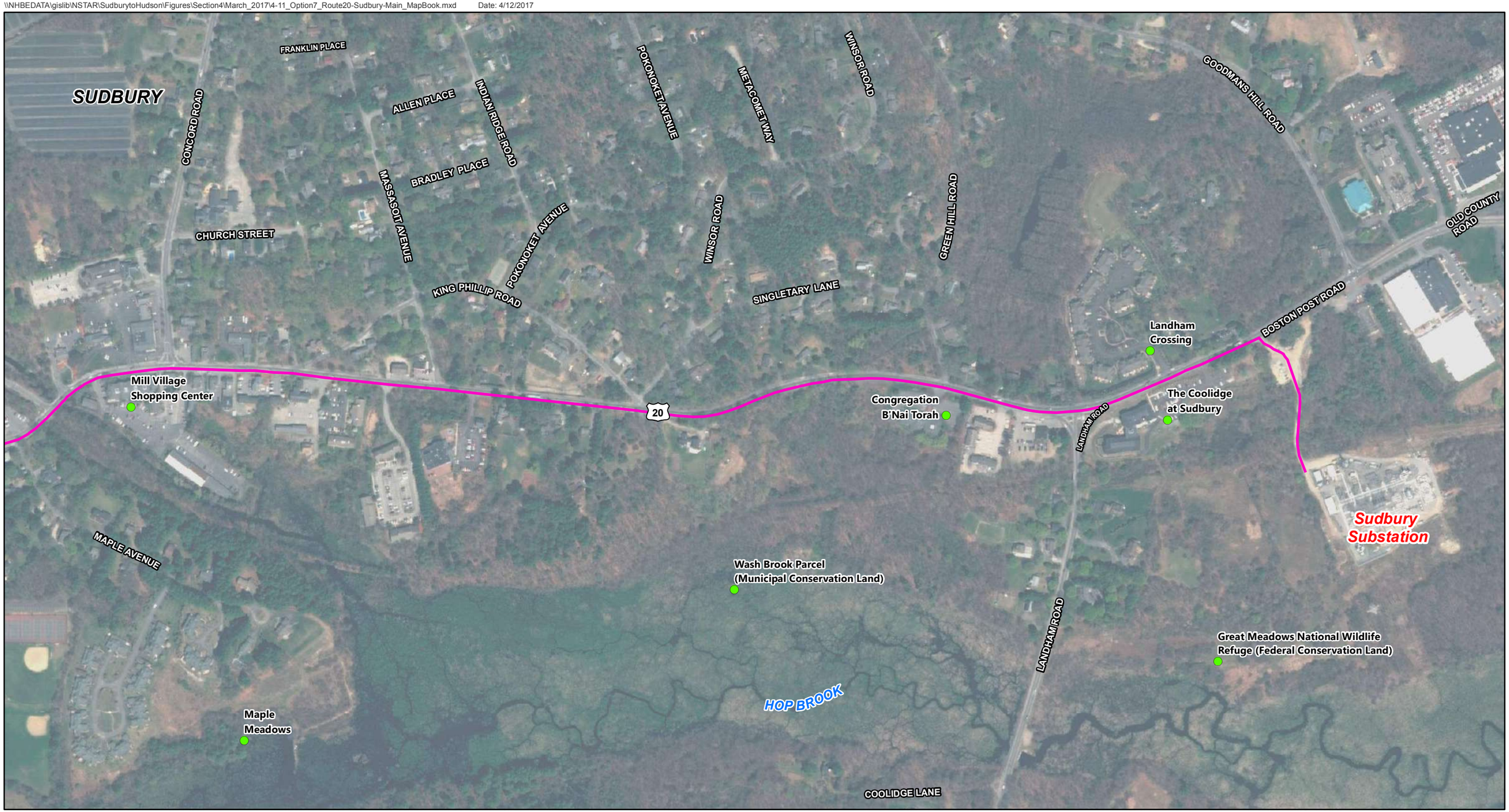

Route 7: Route 20 - Sudbury - Main [10.8 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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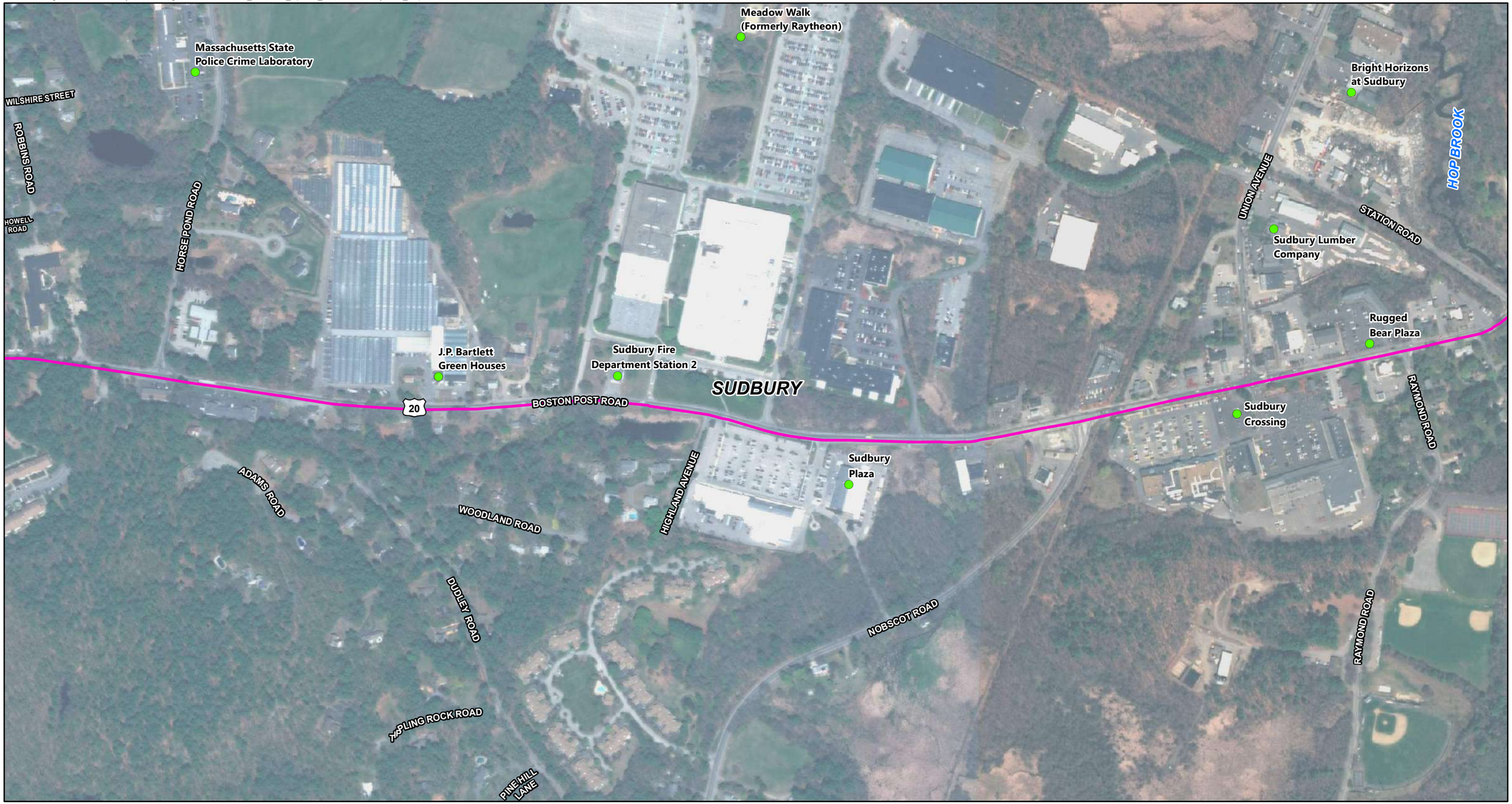
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-11: Candidate Route 7
Route 20 - Sudbury - Main

Sheet 1 of 9

vhb



Route 7: Route 20 - Sudbury - Main [10.8 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-11: Candidate Route 7
Route 20 - Sudbury - Main

Sheet 2 of 9

vhb

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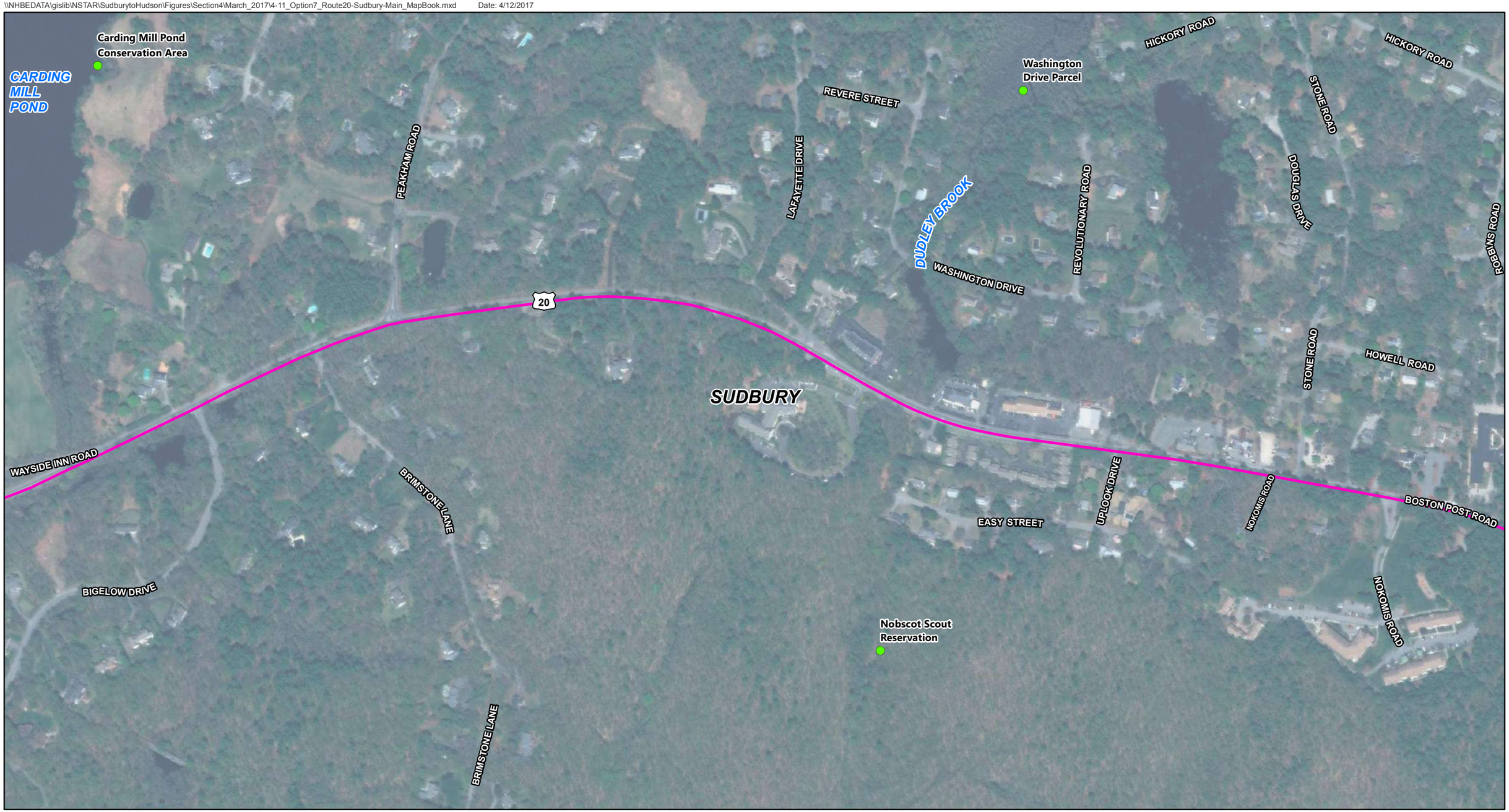

Route 7: Route 20 - Sudbury - Main [10.8 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

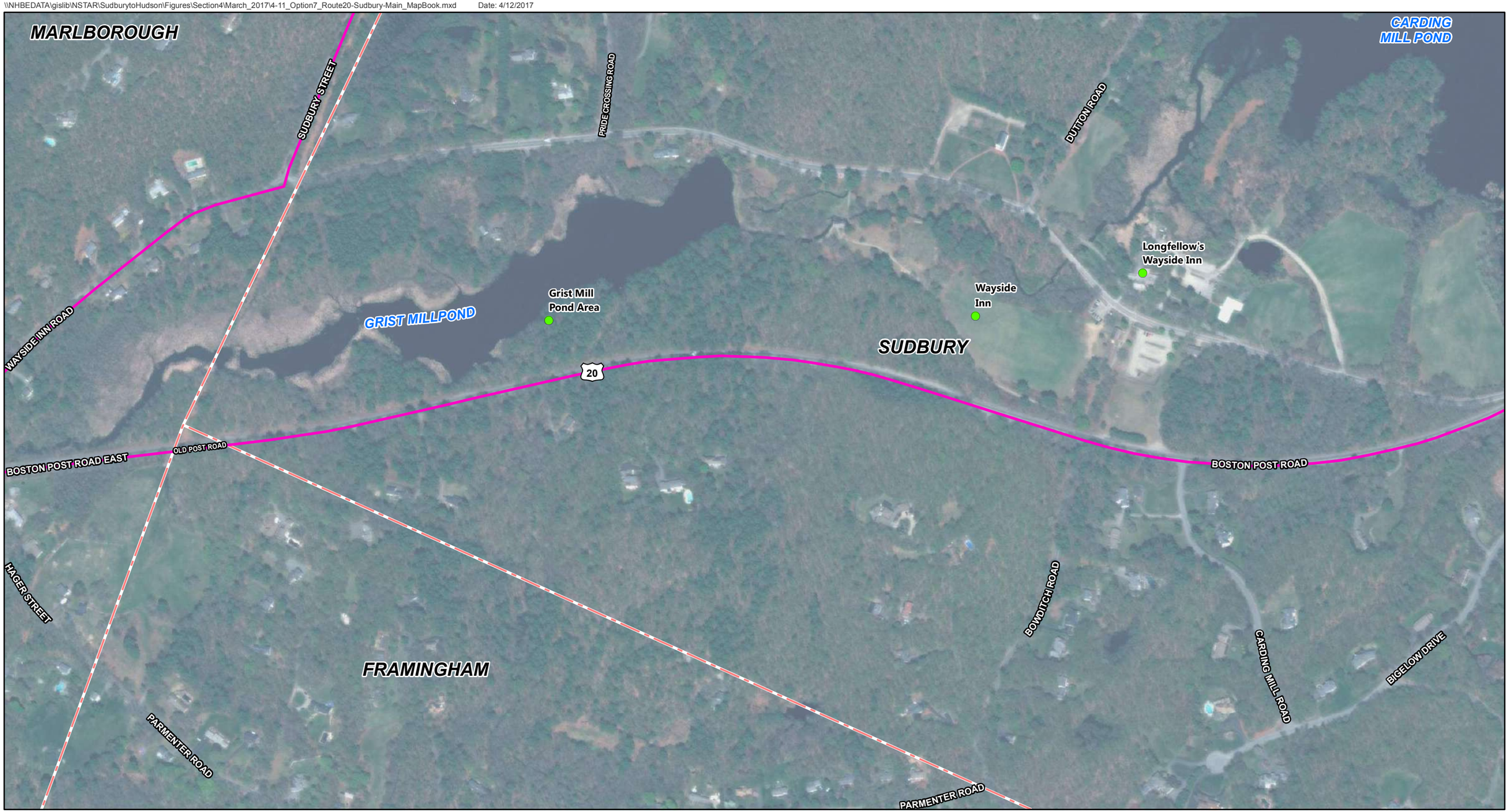
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-11: Candidate Route 7
Route 20 - Sudbury - Main**

Sheet 3 of 9

vhb



Route 7: Route 20 - Sudbury - Main [10.8 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

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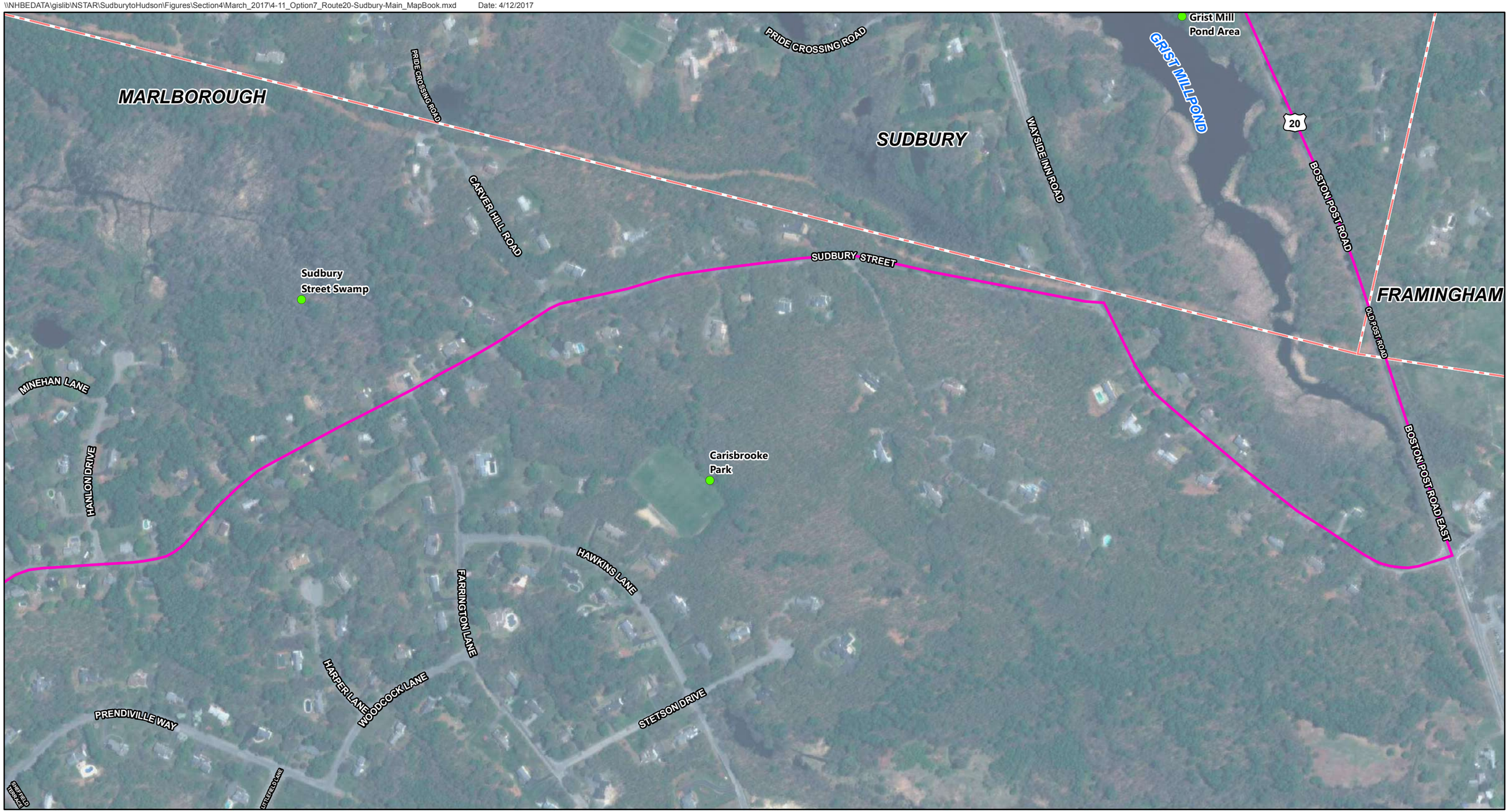
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-11: Candidate Route 7 Route 20 - Sudbury - Main

Sheet 4 of 9

vhb



Route 7: Route 20 - Sudbury - Main [10.8 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-11: Candidate Route 7 Route 20 - Sudbury - Main

Sheet 5 of 9

vhb

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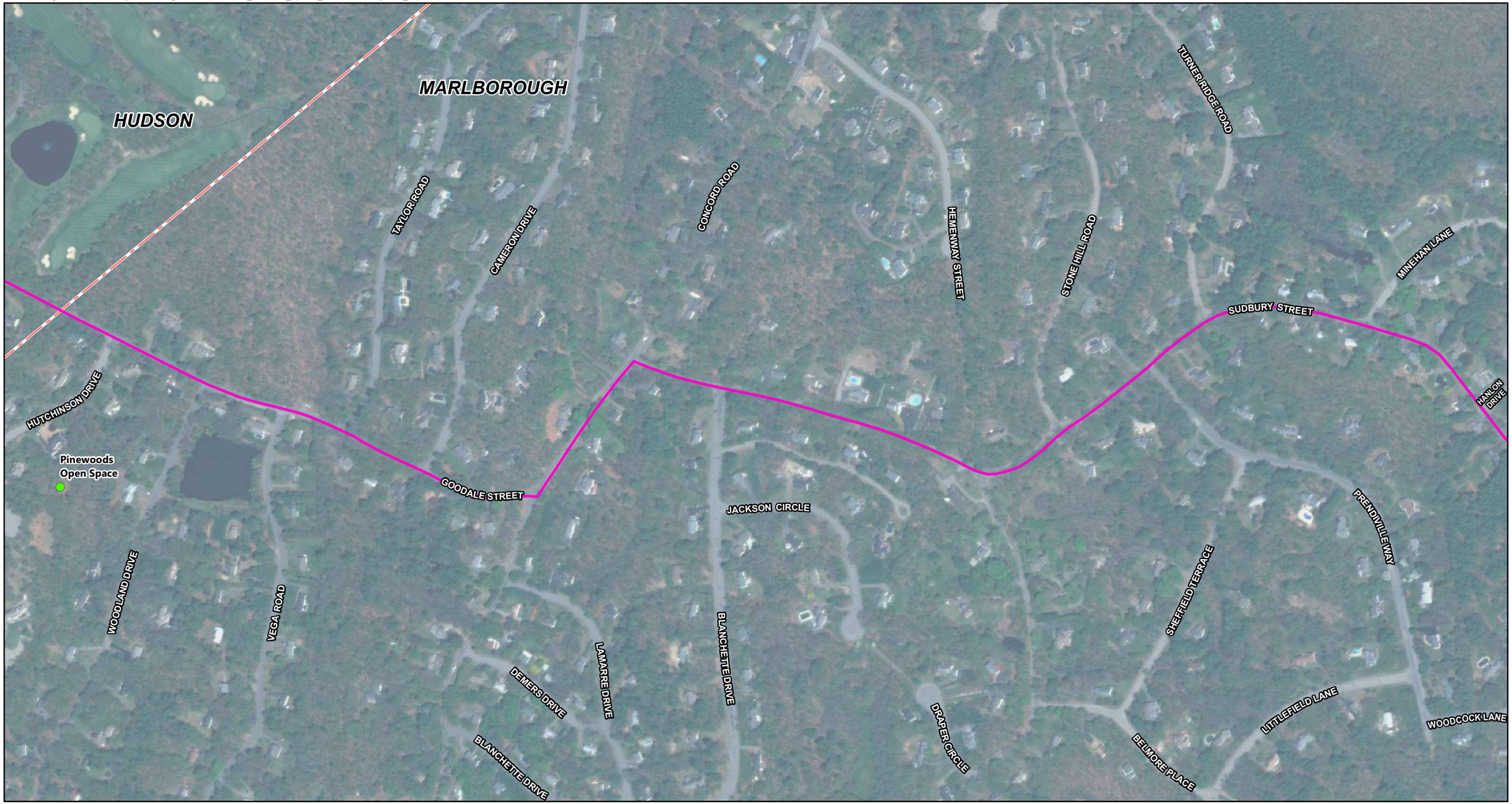

Route 7: Route 20 - Sudbury - Main [10.8 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

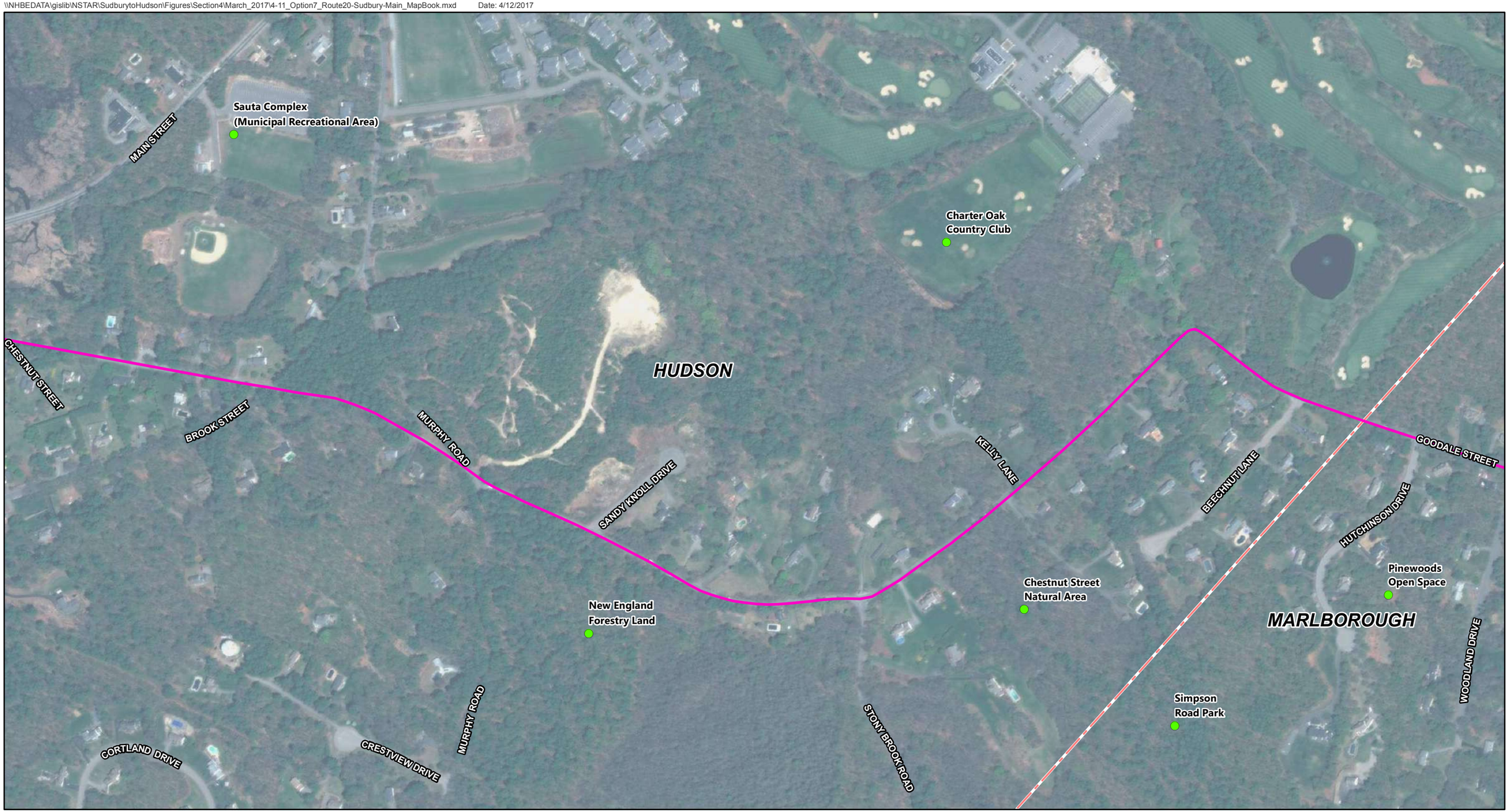
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-11: Candidate Route 7
Route 20 - Sudbury - Main

Sheet 6 of 9

vhb



Route 7: Route 20 - Sudbury - Main [10.8 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-11: Candidate Route 7
Route 20 - Sudbury - Main**

Sheet 7 of 9

vhb

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Route 7: Route 20 - Sudbury - Main [10.8 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-11: Candidate Route 7
Route 20 - Sudbury - Main

Sheet 8 of 9

vhb

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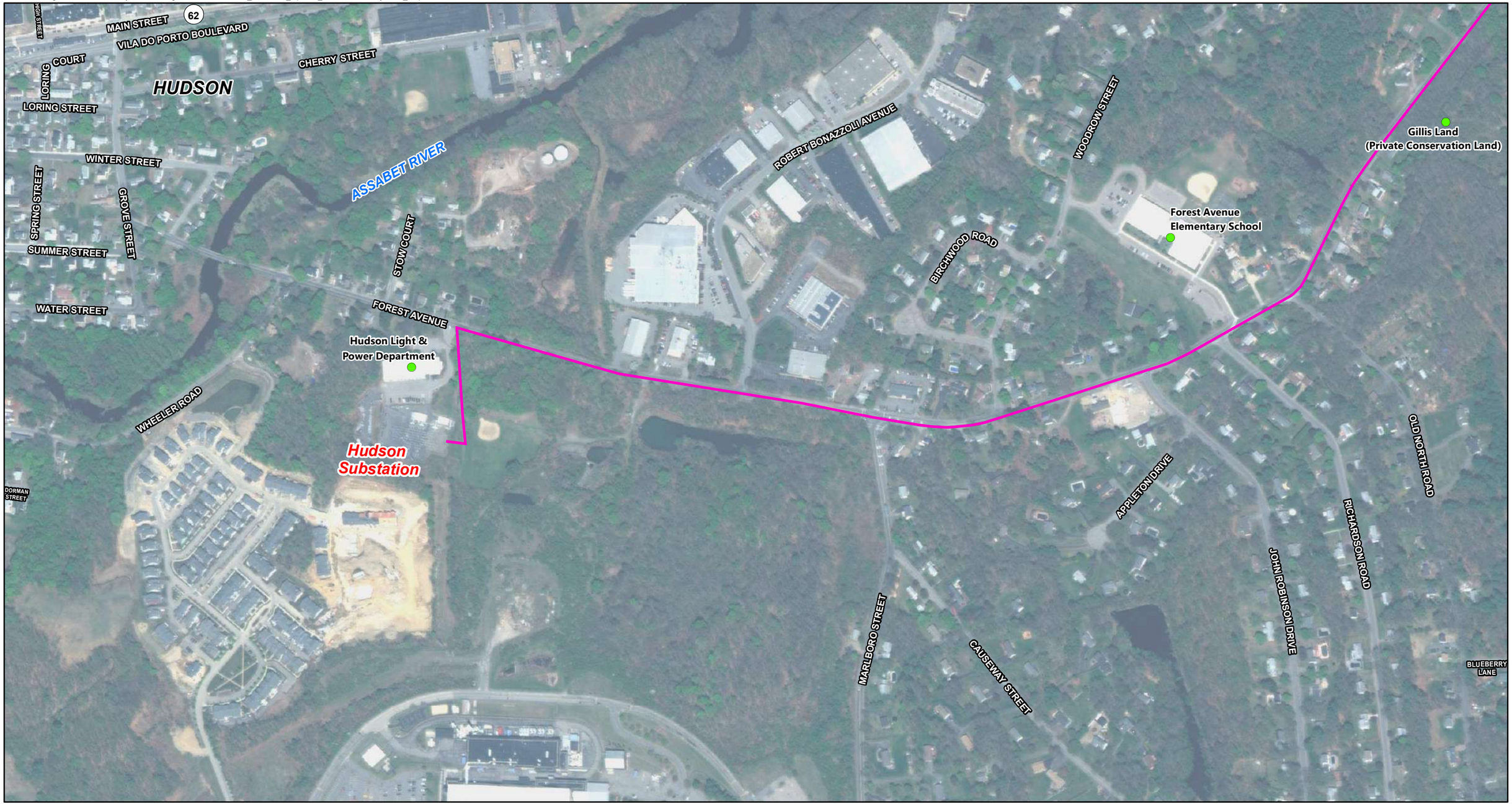

Route 7: Route 20 - Sudbury - Main [10.8 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

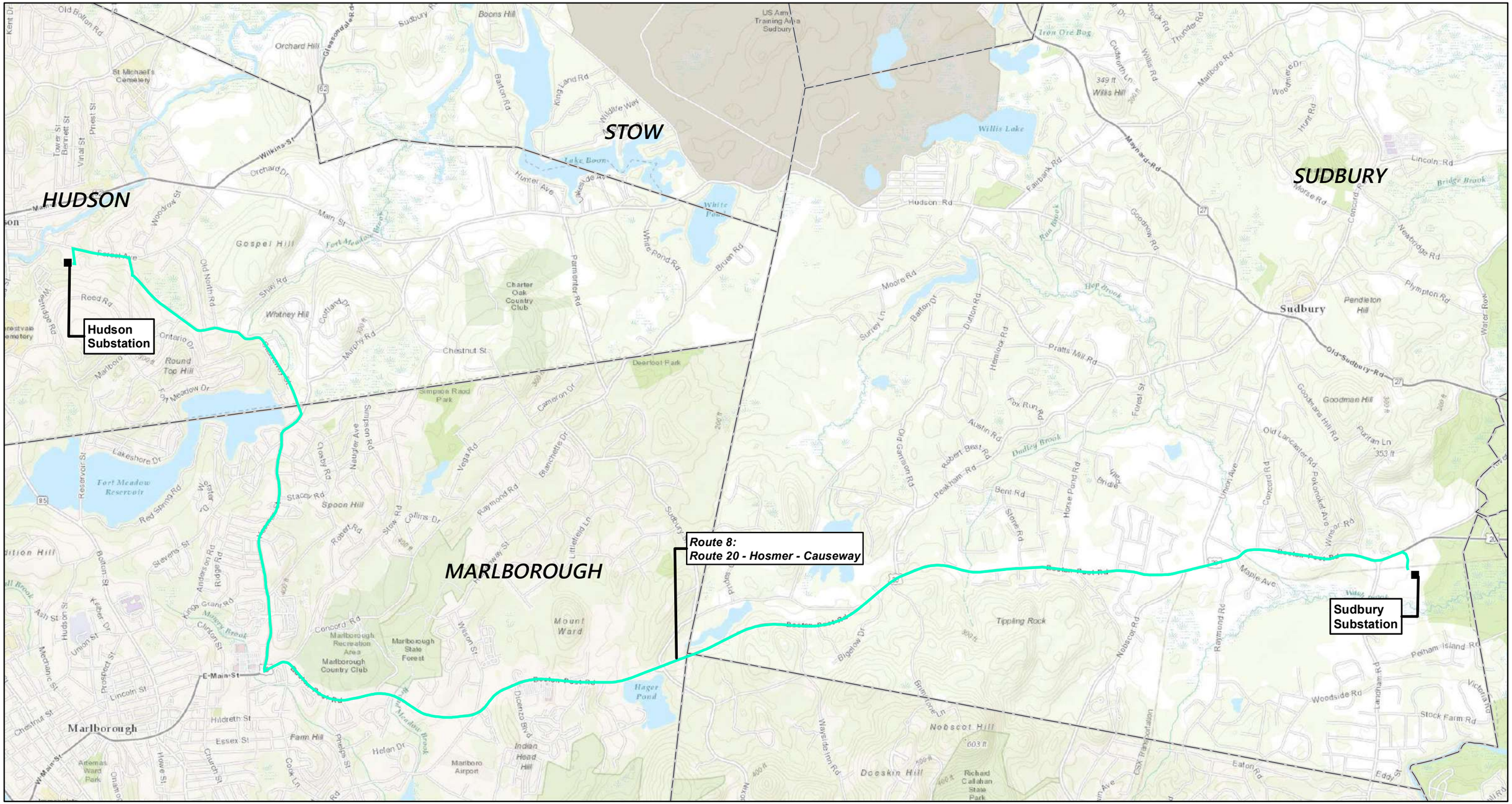
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-11: Candidate Route 7
Route 20 - Sudbury - Main

Sheet 9 of 9

vhb


HUDSON
STOW
SUDBURY
MARLBOROUGH
Marlborough
Sudbury
Hudson Substation
Sudbury Substation
Route 8:
Route 20 - Hosmer - Causeway
Gospel Hill
Whitney Hill
Round Top Hill
Chestnut St
Spoon Hill
Tippling Rock
Nobscot Hill
Deacon Hill
Mount Ward
Pendleton Hill
Goodman Hill
Fort Meadow Reservoir
Lake Boon
Willis Lake
Hop Brook
Run Brook
Charter Oak Country Club
Marlborough Country Club
Marlborough Recreation Area
Marlborough State Forest
Deerfoot Park
Simpson Road Park
Hager Pond
Indian Head Hill
Richard Callahan State Park
Marlboro Airport
US Army Training Area Sudbury
Iron Ore Bog
Old Boston Rd
Orchard Hill
Boons Hill
Wilkins St
Main St
Hudson Rd
Maynard Rd
Old Sudbury Rd
Lincoln Rd
Concord Rd
Boston Post Rd
Parmenter Rd
Pratts Mill Rd
Peakham Rd
Bent Rd
Old Lancaster Rd
Peham Island Rd
Woodside Rd
Stock Farm Rd
Eaton Rd
Maple Ave
Union Ave
Raymond Rd
Horse Pond Rd
Dudley Brook
Fox Run Rd
Austin Rd
Robert Best Rd
Old Garrison Rd
Forest St
Goodnows Hill Rd
Puritan Ln
Pokonoket Ave
Winnot Rd
Landham Rd
Victoria Rd
Eddy St
Bigelow Dr
Noanet Woodland
Nobscot Rd
Waysidetrm Rd
Brimstone Ln
Dicenzo Blvd
Lakeshore Dr
Reservoir St
Red Spring Rd
Stacy Rd
Robert Rd
Stow Rd
Collins Dr
Raymond Rd
Littlefield Ln
Sudbury Rd
Vega Rd
Blanchette Dr
Cameron Dr
Simpson Rd
Closely Rd
Naugler Ave
Old North Rd
Shay Rd
Cortland Dr
Murphy Rd
Parmenter Rd
Barton Rd
King Land Rd
Wildlife Way
Lakeside Ave
Hunter Ave
White Pond Rd
Bruen Rd
Woodrow St
Fairbank Rd
Moore Rd
Surrey Ln
Barton Dr
Dutton Rd
Hemlock Rd
Goodnow Rd
Concord Rd
Worse Rd
Bridge Brook
Newbridge Rd
Plympton Rd
Water Row
Cuttingbrook Rd
Thunder Rd
Willis Rd
Marlboro Rd
Woodmere Dr
Hunt Rd
Cudworth Ln
Wills Hill
Meadow Dr
Ontario Dr
Marlboro
Reed Rd
Spring Rd
Forest Ave
Priest St
Viral St
Bennett St
Tower St
St Michael's Cemetery
Kent Dr
Ridge Rd
Anderson Rd
Stevens St
Bolton St
Hudson St
Ash St
Kimber Dr
Union St
Prospect St
Lincoln St
Chestnut St
Merriam St
Main St
E Main St
Hildreth St
Essex St
Farm Hill
Church St
Howe St
Phelps St
Cook Ln
Helen Dr
Artemas Ward Park
Kings Grant Rd
Maple Brook
Clarkson St
Concord Rd
Wason St
Meadow Brook
Dicenzo Blvd
Boston Post Rd
Maple Ave
Tippling Rock
Noanet Woodland
Nobscot Rd
Waysidetrm Rd
Brimstone Ln
Eaton Rd
Eddy St
Peham Island Rd
Victoria Rd
Woodside Rd
Stock Farm Rd
Landham Rd
Winnot Rd
Pokonoket Ave
Concord Rd
Old Lancaster Rd
Goodnows Hill Rd
Puritan Ln
Union Ave
Raymond Rd
Maple Ave
Boston Post Rd
Bigelow Dr

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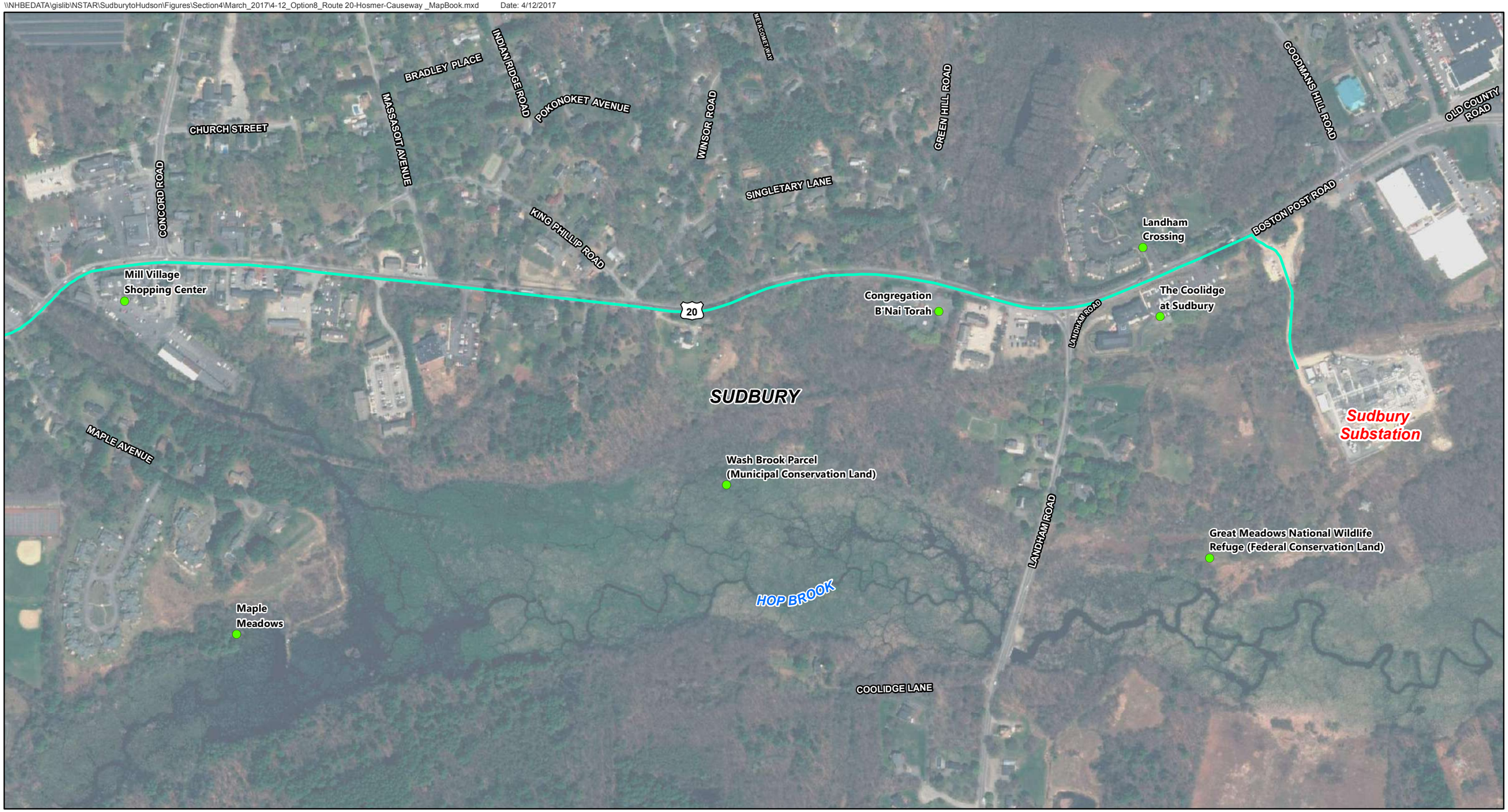

Route 8: Route 20 - Hosmer - Causeway [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-12: Candidate Route 8
Route 20 - Hosmer - Causeway

Sheet 1 of 9

vhb

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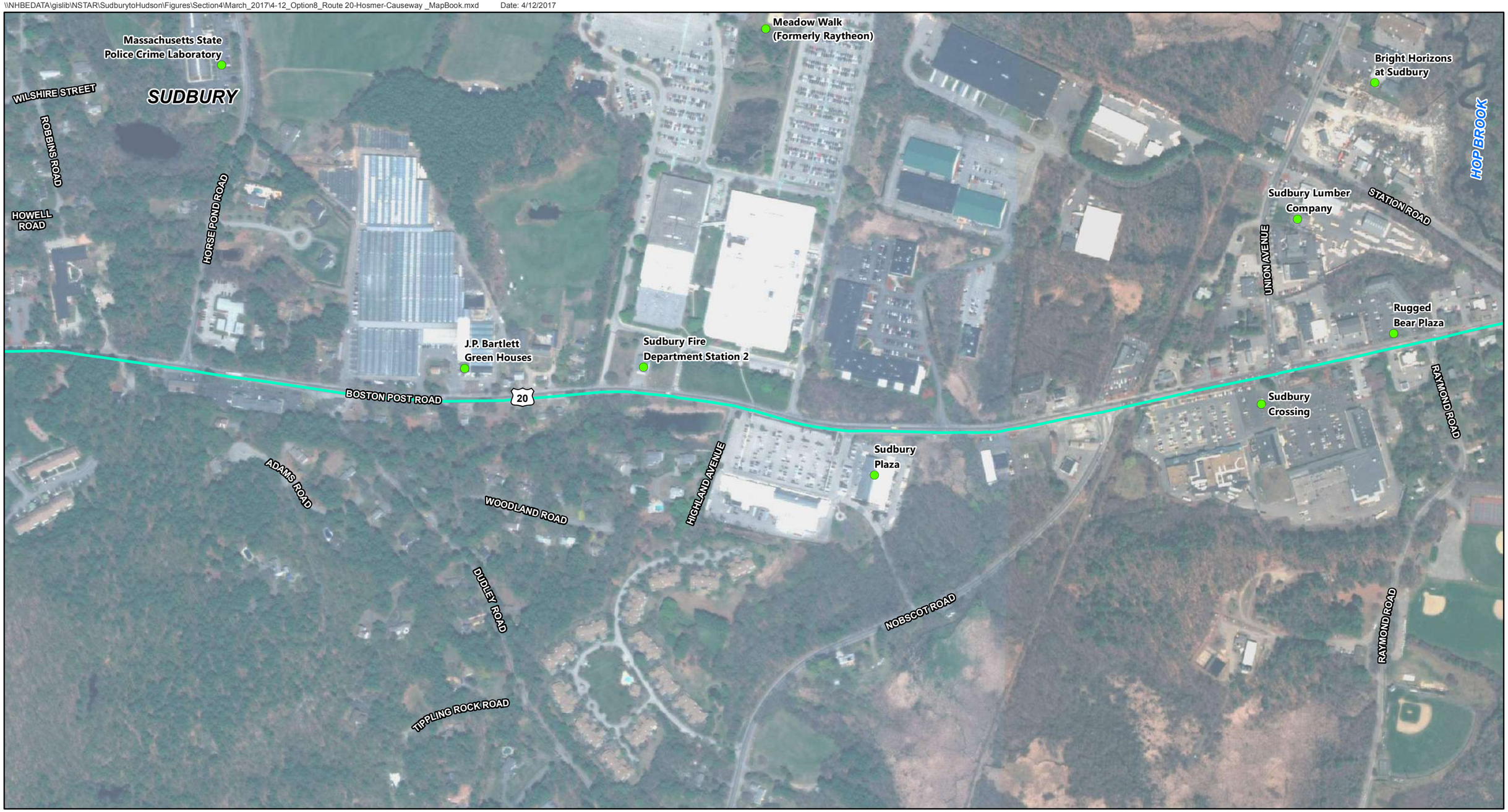

Route 8: Route 20 - Hosmer - Causeway [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-12: Candidate Route 8
Route 20 - Hosmer - Causeway**

Sheet 2 of 9

vhb

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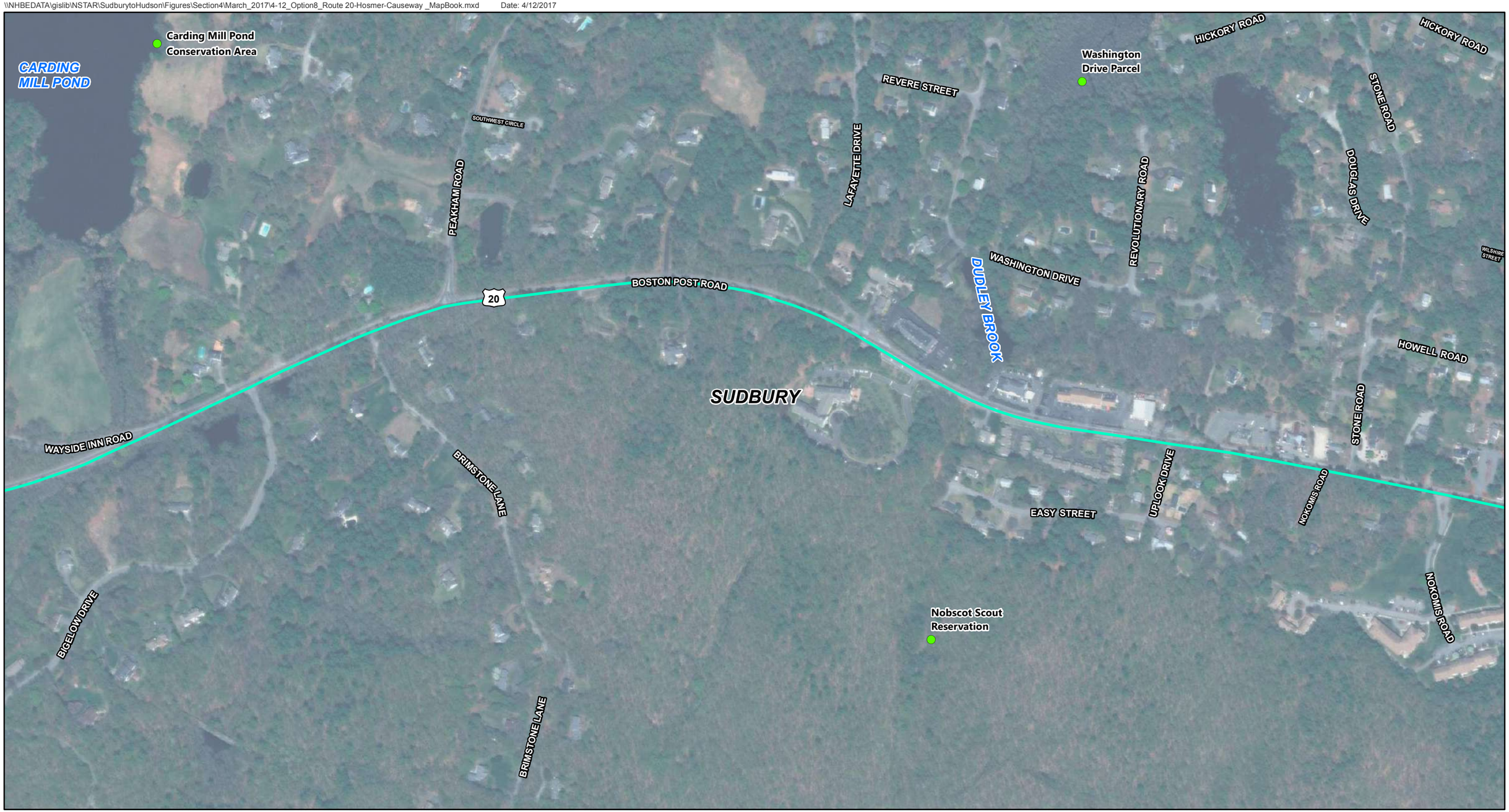

Route 8: Route 20 - Hosmer - Causeway [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-12: Candidate Route 8
Route 20 - Hosmer - Causeway

Sheet 3 of 9

vhb

MARLBOROUGH
SUDBURY
FRAMINGHAM
CARDING MILL POND
GRIST MILLPOND
SUDBURY STREET
PRIDE CROSSING ROAD
DUTTON ROAD
WAYSIDE INN ROAD
OLD POST ROAD
BOSTON POST ROAD EAST
BOSTON POST ROAD
HAGER STREET
PARMENTER ROAD
BOWDITCH ROAD
CARDING MILL ROAD
BIGELOW DRIVE
20
Grist Mill Pond Area
Wayside Inn
Longfellow's Wayside Inn

Route 8: Route 20 - Hosmer - Causeway [11.1 Miles]
Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB
4/12/2017

N
0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-12: Candidate Route 8
Route 20 - Hosmer - Causeway

Sheet 4 of 9

vhb

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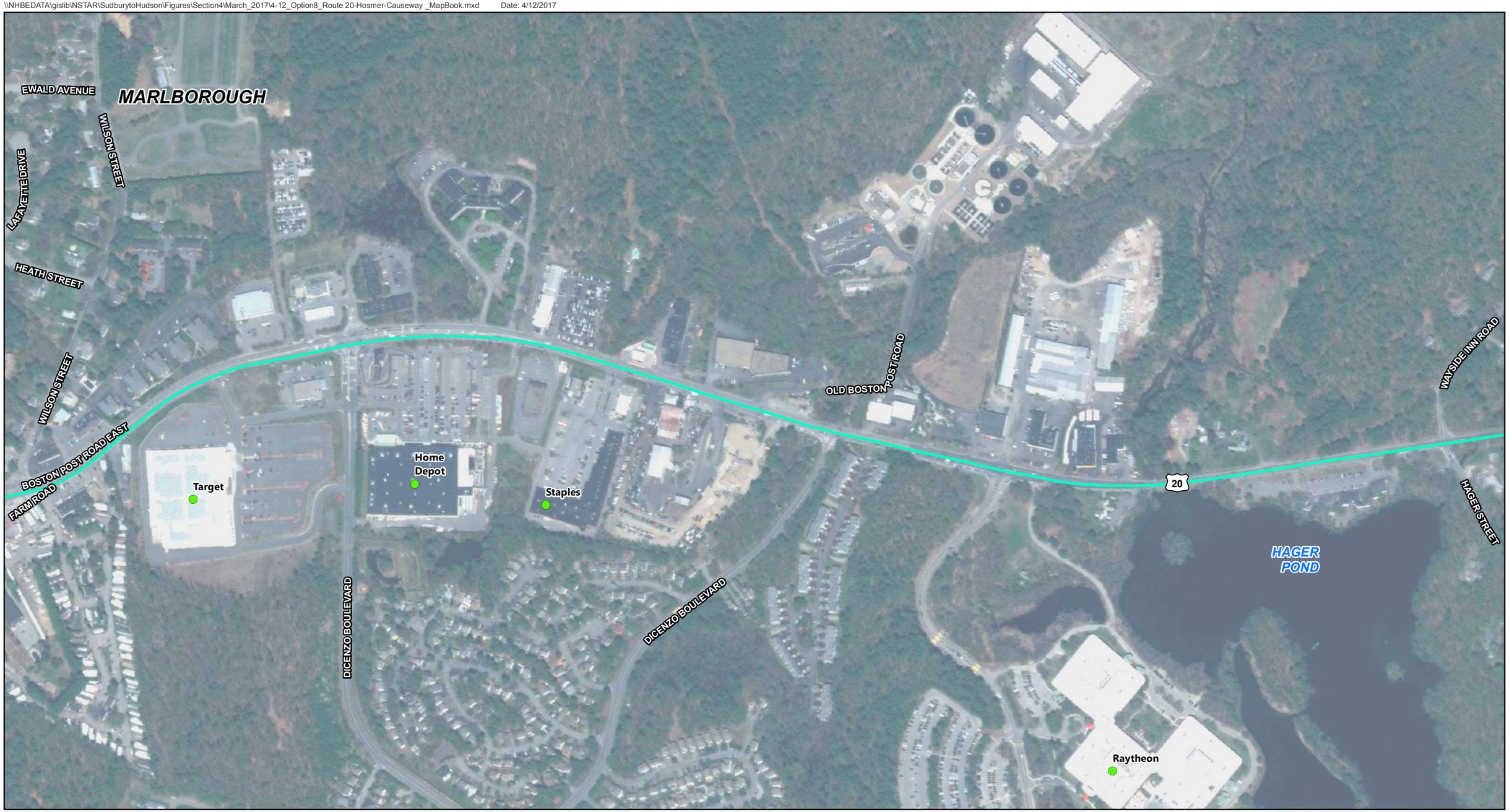


Route 8: Route 20 - Hosmer - Causeway [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

0 400 800 Feet

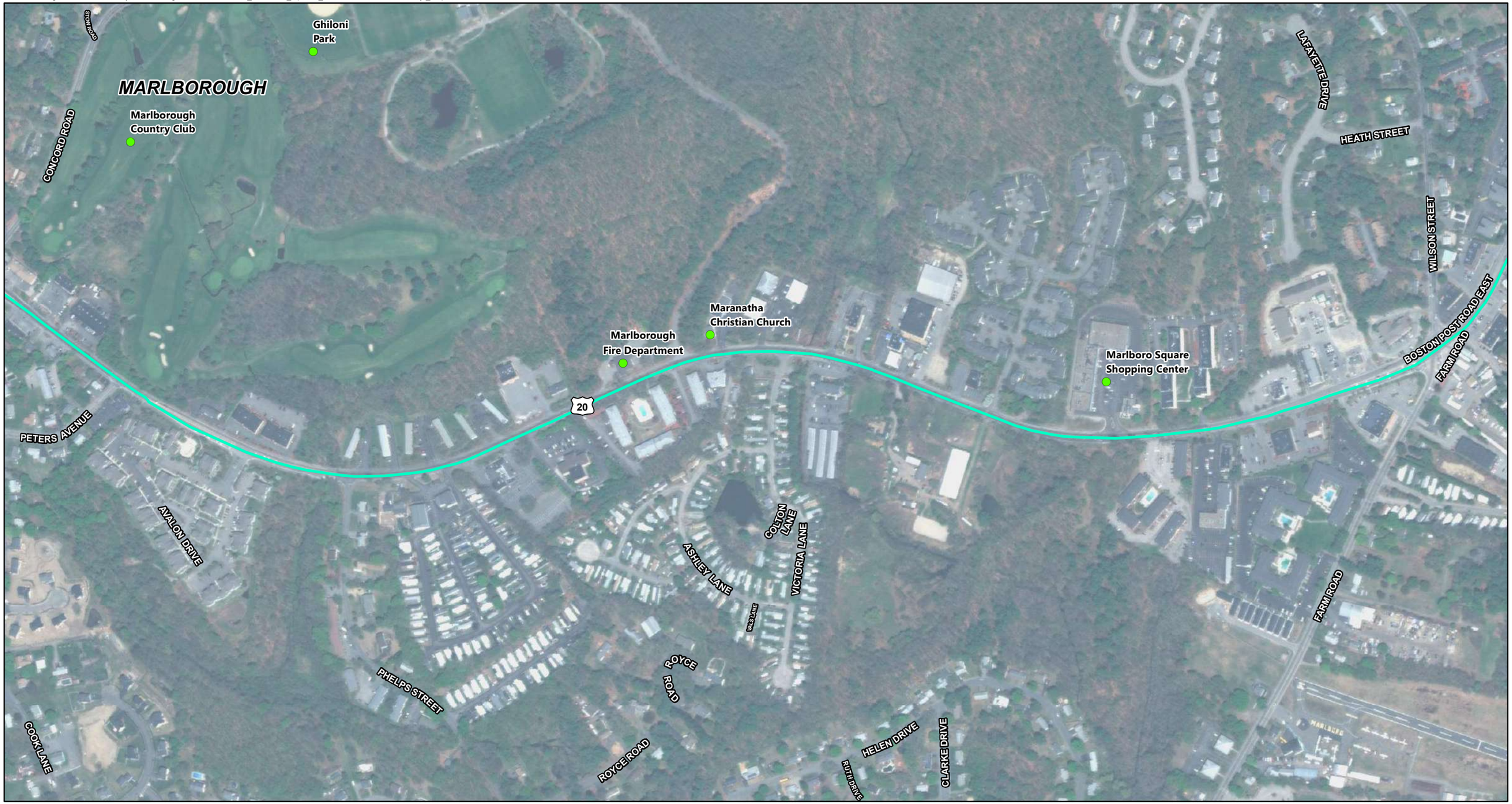
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-12: Candidate Route 8 Route 20 - Hosmer - Causeway

Sheet 5 of 9

vhb



Route 8: Route 20 - Hosmer - Causeway [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-12: Candidate Route 8
Route 20 - Hosmer - Causeway

Sheet 6 of 9

vhb

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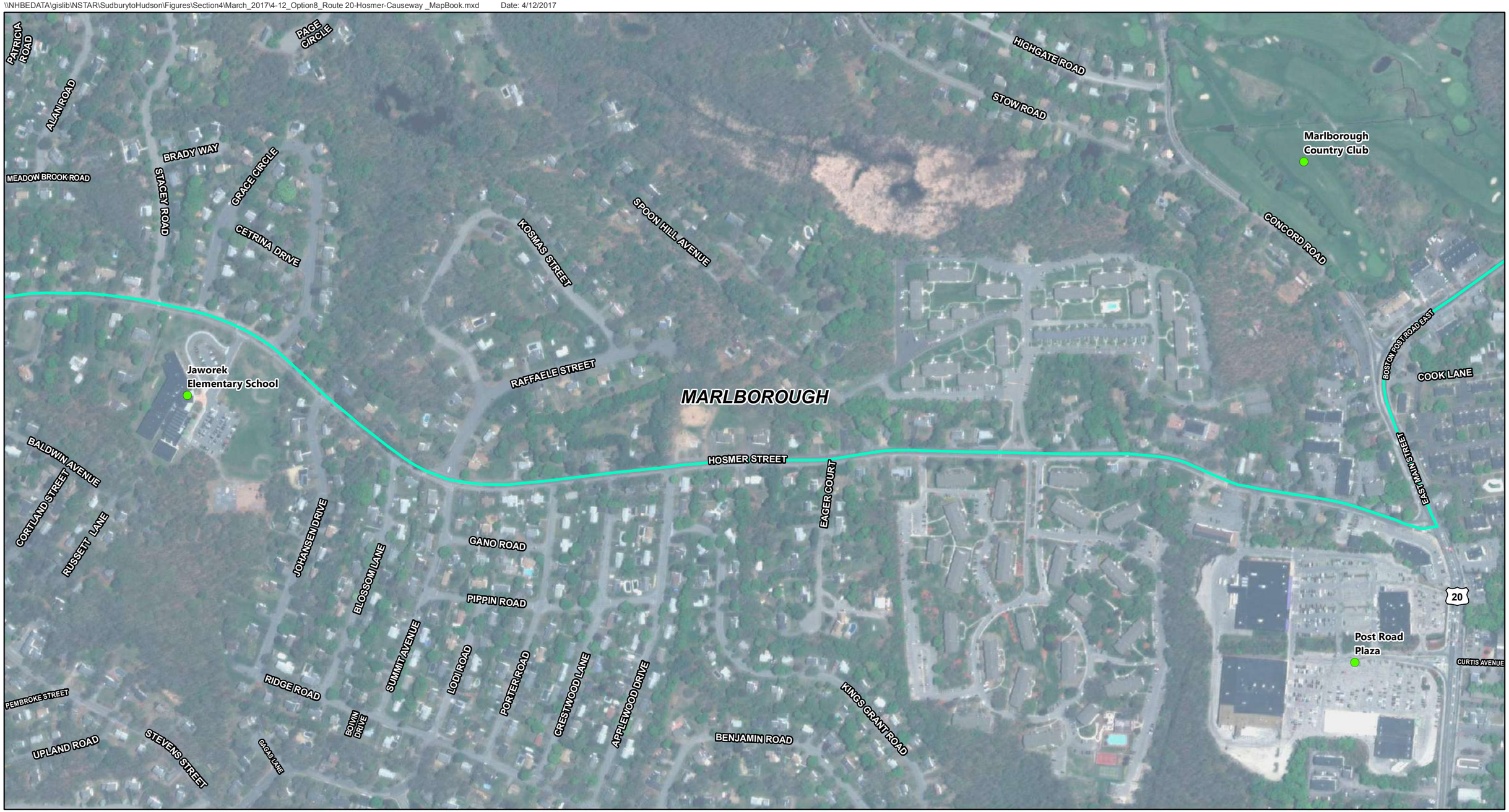

Route 8: Route 20 - Hosmer - Causeway [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-12: Candidate Route 8 Route 20 - Hosmer - Causeway

Sheet 7 of 9

vhb

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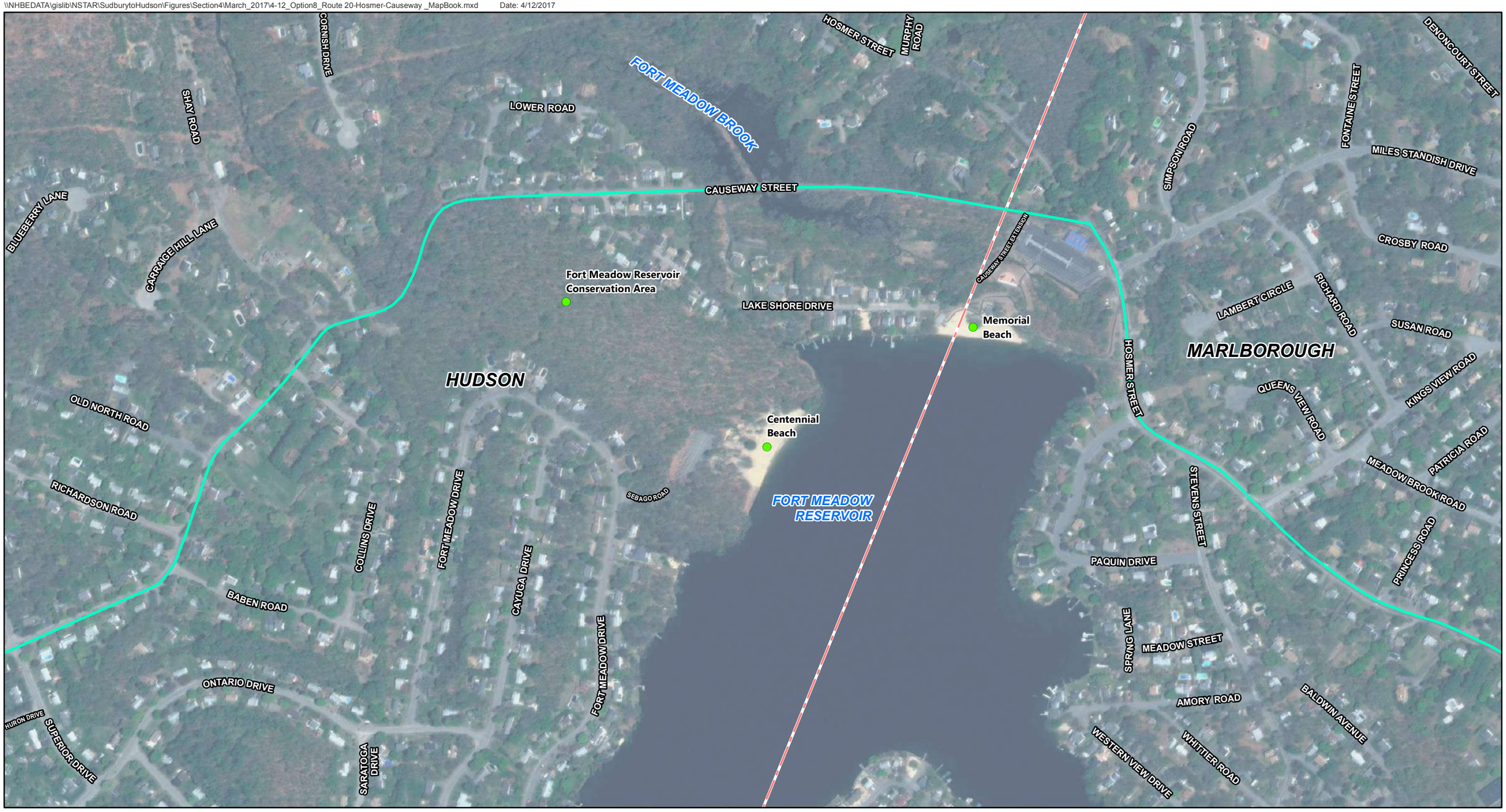

Route 8: Route 20 - Hosmer - Causeway [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-12: Candidate Route 8
Route 20 - Hosmer - Causeway

Sheet 8 of 9

vhb

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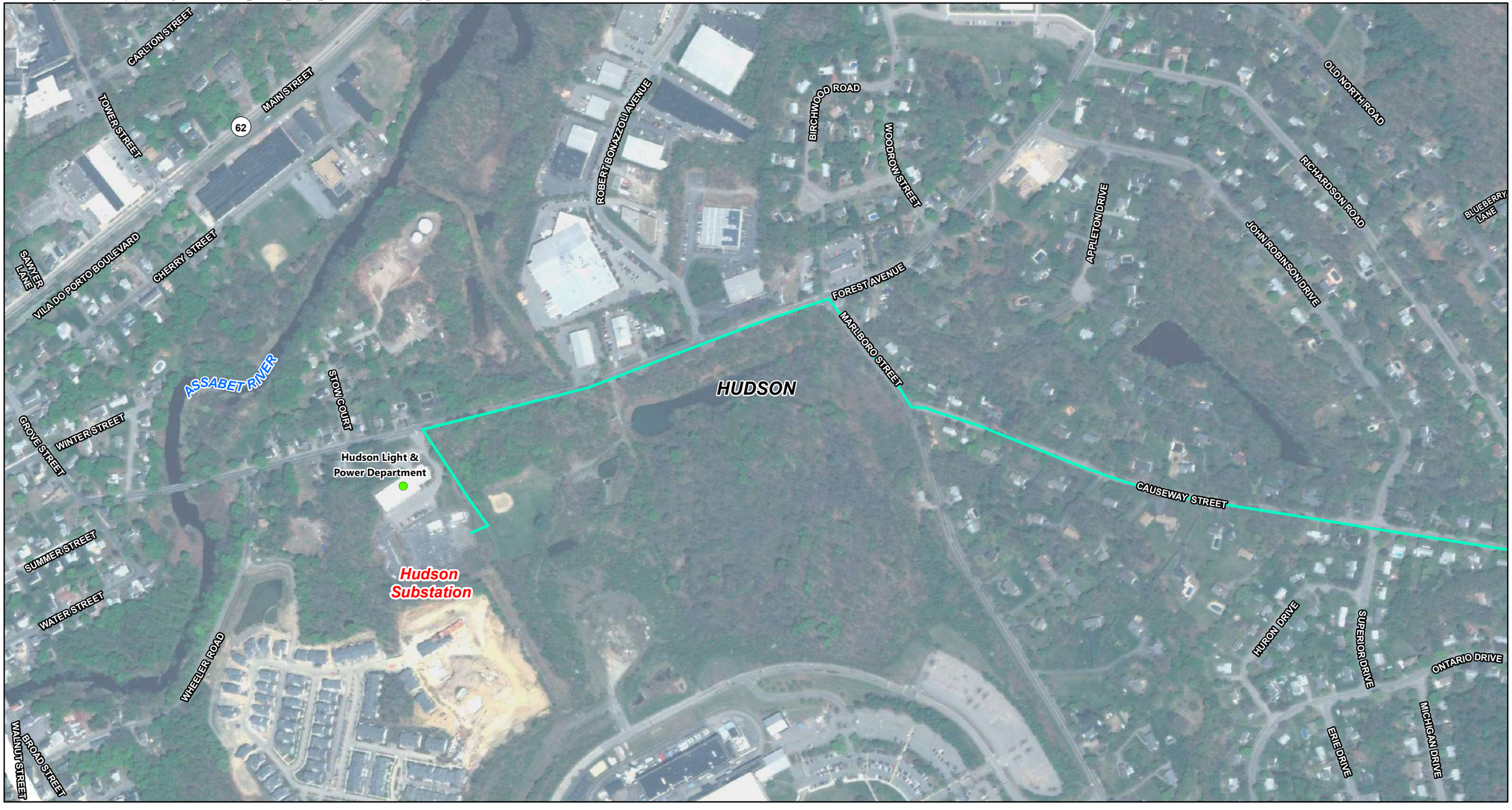


Route 8: Route 20 - Hosmer - Causeway [11.1 Miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

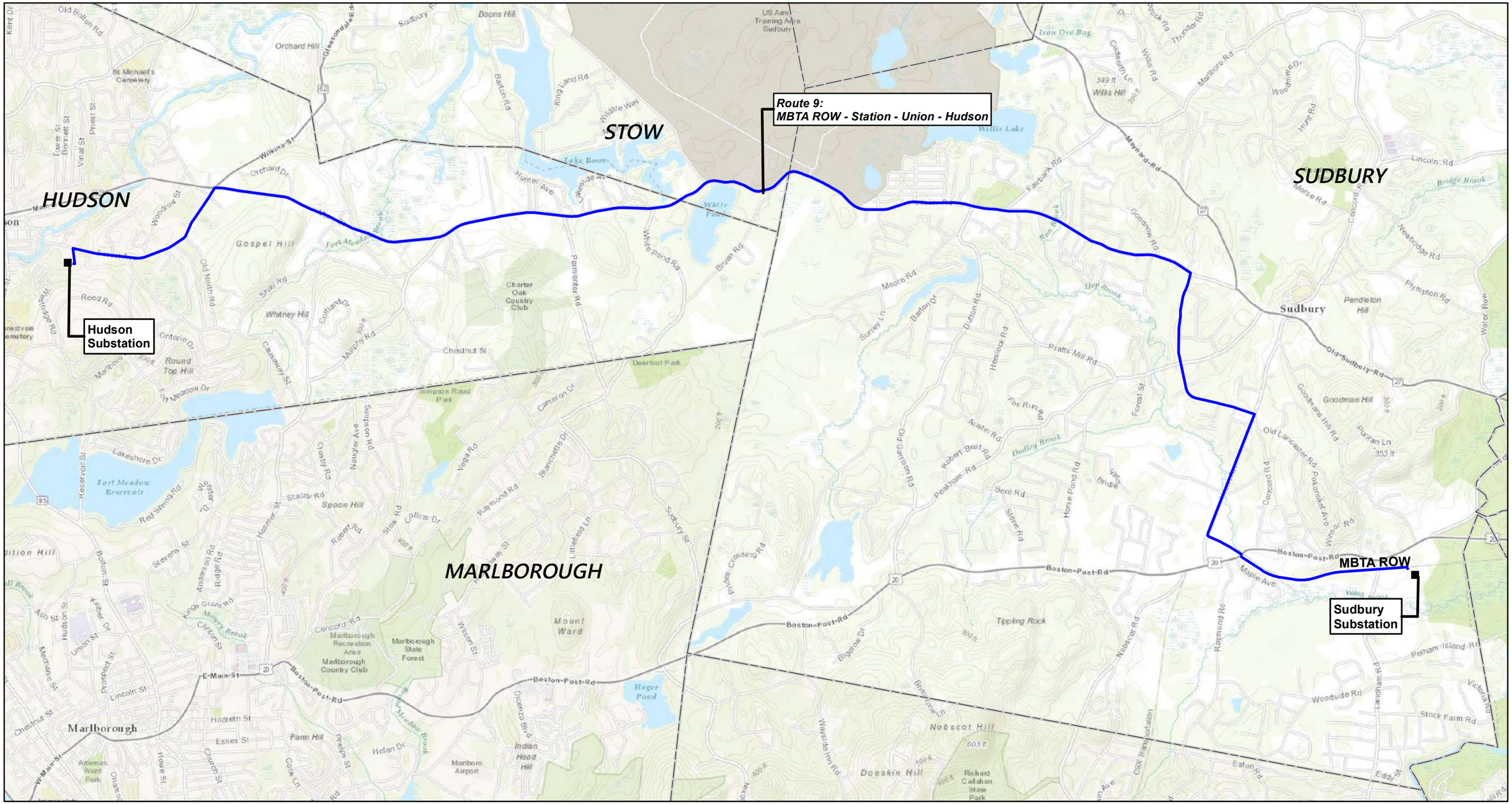
Sudbury-Hudson Transmission Reliability Project

Figure 4-12: Candidate Route 8 Route 20 - Hosmer - Causeway

Sheet 9 of 9

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\March_2017\4-13_Option9_MBTA ROW_Station Road_Union_Hudson_Cover.mxd Date: 4/12/2017



Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 3,000 6,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9
MBTA ROW - Station - Union - Hudson

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\March_2017\4-13_Option9_MBTA ROW_Station Road_Union_Hudson_MapBook.mxd Date: 4/12/2017

Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9
MBTA ROW - Station - Union - Hudson

Sheet 1 of 9

vhb

\\WHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\March_2017\4-13_Option9_MBTA ROW_Station Road_Union_Hudson_MapBook.mxd Date: 4/12/2017

Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

0 400 800 Feet

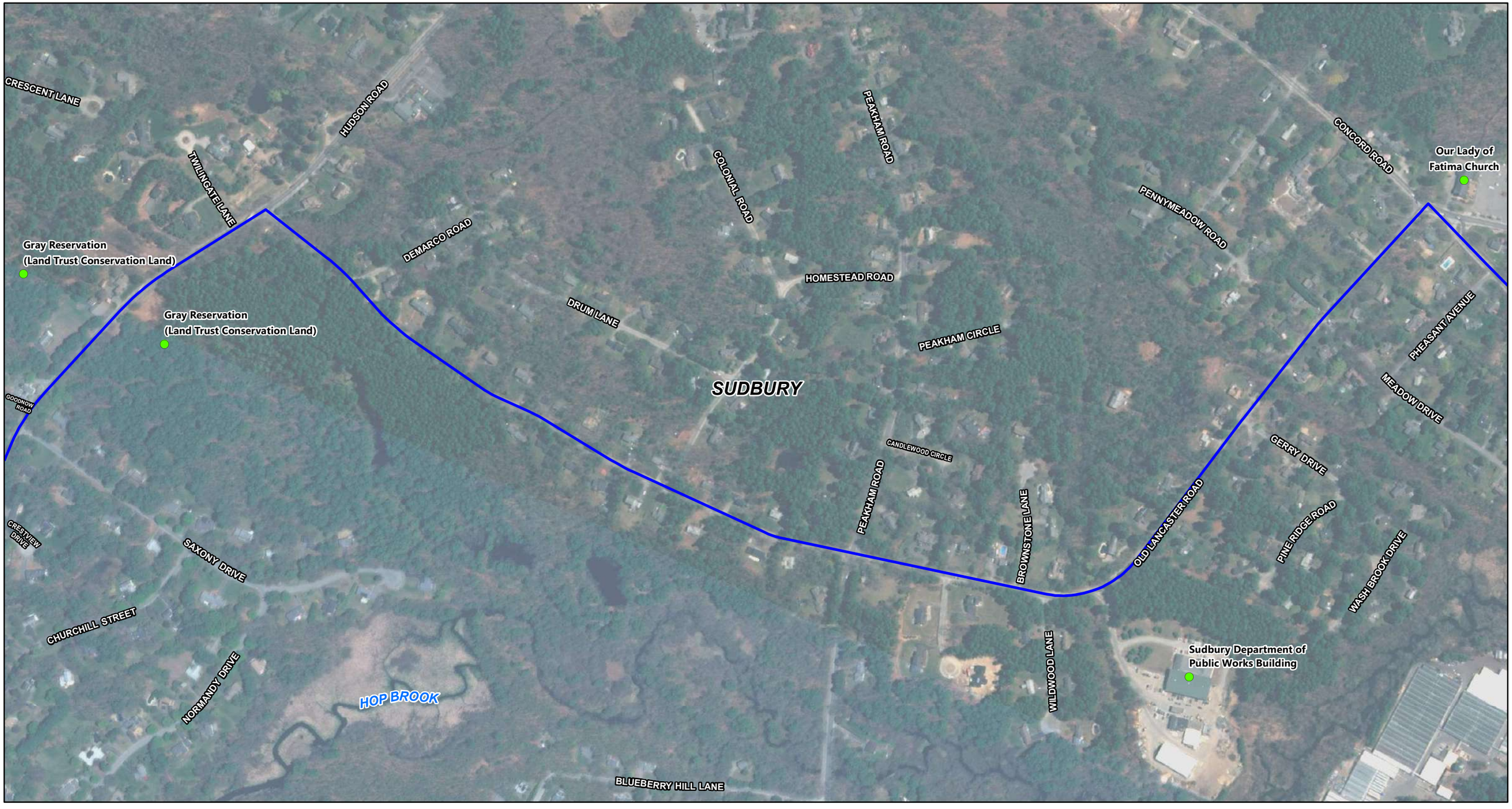
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9 MBTA ROW - Station - Union - Hudson

Sheet 2 of 9

vhb



Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

0 400 800 Feet

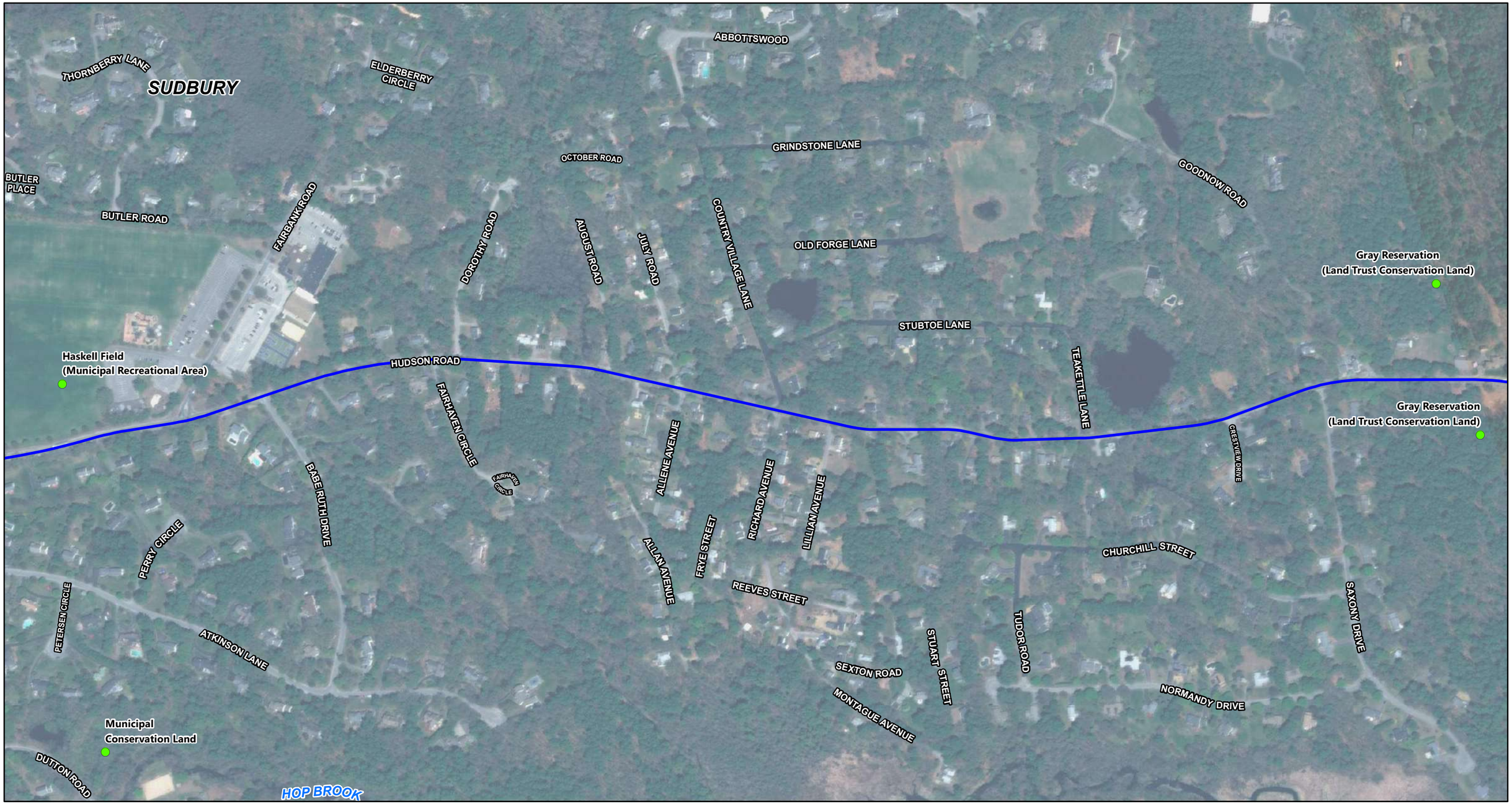
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9 MBTA ROW - Station - Union - Hudson

Sheet 3 of 9

vhb



Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9
MBTA ROW - Station - Union - Hudson

Sheet 4 of 9

vhb

Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9
MBTA ROW - Station - Union - Hudson

vhb

Sheet 5 of 9

Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

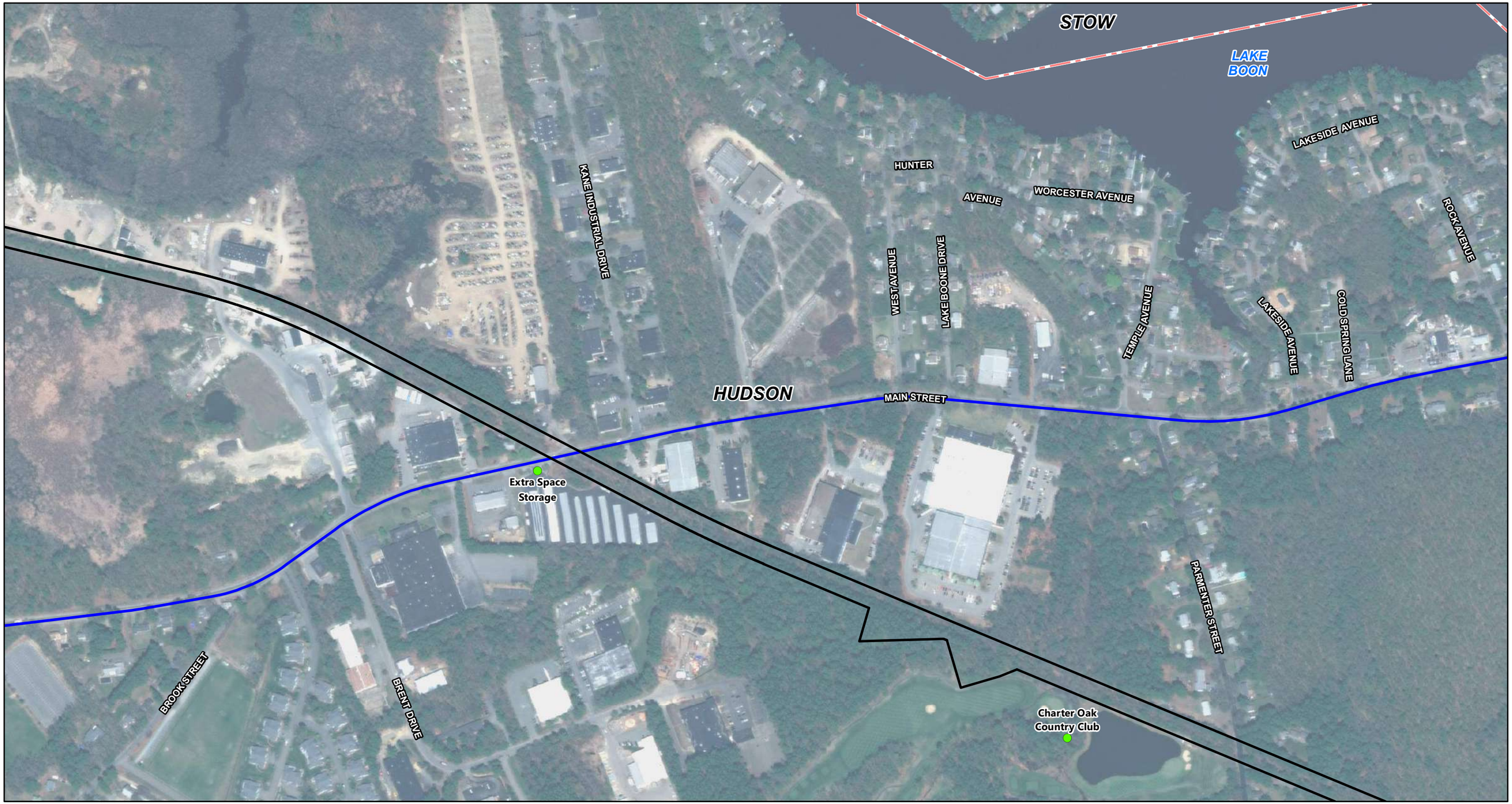
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9
MBTA ROW - Station - Union - Hudson

Sheet 6 of 9

vhb



Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9 MBTA ROW - Station - Union - Hudson

vhb

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Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

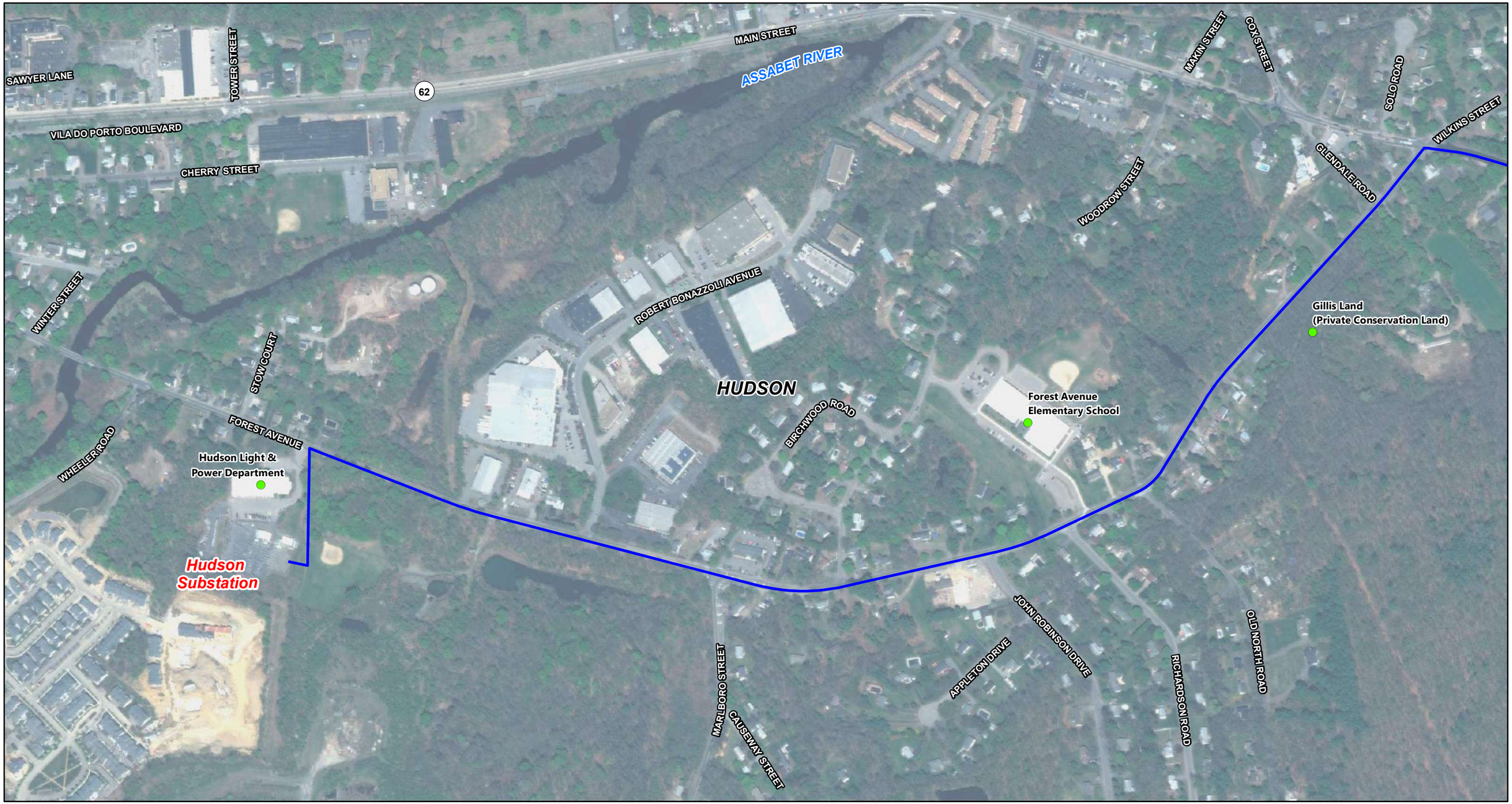
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9
MBTA ROW - Station - Union - Hudson

Sheet 8 of 9

vhb



Route 9: MBTA ROW - Station - Union - Hudson [10.7 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

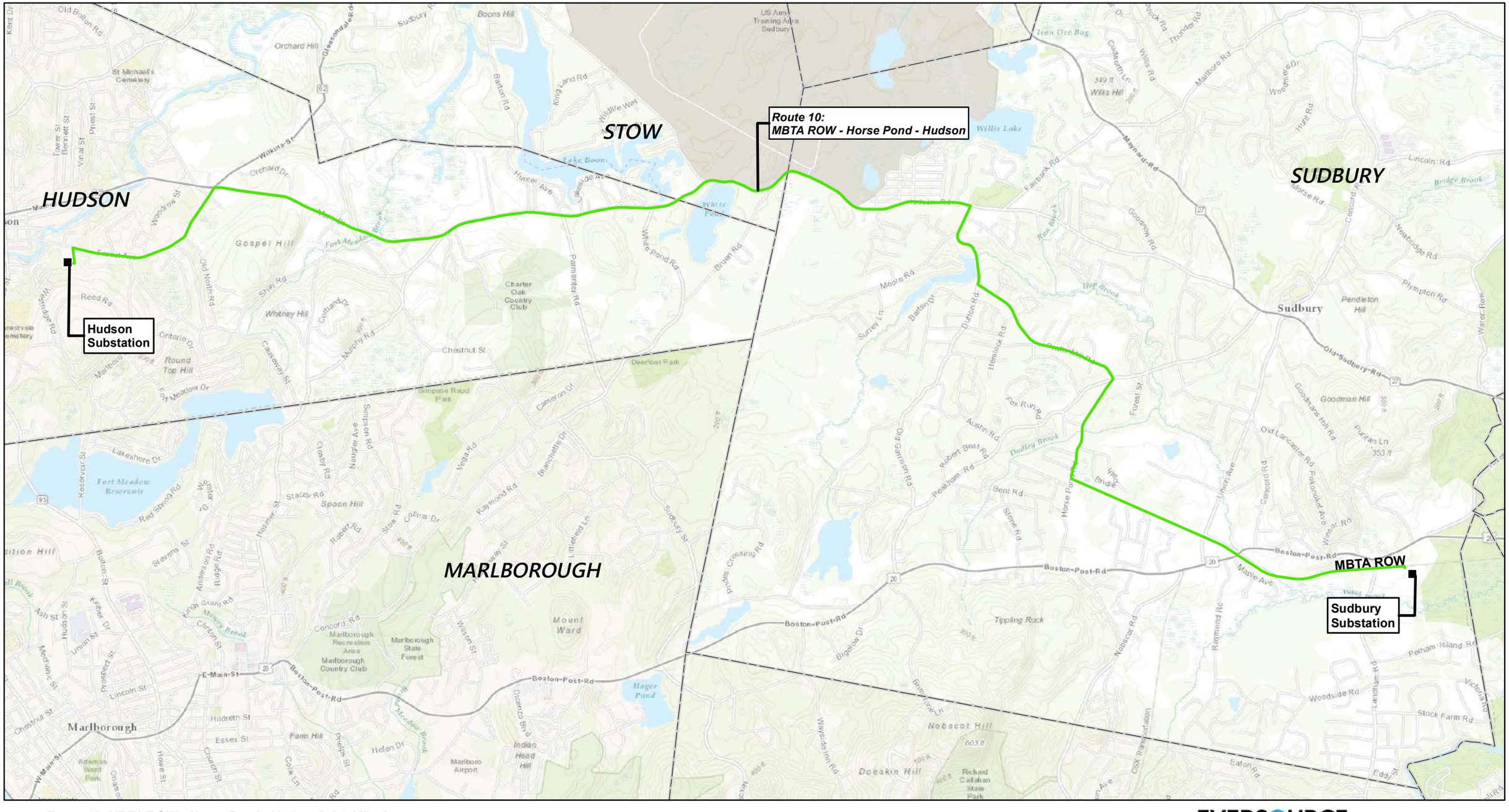
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-13: Candidate Route 9
MBTA ROW - Station - Union - Hudson

Sheet 9 of 9

vhb



Route 10: MBTA ROW - Horse Pond - Hudson [10.5 Miles]

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 3,000 6,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-14: Candidate Route 10
MBTA ROW - Horse Pond - Hudson

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Route 10: MBTA ROW to Horse Pond to Hudson [10.5 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-14: Candidate Route 10
MBTA ROW - Horse Pond - Hudson**

Sheet 1 of 8

vhb

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Route 10: MBTA ROW to Horse Pond to Hudson [10.5 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-14: Candidate Route 10
MBTA ROW - Horse Pond - Hudson**

Sheet 2 of 8

vhb

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Route 10: MBTA ROW to Horse Pond to Hudson [10.5 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-14: Candidate Route 10 MBTA ROW - Horse Pond - Hudson

Sheet 3 of 8

vhb

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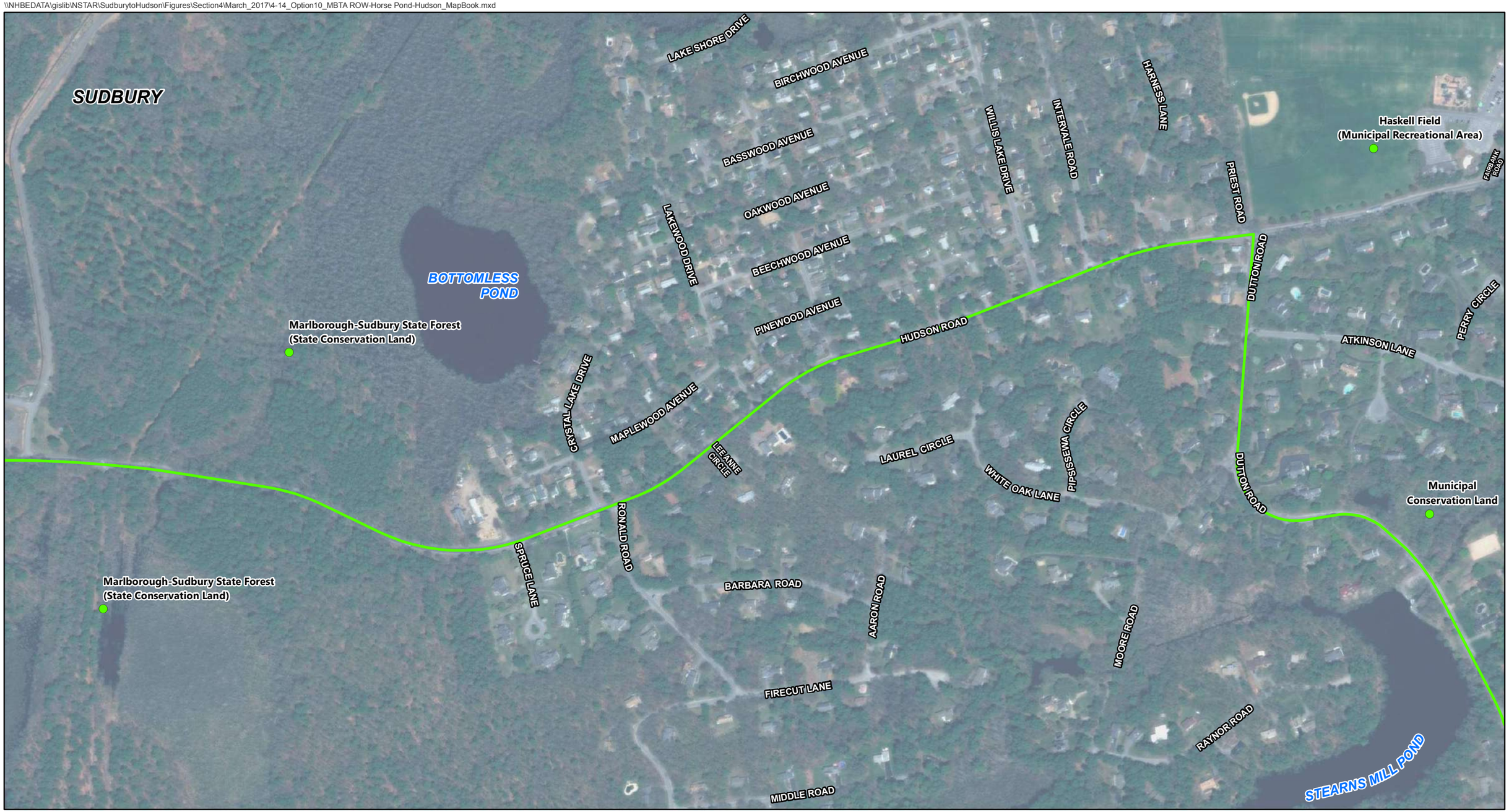

Route 10: MBTA ROW to Horse Pond to Hudson [10.5 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-14: Candidate Route 10
MBTA ROW - Horse Pond - Hudson

Sheet 4 of 8

vhb

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Route 10: MBTA ROW to Horse Pond to Hudson [10.5 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-14: Candidate Route 10
MBTA ROW - Horse Pond - Hudson

Sheet 5 of 8

vhb

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Route 10: MBTA ROW to Horse Pond to Hudson [10.5 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-14: Candidate Route 10
MBTA ROW - Horse Pond - Hudson

Sheet 6 of 8

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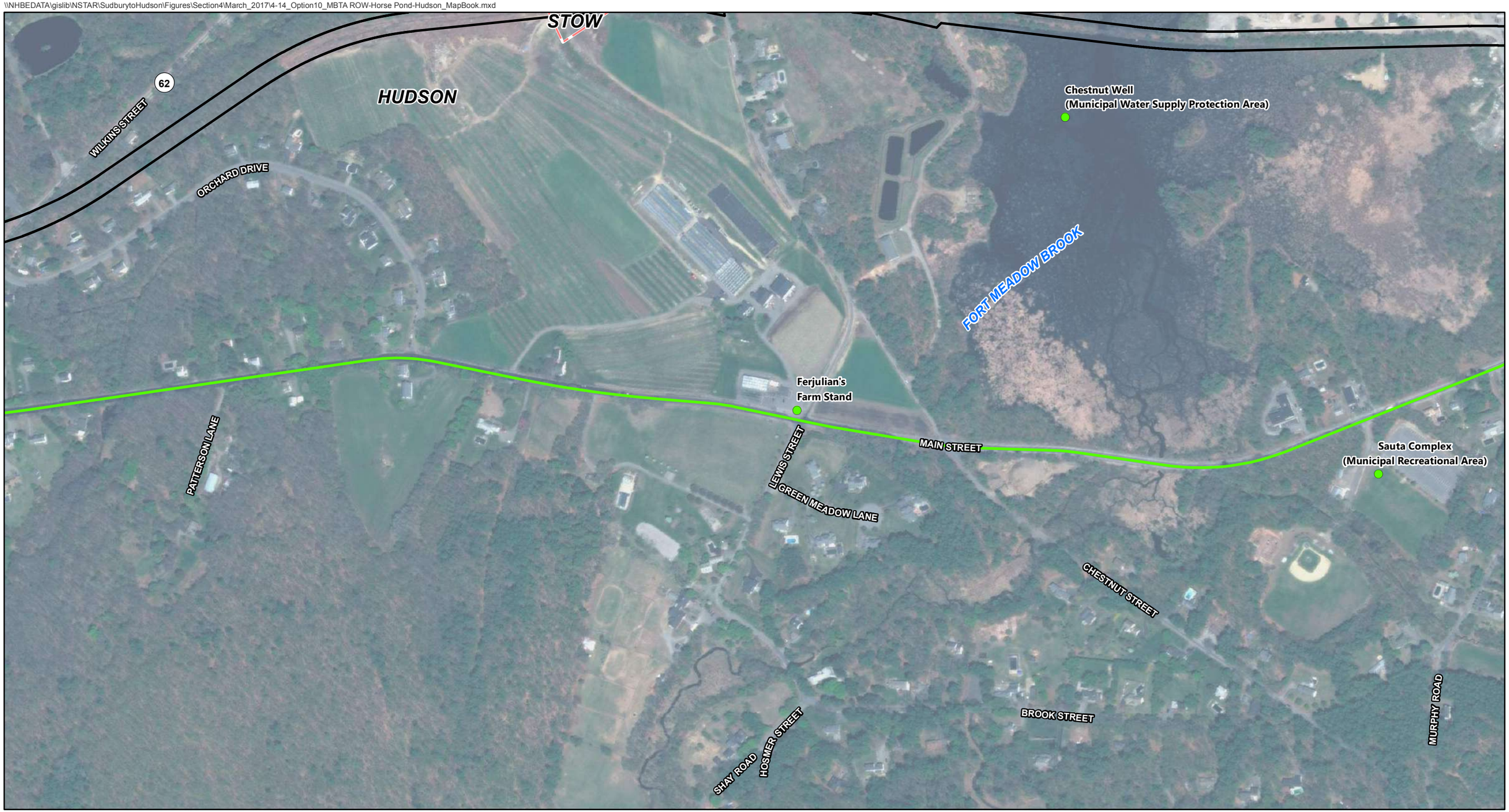

Route 10: MBTA ROW to Horse Pond to Hudson [10.5 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-14: Candidate Route 10
MBTA ROW - Horse Pond - Hudson

Sheet 7 of 8

vhb

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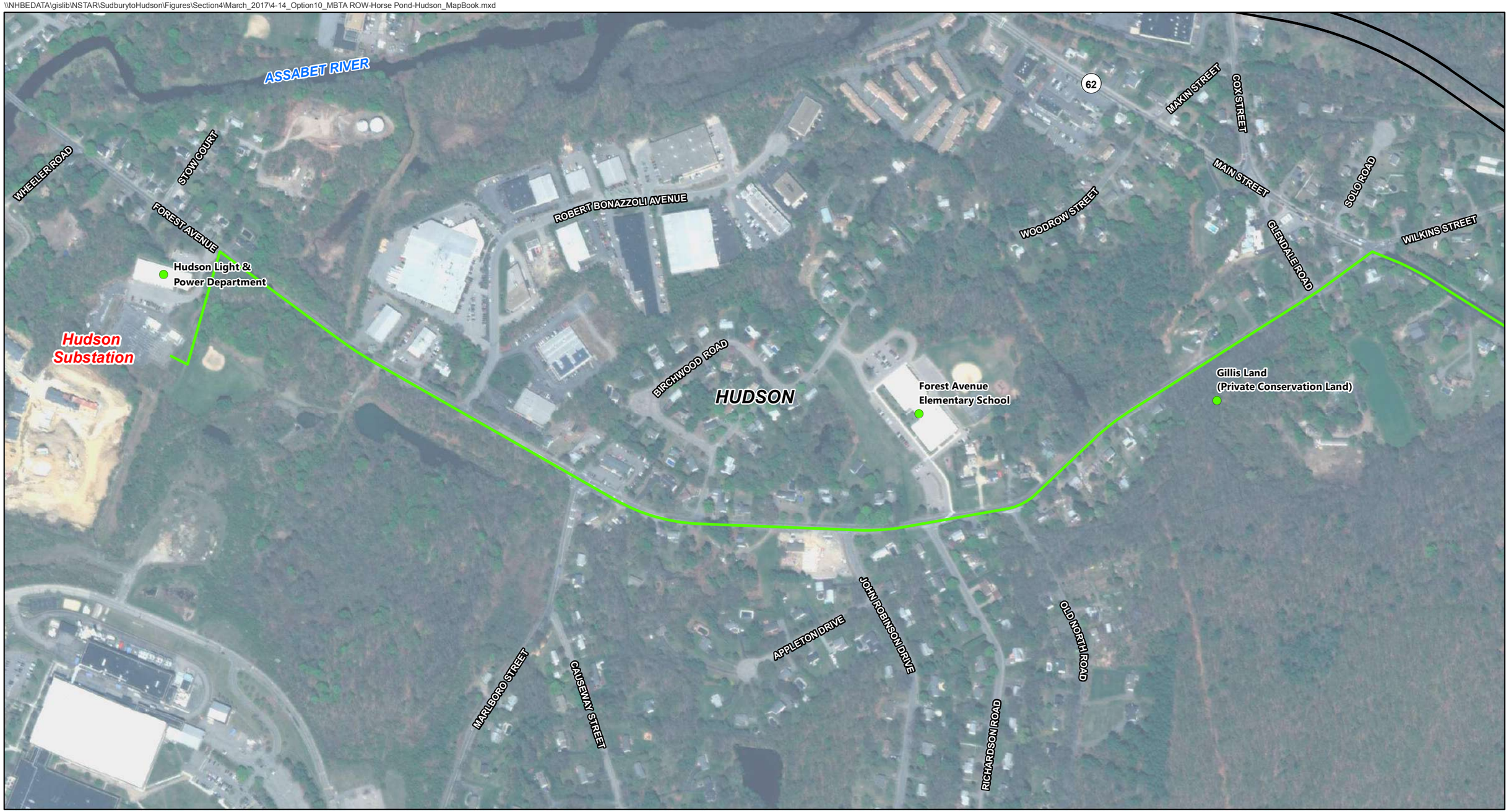


Route 10: MBTA ROW to Horse Pond to Hudson [10.5 Miles]

Approximate Limits of MBTA ROW

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

EVERSOURCE ENERGY

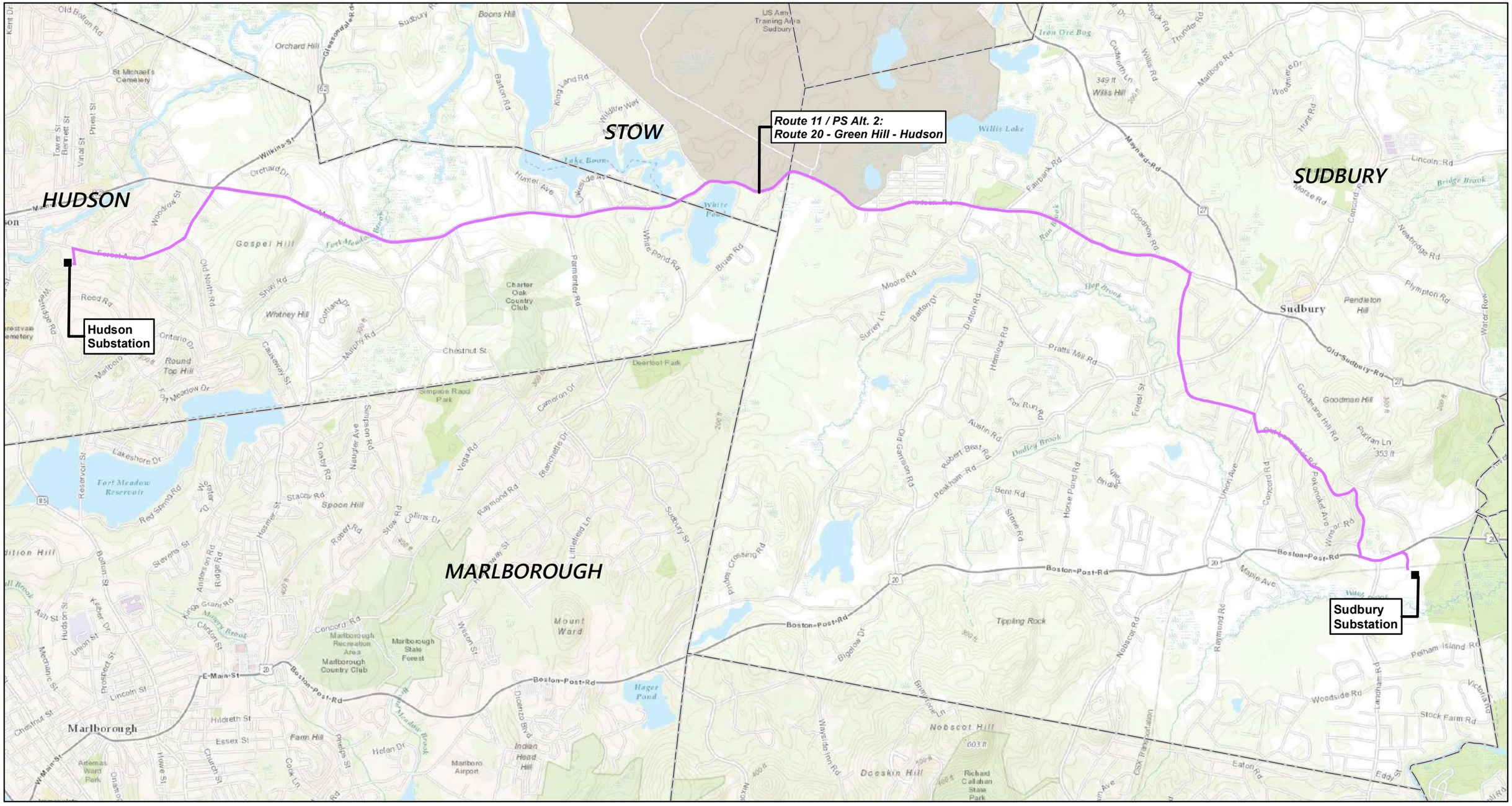
Sudbury-Hudson Transmission Reliability Project

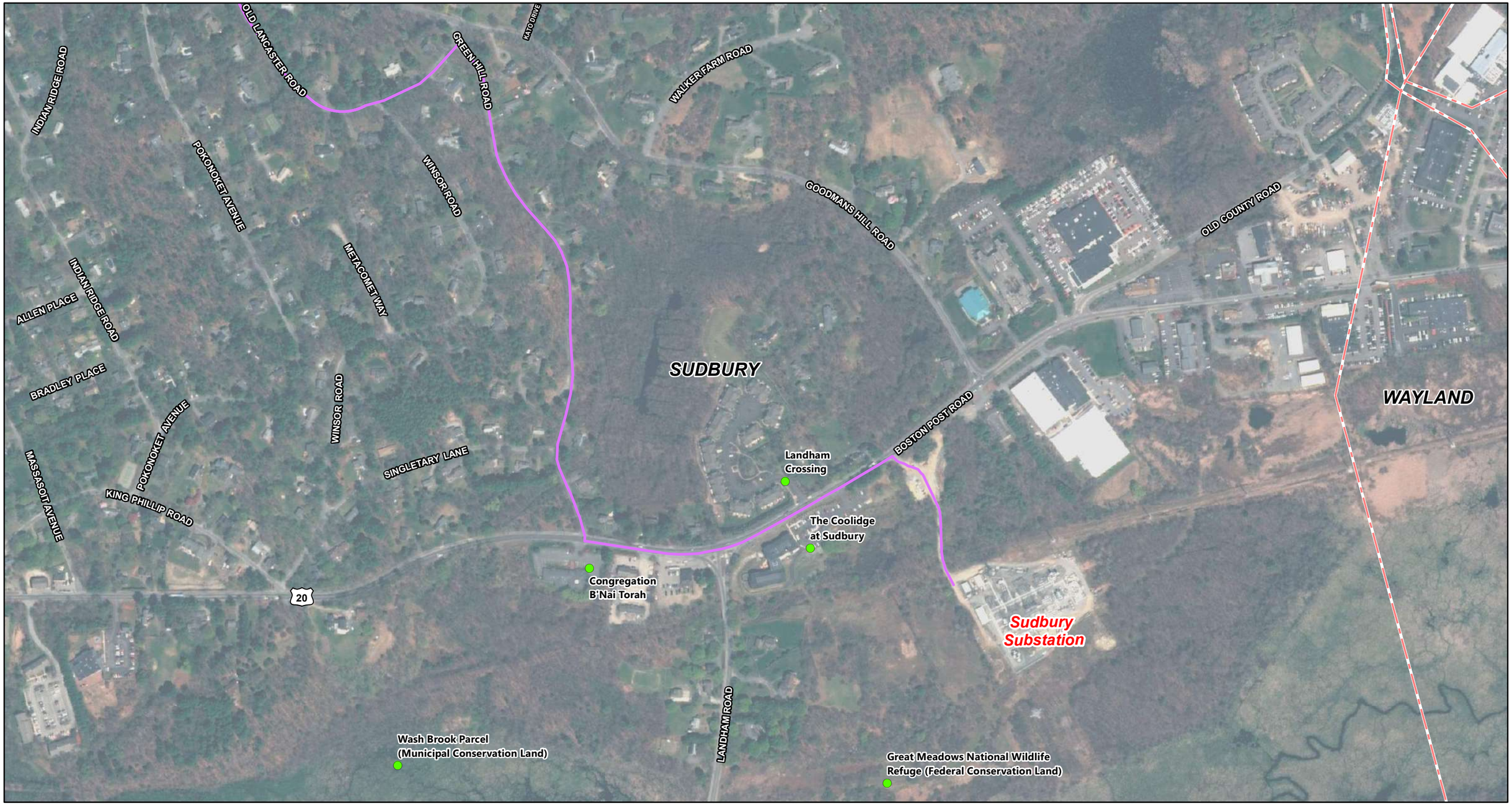
**Figure 4-14: Candidate Route 10
MBTA ROW - Horse Pond - Hudson**

Sheet 8 of 8

vhb

\\NHBEDATA\gislib\NSTAR\SudburytoHudson\Figures\Section4\March_2017\4-15_Option11_Route20-Greenhill-Hudson_Cover.mxd Date: 4/12/2017


Route 11 / PS Alt. 2:
Route 20 - Green Hill - Hudson
Hudson Substation
Sudbury Substation
HUDSON
STOW
SUDBURY
MARLBOROUGH
Marlborough
Sudbury
US Army Training Area Sudbury
Fort Meadow Reservoir
Lake Boon
Willis Lake
Hop Brook
Dudley Brook
Nobscot Hill
Tipping Rock
Mount Ward
Hager Pond
Charter Oak Country Club
Marlborough Country Club
Marlborough Recreation Area
Marlborough State Forest
Marlboro Airport
Richard Callahan State Park
Deertoot Park
Simpson Road Park
Artemas Ward Park
Indian Head Hill
Gospel Hill
Round Top Hill
Whitney Hill
Spoon Hill
Farm Hill
Pendleton Hill
Goodman Hill
Boston Post Rd
Old Sudbury Rd
Lincoln Rd
Hudson Rd
Maynard Rd
Marlboro Rd
Wilkins St
Main St
Parmenter Rd
Pratts Mill Rd
Peakham Rd
Bent Rd
Stone Rd
Horse Pond Rd
Fairbank Rd
Goodnow Rd
Moore Rd
Barton Dr
Dutton Rd
Hemlock Rd
Surrey Ln
Old Garrison Rd
Austin Rd
Robert Best Rd
Fox Run Rd
Forest St
Union Ave
Concord Rd
Maple Ave
Raymond Rd
Nobscot Rd
Bigelow Dr
Pelham Island Rd
Woodside Rd
Stock Farm Rd
Eaton Rd
Landham Rd
Victoria Rd
Water Row
Plympton Rd
Newbridge Rd
Bridge Brook
Iron Ore Bog
Wills Hill
Orchard Hill
Boons Hill
St Michael's Cemetery
Lakeshore Dr
Red Spring Rd
Stacy Rd
Raymond Rd
Sudbury St
Hudson St
Union St
Lincoln St
Chestnut St
Hildreth St
Essex St
Church St
Howe St
Pleasant St
Prospect St
Mechanic St
Ash St
Keltner Dr
Andrews Rd
Ridge Rd
Kings Grant Rd
Stevens St
Boston St
Reed Rd
Ontario Dr
Meadow Dr
Causeway St
Shay Rd
Old North Rd
Woodrow St
Orchard Dr
Glasscock Rd
Sudbury Rd
Barton Rd
King Land Rd
Wildlife Way
Lakeside Ave
Hunter Ave
White Pond Rd
Bruen Rd
Cortland Dr
Murphy Rd
Cameron Dr
Blanchette Dr
Vega Rd
Closely Rd
Nauyler Ave
Sampson Rd
Stow Rd
Collins Dr
Robert Rd
Hosmer St
Littleleigh Ln
Wayside Inn Rd
Peters Crossing Rd
Bruce Bridge
Cudworth Ln
Willis Rd
Thunder Rd
Marlboro Rd
Woodmere Dr
Hunt Rd
Worse Rd
Concord Rd
Pokonoket Ave
Wilson Rd
Maple Ave
Union Ave
Bent Rd
Brimstone Ln
Dicenzo Blvd
Meadow Brook
Mill Brook
Cook Ln
Phelps St
Helen Dr
Farm Hill



Route 11 / PS Alt. 2: Route 20 - Green Hill - Hudson [10.3 miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

N

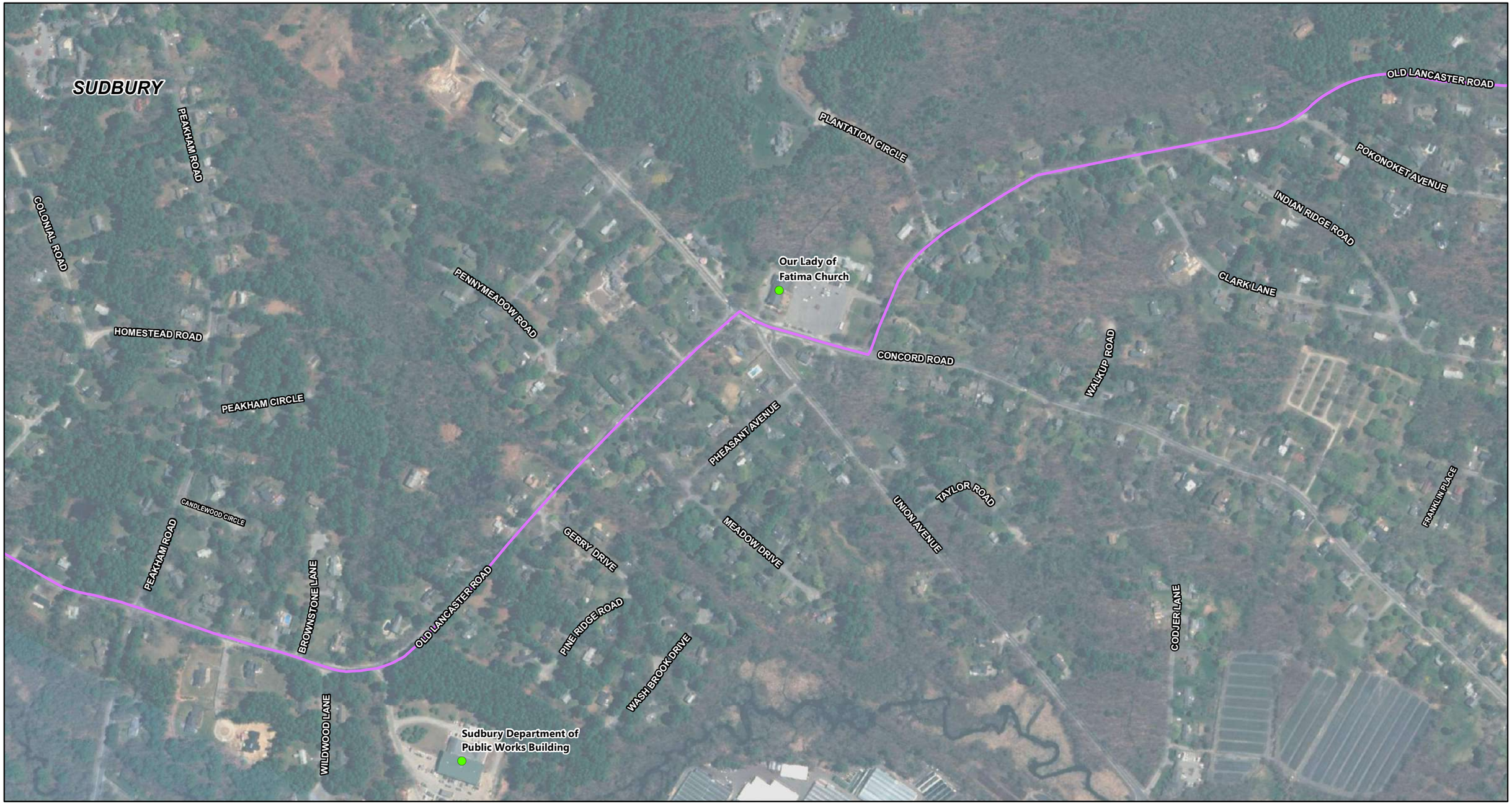
0 400 800 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-15: Candidate Route 11 Route 20 - Green Hill - Hudson

vhb



Route 11 / PS Alt. 2: Route 20 - Green Hill - Hudson [10.3 miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

4/12/2017

0 400 800 Feet

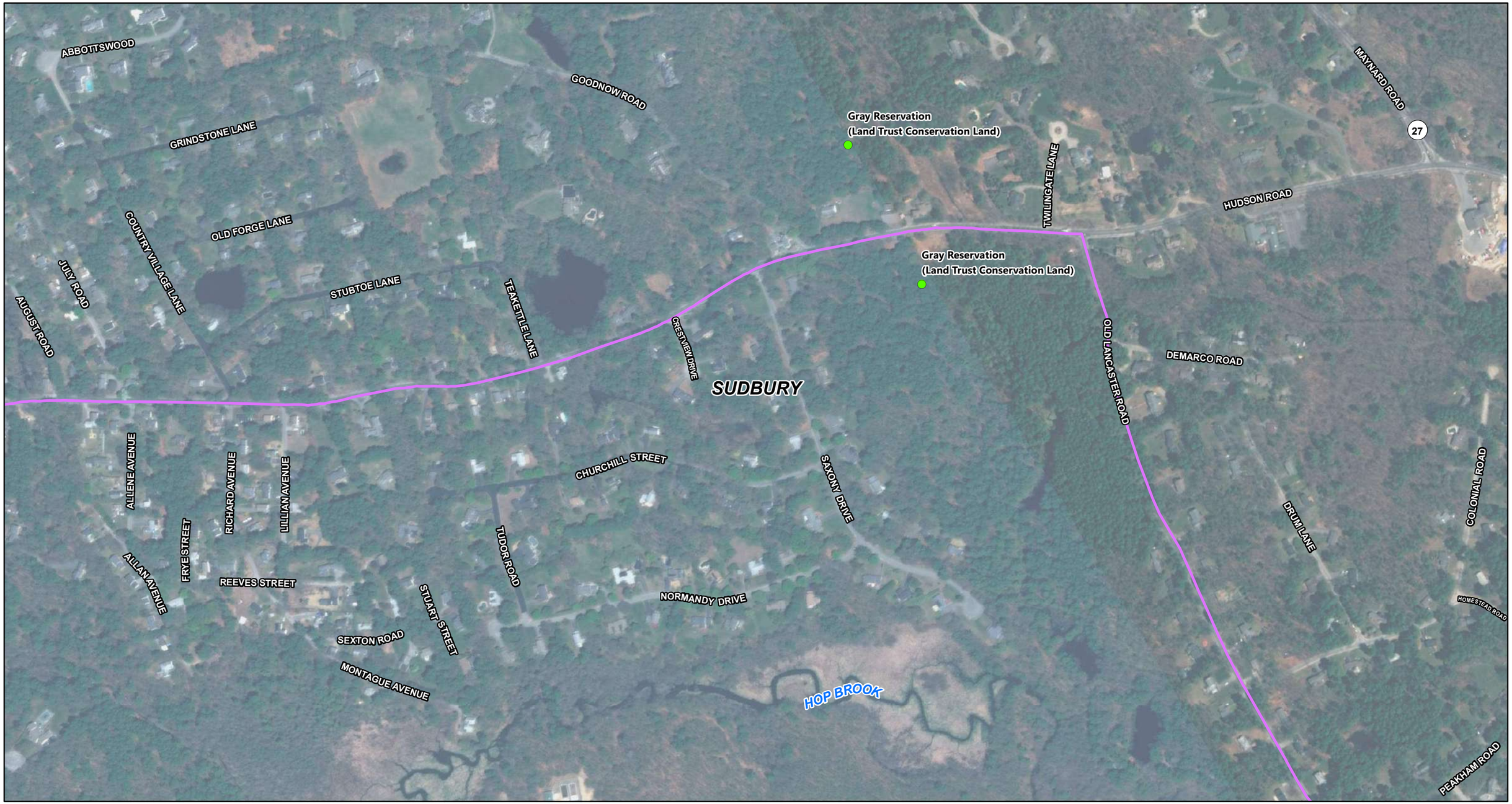
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-15: Candidate Route 11 Route 20 - Green Hill - Hudson

Sheet 2 of 9

vhb



Route 11 / PS Alt. 2: Route 20 - Green Hill - Hudson [10.3 miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

N

0 400 800 Feet

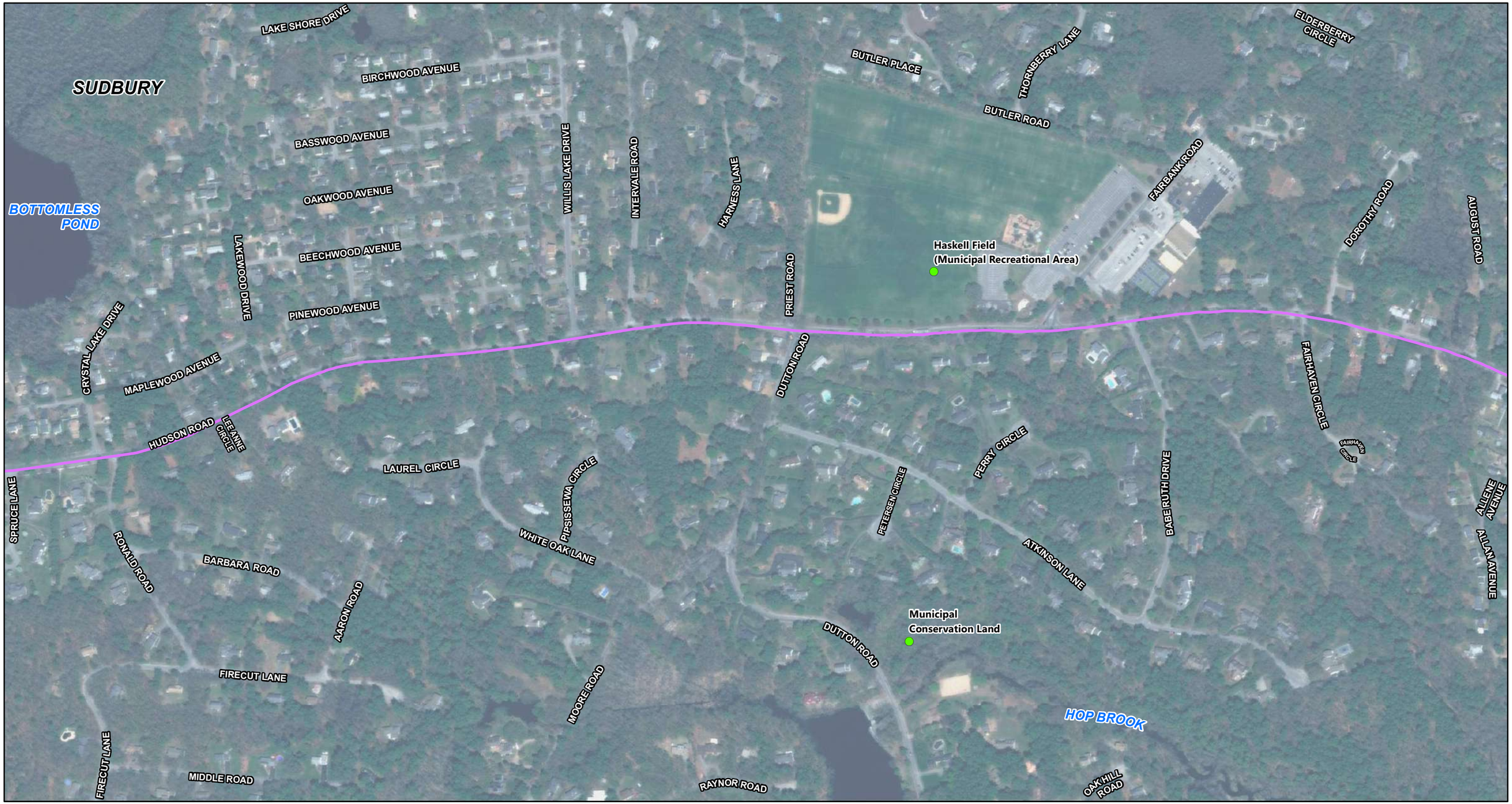
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-15: Candidate Route 11
Route 20 - Green Hill - Hudson**

vhb

Sheet 3 of 9



Route 11 / PS Alt. 2: Route 20 - Green Hill - Hudson [10.3 miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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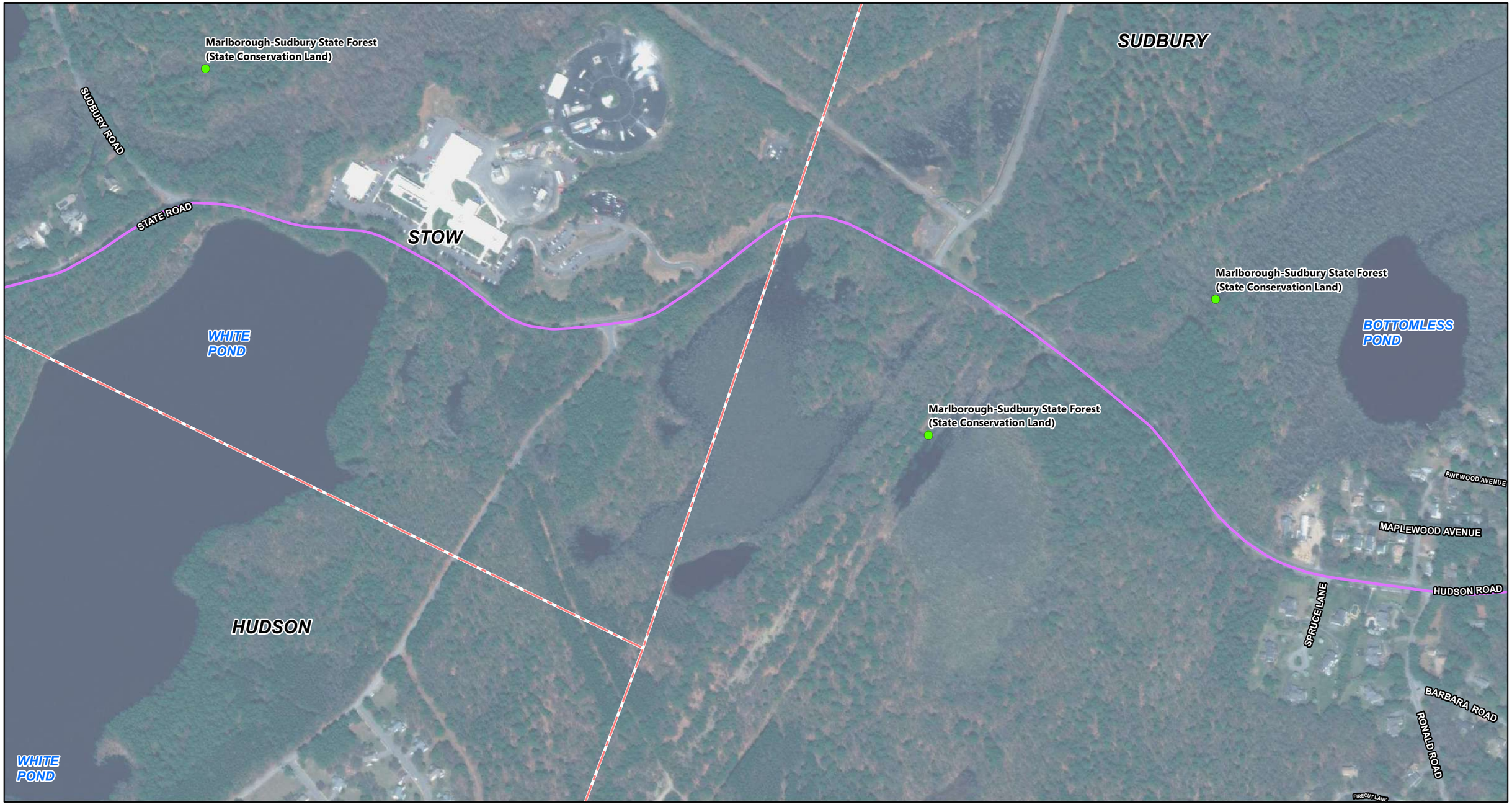
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-15: Candidate Route 11
Route 20 - Green Hill - Hudson**

Sheet 4 of 9

vhb



Route 11 / PS Alt. 2: Route 20 - Green Hill - Hudson [10.3 miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-15: Candidate Route 11
Route 20 - Green Hill - Hudson**

Sheet 5 of 9

vhb

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Route 11 / PS Alt. 2: Route 20 - Green Hill - Hudson [10.3 miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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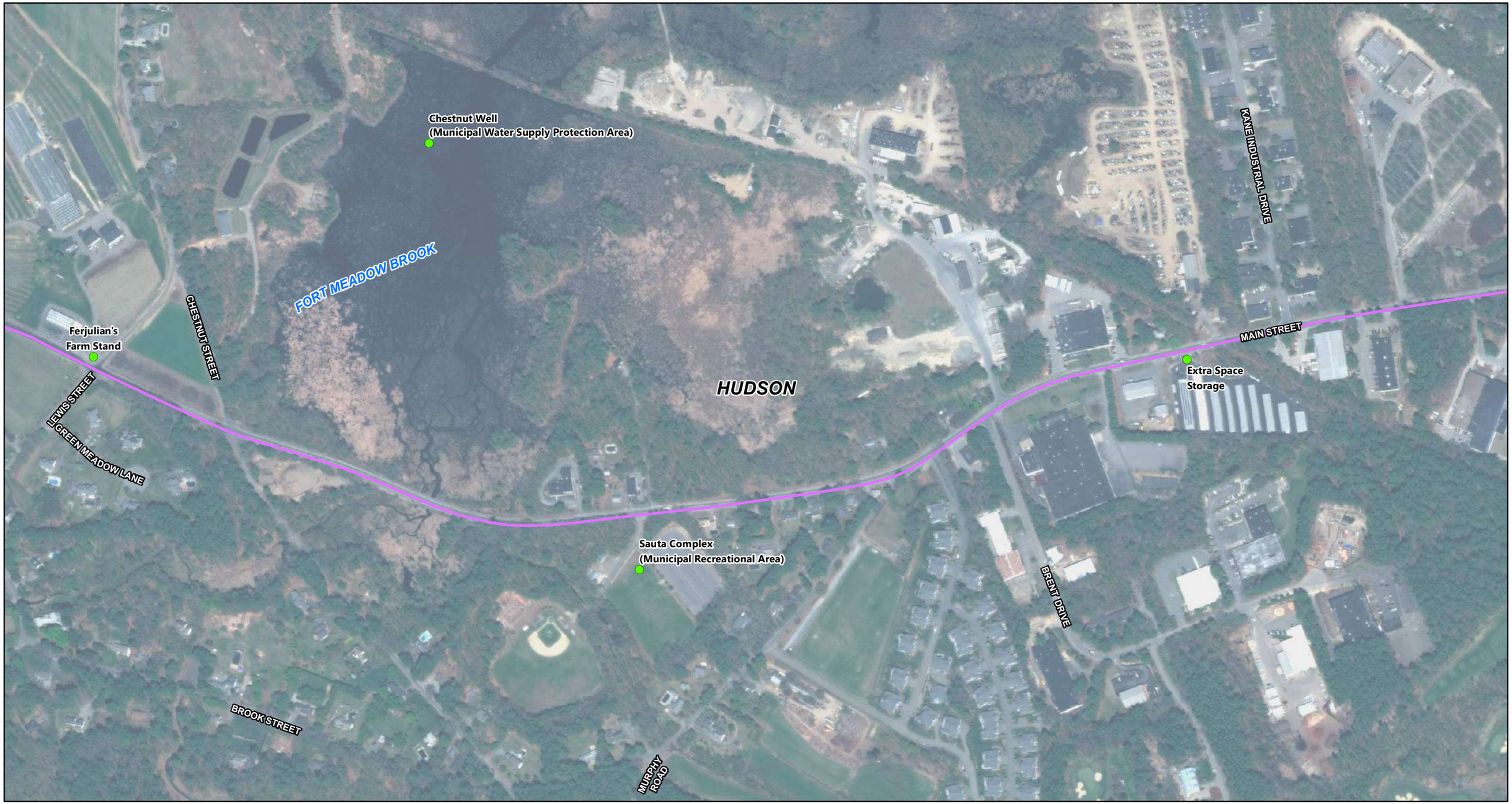
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-15: Candidate Route 11
Route 20 - Green Hill - Hudson**

Sheet 6 of 9

vhb



Route 11 / PS Alt. 2: Route 20 - Green Hill - Hudson [10.3 miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

4/12/2017

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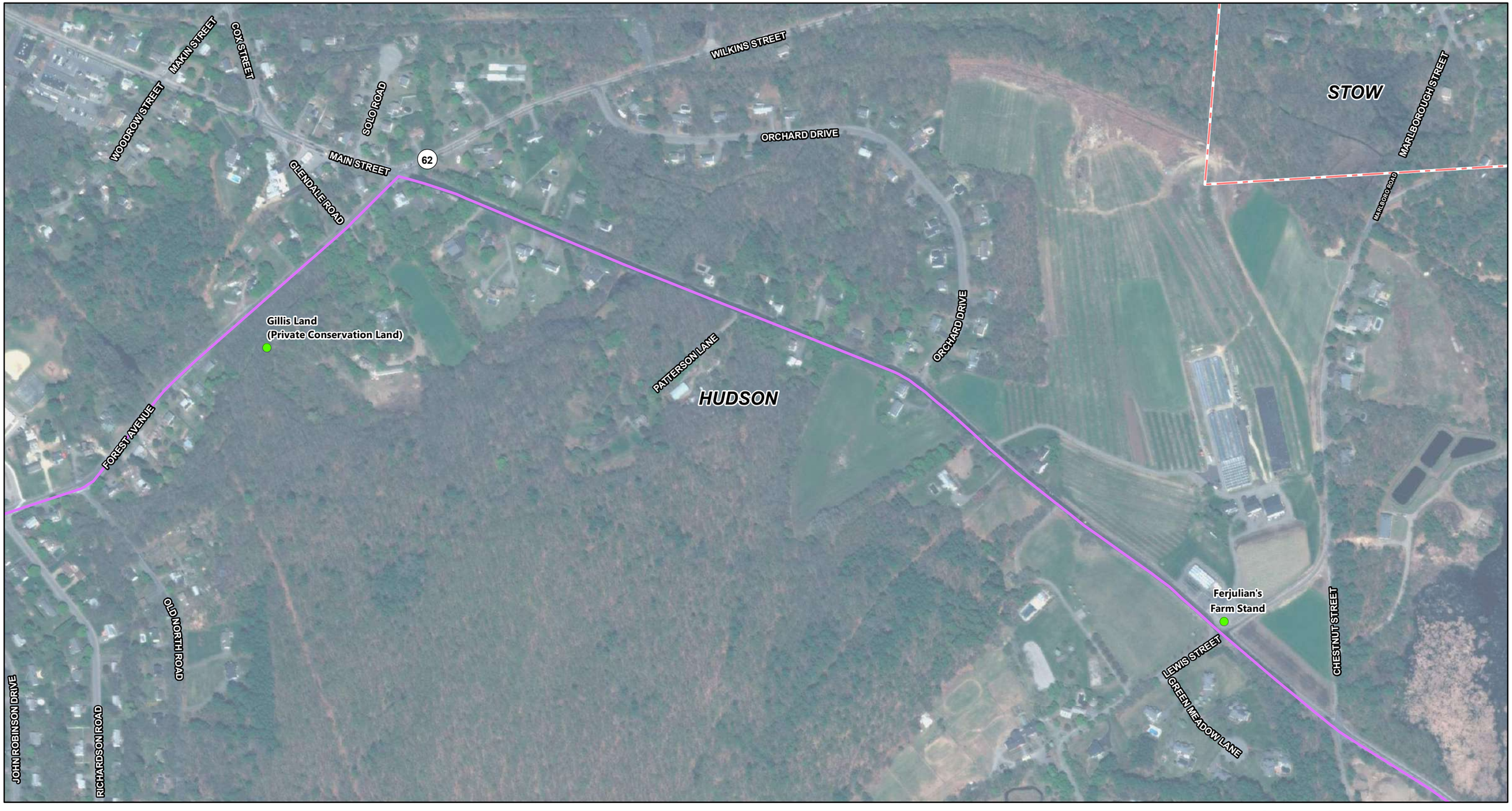
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-15: Candidate Route 11
Route 20 - Green Hill - Hudson**

Sheet 7 of 9

vhb



Route 11 / PS Alt. 2: Route 20 - Green Hill - Hudson [10.3 miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source:
MassGIS, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 4-15: Candidate Route 11
Route 20 - Green Hill - Hudson**

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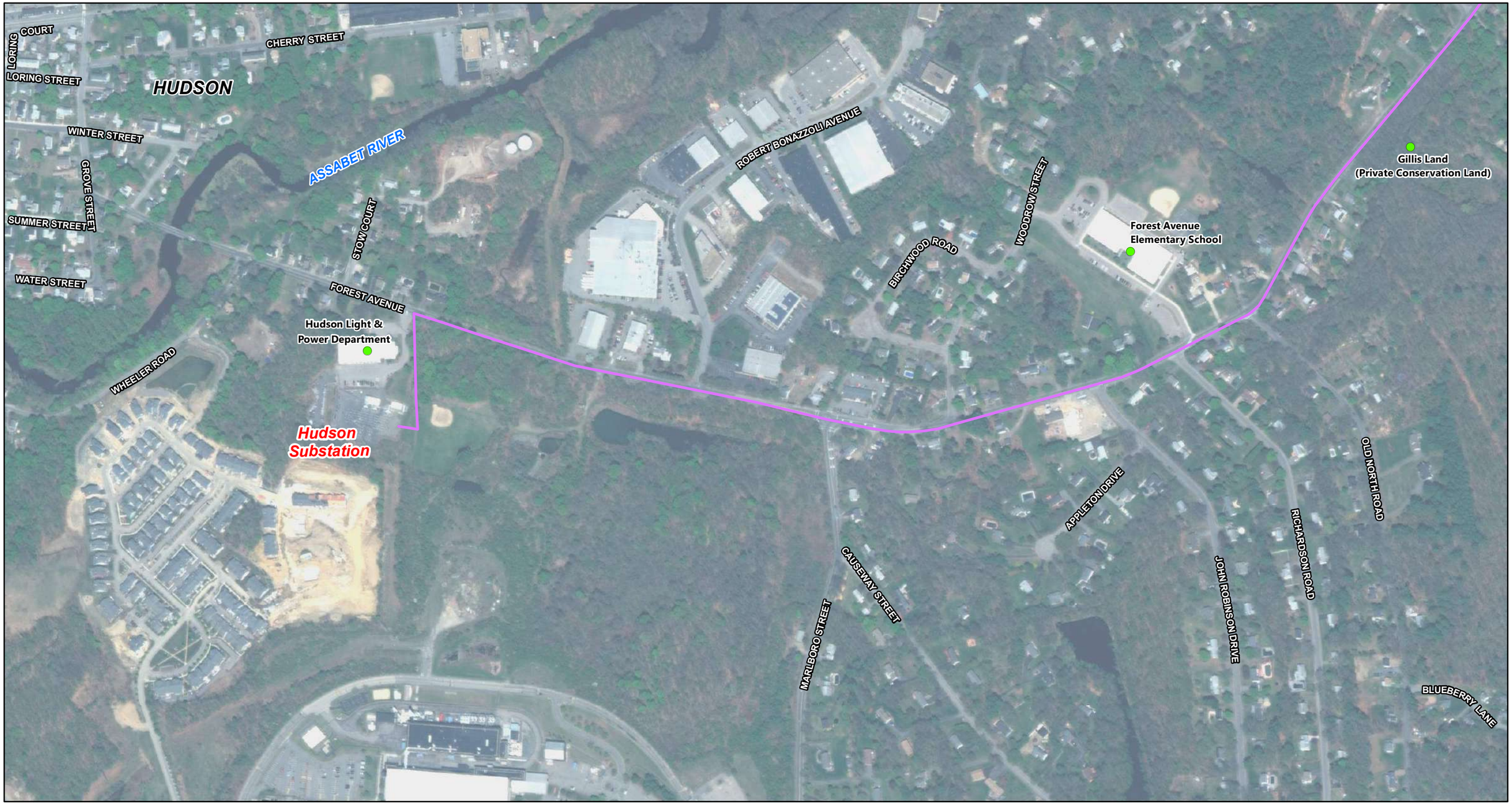
Sheet 8 of 9



Route 11 / PS Alt. 2: Route 20 - Green Hill - Hudson [10.3 miles]

Landmark

NOTE: Not to scale. Alignments shown are for graphical purposes only.

Source: MassGIS, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-15: Candidate Route 11 Route 20 - Green Hill - Hudson

Sheet 9 of 9

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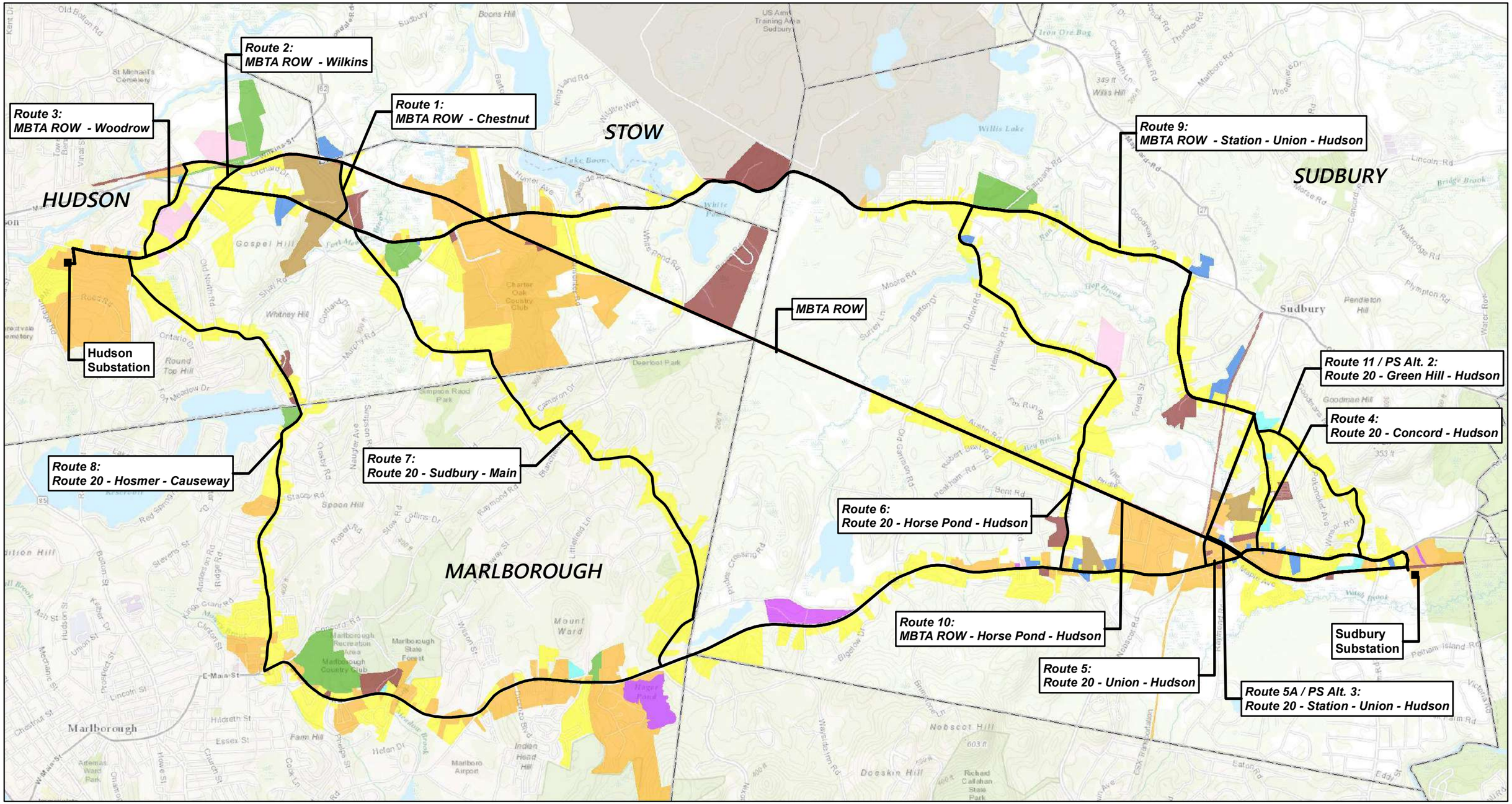

Candidate Routes
Municipal Boundary

Agricultural/Horticultural
Charitable
Commercial/Industrial
Educational
Government
Mixed Use
Open Land
Recreational
Religious
Residential

Source:
MassGIS, VHB

4/12/2017

N

0 3,000 6,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 4-16: Candidate Route Land Uses

vhb

5.0 COMPARISON OF PROJECT, NOTICED VARIATION, AND NOTICED ALTERNATIVE ROUTE

5.1 Introduction and Overview

As presented in Section 4, the Company selected Candidate Route 2B (MBTA ROW to Wilkins (UG)) as the Project based on the best balance of the applied route selection criteria including environmental impacts and cost. The Company selected an overhead design variation in the MBTA ROW, Candidate Route 2A (MBTA ROW to Wilkins (OH)) as the Noticed Variation to the Project. A geographically distinct routing alternative, Candidate Route 11 (Route 20 to Green Hill to Hudson), is presented as the Noticed Alternative Route.

This Section provides a detailed comparison of the potential environmental impacts and mitigation, cost, and reliability associated with the construction and operation of the Project, Noticed Variation and Noticed Alternative Route. Included herein are descriptions, maps, construction methods and photographs of each of the three options, including the work proposed at Eversource's Sudbury Substation and HLPD's Hudson Substation.[32] The construction methods and associated impacts described within Section 5 are based on preliminary engineering design. A more detailed engineering design will be developed as part of the final design phase and will include input from stakeholders, such as DCR and the MBTA.

Based on this detailed comparison, the Company determined that while the Project, Noticed Variation and Noticed Alternative Route would offer comparable reliability, the Project, on balance, is superior to the Noticed Variation and Noticed Alternative Route. The Noticed Variation would cost significantly less, but would have a greater potential for environmental impacts compared to the Project. The Noticed Alternative Route would have the least potential for impacts to the natural environment, but would have the highest cost.

[32] The Company is not seeking approval for the modifications at Hudson Substation. Information about these modifications is provided for informational purposes.

Siting Board Standard of Review

In implementing the statutory mandate to ensure a reliable energy supply for the Commonwealth with minimum impact to the environment and at the lowest possible cost, the Siting Board requires a petitioner to demonstrate that the proposed facility achieves these goals, while ensuring a reliable energy supply (NEP/IRP, at 46-47; Hampden County, at 370; Lower SEMA, at 57; GSRP Decision, at 66).

An assessment of all impacts of a proposed facility is necessary to determine whether an appropriate balance is achieved between conflicting environmental concerns and environmental impacts, cost, and reliability. A facility that meets the goals of the Siting Board's statutory requirements minimizes environmental impacts at the lowest possible cost (NEP/IRP, at 47; Hampden County, at 370; Russell Biomass, LLC & W. Mass. Elec. Co., 17 DOMSB 1, at 34 (2009) ("Russell 2009")).

The Siting Board first determines whether sufficient information regarding environmental impacts and potential mitigation measures has been provided, to determine whether a petitioner has met the statutory requirements in the siting of a new facility. It then determines whether environmental impacts would be, or have been sufficiently, minimized or mitigated. Finally, the Siting Board must find that the petitioner has provided sufficient cost and reliability information in order to determine whether the appropriate balance is achieved (Russell 2009, at 34-35; Cape Wind Decision, at 65; Cambridge Elec. Light Co., 12 DOMSB 305, at 335 (2001)).

The Siting Board examines the environmental impacts, reliability, and cost of the proposed facilities along the preferred and noticed alternative routes to determine: (1) whether environmental impacts would be minimized; and (2) whether an appropriate balance is achieved between conflicting environmental impacts and environmental impacts, cost, and reliability. In this examination, the Siting Board compares the primary and alternative routes to determine which is superior with respect to providing a reliable energy supply for the Commonwealth with a minimum impact to the environment at the lowest possible cost (NEP/IRP, at 47; Hampden County, at 370; Russell 2009, at 34-35; Cape Wind Decision, at 65).

5.2 Route Descriptions

5.2.1 Project

The Project includes an underground transmission line design along a 9.01-mile route. This route begins at the Sudbury Substation, located off Route 20, and travels in a northwesterly direction within the existing MBTA ROW for approximately 7.64 miles, traversing through the municipalities of Sudbury (4.29 miles), Stow (0.07 miles), Marlborough (0.01 miles), and Hudson (3.27 miles). At the intersection of the MBTA ROW and Wilkins Street in Hudson, the route leaves the MBTA ROW and proceeds in a southwesterly direction along Wilkins Street (Route 62) and Forest Avenue for a distance of approximately 1.37 miles before terminating at the Hudson Substation.

Representative photographs taken in 2015 of existing conditions along the Project and an overview map showing the photograph locations are provided as Figure 5-1. A description of existing environmental and cultural (historic and archeological) resources and adjacent land uses along the Project are provided in Sections 5.8 through 5.21 and depicted in Figures 5-2, 5-3, and 5-4 using aerial photography and data layers available from ArcGIS Online and MassGIS.

5.2.2 Noticed Variation

The Noticed Variation follows the same 9.01-mile route as the Project, consisting of an overhead design along the MBTA ROW. The Noticed Variation begins with a short segment of underground transmission line exiting the Sudbury Substation to the MBTA ROW, where it then transitions to an overhead line design along the MBTA ROW. At Wilkins Street in the Town of Hudson, the line would transition to an underground design and proceed within the same roadways as the Project, terminating at the Hudson Substation.

Representative photographs taken in 2015 of existing conditions along the Noticed Variation and an overview map showing the photograph locations are provided as Figure 5-1. A description of existing environmental and cultural (historic and archeological) resources and adjacent land uses along the Noticed Variation are provided in Sections 5.8 through 5.21 and depicted in Figures 5-2, 5-3, and 5-4 using aerial photography and data layers available from ArcGIS Online and MassGIS.

5.2.3 Noticed Alternative Route

The Noticed Alternative Route consists of an underground transmission line design within roadways for the entire length (10.30 miles). The route traverses through 5.46 miles in Sudbury, 0.75 miles in Stow, and 4.09 miles in Hudson. Beginning at the Sudbury Substation, the route travels west along Boston Post Road/Route 20, then turns north onto Green Hill Road and proceeds west to Old Lancaster Road at the northern end of Green Hill Road. The route follows Old Lancaster Road to the intersection with Hudson Road then turns west and continues along State Road in Stow and then to Main Street in Hudson. At the intersection of Forest Avenue in Hudson, the route turns southwest to reach the Intel access road before terminating at the Hudson Substation.

Representative photographs of existing conditions along the Noticed Alternative Route (taken during 2015) and an overview map showing photograph locations are provided as Figure 5-5. A description of environmental resources, land uses, and historic and archaeological resources along the Noticed Alternative Route are provided in Sections 5.9 through 5.22 and depicted in Figures 5-6, 5-7, and 5-8 using aerial photography and data layers available from ArcGIS Online and MassGIS.

5.3 Ancillary and Related Facilities

This Section discusses the modifications at the Sudbury Substation and the Hudson Substation that are necessary to accommodate the New Line. The locations of the substations are shown on Figure 5-9.

5.3.1 Sudbury Substation

Eversource's Sudbury Substation is located at 163 Boston Post Road on approximately 8.9 acres of Eversource-owned property. This property is bisected by the MBTA ROW. The Sudbury Substation is set back approximately 600 feet to the south of Boston Post Road. The substation is bordered by the Great Meadows National Wildlife Refuge to the east, south, and west, and the MBTA ROW to the north. Abutters north of the MBTA ROW include a sports club, humane society, a 55+ residential community, and a vacant parcel owned by Eversource. An aerial view of the existing Sudbury Substation, along with environmental resources and land uses within 300 feet, is provided in Figure 5-10.

The installation of additional equipment will be required at the Sudbury Substation if the new line is installed with an underground design (Project or Noticed Alternative), as opposed to

an overhead design (Noticed Variation). The specific equipment required for each option is described in the following paragraphs. Regardless of which option is constructed, all work necessary to accommodate the transmission line termination at the Sudbury Substation will occur within the existing substation fence line and utilize existing access driveways.

5.3.1.1 Modifications at Sudbury Substation to Accommodate the Project

An aerial photograph depicting the existing substation and the overlay of the proposed conceptual layout specific to an underground transmission line is provided in Figure 5-11. To accommodate the Project, the following equipment would be installed at the existing Sudbury Substation:

- 115-kV breaker with associated disconnect switch
- 115-kV surge arresters (three)
- 115-kV cable disconnect switch (one) and termination structure(s) (three)
- 115-kV air core shunt reactor with associated foundations
- 115-kV breaker with associated disconnects and foundations to switch the shunt reactor
- Shielding mast (approximately 100 feet tall)
- 115-kV bus support structure (one) for 115-kV conductors
- Control, protection, and communication equipment inside the existing control house
- Underground conduits and cable trench for control cables

For the Project, a duct bank would be installed to route the New Line from Sudbury Substation to the MBTA ROW.

Potential Environmental Impacts at Sudbury Substation from the Project

The substation is located within an area mapped as Priority Habitat; however, the work would be exempt from review under the Massachusetts Endangered Species Act ("MESA") (321 CMR 10.00) as all work would be located within previously developed areas. No wetland impacts are anticipated from the proposed work, and the substation is not located within any public water supply protection areas.

The addition of new equipment at Sudbury Substation could result in a view of the substation that is different from current conditions. However, this substation is largely surrounded by vacant land. The nearest building, an indoor sports dome with no windows, is approximately 325 feet to the northeast. As a result, impacts to the view of the Sudbury Substation from this location would be minimal.

The Company assessed the potential noise impact from the operation of a new shunt reactor and associated switching and protection equipment at Sudbury Substation. (No other equipment is anticipated to result in any changes to existing noise levels.) According to the Massachusetts Department of Environmental Protection ("MassDEP") policy, a source of sound violates the agency's noise regulation if the source:

- Increases the broadband sound level by more than 10 dB(A) above ambient, or
- Produces a "pure tone" condition – when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by three decibels or more.

The Town of Sudbury Zoning Bylaw has Performance Standards that prohibit excessive noise that would cause nuisance or hazard to persons or property. The Town Bylaw adopts the MassDEP regulation to implement this Performance Standard.

The Company conducted noise measurements at the existing substation and at a distance representative of the closest residences on Landham Road (approximately 700 feet away). Based on these measurements, typical background sound levels (L90) range between 33 and 46 dBA, with the quietest period between 2:00 and 3:00 a.m. The sound level generated by the existing shunt reactor at the Sudbury Substation is 68.1 dBA overall. The potential noise contribution of an additional shunt reactor would increase sound levels by approximately 0.3 to 0.4 dBA, and no pure tone condition would be produced. Because the operation of the new shunt reactor would not produce a pure tone condition nor increase ambient noise levels by more than 10dBA, even during the quietest period of the night, the addition of the new shunt reactor would not violate MassDEP's noise regulations nor the Town of Sudbury's Zoning Bylaw. The noise assessment report completed for the Sudbury Substation is included as Appendix 5-1.

5.3.1.2 Modifications at Sudbury Substation to Accommodate the Noticed Variation

An aerial photo showing the existing substation overlain with the proposed conceptual layout for a partially overhead transmission line is provided in Figure 5-12. To accommodate the Noticed Variation, the following equipment would be installed at the existing Sudbury Substation:

- 115-kV breaker with associated disconnect switch
- 115-kV surge arresters (three)
- 115-kV cable disconnect and termination structure(s)
- Control, protection and, communication equipment inside the existing control house

As with the Project, a duct bank would be installed to route the transmission line from Sudbury Substation to the MBTA ROW.

Potential Environmental Impacts at Sudbury Substation from Noticed Variation

The substation is located within an area mapped as Priority Habitat; however, the work would be exempt from review under MESA as all work would be located within previously developed areas. No wetland impacts are anticipated from the proposed work; the substation is not located within any public water supply protection areas. The proposed equipment is not anticipated to result in any new noise sources.

5.3.1.3 Modifications at Sudbury Substation to Accommodate the Noticed Alternative Route

The Noticed Alternative Route would require the same design at Sudbury Substation as the Project and would result in the same potential environmental impacts. In addition to the work within the substation, a duct bank would be installed to route the transmission line from Sudbury Substation to Boston Post Road.

5.3.2 Hudson Substation

The existing HLPD Hudson Substation is located at 49 Forest Avenue in Hudson.[33] The HLPD garage and office building is located immediately adjacent to the substation to the north with residences located further north across Forest Avenue. The substation is bordered elsewhere by undeveloped forested land to the west, and a ball field located on the property of the Intel Corporation is located to the east. A multi-unit residential development is located immediately to the south. An aerial view of the existing Hudson Substation, along with environmental resources and land uses within 300 feet, is provided in Figure 5-13.

It is the Company's understanding that the work required at the Hudson Substation will be the same regardless of which variation or option is chosen, and that it will be necessary to expand the limits of the existing fence line at the Hudson Substation to install the equipment necessary to support the New Line. An aerial photo showing the existing substation overlaid with the proposed conceptual layout is provided in Figure 5-14, respectively. Based on a site visit completed by a Company representative in November 2016, it appears that the area proposed for the expansion has previously been cleared of vegetation and no additional vegetation removal would be necessary.

It is the Company's understanding that to accommodate the New Line, the following equipment will be installed at Hudson Substation:

- Three (3) new 115-kV circuit breakers and associated disconnect switches
- 115-kV cable termination structures
- Protective relaying
- Control house
- Modification of existing bus work
- Security infrastructure

[33] HLPD is not a co-petitioner with Eversource in this proceeding. Pursuant to an agreement between the Company and HLPD, the Eversource petition to the Siting Board is filed in conjunction with, and in support of, HLPD's plans to undertake the actual construction of the three new 115-kV breakers at the Hudson Substation. Other than the New Line, the Company will not construct, own, operate or maintain any substation facilities at Hudson Substation. The information provided regarding the Hudson Substation is for informational purposes only.

- Two (2) transmission towers to re-terminate existing H-160 & N-166 transmission lines with concrete foundations
- SCADA system and remote communications

Potential Environmental Impacts at Hudson Substation

It is the Company's understanding that the Hudson Substation is not located within any state-listed rare species habitat or public water supply protection areas, and the proposed work is not anticipated to result in the creation of any additional noise sources.

HLPD will be responsible for constructing, owning, and operating any transmission facilities at the Hudson Substation that will be necessary to support the New Line.

The expansion of the fence line could result in a view of the substation that is different from current conditions; however, based on the information available at the time of this analysis, the expansion of the Hudson Substation will result in a visual change that is similar to what is existing and will have a minimal impact to views from the surrounding landscape.

5.4 General Construction Best Management Practices

Throughout all the phases of construction, the Company and its contractors will follow the procedures outlined in Eversource's Massachusetts Best Management Practices Manual (September 2016; provided as Appendix 5-2) ("BMP Manual"). The following best management practices ("BMPs") will be implemented related to dust and air quality in and around the active construction zone.

To minimize the potential for airborne dust from earth disturbing activities, Eversource will require its contractors to place water trucks with misters in or near the work areas during construction activities and utilize them as appropriate. Water sprinkling and street sweeping will be used in combination within the roadway construction areas. The Company will determine whether water sprinkling is required at roadway construction areas after weekly stormwater pollution prevention plan inspections. In addition, excavated soils will be either directly transferred from the trench to a covered truck or stockpiled and covered with plastic sheeting or a similar barrier to minimize the potential for the release of dust and for soil migration from the work area. There also will be installation of anti-tracking pads and regular sweeping of the pavement of adjacent roadway surfaces during the construction period to minimize the potential for construction traffic to kick up dust and particulate matter.

To minimize air emissions from equipment operation, the Company will direct its contractors to retrofit any diesel-powered, non-road construction equipment rated 50 horsepower or above, whose engine is not certified to United States Environmental Protection Agency ("USEPA") Tier 4 standards and that will be used for 30 days or more over the course of the Project, with USEPA-verified (or equivalent) emission control devices (e.g., oxidation catalysts or other comparable technologies). Eversource exclusively uses ultra-low-sulfur diesel ("ULSD") fuel in its own diesel powered construction equipment and will require its contractors to do the same for the Project. ULSD has a maximum sulfur content of 15 parts per million compared to 500 parts per million for low-sulfur diesel fuel (a 97 percent reduction). The Company and its contractors will comply with state law (G.L. c. 90, § l6A) and MassDEP regulations (310 CMR 7. 11 (1)(b)), which limit vehicle idling to no more than five minutes except for vehicles being serviced, vehicles making deliveries that need to keep their engines running, and vehicles that need to run their engines to operate accessories.

A combination of temporary storage areas, staging areas, and laydown areas will be needed to support construction. Areas for material staging will be required at locations in the vicinity of the Project. Although these areas do not necessarily have to be adjacent to the Project, the closer these areas are to the Project, the less likely the disturbance of the public. Eversource or its designated contractor(s) will be responsible for selecting these sites and for making arrangements with property owners for use of the land during construction. License or lease agreements for such sites will contain normal and customary terms and conditions designed to minimize the impact of the use of the sites on the surrounding properties.

5.5 General Construction Methods for the Project

This Section describes the general construction methods anticipated for the Project within the MBTA ROW between the existing Sudbury Substation and Wilkins Street in Hudson. The Project consists of an underground transmission line from the Sudbury Substation along the MBTA ROW to the Hudson Substation. The New Line will consist of three cross-linked polyethylene ("XLPE") insulated cables. The duct bank will contain a total of eight conduits: four high density polyethylene ("HDPE") 8-inch-diameter conduits (including one spare) for the insulated XLPE cables, two 4-inch-diameter polyvinyl chloride ("PVC") conduits for relay and communication cables, and two 2-inch-diameter PVC conduits (one for a grounding conductor and one for possible future temperature-monitoring cables). A common thermal concrete envelope encases the conduits to form the "duct bank". See Figure 5-15 for a depiction of the general arrangement in the duct bank. The typical duct bank trench detail

will consist of a duct bank that is four feet wide and five and a half to eight feet deep, depending on the design profile of the duct bank.

The following list provides an overview of the phases and sequence of construction associated with the Project within the MBTA ROW from Sudbury Substation to Wilkins Street in Hudson, in the approximate order of implementation.

1. Vegetation removal
2. Implementation of erosion and sedimentation controls
3. Rail removal and access road subgrade construction
4. Construction of duct bank and splice vault system (including rehabilitation of existing railroad bridges)
5. Cable pulling and splicing, testing, and commissioning
6. Access road final grading, restoration, and demobilization
7. Operation and maintenance

The following sections provide more detail about each phase listed above.

Vegetation Removal

Vegetation management contractors will access the MBTA ROW from existing public ways. Prior to the start of construction, the proposed clearing limits will be surveyed and staked and trees will be visibly marked for removal. In addition, prior to vegetation removal, the boundaries of wetlands will be clearly marked to prevent unauthorized encroachment. As needed, the use of temporary construction matting within wetland areas will prevent rutting and provide stable pads for equipment to operate safely. The Company will provide environmental compliance training and copies of all applicable permits to the vegetation management crews prior to the commencement of work.

Based on a conceptual design, the Project requires an approximately 30-foot-wide corridor cleared of trees and woody shrubs to facilitate the installation of the duct bank/splice vault system and the access road. At each proposed splice vault location, the limits of clearing will be temporarily expanded to an approximate width of 40 to 50 feet, for a length of approximately 50 feet to accommodate installation of the vault. Specific clearing requirements will be assessed when advanced engineering design is available.

Tree removal will consist of cutting trunks as close to the ground as possible and leaving the stumps and roots in place, except where grading for construction of the access road and

installation of the New Line requires grubbing of stumps and roots. Tree trunks and large limbs will be cut and smaller limbs and brush will be chipped and then removed from the MBTA ROW. Selective cutting of vegetation along existing stream banks will minimize the disturbance of bank soils and limit the potential for erosion. Where appropriate, and/or when permit conditions require, felled trees may remain to decompose in place to avoid disturbing saturated soil and to provide wildlife habitat after construction of the access road and New Line.

Typical equipment used to clear vegetation includes tree shears, brush mowing units, a skidder bucket and/or manual climbers, a forwarder or tree dump truck, and a chipper with a winch. Hand cutting using chainsaws and brush saws may be necessary in sensitive areas such as wetlands.

Implementation of Erosion and Sedimentation Controls

Following vegetation removal activities, erosion and sediment controls such as straw bales, silt fence, and/or straw wattles will be installed in accordance with Eversource's Massachusetts BMP Manual and with any applicable permit requirements. The Company's Construction Supervisor and designated Environmental Monitor will oversee the installation of erosion controls by the Company's contractor. The erosion and sediment controls will be installed between the work area and environmentally sensitive areas, such as wetlands, streams, drainage courses, roads, and adjacent property. These controls will be inspected regularly and promptly repaired or replaced, as needed.

Rail Removal and Access Road Construction

The conversion of the existing rail bed to an access road requires the removal and salvage of the steel rails and disposal of the wooden rail ties prior to grading and leveling, in accordance with all applicable regulations. A detailed cut and fill analysis will be completed as the Project advances to the final design to meet the final grades required to construct the access road along the MBTA ROW.

Excess soil will be removed from the construction area and transported to a temporary construction laydown area. The Company will manage soils pursuant to all applicable regulations.

The proposed access road will support construction activities and future maintenance of the New Line. The subgrade of the access road will facilitate development of a multi-use path

that the DCR has planned within the MBTA ROW. Within the 30 feet of clearing, a 22-foot-wide construction platform will be developed that consists of:

- a 14-foot-wide access road
- a 4-foot-wide duct bank (offset from the access road by 2 feet)
- splice vaults (requiring additional workspace outlined below)
- 4 feet of additional construction area to facilitate installation of the duct bank

At proposed splice vault locations, a temporary work pad approximately 40 to 50 feet wide by 50 feet long will be necessary to support cranes and other specialized equipment that are required during vault installations and cable pulling and splicing. All temporary work pads for the splice vaults will be reduced to a uniform 22-foot-wide construction platform following installation of the splice vaults and the pulling and splicing of the cable, and the vegetation removed will be allowed to grow back to the final maintained ROW width of 30 feet.

Due to size, most of the splice vaults will be located partially under the 14-foot access road with the manhole covers adjacent to the travel way and in the shoulder. The access road will be designed to support construction and maintenance vehicles. Refer to Figure 5-16 for typical cross-section of the proposed access road, including the proposed location of the duct bank/splice vault system.

Construction of Duct Bank and Splice Vault System within MBTA ROW (including rehabilitation of existing railroad bridges)

The installation of pre-cast concrete splice vaults will follow the completion of the 22-foot wide construction platform to facilitate cable installation and splicing and enable access for maintenance and future repairs. For the Project, it is anticipated that each splice vault will be approximately 10 feet wide by 8 feet high and 30 feet long (inside dimensions; see Figure 5-17 for a splice vault schematic). The splice vault depth will vary by location, with the base measuring approximately 12 to 15 feet below the proposed final grade of the access road. The splice vaults will be located entirely underground with only manhole covers being visible at ground level at final grade. At each splice vault, a precast communication handhole measuring 4 feet by 4 feet by 4 feet will be installed parallel to each splice vault.

Splice vaults for the Project will be spaced approximately every 1,500 to 1,800 feet along the MBTA ROW. Placement of the splice vaults is determined by a number of factors including, but not limited to: allowable pulling tensions; sidewall pressure on the cables as they are pulled around a bend; the maximum length of a cable that can be transported on the width, height, and weight of the cable reel; and accessibility of the site based on existing environmental constraints.

The excavation for the splice vault will be shored as required by soil conditions and U.S. Occupational Safety and Health Administration safety regulations and local and state requirements. The work area will be secured during non-working hours.

It is anticipated that each splice vault will take approximately five to seven days to install. Once the splice vaults have been installed, trenching will begin for installation of the duct bank. Once a portion of the trench is prepared, each of the conduit sections will be assembled inside the trench or pre-assembled at the ground surface and lowered into the trench. High-strength thermal concrete (3,000 pounds per square inch ("psi")) will be placed in the area around the conduit to create the duct bank to protect the cable. The trench will then be back-filled with fluidized thermal backfill or native soil (to be determined by final cable design).

It is assumed that the duct bank can be installed above all existing culverts along the MBTA ROW. In addition, there are three existing bridges over waterbodies along the MBTA ROW. Based upon a preliminary engineering review, the Company plans to reuse the existing bridge structures and rehabilitate them such that they can accommodate a utility crossing. The bridge improvements will also incorporate the future multi-use path, in accordance with DCR's proposed design plans.

Equipment used during construction of the Project within the MBTA ROW may include: concrete trucks, dump trucks to transport fill materials to and from work sites, and bulldozers, excavators, backhoes, and graders to place fill materials or to make cuts to achieve the proper profile. Flat-bed trailer trucks will deliver the pre-cast concrete splice vaults to their proposed locations and cranes will be used to pick and place splice vaults. Throughout the Project, pick-up trucks will transport crews and small equipment to the work areas. Low-bed trailers will transport cable reels, and tracked equipment to the work sites.

Cable Pulling, Splicing, Testing and Commissioning

Each conduit is tested and cleaned by pulling a mandrel (a close-fitting cylinder designed to confirm a conduit's shape and size) and swab through each of the ducts, prior to cable

installation. The cables are installed in sections between two adjacent splice vaults. A cable reel is set up at the "pull-in" splice vault and a cable puller is set up at the "pull-out" splice vault. Once the mandrel and pulling line are pulled through each duct, a hydraulic cable winch and tensioner is used to pull cables individually between the pull-in and pull-out splice vaults. Installation of cable sections typically takes three 8-hour days and is repeated until all cables are installed.

Adjacent cable sections are then spliced together inside the vaults over the course of several extended work days. Splicing high-voltage solid-dielectric transmission cable is a time-consuming, complex operation that typically requires 40 to 60 hours to splice all three cables at each vault. The splicing activities are not continuous, but take place over four or five extended (12-hour) workdays at each splice vault location. The splicing operation requires a specialized splicing van and a generator. The splicing van will contain all of the equipment and material needed to make a complete splice. An air conditioning unit may be used to control the moisture content in the splice vaults during the splicing activity. A portable generator will provide the electrical power for the splicing van and air conditioning unit, and will be muffled to minimize noise. Typically, the splicing van will be located over one splice vault access cover. The air conditioner will be located near the second splice vault access cover and the generator will be located in a convenient area nearby out of the immediate work zone.

Once the electric line conductor is installed and spliced in electric cable manholes, the communications fiber cable will be pulled and spliced in the communications manholes.

Since the communications fiber cable is a single strand and is much smaller than the electric cable, pulling it is a much faster operation. Up to three sections can be pulled per day. A cable reel will be set up at the "pull-in" manhole and a cable puller will be setup at the "pull-out" manhole. A hydraulic cable pulling winch and tensioner will be used to pull the fiber cable from the pull-in to the pull-out manhole.

Once all adjacent communications fiber cable sections are installed, they will be spliced together inside the communications manholes. Like splicing for the transmission cables, splicing of the communications fiber cable will not be continuous and will require a splicing van, portable generator, and air conditioning unit. Splicing the communications fiber cable typically requires three (10-hour) work days to complete at each of the manholes.

Once the cable system installation is complete, the cables will be field-tested from the substations. At the completion of successful testing, the line will be energized.

Access Road Final Grading, Restoration and Demobilization

Following the installation of the New Line, soils disturbed during construction will be stabilized with an appropriate seed mixture and/or mulch in accordance with applicable regulations and in coordination with DCR. The Company will follow the MassDEP guidance document, "Best Management Practices for Controlling Exposure to Soil during the Development of Rail Trails" (Appendix 5-3).

At the completion of the Project, the temporary construction access areas will be restored and all equipment and construction debris will be removed from the MBTA ROW. Temporary erosion and sedimentation control measures will be removed when site stabilization is achieved.

Vegetation Management

Vegetation along a section of the MBTA ROW will be maintained and managed to provide for both the use multi-use path and the reliable operation of the Project. It is anticipated that this maintained area will consist of an approximately 30-foot corridor; 22 feet of this width including the access road, duct bank, and shoulder adjacent to the duct bank, will be maintained cleared of trees and woody shrubs. In the remaining shoulder adjacent to the other side of the access road, some plantings with limited woody vegetation may be allowed to grow up to a height of 15 feet. Refer to Figure 5-16 for proposed cross-section. These are approximate dimensions and are subject to the final design of the Project.

The Company expects to come to an agreement with the DCR regarding responsibility for vegetation management on the MBTA ROW and expects that the DCR will ultimately carry out maintenance activities (e.g., mowing, trimming) associated with the maintained area over the trench and on the shoulders of the multi-use trail.

The Company expects that vegetation management carried out by DCR will conform with DCR Trail Guidelines and Best Practices Manual and with electric utility best management practices.

5.6 General Construction Methods for Noticed Variation

This section describes the general construction methods anticipated for the Noticed Variation within the MBTA ROW between the existing Sudbury Substation and Wilkins Street in Hudson. The Noticed Variation consists of a short segment of underground transmission line

exiting the Sudbury Substation to the MBTA ROW (all on the existing Substation property), transitions to an overhead transmission line design from Sudbury Substation along the MBTA ROW, and transitions back to an underground design at Wilkins Street.

Within the MBTA ROW, the Noticed Variation from Sudbury Substation to Wilkins Street would consist of the construction of 90 steel monopole transmission structures anchored on six to eight-foot-diameter concrete engineered foundations. The transmission structures would range in height from 75 to 105 feet, depending on topography and span length, with an average height of approximately 87.5 feet and would be located approximately 18 feet to either side of the centerline of the existing rail bed, depending on location and bends within the ROW. Figure 5-18 depicts the typical cross-section of the transmission structures along the MBTA ROW.

The following list provides a summary overview of the phases of construction associated with the Noticed Variation in the MBTA ROW, in the approximate order of implementation.

1. Mobilization and vegetation removal
2. Installation of erosion and sedimentation controls
3. Rail removal and access road construction
4. Work pad preparation
5. Installation of foundations and structures
6. Conductor and shield wire installation
7. Access road final grading, restoration, and demobilization
8. Vegetation management

The following sections provide more detail about each phase listed above.

Mobilization and Vegetation Removal

The Company would generally follow the same mobilization and vegetation removal methods for the installation of the Noticed Variation as the Project, outlined in Section 5.5 above.

The Noticed Variation requires the MBTA ROW to be cleared of trees from edge to edge to maintain required safety clearances, but low growing woody vegetation would be allowed to remain outside of proposed limits of work. The width of the existing MBTA ROW varies in some locations, but is approximately 80 feet wide.

Installation of Erosion and Sedimentation Controls

The Company would follow the same phased construction for the installation of the Noticed Variation as the Project, outlined in the Section 5.5 above.

Rail Removal and Access Road Construction

The Company would generally follow the same rail removal and access road construction methods for the installation of the Noticed Variation as the Project, outlined in section 5.5 above. The access road for the Noticed Variation would be approximately 14 feet wide, which includes a 10-foot gravel travel way and 2 feet of shoulders on both sides, and is sufficient to handle the weight of a 20-ton truck. Refer to Figure 5-19 for a typical cross-section of the proposed access road.

Work Pad Preparation

Work pads would provide a safe and level work area for construction equipment to undertake foundation work and structure assembly. Removal of lower growing shrubs and minor grading may be necessary to create a work pad of approximately 75 feet by 75 feet at each proposed structure location. The work pads may be slightly smaller or larger depending on terrain, equipment, and overall site conditions at each structure location. Portions of work pads located within wetlands would consist of construction mats.

Installation of Foundations and Structures

Upon completion of the access road and work pads, installation of the concrete foundations for the new overhead electric transmission structures would occur. The concrete foundations would typically be drilled piers (also known as drilled caissons), which range from six to eight feet in diameter and 15 to 30 feet in depth, depending on the height and load conditions for the structure.

Dewatering may be required during the foundation installation. Groundwater pumped from an excavation would be discharged to an upland area if there is adequate vegetation to function as a filter medium. Where conditions are not adequate for infiltration, the dewatering waters would be pumped into a sediment filter bag within a straw bale/silt fence corral (basin) located within an upland area or a construction mat. The basin and all accumulated sediment would be removed following dewatering operations and the area would be restored, as needed.

Three proposed structures would be located in wetlands. During the foundation installation for these structures, the topsoil (upper 12 inches) would be set aside on construction mats or geotextile fabric for later use to promote natural revegetation of disturbed areas around the new pole location. Soil material would not be placed directly within vegetated wetland areas.

Steel monopoles would be delivered to the structure sites in sections using trucks and then assembled with a crane. Davit arms, or insulated supports, would be individually hoisted and framed to the monopole. Insulators, clamps, travelers (stringing blocks, consisting of urethane-lined sheaves or pulley wheels), and other hardware would be installed.

Conductor and Shield Wire Installation

Following the erection of the transmission structures, conductors and shield wire would be installed in sections that may range from one to three miles in length. The conductors would be pulled under tension, using special equipment located at predetermined areas within the ROW, to avoid contacting the ground or other objects. The insulators and hardware would be installed and the wires would be connected to the structures and sagged in accordance with industry standards and design specifications. When it is necessary to position stringing and tensioning equipment within a wetland, construction mats would be used to support the equipment and minimize disturbance to the resource area.

During the stringing operation, temporary guard structures or boom trucks would be placed at road crossings and at crossings of existing overhead utility lines. These guard structures are used to ensure public safety and uninterrupted operation of the other utilities.

Access Road Final Grading, Restoration, and Demobilization

The Company would follow the same access road final grading, restoration and demobilization activities as for the Project, outlined in section 5.5 above. Please note that for the Noticed Variation, the existing railroad bridges within the MBTA Corridor would not be rehabilitated given that they would not need to accommodate an underground line.

Vegetation Management

For the Noticed Variation along the MBTA ROW, Eversource would maintain vegetation at varying heights. An area approximately 30 feet wide centered on the overhead transmission line would be managed to allow herbaceous and/or low-growing woody vegetation to grow

up to, but not exceeding, a height of 15 feet ("the wire zone"). All other portions of the ROW would be managed by the Company to allow for the growth of native woody vegetation growing up to, but not exceeding, 25 feet in height (the "peripheral zone").

For an overhead transmission line, Eversource must comply with the Massachusetts ROW Vegetation Management Regulations (333 CMR 11.00). Eversource has an approved VMP (see Appendix 5-4) as well as a Yearly Operating Plan ("YOP," see Appendix 5-5). The Company would conduct vegetation maintenance in accordance with its VMP and any stipulations identified in final Memoranda of Understanding with DCR and the MBTA.

Eversource's approved VMP specifies an Integrated Vegetation Management Program for maintaining ROW clearings with three components: mechanical control, chemical control, and natural control after construction. Mechanical control involves the physical removal of stems and branches, usually leaving the root system intact. Chemical control involves the selective use of herbicides applied to foliage, stems, and/or the plant's root zone to suppress growth and achieve root control. Natural control is the science of working in concert with the stages of plant succession and interspecies competition to limit the establishment of undesirable vegetation. These components work together to maintain the early successional vegetation communities necessary on the ROW. Mechanical and chemical control techniques provide the openings necessary to allow for desirable low-growing native plants to form dense thickets or communities that inhibit the germination and growth of tree seedlings through competition for light, moisture, and nutrients (natural control).

Eversource is committed to the responsible and limited use of herbicides on ROWs, and is a member of the USEPA's Pesticide Environmental Stewardship Program, which focuses on proper management of ROW vegetation programs and on reducing risks with pesticide applications. The Company's vegetation management strategies have been recognized by state agencies and by the USEPA, which in 2003 named Eversource (then NSTAR) as the first electric utility to receive the Champion Award under the Pesticide Environmental Stewardship Program.

Eversource chooses herbicide formulations that are low in acute toxicity, do not bio-accumulate and, as applied, have a short half-life with low soil mobility. These herbicides have been reviewed by veterinarians who have determined that, when used in accordance with label directions and by certified applicators, pose no adverse health threat to wildlife or pets. Furthermore, these herbicides have gone through extensive testing to be considered for registration by the USEPA and then undergo further scrutiny by the Massachusetts

Department of Agricultural Resources ("MDAR") and MassDEP to be included on the list of herbicides approved for use in sensitive areas. Eversource takes this one step further and only uses sensitive area–approved herbicides along ROWs throughout Massachusetts.

In accordance with the ROW Vegetation Management regulations at 333 CMR 11.04, no herbicides are used within 50 feet of any private well, nor within 100 feet of any Class A surface water source or tributary to such a source. Limited use of approved herbicides is allowed within Zone II (the area of an aquifer that contributes to a well under the most severe pumping and recharge conditions) of a public water supply; the area between 100 and 400 feet of a Class A surface water source; and the area between 50 and 100 feet of any identified private well.

5.7 General Construction Methods for Underground Design Within Public Roadways (Project, Noticed Variation, and Noticed Alternative Route)

All of the options considered for the New Line contain an underground design within public roadways.

The Project and Noticed Variation both include underground construction within roadways for a distance of approximately 1.37 miles. The underground portion begins at the intersection of the MBTA ROW and Wilkins Street in Hudson and follows Wilkins Street (Route 62) to Forest Avenue before terminating at the Hudson Substation.

The Noticed Alternative Route is 10.30 miles and is an underground design within roadways for the entire length. This route begins at the Sudbury Substation and traverses through Sudbury along Boston Post Road/Route 20, Green Hill Road, Old Lancaster Road, and Hudson Road, then crosses into Stow along State Road and into Hudson on Main Street. From there, the route travels along Forest Avenue before terminating at the Hudson Substation.

The following list provides a summary overview of the phases of construction associated with the installation of the New Line within the public roadways portions of the Project, Noticed Variation, and the Noticed Alternative Route.

1. Implementation of erosion control
2. Splice vault installation
3. Roadway trench excavation, duct bank installation, and pavement restoration

4. Cable pulling, splicing, and testing in roadways
5. Final pavement restoration

The following sections provide more detail about each phase listed above.

Implementation of Erosion Control

Prior to the start of any earth disturbance activities, the Company will install all appropriate erosion control measures to protect any adjacent wetland and water resources in accordance with any applicable permit requirements.

Splice Vault Installation

Installation of the pre-cast concrete splice vaults will occur prior to installation of the conduit bank. Pre-cast concrete splice vaults facilitate cable installation and splicing and allow access for maintenance requirements and future repairs. Each splice vault would be approximately 10 feet wide by 8 feet high and 30 feet long (see Figure 5-17 for a splice vault schematic). The splice vault depth would vary by location with the splice vault base approximately 12 to 15 feet below grade. Similar to the underground portions in the MBTA ROW of the Project, the splice vaults would be located entirely underground; the only visible aspects at ground level would be the manhole covers. At each splice vault, a precast communication handhole measuring 4 feet by 4 feet by 4 feet would be installed parallel to the splice vault.

Splice vaults would be spaced approximately 1,500 to 1,800 feet apart. The factors contributing to final placement of the splice vaults include allowable pulling tensions; sidewall pressure on the cables as they are pulled around a bend; the maximum length of a cable that can be transported on the width, height, and weight of the reel; and accessibility. Each splice vault is expected to take approximately seven to ten days to install due to construction restrictions associated with traffic and work hour limitations. It is anticipated that it would take longer to install splice vaults within public roadways versus along the MBTA ROW given that the contractor's ability to set up and leave a crane in place would be impacted by the work hours and traffic related restrictions that are typically associated with construction in streets. In addition, it is expected that the contractor would encounter a higher density of underground utilities within streets that are not present along the MBTA ROW, which would also potentially lead to a longer duration to install splice vaults within public roadways versus the MBTA ROW.

Some existing underground utilities in roadways may need to be relocated to create space for the new splice vaults. As this is a method of last resort, the Company would work with local communities and utility companies regarding these relocations on a case-by-case basis as splice vault locations are finalized and as far in advance of splice vault installations as practical.

Roadway Trench Excavation, Duct Bank Installation, and Pavement Restoration

Following installation of the splice vaults, the underground duct bank construction will begin. The primary method for underground duct bank construction in roadways is open-cut trenching. For installation of the transmission line within roadways, the width of the trench would be marked on the street, Dig-Safe would be contacted, the location of existing utilities would be marked, and the pavement would be saw-cut. Saw cutting provides a clean break in the pavement and defines the parameters of the trench for asphalt removal and trench excavation.

Following saw cutting, the existing pavement would be removed with an asphalt bucket on an excavator and loaded into a dump truck with a backhoe. Pavement material would be handled separately from excavated soil, and would be recycled at an asphalt batching plant. Subsequently, a backhoe/excavator would excavate the trench to the required depth. In some areas, excavation may be done by hand to avoid disturbing existing utility lines and/or service connections. A "clean trench" or "live loading" method would be used in which soil would be loaded directly into a dump truck to an off-site facility for recycling, reuse, or disposal. Soil would not be stockpiled along the edge of the roadway, thus reducing the size of the required work area and the potential for sedimentation or the creation of nuisance dust. Any rock encountered during excavation would be removed by mechanical means and brought to an off-site facility for recycling, reuse, or disposal.

In the event there are contaminated soils or other regulated materials encountered during construction, soils/materials would be managed pursuant to the Utility-Related Abatement Measure ("URAM") provisions of the Massachusetts Contingency Plan ("MCP"). The Company would also contract with an LSP as necessitated by conditions encountered along the Project alignment, consistent with the requirements of the MCP at 310 CMR 40.0460 et seq.

Once a section of the trench is prepared, each of the conduit sections would be assembled inside the trench or pre-assembled at the ground surface and then lowered into the trench. The area around the conduit would be filled and protected with high-strength thermal

concrete (3,000 psi) that creates a duct bank around the conduits. The trench would then be back-filled with fluidized thermal backfill or native soil (to be determined by final cable design). Each conduit would then be cleaned by pulling a mandrel and swab through each of the ducts.

The length of time for trench excavation, duct bank installation, and pavement patching in front of any single property would generally be two to three weeks. As noted above, the installation of splice vaults (which is a separate operation from the trench work) would take an additional seven to ten days. The pace of construction may be slower in areas of higher existing utility density, and especially where unanticipated obstructions, such as ledge or rock, are encountered, or where the trench depth is increased, or in areas of higher traffic volumes.

Trenchless Crossings

The current preliminary design within public roadways assumes that it may be necessary to utilize trenchless crossing techniques, such as pipe jacking/jack and bore ("J&B"), or horizontal directional drilling ("HDD") at locations where existing culverts convey waterbodies underneath existing road ways. The need for and location of these trenchless crossings has been preliminarily determined, but would be confirmed as the design is finalized. Trenchless crossings can take 2 to3 months each to complete. A brief summary of each method is provided below:

Jack and Bore: The J&B operation is used for short crossings (400 feet or less) of shallow waterways or under railroads and streets. The process would require digging a pit approximately 16 feet wide by 30 feet long; deep enough to go under the obstruction. Sections of steel pipe would be "jacked" under the obstruction and the hole would be bored out as the pipe progress under the obstruction during the jacking activity. The bore pit houses the drilling and jacking equipment, while a receiving pit on the other side of the obstruction receives the pipe.

Once in place, the outside of the pipe casing is grouted and smaller HDPE or PVC pipes are installed inside the casing to contain the cables. When completed, the casing would mate up with the duct bank on each side of the crossing. Prior to cable installation, the casing is filled with a thermally designed fluidized fill.

Once the J&B equipment is in place, it must remain in place and the drill pits must remain open until the operation is completed.

Horizontal Directional Drilling: HDD is typically used for comparatively deeper and longer crossings, such as those under interstate highways, non-perpendicular crossing of railroads and other infrastructure or larger water bodies.

For a crossing involving the use of HDD, staging areas would be set up on both sides of the crossing. The staging areas would require a larger temporary construction footprint than for J&B because the boring equipment is larger, and the supporting equipment requires more space. Additional work area is also needed for pipe assembly. Also, additional shallow pits would be required on both sides to collect the drilling fluid.

A temporary drill rig, likely mounted on a trailer, would be hauled to the site and positioned to drill at the desired angle. The drilling would be guided along a selected path, typically an arc, under the obstruction to the exit point on the opposite side. The assembled steel pipe would then be pulled back through the hole. The entire pipe would be grouted to seal the installation. Due to the high risk that the bore hole could collapse, once the "pullback process" begins, it cannot be stopped until the entire length of the steel pipe is in place. If an HDD fails at any point during execution of the work, the existing drill would be abandoned and the entire process would need to start again in an adjacent location.

Cable Pulling, Splicing, and Testing in Roadways

The Company would generally follow the same cable pulling, splicing, and testing methods as those for the Project, outlined in Section 5.5 above.

Final Pavement Restoration

Following installation of the duct bank and splice vaults, roadway surfaces would be restored to pre-construction condition or better, in compliance with applicable state standards and requirements of municipalities along the route.

5.8 Construction Schedule and Hours

5.8.1 Schedule

Table 5-1 below summarizes the Company's estimated construction duration for the Project, the Noticed Variation, and the Noticed Alternative Route.

Construction of the Noticed Variation along the MBTA ROW requires less civil work than for the Project, which impacts schedule in addition to cost. The Project is anticipated to require 18 months of construction, a longer construction duration than that estimated for the Noticed Variation, which would require approximately 12 to 16 months to complete. The construction duration along the Noticed Alternative Route is estimated to be at least 24 months given additional length of the line and also the potential limitations associated with construction within public streets.

Table 5-1: Comparison of Approximate Construction Duration

Route/Design	Construction Duration
Project	18 months
Noticed Variation	12-16 months
Noticed Alternative Route	24 Months

5.8.2 Construction Hours

Typical construction work hours for the Project are proposed to be from 7:00 a.m. to 7:00 p.m. Monday through Friday and from 9:00 a.m. to 5:00 p.m. on Saturdays, when daylight and weather conditions allow.[34]

In some instances, and as dictated by MassDOT or the local authority, the Company may be required to perform work at night to minimize daytime impacts to commuters and abutters. The Company will work with MassDOT and the local communities through the grant of location process to formalize allowable work hours and schedule.

As mentioned previously, some work tasks, once started, may require continuous operation until completion. Work requiring scheduled outages (i.e., work at existing substations and crossings of certain transportation and utility corridors) and work that requires continuous operation until completion may need to be performed on a limited basis outside of normal work hours, including evenings, Sundays and holidays. In these cases, the Company will coordinate with the applicable municipality or MassDOT in the case of roads under MassDOT jurisdiction.

Table 5-2 below summarizes the municipal ordinances/regulations governing construction work hours.

[34] The Company is seeking an exemption from the construction hour limitation in its Zoning Petition.

Table 5-2: Summary of Local Noise Ordinance Work Hour Restrictions

	Allowed construction hours, weekday	Allowed construction hours, weekend	Exceptions
Town of Hudson General By-Laws, Article VI, Section 33	7 a.m. – 11 p.m.	7 a m. – 11 p m.	Only emergency road repair or construction may be done between 11 p.m. and 7 a.m.
Town of Sudbury Zoning Bylaw Article IX, Article 3423	7 a.m. – 6 p m.	Allowed in accordance with MassDEP noise policy limits which implement 310 CMR 7.10 regulation	Construction activities are limited to M – F 7 a m. – 6 p.m.
Town of Stow Zoning Bylaw Section 3.8.1.3	No construction work hour prohibitions found	No construction work hour prohibitions found	None
City of Marlborough Noise Ordinance Chapter 431	7 a.m. – 7 p m.	7 a m. – 7 p.m. (Saturday only)	None

5.9 Comparison of Potential Environmental Impacts

The following sections describe the existing environment along the route for the Project, the Noticed Variation, and the Noticed Alternative Route; present a comparative analysis of potential impacts along each route; and provide a brief overview of mitigation measures the Company could implement for these potential environmental impacts associated with each route.

The potential environmental impacts presented herein are based upon the current conceptual design for each route developed by the Company and represent a reasonable attempt to identify and characterize the differences in potential for environmental impacts associated with each route. In addition, the overview of mitigation measures presented herein includes those typically implemented by the Company or that may be required by applicable local, state or federal regulations.

5.10 Public Shade Trees

Public shade trees are subject to protection under G.L. c. 87, which is administered by locally appointed Tree Wardens in each municipality when located within public roadways or by the MassDOT when located within state-controlled roadways. As per G.L. c. 87, public shade trees are defined as any tree located within a public way or on the boundaries thereof. Each

municipality's Tree Warden is responsible for the care, control, protection, and maintenance of all public shade trees (except those within a state highway), and enforces all the provisions of law for the preservation of such trees.

5.10.1 Project

To construct the Project, an estimated 12 shade trees would need to be removed. All 12 of these public shade trees are at locations where the MBTA ROW intersects public roadways in areas where tree clearing is required. At the current level of design, the portion of the Project proposed to be located within public roadways is intended to be installed within the limits of the paved roadways and is not anticipated to result in the need to cut any public shade tree.

5.10.2 Noticed Variation

To construct the Noticed Variation, an estimated 47 shade trees would need to be removed. All 47 of these public shade trees are located at points along the route where the MBTA ROW intersects public roadways in areas where tree clearing is required. As with the Project, the Noticed Variation is not anticipated to impact any public shade trees along the underground portion of the route.

5.10.3 Noticed Alternative Route

There are approximately 626 public shade trees adjacent to the paved portions of the public roadways that comprise the Noticed Alternative Route. However, at the current level of design, it is not anticipated that construction of the Noticed Alternative Route would result in the need to cut any public shade tree, as the line would be installed within the limits of the paved roadways, though some trimming may be required.

5.10.4 Mitigation

The Company would implement the same practice to protect public shade trees regardless of the route selected. As required by G.L. c. 87, the Company would obtain a permit from the Tree Warden or MassDOT, as applicable, in each municipality and work with the Tree Warden/MassDOT to identify appropriate mitigation. The Company would implement the following practices to protect public shade trees that could be impacted:

- Erect and maintain a temporary fence around the perimeter of individual tree pits (the area between the curb or sidewalk where the tree resides). Remove fence when construction is complete. The temporary fence will serve to:
    - Prohibit the storage of construction materials, debris, or excavated material within the tree pit area or on any sidewalks, and
    - Prohibit vehicles, equipment, or foot traffic within the tree pit area.
- If excavation for new construction is required within the tree pit area and/or sidewalk, the Tree Warden will be contacted before any work begins to review whether the contractor may commence with the work or if a qualified arborist must be hired to conduct root pruning.
    - If permission is granted to the contractor to commence with root pruning, the following practices will be implemented:
        - Narrow-tine spading forks will be used to comb soil to expose roots.
        - Roots will be cut cleanly after excavation with clean, sharp tools, to promote callous formation and wound closure.
        - Tree rooting will be dressed with a hormone compound.
        - The excavation will be backfilled as soon as possible and the soil around the roots will be watered to avoid leaving air pockets. If backfilling immediately is not possible, the exposed roots will be covered with wet burlap and watered regularly to prevent roots from drying out, and backfilling with soil will occur as soon as possible.
- Trees will be repaired or replaced in a manner approved by the Tree Warden at the Company's expense.

5.10.5 Comparison of Potential Impacts to Public Shade Trees

The Noticed Variation would require the highest number of public shade trees to be removed for construction of the New Line (47), with the Project the next highest (12), and the Noticed Alternative Route the least (0). The Company would obtain approval from the Tree Warden and/or MassDOT in each municipality and work with each to identify appropriate mitigation.

5.11 Wetland Resource Areas

Wetland resource areas include bordering vegetated wetlands ("BVW"); bordering lands subject to flooding ("BLSF"); 200-foot riverfront areas; vernal pools ("VP"); and 100-foot

Buffer Zones to BVW, banks of perennial and intermittent streams, BLSF, and vernal pools. All of the options would have the potential for impacts to wetland resource areas. The estimated impacts to all of these resource areas in total, as evaluated in Section 4, is provided in Table 5-3 below.

Table 5-3: Estimated Impacts to Wetland Resource Areas

Route	Estimated Impacts (acres)
Project	13.53
Noticed Variation	35.81
Noticed Alternative Route	0

Table 5-4 below provides a summary of the estimated impacts to wetland resource areas along the Project, Noticed Variation, and Noticed Alternative Route. Note that the impact numbers provided in this table are for each individual resource area. Some resource areas, such as 100-foot buffer zones to bank, and 200-foot riverfront areas, may overlap; as such, the numbers in Table 5-4 cannot be added to arrive at the numbers presented above in Table 5-3.

Table 5-4: Summary of Impacts to Wetland Resource Areas[1]

	Tree Clearing (Conversion) (acres)						Temporary Fill (square feet)						Permanent Fill (square feet)					
Route	BVW	VP	BLSF	RFA	100-ft BLSF Buffer Zone	100-ft BVW Buffer Zone	BVW	VP	BLSF	RFA	100-ft BLSF Buffer Zone	100-ft BVW Buffer Zone	BVW	VP	BLSF	RFA	100-ft BLSF Buffer Zone	100-ft BVW Buffer Zone
Project																		
	(30-ft width + 40x50 Splice Vault Locations)						*(No Temporary Impacts)*						*(22-ft Platform)*					
Hudson	0.04	0.00	0.85	2.18	0.00	4.19	-	-	-	-	-	-	1,236	15	27,351	63,696	-	130,241
Sudbury	0.27	0.02	0.73	3.14	3.58	6.06	-	-	-	-	-	-	11,726	1,121	28,131	100,688	107,949	189,001
Stow	0.00	0.00	0.00	0.17	0.05	0.03	-	-	-	-	-	-	-	-	-	5,918	1,999	1,331
Marlborough	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	***0.32***	***0.02***	***1.59***	***5.49***	***3.63***	***10.28***	**-**	**-**	**-**	**-**	**-**	**-**	***12,962***	***1,136***	***55,482***	***170,302***	***109,949***	***320,573***
Noticed Variation																		
	(Full width of ROW)						*(Work Pads)*						*(14-ft Platform and Structure Locations)*					
Hudson	1.09	0.15	3 25	5.64	0.00	10.40	1,837	262	8,984	19,715	-	27,259	639.85	-	16915.65	53775.17	-	106677.3
Sudbury	2.45	0.37	3 14	8.30	8.17	14.40	3,661	524	15,018	37,884	34,318	57,976	2520.66	-	12417.35	63610 5	76159.07	126610.43
Stow	0.00	0.00	0.01	0.51	0.15	0.09	-	-	-	1,914	854	344	-	-	-	3372.36	1018 52	685.21
Marlborough	0.00	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	***3.54***	***0.52***	***6.40***	***14.46***	***8.32***	***24.88***	***5,498***	***786***	***24,002***	***59,514***	***35,171***	***85,580***	***3,161***	**-**	***29,333***	***120,758***	***77,178***	***233,973***
Noticed Alternative Route																		
	(No Impacts)																	
Hudson	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sudbury	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marlborough	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 BVW: Bordering Vegetated Wetland
VP: Vernal Pool
BLSF: Bordering Land Subject to Flooding
RFA: Riverfront Area

The following sections provide a more detailed comparison of the anticipated impacts from construction of each option.

5.11.1 Project

Wetland resource areas are shown in the vicinity of the Project in Figure 5-20.

Construction of the Project within the MBTA ROW would result in impacts to wetland resource areas in the towns of Sudbury, Stow, and Hudson as a result of tree clearing and creation of the construction platform. As described previously, the ROW would need to be cleared to a width of 30 feet along the entire length, with temporary areas in splice vault locations measuring approximately 40 to 50 feet wide and 50 feet long. These expanded areas would be allowed to grow back to maintain a 30-foot width after construction is completed. The 22-foot construction platform needed to install the access road and transmission line would result in permanent fill. These impacts are summarized above in Table 5-4.

Although there are BVWs and Buffer Zones along the public roadway portion of the Project, no impacts would be anticipated from construction of the Project within the existing pavement, and proper implementation of BMPs would protect these resources during construction.

5.11.2 Noticed Variation

Wetland resource areas are shown in the vicinity of the Noticed Variation in Figure 5-21.

Construction of the Noticed Variation within the MBTA ROW would result in impacts to wetlands in the towns of Sudbury, Stow, and Hudson as a result of tree clearing and access road and work pad construction. As described previously, the ROW would need to be cleared to the full width (approximately 80 feet on average) to provide safe clearance for the overhead line. The structure foundations located in wetlands would result in some permanent fill, and construction of the 14-foot-wide access road would also result in some permanent fill in areas where the existing railroad berm is narrower than the required width of the access road. Installation of the overhead transmission line would also result in temporary impacts from the placement of work pads. These impacts are summarized above in Table 5-4.

Similar to the Project, no impacts would be anticipated from construction along the public roadway portion of the Noticed Variation.

5.11.3 Noticed Alternative Route

Wetland resource areas are shown in the vicinity of the Noticed Alternative Route in Figure 5-22. The Noticed Alternative Route passes through approximately 5,200 square feet of Buffer Zone to BVW; 26,500 square feet of Buffer Zone to BLSF; and 2,600 square feet of Riverfront Area. However, no impacts to these resources would be anticipated from construction within the existing roadways, and proper implementation of BMPs would protect these resources during construction.

5.11.4 Mitigation

Project

Impacts from the construction of the Project will be minimized by designing the placement of the access road and duct bank outside of these resources whenever possible. During construction, wetland resources will be protected by the installation of appropriate erosion and sedimentation BMPs as described in Section 5.5.

For any unavoidable impacts, the Company will work with the United States Army Corps of Engineers ("USACE"), MassDEP, Massachusetts Natural Heritage and Endangered Species Program ("NHESP"), and local Conservation Commissions to develop the necessary compensatory mitigation plans and could include, but not be limited to the following:

- USACE New England District Compensatory Mitigation Guidance (2016) recommends that proposed mitigation provide compensation at a ratio of at least 2:1 and up to 20:1 depending on the type of resource areas impacted and the mitigation approach proposed (restoration, creation, rehabilitation, and/or preservation).
- Massachusetts Water Quality Certification Regulations require a minimum of 1:1 restoration or replication for discharges to bordering vegetated wetlands.
- Massachusetts Wetlands Protection Act ("MWPA") Regulations prescribe certain performance standards for impacts within different resource areas, including creation of BVW at a 1:1 ratio to mitigate for any permanent fill and for the creation of compensatory flood storage for any permanent fill within BLSF.
- Local bylaws: Stow and Sudbury both have local wetlands protection bylaws that prescribe certain performance standards for impacts within different resource areas and

that and may require additional mitigation beyond what is prescribed in the MWPA regulations.

Final details regarding the overall wetland-related mitigation approach will be determined when final design is complete. Mitigation plans will be included in the various permit applications to be submitted to local, state, and federal regulatory agencies for review, and the permits issued will contain conditions specifying the mitigation required.

Noticed Variation

Similar to the Project, impacts to wetland resource areas from construction along the Noticed Variation would be minimized by designing the placement of the access road and transmission structures outside of wetland resource areas whenever possible. During construction, these resources would also be protected by the installation of appropriate erosion and sedimentation BMPs as described in Section 5.6.

For any unavoidable impacts, the Company would work with the USACE, MassDEP, NHESP, and local Conservation Commissions to develop the necessary compensatory mitigation plans as described above.

Noticed Alternative Route

No impacts to wetlands are anticipated from construction along public roadways on the Noticed Alternative Route and so no mitigation would be required.

5.11.5 Comparison of Wetland Impacts for the Project, Noticed Variation and Noticed Alternative Route

No impacts to wetland resource areas are anticipated to result from construction within public roadways along the length of the Noticed Alternative Route. The Noticed Variation would result in the largest amount of overall impact within wetland resource areas due to the greatest amount of tree clearing required as well as temporary impacts from the placement of work pads at transmission structure locations. However, the Project is anticipated to result in the largest amount of permanent fill within wetland resources resulting from the construction and installation of the underground transmission line.

5.12 Public Water Supply Protection Areas

Public water supply protection areas within the vicinity of the project consist of Zone I and Zone II Wellhead Protection Areas ("WPAs"), both regulated by the MassDEP, as well as water supply protection overlay districts that are regulated by local zoning authorities. A Zone I WPA is the protective 400-foot radius required around a public water supply well or wellfield. Zone II WPAs are those portions of an aquifer that contribute to the recharge of an existing public water supply well or wellfield. Water supply protection overlay districts are regions that are important to the recharge of local water supply sources. Figure 5-23 shows public water supply protection areas associated with the Project, Noticed Variation, and the Noticed Alternative Route. The Company hired a professional hydrogeologist, who is a Certified Ground Water Professional ("CGWP"), to complete a detailed Groundwater Hydrology Assessments (Appendices 5-6 and 5-7) for the potential for the proposed Project and Noticed Variation designs to affect the flow and quantity of water to public water supply wells in Sudbury and Hudson.

The Noticed Alternative Route was not included in the Groundwater Hydrology Assessments. The installation of a new underground electric transmission line entirely within public roadways is presumed not to have any appreciable impact on groundwater flow or public water supply well yields in Sudbury, Stow, or Hudson, given that installation would be within the same subsurface zone currently impacted and occupied by other underground utilities.

5.12.1 Project

The Project traverses approximately 6.49 miles of public water supply protection areas, including three Zone II WPAs and three local water supply protection overlay districts in both Sudbury and Hudson. As concluded in the Groundwater Hydrology Assessments (Appendices 5-6 and 5-7), the installation of the Project will not have any appreciable impact on groundwater flow or public water supply well yields in either Sudbury or Hudson. Furthermore, the design of the New Line will not involve any circulating coolant or other potential liquid contaminants. Eversource will develop and implement a Storm Water Pollution Prevention Plan ("SWPPP") that includes spill protection controls and countermeasures to ensure that there are no impacts to groundwater in the event of a spill during construction. The Company will prepare and implement the SWPPP in accordance with the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System Construction General Permit. Following construction of the Project, the Company

expects that vegetation management will be carried out by DCR and will conform with DCR Trail Guidelines and Best Practices Manual and electrical utility best management practices, which meet all applicable regulatory standards for aquifer protection areas.

5.12.2 Noticed Variation

The Noticed Variation traverses the same distance (6.49 miles) as the Project through public water supply protection areas. As concluded in the Groundwater Hydrology Assessment, the installation of the Noticed Variation would not have any appreciable impact on groundwater flow or public water supply well yields in either Sudbury or Hudson. As with the Project, Eversource would develop and implement a SWPPP that includes spill protection controls and countermeasures to ensure that there are no impacts to groundwater in the event of a spill during construction. Following construction of the Noticed Variation, the Company would be required to manage vegetation along the ROW in accordance with all applicable regulatory standards for aquifer protection areas, as described in detail in Section 5.6.

5.12.3 Noticed Alternative Route

The Noticed Alternative Route traverses approximately 6.63 miles of public water supply protection areas, including a Zone I WPA in Stow, three Zone II WPAs, and three local water supply protection overlay districts. The Zone II WPAs and local overlay districts are located in Sudbury, Stow, and Hudson. As discussed above, installation of the line within public roadways is presumed not to have any impact on groundwater flow or public water supply well yields. As with the Project and the Noticed Variation, Eversource would develop and implement a SWPPP that includes spill protection controls and countermeasures to ensure that there are no impacts to groundwater in the event of a spill during construction.

5.12.4 Mitigation

To ensure that there are no impacts to public water supplies during construction of any of the options, Eversource will develop and implement a SWPPP that includes spill protection controls and countermeasures to ensure that there are no impacts to groundwater in the event of a spill during construction. The Company will prepare and implement the SWPPP in accordance with Eversource's BMPs and any applicable permit requirements including the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System Construction General Permit.

Eversource will require its contractors to utilize equipment that has been properly maintained to reduce the risk of a spill. Contractors will also be required to have spill containment and prevention devices (e.g., drip pans, absorbent pads, etc.) accessible to crews at each work location. The Company will require its contractors to adhere to its BMPs, including those relative to the storage and handling of oils, lubricants, and other chemicals during construction. Other than equipment that is not readily mobile, equipment will not be refueled or maintained within wetland resource areas and equipment/material storage will not be permitted within 100 feet of any wetland or waterbody. Contractor staging areas and contractor yards typically will be located at existing developed areas (such as parking lots), where the storage of construction materials and equipment, including fuels and lubricants, will not conflict with protection of public surface water supplies or wetland resources.

Project

The Company expects to come to an agreement with DCR regarding responsibility for vegetation management on the MBTA ROW. As part of the agreement, DCR will ultimately carry out maintenance activities (e.g., mowing, trimming) associated with the maintained area over the trench and on the shoulders of the multi-use trail.

The Company expects that vegetation management carried out by DCR will conform with DCR Trail Guidelines and Best Practices Manual and electric utility best management practices, which meet all applicable regulatory standards for aquifer protection areas and ensure that there are no impacts to public water supplies during operation of the Project.

Noticed Variation

To ensure that there are no impacts to public water supplies during operation of the Noticed Variation, the Company will manage vegetation along the ROW to comply with the MassDEP regulations stated in 333 CMR 11.00 and the Massachusetts Pesticide Control Act (G.L. c. 132B), which protect public water supplies with the following requirements:

- No person shall apply any herbicide identified as a Potential Ground Water Contaminant pursuant to 333 CMR 12.00
- No herbicides shall be applied within Public Groundwater Water Sources (Zone II or Interim Wellhead Protection Area) unless: (a) a minimum of 24 months have elapsed since the last application to the site; and (b) herbicides are applied selectively by low

pressure (less than 60 psi), using foliar techniques, basal, or cut-stump applications (333 CMR 11.04(2)(a)(2)).

- No herbicides shall be applied within 50 feet of an identified Private Well (333 CMR 11.04(2)(c)(1)).
- The work must be done by appropriately certified private applicator, appropriately certified commercial applicator, or competent individual acting under the direct supervision of an appropriately certified applicator (G.L. c. 132B(6A)).
- In addition, it is not permissible to mix/load herbicide within 100 feet of a Sensitive Area; conduct foliar application for vegetation greater than 12 feet in height; or apply pesticides when the wind velocity would cause the pesticides to drift off target (333 CMR 11)).

Maintenance along the Noticed Variation will be conducted in accordance with the Company's VMP and YOP, as described in more detail in Section 5.6.

5.12.5 Comparison of Impacts to Public Water Supply Protection Areas

Both the Project and Noticed Variation traverse 6.49 miles of public water supply protection areas, whereas the Noticed Alternative Route traverses 6.63 miles of public water supply protection areas. The Project and Noticed Variation are located within three Zone II WPAs and three local water supply protection overlay districts in both Sudbury and Hudson, while the Noticed Alternative is located within a Zone I WPA in Stow, three Zone II WPAs, and three local water supply protection overlay districts. The Zone II WPAs and local overlay districts are located in Sudbury, Stow, and Hudson.

The Project and Noticed Variation are located within 0.14 less miles of public water supply protection areas than the Noticed Alternative Route. Based upon the Groundwater Hydrology Assessment (Appendices 5-6 and 5-7) completed by a professional hydrogeologist, the Company concludes that there will be no impact to public water supplies from the Project or Noticed Variation for those portions along the MBTA Corridor. Installation of an underground transmission line within public roadways is presumed not to have any impact on groundwater flow or public water supply well yields for any of the options.

5.13 Coldwater Fisheries

The MWPA Regulations (310 CMR 10.04(a)) define a coldwater fishery as "waters in which the mean of the maximum daily temperature over a seven-day period generally does not exceed 68ºF (20ºC), and when other ecological factors are favorable (such as habitat) and are capable of supporting a year round population of coldwater stenothermal aquatic life, such as trout." Waters designated as coldwater fisheries by the MassDEP are listed in 314 CMR 4.00: Massachusetts Surface Water Quality Standards. The Massachusetts Division of Fisheries and Wildlife ("DFW") also designates waters as coldwater fishery resources when there is evidence, based on a fish survey, that a coldwater fish population and suitable habitat exists. Streamside vegetation provides nutrients, bank stabilization, and cover for fish and helps to keep the water shaded and cool enough to maintain suitable temperatures for coldwater fisheries. Coldwater fish species include, but are not limited to, brook trout (*Salvelinus fontanilis*), rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), creek chubsucker (*Erimyzon oblongus*), and fallfish (*Semotilus corporalis*).

The Project and Noticed Variation cross a coldwater fishery associated with Hop Brook in two locations (both in Sudbury), identified below. The banks of the brook are not currently fully shaded in either location.

- Approximately 1,300 feet southeast of the crossing at Boston Post Road (Route 20)
- Approximately 1,600 feet west of the crossing at Dutton Road

Figure 5-24 illustrates the two locations where the Project and Noticed Variation cross Hop Brook and the associated coldwater fishery.

The Noticed Alternative Route crosses two separate coldwater fisheries, identified below.

- On Old Lancaster Road near Wildwood Lane, the route crosses an unnamed tributary ("UNT") to Hop Brook.
- On Hudson Road near August Road, the route crosses Run Brook.

Figure 5-24 illustrates the two locations where the Noticed Alternative Route crosses a waterbody identified as a coldwater fishery.

The sections that follow discuss the proposed work and potential impacts from the Project, Noticed Variation, and Noticed Alternative Route.

5.13.1 Project

The Project generally requires a 30-foot-wide corridor within the MBTA ROW to be cleared of trees and woody shrubs to facilitate development of a 22-foot wide construction platform. The duct bank and access road will be installed within this 22-foot-wide area. At each proposed splice vault location, the limits of clearing will be expanded from the 30-foot wide corridor to an area approximately 40 to 50 feet wide by 50 feet long. The proposed corridor for the construction and operation of DCR's planned multi-use path would result in similar tree clearing impacts as the Project.

Following completion of construction, the entire corridor will be maintained at a 30-foot width. Above the duct bank, only herbaceous vegetation would be permitted. On the opposite side of the access road, limited woody vegetation may be allowed up to a height of 15 feet. Areas within the MBTA ROW outside of the 30-foot corridor of clearing and the clearing areas for the splice vault locations will not be impacted from the Project. Refer to Figure 5-25 for a rendering of the proposed ROW.

5.13.2 Noticed Variation

The Noticed Variation requires the MBTA ROW to be cleared of trees from edge to edge of the ROW boundary. The width of the existing MBTA ROW varies in some locations, but is approximately 80 feet wide.

Following completion of construction of the Noticed Variation, vegetation within the ROW would be managed for varying heights. An area approximately 30 feet wide (centered on the overhead transmission line) would be managed to allow herbaceous and/or low growing woody vegetation to grow up to the wire zone. The proposed 14-foot-wide access road would be located within the wire zone. All other portions of the ROW would be managed by the Company to allow for the growth of native woody vegetation growing up to, but not exceeding the peripheral zone. Refer to Figure 5-26 for proposed cross-section.

5.13.3 Noticed Alternative Route

No impacts are anticipated to coldwater fisheries from the Noticed Alternative Route as the construction of an underground transmission line within the public roadways is assumed to fall within the existing paved areas and no tree clearing is anticipated.

5.13.4 Mitigation

Project and Noticed Variation

Mitigation techniques related to coldwater fisheries would be similar for the Project and Noticed Variation. At both crossings of Hop Brook, construction activities would result in some ground disturbance and removal of trees. Implementation of appropriate BMPs will mitigate the risk for the potential of erosion and deposition of sediment into the brook. Maintenance of the ROW following standard vegetation management practices and adherence to applicable state and federal requirements will be protective of water quality concerns and coldwater fisheries. In addition, the Company will comply with the applicable performance standards in the MWPA regulations and the Massachusetts Surface Water Quality Standards during construction and maintenance of the Project. Where appropriate, the Company will assess potential impacts to coldwater fisheries and propose replantings to maintain shading where possible.

There are three existing bridges over major waterbodies along the MBTA ROW (including Hop Brook). For the Project, the Company plans to reuse the existing bridge structures and rehabilitate them such that they can accommodate a utility crossing. The Company will design the bridge work such that there will be no direct impact to the underlying waterbodies. The Company will also implement appropriate best management practices during construction to prevent erosion and deposition of sediment into the brook from the bridge work.

There will be no bridge work associated with the Noticed Variation.

Noticed Alternative Route

Construction of an underground transmission line would fall within the public roadways and the Company would implement erosion and sedimentation controls and BMPs that would be protective of water quality and coldwater fisheries.

5.13.5 Comparison of Potential for Impacts to Coldwater Fisheries

Table 5-5 summarizes the estimated amount of tree removal along the coldwater fisheries crossed by the Project, Noticed Variation, and the Noticed Alternative Route.

Table 5-5: Average Width of Clearing and Maintenance along Coldwater Fisheries

Route	Average Width of Clearing and Maintenance (feet)
Project	Construction: 30 Permanent Access Road: 14 Maintained Zone: 22
Noticed Variation	Construction: 80 Permanent Access Road: 14 Maintained Wire Zone (15-ft height limit): 22 Maintained Peripheral Zone (25-ft height limit): 44
Noticed Alternative Route	Construction: 0 Maintenance: 0

Along the banks of existing coldwater fisheries, there would be more tree cover removed to facilitate construction for the Noticed Variation than for the Project. No tree removal is anticipated along the Noticed Alternative Route.

5.14 Wildlife Habitat

The Project, Noticed Variation, and Noticed Alternative Route would traverse land areas containing vegetative cover types that provide wildlife habitat for a variety of species. Figure 5-27, developed from National Oceanic and Atmospheric Administration ("NOAA") 2010 land cover GIS data, identifies the generalized habitat/land use types found along the routes. Habitat areas mapped on this figure include pasture/hay fields, scrub/shrub, deciduous forest, mixed forest, evergreen forest, and wetlands. Although there are a variety of habitat areas along each route, the focus of the comparison presented in this Analysis is the estimated required clearing of forested areas (deciduous, mixed, and evergreen, collectively).

The Project and Noticed Variation consist of a segment along an existing MBTA ROW from the Sudbury Substation to the intersection with Wilkins Street in Hudson where the route comes off the ROW and continues through public roadways to the Hudson Substation. The MBTA ROW is the former Massachusetts Central Railroad Corridor used for freight service

from approximately 1887 to 1976. For over forty years, the MBTA ROW has not been used for rail service and currently contains remnants of the single-track railroad (ballast, tracks, and ties) in some portions. Vegetation within the MBTA ROW has not been maintained since rail service was discontinued and consists mainly of shrubby growth and forested areas.

Along the MBTA ROW, the route traverses through a mix of developed and undeveloped areas. The largest of the undeveloped areas is associated with protected open space areas that include lands held and/or managed by the Town of Sudbury, the City of Marlborough, the Sudbury Valley Trustees ("SVT"), and the U.S. Fish and Wildlife Service ("USFWS"). Based upon a review of existing on-line resources, field reconnaissance by ecologists, a meeting with USFWS representatives (July 22, 2016), and from letters received from some of these organizations, it is the Company's understanding that important pitch pine–oak habitat is present within and adjacent to portions of the MBTA ROW in these areas. In addition, efforts are being made by the SVT, the USFWS and the DCR to manage habitat in these areas.

In some portions of the MBTA ROW used for the Project and Noticed Variation, there are existing pathways and/or trails currently used by local residents for hiking, running, dog walking, horse riding, and mountain biking. Evidence of off-road-vehicle use is evident in some locations as well. Public use of the MBTA ROW is most apparent west of Dutton Road in Sudbury through Parmenter Road in Hudson.

The entire length of the Noticed Alternative Route is located within public roadways. The route begins at the Sudbury Substation and will be within Boston Post Road/Route 20, Green Hill Road, Old Lancaster Road, Hudson Road/Sudbury Road/Main Street, Forest Avenue, and terminates at the Hudson Substation. The assumption for this route is that the line will be installed entirely within the paved limits of each roadway.

The sections that follow discuss the proposed work and potential impacts to wildlife habitat from the Project, Noticed Variation, and Noticed Alternative Route.

5.14.1 Project

As previously described, the Project will require clearing of a 30-foot-wide corridor within the MBTA Corridor to facilitate a 22-foot-wide construction platform, with expanded limits of clearing (40 to 50 feet wide by 50 feet long) at splice vault locations. Once construction is completed, the entire corridor will be maintained at a 30-foot width, with herbaceous

vegetation only above the duct bank, and limited woody vegetation on the other side of the access road, consistent with a landscaping plan to be developed in conjunction with the DCR. Areas within the MBTA Corridor outside of the 30-foot corridor of clearing and the clearing areas for the splice vault locations will not be impacted from the Project. Refer to Figure 5-25 for a rendering of the proposed Corridor. Approximately 26.71 acres of forest will be cleared from the MBTA Corridor for the Project.

5.14.2 Noticed Variation

The Noticed Variation requires the MBTA Corridor to be cleared of trees from edge to edge of the ROW boundary. The width of the existing MBTA Corridor varies in some locations, but is approximately 80 feet wide.

Following completion of construction of the New Line along the MBTA ROW, vegetation within the ROW would be managed for varying heights. An area approximately 30 feet wide (centered on the overhead transmission line) would be managed to allow herbaceous and/or low growing woody vegetation to grow up to, but not exceeding the wire zone. The proposed 14-foot wide access road would be located within the wire zone area. All other portions of the ROW would be managed by the Company to allow for the growth of native woody vegetation growing up to, but not exceeding, the peripheral zone. Refer to Figure 5-26 for proposed cross-section. Approximately 70.05 acres of forest will be cleared from the MBTA ROW for the Noticed Variation.

5.14.3 Noticed Alternative Route

No impacts are anticipated to wildlife habitat from the Noticed Alternative Route as the construction of an underground transmission line within the public roadways is assumed to fall within the existing paved areas and no tree clearing is anticipated.

5.14.4 Mitigation

Project and Noticed Variation

In general, transmission line ROWs can have both beneficial and detrimental ecological effects on the areas they traverse. New edge habitat can be a benefit to species (such as deer) that live in or use early successional habitat. Typical ROW vegetation management practices for electric transmission corridors encourage the development of tree-free habitats dominated

by scrub-shrub and/or herbaceous habitats. The removal of the railroad tracks within the MBTA Corridor would also provide some value for amphibians and reptile species that may have difficulty crossing the tracks. However, ROW corridors can afford increased connectivity and movement by animals and humans for management and recreation purposes, which can facilitate the spread of invasive species into areas previously inaccessible. Similarly, increased edge habitat has also been associated with negative effects such as brood parasitism from brown-headed cowbirds and predation of song bird nests.

For the Project, the Company expects that DCR will ultimately carry out maintenance activities in conformance with the DCR Trail Guidelines and Best Practices Manual and with electric utility best management practices. For the Noticed Variation, the Company will use an Integrated Vegetation Management program that implements mechanical and/or approved chemical controls, as necessary, to remove and limit the spread of invasive species so that native plant communities can be established and provide habitat value for species that inhabit early successional habitat along the corridor following construction of the New Line. For any option along the MBTA Corridor, the Company is committed to continued discussions to explore the potential to work cooperatively with the SVT, USFWS, DCR and the local land management agencies to develop a vegetation management strategy that promotes and helps achieve the current habitat management goals along the MBTA Corridor and that is compatible with the safe operation and maintenance of the New Line.

Noticed Alternative Route

Construction of the transmission line would be underground within the public roadways and the Company would implement erosion and sedimentation controls and BMPs to protect adjacent natural resources.

5.14.5 Comparison of Potential for impacts to Wildlife Habitat

Table 5-6 summarizes the estimated amount of tree clearing that would be anticipated along the Project, Noticed Variation, and Noticed Alternative Route.

Table 5-6: Estimated Removal of Existing Forested Areas

Route	Acres of Clearing (acres)	Average Width of Clearing and Maintenance (feet)
Project[35]	26.71	Construction: 30 Permanent Access Road: 14 Maintained Zone: 18
Noticed Variation	70.05	Construction: 80 Permanent Access Road: 14 Maintained Wire Zone (15-ft height limit): 22 Maintained Peripheral Zone (25-ft height limit): 44
Noticed Alternative Route	0	0

The Project and the Noticed Variation along the MBTA ROW would result in the clearing of existing forested areas, whereas the Noticed Alternative Route would not require tree clearing. The Noticed Variation would result in approximately 43 more acres of clearing than the Project. The average width of clearing associated with the Noticed Variation (80 feet) is approximately 50 feet more than the average width of clearing associated with the Project (30 feet).

The creation of increased forest-edge habitat along the MBTA corridor from either the Project or the Noticed Variation would create new edge habitat that could be beneficial to species that live in or use early successional habitat. The Noticed Variation would create a wider corridor with more shrubland habitat that could provide a greater benefit to songbirds that favor this type of habitat, while the Project will create a narrower corridor. The removal of the railroad tracks, associated with both the Project and the Noticed Variation, would also provide some value for amphibians and reptile species that may have difficulty crossing the existing tracks, where present.

Conversely, the increased forest-edge habitat along both the Project and the Noticed Variation could have potential negative effects such as brood parasitism from brown-headed cowbirds and predation of song bird nests. Both the Project and the Noticed Variation would

[35] Impacts from the Project would be similar to those associated with the construction and operation of the planned multi-use MCRT proposed by DCR to benefit the community. As a result, assuming the rail trail would be constructed in any event, the incremental impact of the Project construction is significantly less.

also result in the creation of a new access road that is anticipated to be utilized for a future multi-use recreational trail that the DCR has planned within the MBTA ROW. The creation of this corridor would increase connectivity and the movement of animals and humans, which carries with it the potential to introduce and disperse invasive species that might not otherwise be introduced into these areas. However, as previously identified, there are existing pathways and/or trails currently used by local residents for hiking, running, dog walking, horse riding, and mountain biking along the MBTA ROW and as such this corridor already experiences some of the negative effects that might be attributed to the creation of a new corridor.

In conclusion, the effects of the construction of the Project or Noticed Variation on wildlife will vary with regard to general effect, species affected, and given the vegetation management strategy that is applied. Construction of the Noticed Variation will require more forested areas to be cleared than the Project. Construction of the Noticed Alternative Route is not anticipated to result in any impacts to wildlife habitat as the line would be installed within existing roadways and no tree removal would be necessary.

5.15 State-Listed Rare Species Habitat

MESA protects state-listed rare species and their habitats on the state list, as approved by DFW. The NHESP staff is responsible for implementing the regulations associated with MESA. During the regulatory review process, NHESP staff will review a proposed action and determine whether the project, as proposed, will impact state-listed species and their habitats. If it is determined that a proposed action will result in a "take" and cannot be revised to avoid a "take," then the proponent must file for the issuance of a Conservation and Management Permit ("CMP") and the proposed action must meet the performance standards for the CMP. Some proposed actions located within mapped habitat may be exempt from NHESP staff review.

Areas of protected habitat for state-listed rare species along the route for the Project and Noticed Alternative Route were identified utilizing ArcGIS and applying MassGIS mapping of NHESP Priority and Estimated Habitat areas.

5.15.1 Project and Noticed Variation

Existing Conditions

The Project and Noticed Variation consist of a segment along an existing MBTA ROW from the Sudbury Substation to the intersection with Wilkins Street where the route comes off the ROW and continues within public roadways to the Hudson Substation. There are two areas mapped as protected habitats for state-listed rare species along the route for the Project and Noticed Variation for a total linear distance of approximately 7,300 feet. The Company submitted an information request to confirm the species present within these mapped areas. Based upon the response from NHESP, one of the areas contains a state-listed amphibian species while the other contains two state-listed reptiles and one state-listed bird species.

Following receipt of the rare species information from NHESP, professional wildlife biologists conducted habitat assessments along the route for the Project and Noticed Variation specifically for these species. This information will be included in the Company's submission to NHESP for project review under MESA. In addition, the Company will develop avoidance or minimization techniques, as feasible, into the final design.

The state-listed reptile species mapped along route for the Project and Noticed Variation utilizes different types of habitats. One of these reptile species utilizes a variety of different habitat, primarily terrestrial habitats, including forests, fields, and early successional areas and typically overwinters underground within wooded areas. The second reptile species utilizes riparian areas and typically overwinters under water in perennial streams. This species migrates away from streams, spending most of the spring and summer foraging within forests, fields, early successional areas, and riparian wetland areas. Both species are generally dormant in Massachusetts from late October or November until mid-March or April depending on weather conditions. The habitat areas within and surrounding route for the Project and Noticed Variation appear to offer suitable foraging, migrating, mating, and nesting habitat for both species.

The state-listed bird species identified along the route for the Project and Noticed Variation overwinters in warmer climates, but arrives in Massachusetts as early as mid-April to mate, nest, and forage. This species nests directly on the ground within woodlands, but requires more open areas such as pine barrens, utility corridors, logging areas, and gravel pits for foraging. Areas within and adjacent to route for the Project and Noticed Variation appear to offer suitable foraging, migrating, mating, and nesting habitat for this species; however,

because of the frequent human use currently exhibited on the MBTA ROW (pedestrians, joggers, horseback riders, dog walkers, and bike riders), mating and nesting activities are less likely, and due to the amount of tree shading along the ROW, it does not appear to provide suitable open foraging habitat for this species.

The state-listed amphibian species mapped along route for the Project and Noticed Variation typically utilize mature forests with loose soils, thick leaf litter, and woody debris on the ground. This species overwinters below the frost line, but is generally active between early spring and fall. Areas along and adjacent to the MBTA ROW appear to offer suitable foraging, migrating, and overwintering habitat for this species and breeding habitat may exist within various wetland areas. The MBTA ROW does not appear to offer good foraging or overwintering habitat for this species and no breeding habitat was identified within the MBTA ROW. However, migration of this species through the MBTA ROW is possible.

Project Impact Overview

The Project will result in disturbance to approximately 5.0 total acres of mapped habitat along the route. Habitat impacts include habitat conversion due to tree clearing (a total of approximately 5.0 acres) and permanent habitat loss associated with access road construction (approximately 2.30 acres). Note that the access road falls entirely within the limit of clearing.

Noticed Variation Impact Overview

The Noticed Variation would result in disturbance to approximately 13.20 acres of mapped habitat along the route. Habitat impacts include temporary disturbance caused by the placement of work pads for access of construction equipment (a total of approximately 1.10 acres); habitat conversion due to tree clearing (a total of approximately 13.20 acres); and permanent habitat loss associated with access road construction and placement of structures (approximately 2.51 acres). Again, the work pads, access road, and structures all fall within the limit of clearing.

5.15.2 Noticed Alternative Route

The Noticed Alternative Route is located within public roadways for the entire length. There are three areas mapped as protected habitats for state-listed rare species for a total linear distance of approximately 5,030 feet. The assumption for this route is that no impacts are

anticipated to these protected habitat areas as the line would be installed entirely within the paved limits of public roadways, and the proposed installation would be exempt from review of NHESP as per the existing MESA regulations.

5.15.3 Mitigation

Project and Noticed Variation

The Company will work with NHESP staff through the MESA review process to identify appropriate Protection Plans for each state-listed rare species that may be required. These Protection Plans will focus on minimizing direct mortality of state-listed species that may be present within the MBTA ROW during construction. Impact minimization measures could include time of year restrictions for construction, use of temporary exclusionary barriers, and wildlife clearing surveys conducted daily by qualified biologists in advance of construction. If NHESP staff determine that construction along the MBTA ROW would result in a "take," then the Company will file for and meet the performance standards for the issuance of a CMP. Typical mitigation options under a CMP may include offsite habitat protection or funding of programs that directly benefit the affected species. Offsite habitat protection typically requires the acquisition of land, under fee ownership or conservation restriction, for permanent habitat conservation. Other mitigation options consist of financial contribution toward land acquisition, conservation research funding, habitat management, or other programs that directly benefit the affected species.

Noticed Alternative Route

Construction along public roadways for the Noticed Alternative Route would not result in impacts to state-listed rare species or their habitat, therefore no mitigation would be required.

5.15.4 Comparison of Rare Species Habitat Impacts

Three of the four state-listed species regularly utilize open canopied habitats for foraging, reproduction, and/or thermal regulation along the MBTA ROW. Following construction of either the Project or the Noticed Variation it is anticipated that the MBTA ROW will continue to offer suitable habitat for these species as the tree clearing and ongoing vegetation maintenance along the ROW would be considered habitat conversion rather than habitat loss. For the Project, the Company expects that DCR will ultimately carry out maintenance activities in conformance with the DCR Trail Guidelines and Best Practices Manual and with

electric utility best management practices. For the Noticed Variation, vegetation management will be conducted under Eversource's VMP and YOP, which include NHESP's required state-listed species Best Management Practices, and in accordance with any stipulations identified in final Memoranda of Understanding with DCR and the MBTA. Tree clearing and ongoing vegetation management of the ROW will increase potential nesting habitat for two of the four species. Removal of the existing rails will also benefit two of the four species because the removal will increase the ability of these species to migrate across the MBTA ROW. Tree clearing will also increase potential foraging habitat for one of the species. However, the increased recreational pedestrian use of the access road may deter three of the four species from habitation in close proximity to the proposed access road.

The Noticed Variation would result in greater habitat conversion acreage than the Project. The permanent impacts to state-listed species habitat from the access road for both the Noticed Variation and the Project would be similar.

The Noticed Alternative Route is not anticipated to result in any impacts to rare species habitat.

5.16 Residential Land Uses

Residential land uses consist of single- and multi-family housing units, including apartments and condominiums. The Company tallied the total number of units within parcels identified as residential directly abutting the routes.

The results are presented below in Table 5-7. As the Project and Noticed Variation follow the same route, they have the same number of abutting residential units. Residential land uses are shown in relation to each route in Figure 5-3 and Figure 5-7.

Table 5-7: Number of Residential Units Adjacent to the Project, Noticed Variation, and Noticed Alternative Route

Route	Residential Units
Project	315
Noticed Variation	315
Noticed Alternative Route	549

There are significantly more individual residential units adjacent to the Noticed Alternative Route (549) than the Project or Noticed Variation (315).

5.17 Commercial/Industrial Land Uses

Commercial/industrial uses consist of shopping centers, malls, restaurants, larger strip commercial areas, neighborhood stores, medical offices, and light industrial facilities used for manufacturing, storage, or assembly of raw or processed products. The Company tallied the total number of units within parcels identified as commercial/industrial directly abutting the routes.

The results are presented below in Table 5-8. As the Project and Noticed Variation follow the same route, they have the same number of abutting commercial/industrial units. Commercial/industrial land uses are shown in relation to each route in Figure 5-3 and Figure 5-7.

Table 5-8: Number of Commercial/Industrial Units Adjacent to the Project, Noticed Variation, and Noticed Alternative Route

Route	Commercial/Industrial Units
Project	90
Noticed Variation	90
Noticed Alternative Route	61

While there are more commercial/industrial land uses adjacent to the Project and Noticed Variation (90) than the Noticed Alternative Route (61), the Noticed Alternative Route would involve an installation entirely within public roadways and would result in a higher potential for temporary traffic, parking, and access impacts during construction than the Project or Noticed Variation.

5.18 Sensitive Receptors

Sensitive receptors consist of hospitals, schools, day care facilities, elderly housing and convalescent facilities, churches, and horse farms. These are land use types where occupants are considered to be more susceptible to potential impacts from a project and where extra consideration must be made in considering potential mitigation measures to minimize these

impacts. The Company tallied the total number of parcels identified as sensitive receptors directly abutting the routes.

The results are presented below in Table 5-9. As the Project and Noticed Variation follow the same route, they have the same number of abutting sensitive receptors. Sensitive receptors are shown in relation to each route in Figure 5-3 and Figure 5-7.

Table 5-9: Number of Sensitive Receptors Adjacent to the Project, Noticed Variation, and Noticed Alternative Route

Route	No. of Sensitive Receptors	Name	Address
Project	3	*Sudbury*	
		Congregation B'Nai Torah	225 Boston Post Rd.
		Hudson	
		CHAPS, Inc. (Day Care Center)	127 Forest Ave.
		Forest Avenue Elementary School	136 Forest Ave.
Noticed Variation	3	*Sudbury*	
		Congregation B'Nai Torah	225 Boston Post Rd.
		Hudson	
		CHAPS. Inc. (Day Care Center)	127 Forest Ave.
		Forest Avenue Elementary School	136 Forest Ave.
Noticed Alternative Route	9	*Sudbury*	
		Congregation B'Nai Torah	225 Boston Post Rd.
		Our Lady of Fatima Parish	160 Concord Rd.
		Department of Public Works	275 Old Lancaster Rd.
		Fairbank Community Center	40 Fairbank Rd.
		Haskell Field	15 Fairbank Rd.
		Stow	
		Massachusetts Firefighting Academy	1 State Rd.
		Hudson	
		Brandi's Family Child Care	541 Main St.
		CHAPS, Inc. (Day Care Center)	127 Forest Ave.
		Forest Avenue Elementary School	136 Forest Ave.

There are more sensitive receptors adjacent to the Noticed Alternative Route (9) than the Project and Noticed Variation (3).

5.19 Recreational Land Uses

Recreational uses include, but are not limited to, playgrounds, ball fields, and golf courses. The Company tallied the total number of parcels identified as recreational land uses directly abutting the routes.

The results are presented in Table 5-10. As the Project and Noticed Variation follow the same route, they have the same number of abutting recreational land uses. Recreational land uses are shown in relation to each route in Figure 5-3 and Figure 5-7.

Table 5-10: Number of Recreational Land Uses Adjacent to the Project, Noticed Variation, and Noticed Alternative Route

Route	No. of Recreational Land Uses	Name	Address
Project	3	*Hudson*	
		Charter Oak Country Club	394 Chestnut St.
		Assabet River Rail Trail parking lot	14 Wilkins St.
		Forest Avenue Elementary School playgrounds	136 Forest Ave.
Noticed Variation	3	*Hudson*	
		Charter Oak Country Club	394 Chestnut St.
		Assabet River Rail Trail parking lot	14 Wilkins St.
		Forest Avenue Elementary School playgrounds	136 Forest Ave.
Noticed Alternative Route	3	*Sudbury*	
		Haskell Field	15 Fairbank Rd.
		Hudson	
		Sauta Fields & Playground	539 Main St.
		Forest Avenue Elementary School playgrounds	136 Forest Ave.

There are the same number of recreational land uses (three) adjacent to the Project, Noticed Variation, and Noticed Alternative Route.

5.20 Conservation Land Uses

Conservation land uses primarily consist of undeveloped land conserved for the protection of natural resources such as wetlands, waterways, or wildlife habitat. This category may also include parcels considered "open space" or "park lands" if their primary purpose is the protection of natural resources. The Company tallied the total number of parcels identified as conservation land uses directly abutting the routes. Some of the conservation land use parcels are sizeable. In order to represent better the potential for impacts to conservation land uses along each route, the Company also evaluated the length of abutting conservation land uses along the routes in addition to the number.

The results are presented below in Table 5-11. As the Project and Noticed Variation follow the same route, they have the same number and "abutting length" of conservation land uses. Conservation land uses are shown in relation to each route in Figure 5-3 and Figure 5-7.

Table 5-11: Number and Length of Conservation Properties Abutting the Project, Noticed Variation, and Noticed Alternative Route

Project	
Abutting Length (miles)	3.73
Number of Conservation Properties	14
Noticed Variation	
Abutting Length (miles)	3.73
Number of Conservation Properties	14
Noticed Alternative Route	
Abutting Length (miles)	3.09
Number of Conservation Properties	9

Table 5-12 identifies the 14 conservation properties along the Project and Noticed Variation.

Table 5-12: Conservation Lands along the Project and Noticed Variation

Town	Property	Owner/Manager
Sudbury	Great Meadows National Wildlife Refuge	United States Department of the Interior
	Wash Brook Parcel	Town of Sudbury
	Maple Meadows Conservation Restriction	Maple Avenue Meadows LLC
	Stone Agricultural Preservation Restriction	Stone, William P. and Olive T.
	Hopbrook Marsh Conservation Land	Town of Sudbury
	Memorial Forest	Sudbury Valley Trustees
Sudbury & Hudson	Assabet River National Wildlife Refuge	United States Department of the Interior
Hudson	Water Department Land	Town of Hudson
	Cranberry Well	Town of Hudson
	Marlborough-Sudbury State Forest	DCR – Division of State Parks and Recreation
	Chestnut Well	Town of Hudson
	Gillis Land	Sudbury Valley Trustees
	Forest Ave School	Town of Hudson
Marlborough	Desert Conservation Area	City of Marlborough

Table 5-13 identifies the conservation properties along the Noticed Alternative Route.

Table 5-13: Conservation Lands along the Noticed Alternative Route

Town	Property	Owner/Manager
Sudbury	Great Meadows National Wildlife Refuge	United States Department of the Interior
	Gray Reservation	Sudbury Valley Trustees
	Assabet River National Wildlife Refuge	United States Department of the Interior
Sudbury, Stow, & Hudson	Marlborough-Sudbury State Forest	DCR – Division of State Parks and Recreation
Stow & Hudson	White Pond Road Watershed	Town of Maynard
Hudson	Kane Well	Town of Hudson
	Chestnut Well	Town of Hudson
	Gillis Land	Sudbury Valley Trustees
	Forest Ave School	Town of Hudson

Note that for scoring purposes, the length of the abutting conservation land uses along the Noticed Alternative Route was designated as zero, as the line would be installed within a public roadway and would not result in any impact to these land uses. However, the actual length and list of properties is presented above to provide some context for the existing land uses adjacent to each route.

5.20.1 Comparison of Conservation Land Uses

There are more conservation land uses adjacent to the Project and Noticed Variation (14) than the Noticed Alternative Route (9).

5.21 Potential to Encounter Subsurface Contamination

As described previously in Section 4, an online review of the MassDEP database of disposal sites identified under the MCP was performed to determine the potential to encounter subsurface contamination. The database was used to collect information on sites (with a release tracking number) that abutted the routes. The results are presented below in Table 5-14.

Table 5-14: Number of MCP Sites Adjacent to the Project, Noticed Variation, and Noticed Alternative Route

Route	MCP Sites
Project	9
Noticed Variation	9
Noticed Alternative Route	14

5.21.1 Project

The environmental analysis (discussed in Section 4) identified nine MCP sites within or adjacent to the route for the Project. In addition to the MCP sites identified in the database search, this route may also be affected by the presence of currently unidentified contamination along the MBTA ROW segment from historical use as an active railroad corridor.

5.21.2 Noticed Variation

The nine MCP sites within or adjacent to the Project are also within or adjacent to the Noticed Variation and the route may also be affected by currently unidentified contamination from historical use of the MBTA ROW.

5.21.3 Noticed Alternative Route

The analysis completed in Section 4 identified 14 MCP sites within or adjacent to the Noticed Alternative Route.

5.21.4 Mitigation

The Company will follow the procedures and BMPs outlined in Section 5.5, 5.6, and 5.7 to confirm conditions in the field, develop a soil and groundwater management plan, and contract with an LSP as necessary, consistent with the requirements of the MCP.

5.21.5 Comparison of the Potential for Subsurface Contamination

In the event of contamination along either route, Eversource would follow procedures in accordance with the Company's Guideline for Construction Generated Soil Management as well as with state regulations.

5.22 Cultural (Historic & Archaeological) Resources

This section describes cultural (historic and archaeological) resources present in the vicinity of the Project and identifies potential impacts along the route used for the Project, Noticed Variation, and the Noticed Alternative Route. Cultural resources include, but are not limited to, buried archaeological sites, standing historic structures, or thematically related groups of structures (usually identified as historic "districts" or "areas"). Both routes are located adjacent to a number of individual historic buildings, inventoried areas, and historic districts. The historic properties encompass a range of levels of documentation and designation, including Individually Inventoried buildings and National Register–listed and eligible individual buildings and districts.[36] Some individually listed properties are within one or more National Register–listed districts. In addition to those properties identified for potential listing in the State or National Registers, additional unregistered local resources were identified through coordination with local Historic Commissions and Societies and review of publicly available documentation.

The Company contracted with Commonwealth Heritage Group, Inc. ("CHG") to identify known historic and archaeological resources in the area of each route. CHG conducted a search of the Massachusetts Historical Commission's Inventory of the Historic and Archeological Assets of the Commonwealth ("MHC Inventory"). For the purposes of the identification effort, CHG established a study area ¼-mile-radius out from the center of the routes to account for all known historic architectural properties and archeological sites in proximity of the Project, Noticed Variation and Noticed Alternative Route. Field visits were made in May and June 2015 to confirm the identified resources.

Historic resources in the vicinity of the routes are shown in Figures 5-4 and 5-8, and summarized in Table 5-15. The location of archaeological resources is sensitive and protected information per G.L. c. 9 §26A.

[36] Inventoried properties are those that have been documented and are listed in the Inventory of Historic Assets of the Commonwealth. They have the potential to be evaluated for eligibility on the State Register.

Table 5-15: Cultural Resources Located along the Project, Noticed Variation, and Noticed Alternative Route

Resource Type	No. of Resources	Districts/Areas
Project and Noticed Variation		
Archaeological Sites	20	
Individually Inventoried Buildings	22	
Total Districts/Areas	8	
Local Historic Districts	2	Sudbury: George Pitts Tavern Historic District, The Wayside Inn Historic District
Inventoried Areas	3	Sudbury: South Sudbury, Sudbury First Industrial Area Hudson: Natick Research and Development Laboratories
Unregistered Locally Important Areas	3	Sudbury: Wayside Inn Historic Preservation Residential Zone Hudson: MBTA ROW, Gospel Hill
Noticed Alternative Route		
Archaeological Sites	22	
Individually Inventoried Buildings	16	
Total Districts/Areas	3	
Local Historic Districts	0	
Inventoried Areas	1	Stow & Hudson: Lake Boon Historic Area
Unregistered Locally Important Areas	2	Hudson: MBTA ROW, Gospel Hill

5.22.1 Mitigation

Project and Noticed Variation

The Project and Noticed Variation will be subject to review under Section 106 of the National Historic Preservation Act (36 C.F.R 800, "Section 106") and will require a permit from the USACE. The Project and Noticed Variation will also be subject to review by the MHC under G.L. c. 9 §§ 26–27C. The Company will coordinate with the USACE and MHC to avoid and/or minimize adverse effects to any eligible historic resource and to archaeological resources. As part of the USACE's Section 404 permit review, and pursuant to Section 106, the federal agency will also consult with Native American Tribes that express an interest in the cultural resources that may be affected by those portions of the routes subject to USACE and MHC jurisdiction. The Company will file an Environmental Notification Form under

the Massachusetts Environmental Policy Act, and MHC and local historic commissions will provide review and comment under this public process.

The Company will continue to coordinate with CHG to evaluate potential impacts to archaeological resources prior to construction and to identify areas that should be avoided or which, if not able to be avoided, would necessitate measures to protect the cultural resource. Procedures to handle unanticipated discoveries during construction will also be specified as part of a Construction Management Plan.

Noticed Alternative Route

Construction within the existing roadway is not anticipated to result in any impacts to abutting historic or archaeological resources.

5.22.2 Comparison of Impacts to Historic and Archaeological Resources

Construction for the Project and Noticed Variation will occur mainly within an established MBTA ROW and is not anticipated to result in impacts to known archaeological sites due to the previously disturbed nature of the ROW. The Noticed Variation could result in impacts to the existing view shed from abutting above-ground historic properties, resulting from the installation of the overhead transmission line and related tree clearing. The Project would result in a lesser visual impact to above-ground historic properties due to the clearing of a narrower corridor for installation of the underground transmission line. Construction within public roadways along the Noticed Alternative Route is not anticipated to result in any impacts to cultural resources.

5.23 Visual Impacts

Visual impacts at substations would result regardless of which alternative is constructed. In addition, along the proposed route for both the Project and Noticed Variation, visual impacts would result from tree clearing and, in the case of the Noticed Variation, also from the new transmission line structures. No visual impacts are anticipated for the Noticed Alternative along the route, but some visual impacts will occur at the substations.

The Company engaged TRC to assess the potential for visual impacts from construction of the Project along the MBTA ROW. The analysis completed by TRC, *Visual Impact Assessment,*

Sudbury-Hudson Transmission Reliability Project (the "TRC Report") is summarized briefly below and is provided as an attachment in Appendix 5-7.

A 0.5-mile study radius around the MBTA ROW defined the extent of the visual impact assessment. Prior to discussion of any operational and visual impacts to the surrounding landscape, the Company identified potential areas that may be susceptible to potential visual impacts. Visual resources found within the 0.5-mile study radius include areas of open space, areas of potential water-based recreation, trails, historic resources, and resources identified in the Massachusetts Scenic Landscape Inventory. A full list of these resources is provided in Table 1 of Appendix 5-7, and a map is provided in Figure 5-28. Source information for the development of the inventory included GIS data available on federal, state, or agency websites, and other non-GIS based websites that provided information such as regulatory listings or hardcopy mapping.

5.23.1 Project

No visible above ground features would be installed within the ROW, thus no comparative viewshed analysis to the Noticed Variation was performed. In most locations, the existing vegetation would continue to provide a visual buffer from abutting land uses, though the cleared portion of the MBTA ROW would be visible at road crossings.

An artist rendering of the Project at the MBTA ROW's crossing of Boston Post Road and Station Avenue is provided in Figure 5-29 and is representative of visual perspectives at all road crossings. The New Line will be installed entirely underground adjacent to the proposed access road. As shown in the rendering, the multi-use path would be developed within the access road.

5.23.2 Noticed Variation

The Company completed a viewshed analysis for the Noticed Variation to assess potential impacts to abutting land uses and visual resources. The viewshed analysis results are provided in Figure 5-28.

Along the MBTA ROW, viewshed mapping in Figure 5-28 shows the greatest amount of visibility occurring in adjacent open fields, parking lots and commercial areas, as well as in some neighborhood areas. Based on the site visits and the subsequent results of artists renderings and photosimulations, in general, it is not expected that significant full on views

of structures will be seen from these areas. In most cases, it is generally the upper portions of the structures that are expected to be visible.

An artist rendering of the Noticed Variation at the MBTA ROW and Boston Post Road and Station Ave is provided in Figure 5-30 as a typical road crossing. The peripheral zones of the Noticed Alternative would revegetate with shrubs along the MBTA ROW approximately five years following construction.

While the artist renderings focused on views of the line at road crossings, the photo simulations represent areas farther out from the MBTA ROW at oblique angles to the Noticed Variation and were taken at Landham Road in Sudbury, Amanda Road in Sudbury, and Chestnut Street in Hudson. The simulations at Landham Road in Sudbury and Chestnut Street in Hudson show that upper portions of structures are visible above trees and in some instances there are views to cleared portions of the MBTA ROW. The simulation at Amanda Road in Sudbury shows a view of the Noticed Variation from an abutter and the effects of tree clearing when there is no intervening vegetation between the MBTA ROW and landowner property boundary. Simulations at three locations are provided in Figures 5-31, 5-32, and 5-33.

5.23.3 Noticed Alternative Route

There would be minimal visual impacts from the Notice Alternative, if the transmission line is installed within the existing limits of pavement. In some locations (at splice vaults, for example) it could be necessary to trim branches to facilitate construction; however, upon construction completion, the road would be restored to pre-existing conditions and the vegetation would be allowed to grow back.

5.23.4 Mitigation

Project and Noticed Variation

For both the Project and the Noticed Variation, the Company would work with those abutting landowners that experience a material change in view of the MBTA ROW as a result of the construction to determine reasonable and practical screening that could be provided on their properties. Screening options may be in "soft" form (i.e., vegetation) or "hard" form (i.e., fencing), or a combination of the two. In addition, Eversource would work with DCR to

design landscape plantings within the MBTA ROW that are compatible with both the multi-use path as well as the installed transmission line.

Noticed Alternative Route

There would be minimal visual impacts from the Notice Alternative Route; mitigation is not anticipated to be necessary.

5.23.5 Comparison of Visual Impacts

The Project would result in less visual impact along the MBTA ROW, with no above-ground structures and less vegetation removal required than for the Noticed Variation. The visual impact would primarily be increased visibility of the multi-use path from abutting uses due to the removal of vegetation for the required 30 foot width of clearing.

The Noticed Variation would result in the highest potential for visual impacts due to newly introduced vertical and industrial type elements into the existing landscape, as well as a greater amount of required tree clearing out to the entire limits of the MBTA ROW.

There are no visual impacts anticipated from the Noticed Alternative Route, as there would be no new above-ground structures (except for relatively common installations at the substations) nor any permanent vegetation removal.

In summary, vegetation removal along the Project and Noticed Variation would result in a higher potential for visual impacts than there would be for the Noticed Alternative, with the Noticed Variation having the highest potential due to the installation of the overhead structures.

5.24 Traffic

The potential for traffic congestion was determined by VHB transportation consultants using a multi-criteria analysis to assess existing traffic conditions and the potential for impacts, developing a "traffic score" for each option. The traffic analysis considered factors such as existing traffic volumes, roadway widths, number of travel lanes, and the availability of reasonable detours. Available traffic information was obtained from municipal departments or through available public documents for proposed or ongoing projects in the area. Field

reconnaissance verified the existing conditions, including confirming roadway measurements and 15-minute midday (9 a.m.–4 p.m.) traffic counts.

5.24.1 Project and Noticed Variation

The Project and Noticed Variation utilize the same route, which is approximately 9.01 miles in length. The majority (84%) of the route is along the MBTA ROW at 7.61 miles. The remainder of the route is along roadways with low traffic volumes (Wilkins Street and Forest Avenue). Table 5-16 provides a detailed summary of roadway and traffic conditions.

Table 5-16: Roadway Summary along the Project and Noticed Variation

Project and Noticed Variation	Approximate Road Width (feet)	Existing Traffic	Notes
MBTA ROW between Sudbury Substation and Wilkins Street (7.61 miles in Sudbury, Stow, Marlborough, and Hudson)	N/A	• Off Road No Traffic	Ten Roadway Crossings: Landham Road, Boston Post Road (Route 20), Union Avenue, Horse Pond road, Peakham Road, Dutton Road, White Pond Road, Parameter Road, Main Street and Chestnut Street
Wilkins Street between MBTA ROW and Main Street (0.21 miles in Hudson)	28	• Low traffic volume	
Forest Avenue from Main Street to Marlboro Street (0.72 miles in Hudson)	30	• Low traffic volume	Forest Avenue Elementary School
Forest Avenue From Marlboro Road to the Substation (0.36 miles in Hudson)	23	• Low traffic volume	
Hudson Substation Road (0.11 miles in Hudson)	N/A	• Off Road No Traffic	

Project

Construction of the Project will involve trenching along the crossings and will require traffic management for a longer duration than would construction of the Noticed Variation. Crossings with narrow road widths (Union Avenue, Horse Pond Road, Peakham Road and Dutton Road in Sudbury; and White Pond Road and Chestnut Street in Hudson) will likely require a temporary road closure and traffic detour. Crossings with road widths that allow two-way alternating traffic (Landham Road and Boston Post Road in Sudbury and Parmenter

Road and Main Street in Hudson) will require the crossing to be constructed in two stages to allow for one lane of traffic to be open at a time.

Noticed Variation

Construction of the Noticed Variation would require traffic to be stopped briefly at the MBTA ROW crossings when pulling the overhead lines between structures. This temporary condition would occur for each individual line.

5.24.2 Noticed Alternative Route

The Noticed Alternative Route is approximately 10.30 miles in length. This route is located on a variety of low, moderate and high traffic volume roadways. Approximately 67 percent of this route is along streets that have moderate to high traffic volumes. Table 5-17 provides a detailed summary of roadway and traffic conditions.

Table 5-17: Roadway Summary along Noticed Alternative Route

Noticed Alternative Route	Approximate Road Width (feet)	Existing Traffic	Notes
Sudbury Substation Road between Sudbury Substation and Route 20 (0.12 miles in Sudbury)	N/A	• Off Road No Traffic	
Route 20 between Sudbury Substation and Green Hill Road (0.26 miles in Sudbury)	28	• High Traffic Volumes	
Green Hill Road between Route 20 and Old Lancaster Road (0.44 miles in Sudbury)	28	• High Traffic Volumes	
Old Lancaster Road between Green Hill Road and Concord Road (0.77 miles in Sudbury)	18	• Low traffic volume	
Concord Road between Old Lancaster Road and Union Avenue (0.12 miles in Sudbury)	26	• Low traffic volume	
Old Lancaster Road between Union Avenue and Hudson Road (1.17 miles in Sudbury)	22	• Low traffic volume	
Hudson Road between Old Lancaster Road and Sudbury Road (3.12 miles in Stow)	27	• Moderate traffic volume	
Main Street between Sudbury Road and Forest Avenue (3.11 miles in Hudson)	30	• Moderate traffic volume	
Forest Avenue from Main Street to Marlboro Street (0.72 miles in Hudson)	30	• Low traffic volume	Forest Avenue Elementary School
Forest Avenue from Marlboro Road to the Substation (0.36 miles in Hudson)	23	• Low traffic volume	
Hudson Substation Road between Forest Avenue and Hudson Substation (0.11 miles in Hudson)	N/A	• Off Road No Traffic	

5.24.3 Mitigation

Regardless of the route selected, the Company will carefully coordinate construction to minimize impacts to adjacent residences and businesses and others relying on these transportation corridors. Prior to beginning construction, the Company will work closely with the municipalities to develop a construction Traffic Management Plan ("TMP") to minimize the impacts of construction on the traveling public. Items to be included in the TMP are:

- Ongoing coordination with police and fire departments;
- Provisions for emergency vehicle access;

- Timing and delivery of equipment and materials;
- Lane location and width within the work zone to minimize impacts to vehicular traffic movement and promote safe passage;
- Work schedule and duration of proposed lane closures, alternating traffic flow patterns, road closures, and/or detours where necessary;
- Traffic-control devices such as barricades, reflective barriers, advance warning signs, traffic regulation signs, traffic control drums, flashers, detour signs, and other protective devices as approved by the various towns;
- Locations where temporary provisions may be made to maintain access to homes and businesses;
- Routing and safeguarding of pedestrian and bicycle traffic;
- Continuity plans along school bus, and private motor coach routes;
- Method of communication with adjacent businesses to avoid interruptions to critical product deliveries;
- Roadway level of service effects due to short-term lane closure(s); and
- Development of a system to notify municipal officials, local businesses, and the public of the timing and duration of travel restrictions.

The TMP will be submitted for municipal review and approval as part of the Grant of Location permit process by appropriate Hudson, Sudbury and Stow authorities prior to the start of in-street construction. Traffic control plans will be developed consistent with the Federal Highway Administration's *Manual on Uniform Traffic Control Devices for Streets and Highways* and MassDOT's publication, *Work Zone Safety*.

5.24.4 Comparison of Potential for Traffic Impacts

Traffic impacts associated with all options would be temporary in nature and confined to the amount of time necessary for construction. Implementation of a well-designed TMP will reduce the potential for traffic disruptions and inconvenience to drivers. A variety of mitigation measures will be used to minimize transportation disruption during construction.

The Project and Noticed Variation have 1.29 miles located within public roadways, while the Noticed Alternative Route has 10.07 miles located within the roadway, resulting in an additional 8.78 miles of impacted roadway.

As a result, the Noticed Alternative Route has a higher potential to cause traffic congestion as compared to the Project and Noticed Variation, especially where moderate to high traffic volume occurs and along narrow roadways that will require road closures and detours during construction.

5.25 Construction-Related Noise

Construction activities will result in localized, short-term increases in ambient noise levels in the vicinity of the work sites. Construction-related noise will occur as a result of the operation of equipment and vehicles, including vegetation removal equipment, jackhammers, drilling rigs and cranes, depending on the approved design. Requirements of the local noise ordinances are outlined below in Table 5-18.

Table 5-18: Municipal Noise Ordinance Summary

	Allowed construction hours, weekday	Allowed construction hours, weekend	Exceptions/Decibel Limits
Town of Hudson General By-Laws, Article VI, Section 33	7 a.m. – 11 p.m.	7 a m. – 11 p m.	No prescribed decibel level limits in bylaw during the Company's proposed work hours.
Town of Sudbury Zoning Bylaw Article IX, Article 3423	7 a.m. – 6 p m.	Not specified	No prescribed decibel level limitations between 7 a m. and 6 p m. During weekdays between 6 p.m. and 7 a m. and anytime on weekends, construction noise is arguably limited to 10 decibels above ambient L90[1] sound level, as measured both at the property line and at the nearest residence. The Company is seeking a zoning exemption from the allowed construction hours.
Town of Stow Zoning Bylaw Section 3.8.1.3	No construction prohibitions found	Not specified	• No more than 10 dB above natural ambient for more than 5 minutes in any one hour and total sound level shall not be more than 3 dB above natural ambient • No more than 30 dB above natural ambient for more than 60 minutes in any 7-day period and total sound level shall not be more than 3 dB above natural ambient • Natural ambient assumed to be 40 dBA during daylight and 30 dBA at all other times To the extent that these limits apply to construction, the Company is seeking a zoning exemption.
City of Marlborough Noise Ordinance Chapter 431	7 a.m. – 7 p m.	7 a m. – 7 p.m. (Saturday only)	No restrictions appear to apply for construction activities.

1 L90 is a statistical sound level metric that represents the sound level that is exceeded 90 percent of the time. In other words, 90 percent of the time, the fluctuating levels of ambient noise are higher than this number; this number therefore represents a sound level that is at the lower end of fluctuating ambient noise levels.

The potential for, and quality of, noise impacts from construction activities depends on the construction equipment used for each phase of construction and the specific construction activity.

The following sections identify the types of equipment and typical associated sound levels for the construction activities specific to the Project, Noticed Variation, and Noticed Alternative Route. The receptor reference point for the sound levels presented are at a distance of 50 feet from the source, and have also been extrapolated to estimate noise levels at the nearest residential building. Noise is assumed to be generated by a number of pieces of equipment at various locations within the ROW, as appropriate for each phase of construction.

The Company also assessed the number of residential units that could be impacted by the typical construction sound levels at a distance of 50 feet from the limit of work for each route. For the Project, the limit of work along the MBTA ROW was defined as the outer edge of the 30-foot-wide corridor of tree clearing, with expanded areas at splice vault locations measuring approximately 40 to 50 feet wide by 50 feet long. For the Noticed Variation, the limit of work along the MBTA ROW was defined as the full corridor of tree clearing (i.e., the ROW boundary). For the Noticed Alternative Route and for the public roadway portions of the Project and Noticed Variation, the limit of work was defined as the edge of pavement.

5.25.1 Project

Sound levels from typical construction equipment that will be used during construction of the Project are listed below in Table 5-19. These levels range from 60 dBA to 90 dBA at a distance of 50 feet from the construction activity. The only residential unit located within 50 feet of the limit of work for the Project along the ROW is located 34 feet from the limit of work. There are 15 residential units located within 50 feet of the limit of work for the Project along the roadway portion; the closest residence is located 39 feet from the limit of work.

Table 5-19: Anticipated Construction Sound Levels for the Project

Activity	Types of Equipment	Typical Sound Levels at 50 feet (dBA)	Estimated Sound Levels (dBA) at Closest Residence along Project
	MBTA ROW Portion (1 residential unit within 50 feet; closest residence at 34 feet)[1]		
Vegetation Removal and ROW Mowing	Grapple trucks Bulldozers Track-mounted mowers Motorized tree shears Log forwarders Chippers Chain saws Box trailers	84 to 98	87 to 101
Erosion/Sediment Controls and Access Way Construction	Dump trucks Bulldozers, excavators, backhoes Graders Forwarders Grapple trucks	80 to 93	83 to 96
Restoration of the ROW	Bulldozers Excavators Tractor-mounted York rakes Straw blowers Hydro-seeders	80 to 90	83 to 93
Splice vault Installation	Splice vault crane Backhoe Dump truck	82 to 90	85 to 93
Trench Excavation, Duct Bank Installation, and Pavement Patching	Backhoe Dump truck	82 to 90	85 to 93
Cable Pulling, Splicing and Testing	Generator Air conditioner Splicing van	60 to 84	63 to 87
	Roadway Portion (15 residential units within 50 feet; closest residence at 39 feet)[1]		
Splice Vault Installation	Pavement Saw Splice vaults Crane Asphalt Paver Backhoe Dump Truck	82 to 90	85 to 93
Trench Excavation, Duct Bank Installation, and Pavement Patching	Pavement Saw Concrete Batch Truck Pneumatic Hammer Mounted Impact Hammer (Hoe Ram) Backhoe Dump Truck	82 to 90	85 to 93
Cable Pulling, Splicing and Testing	Generator Air conditioner Splicing Van	60 to 84	63 to 87
Final Pavement Restoration	Asphalt Paver	85	88

1 Estimated sound levels at the closest residence to both the MBTA ROW portion and the roadway portion are the same when rounded to the nearest integer.

5.25.2 Noticed Variation

Sound levels from typical construction equipment that would be used during construction of the Noticed Variation are listed below in Table 5-20. These levels range from 60 dBA to 90 dBA at a distance of 50 feet from the construction activity. There are 93 residential units located within 50 feet of the limit of work for the Noticed Variation along the ROW; the closest residence is located 11 feet from the limit of work. There are 15 residential units located within 50 feet of the limit of work along the roadway portion of the Noticed Variation; the closest residence is located 28 feet from the limit of work.

Table 5-20: Anticipated Construction Sound Levels for the Noticed Variation

Activity	Types of Equipment	Typical Sound Levels at 50 feet (dBA)	Estimated Sound Levels (dBA) at Closest Residence along Noticed Variation
MBTA ROW Portion (77 residential units within 50 feet; closest residence at 11 feet)[1]			
Vegetation Removal and ROW Mowing	Grapple trucks Bulldozers Track-mounted mowers Motorized tree shears Log forwarders Chippers Chain saws Box trailers	84 to 98	97 to 111
Erosion/Sediment Controls and Access Way Construction	Dump trucks Bulldozers, excavators, backhoes Graders Forwarders Grapple trucks	80 to 93	93 to 106
Restoration of the ROW	Bulldozers Excavators Tractor-mounted York rakes Straw blowers Hydro-seeders	80 to 90	93 to 103
Installation of Foundations and Structures	Backhoes and excavators Rock drills mounted on excavators Cluster drills with truck-mounted compressors Concrete trucks Cranes Aerial lift equipment Tractor trailers	77 to 93	90 to 106
Conductor and Shield Wire Installation	Puller-tensioners Conductor reel stands Cranes Bucket trucks Flatbed trucks	80 to 90	93 to 103
Roadway Portion (16 residential units within 50 feet; closest residence at 28 feet)			
Splice Vault Installation	Pavement Saw Splice vaults Crane Asphalt Paver Backhoe Dump Truck	82 to 90	87 to 95
Trench Excavation, Duct Bank Installation, and Pavement Patching	Pavement Saw Concrete Batch Truck Pneumatic Hammer Mounted Impact Hammer (Hoe Ram) Backhoe Dump Truck	82 to 90	87 to 95
Cable Pulling, Splicing and Testing	Generator Air conditioner Splicing Van	60 to 84	65 to 89
Final Pavement Restoration	Asphalt Paver	85	90

1 The Coolidge at Sudbury development contains 64 units; this comprises the majority of the residential units within 50 feet of construction along the MBTA ROW.

5.25.3 Noticed Alternative Route

Sound levels from typical construction equipment that would be used during construction along the Noticed Alternative Route are listed below in Table 5-21. These levels range from 60 dBA to 90 dBA at a distance of 50 feet from the construction activity. There are 61 residential units located within 50 feet of the limit of work for the Noticed Alternative Route; the closest residence is located 12 feet from the limit of work.

Table 5-21: Anticipated Construction Sound Levels for the Noticed Alternative Route

Activity	Types of Equipment	Typical Sound Levels at 50 feet (dBA)	Estimated Sound Levels (dBA) at Closest Residence along Noticed Alternative Route (12 feet)[1]
	All In-Road (61 residences within 50 feet)		
Splice Vault Installation	Pavement Saw Splice vaults Crane Asphalt Paver Backhoe Dump Truck	82 to 90	95 to 103
Trench Excavation, Duct Bank Installation, and Pavement Patching	Pavement Saw Concrete Batch Truck Pneumatic Hammer Mounted Impact Hammer (Hoe Ram) Backhoe Dump Truck	82 to 90	95 to 103
Cable Pulling, Splicing and Testing	Generator Air conditioner Splicing Van	60 to 84	73 to 97
Final Pavement Restoration	Asphalt Paver	85	98

1 This single-family home is located at 521 Hudson Road in Sudbury.

5.25.4 Mitigation Methods

To the extent practicable, for all options, the Company will comply with the noise ordinances in the municipalities within which the project is proposed as noted in Table 5-18. In some instances, and as dictated by MassDOT or the local authority, the Company may be required to perform work at night to minimize daytime impacts to commuters and abutters. The Company will work with MassDOT and the local communities through the grant of location process to formalize allowable work hours and schedule and to outline a process by which the Company could get approval to work past any winter moratoriums in public roadways to shorten the overall construction duration.

As noted above, some work tasks, once started, may require continuous operation until completion. Work requiring scheduled outages (i.e., work at existing substations and crossings of certain transportation and utility corridors) and work that requires continuous operation until completion may need to be performed on a limited basis outside of normal work hours, including Sundays and holidays.

During construction, the Company will assign a community outreach representative with the responsibility to keep abutting property owners and municipal officials informed as construction progresses and provide advanced notice of any construction modifications.

The Company and its contractors will also comply with state law (G.L. c. 90, §16A) and MassDEP regulations (310 C.M.R. 7.11(1)(b)), which limit vehicle idling to no more than five minutes. There are exceptions for vehicles being serviced, vehicles making deliveries that need to keep their engines running and vehicles that need to run their engines to operate accessories. There may be other times when idling is permitted as long as the idling is absolutely necessary (e.g., as a matter of safety). With respect to enforcement of the idling restrictions, it is the responsibility of every person on a job site to be in full compliance with all safety and environmental rules and policies. Supervisors and foremen at job sites are responsible for enforcement of these rules on a continuous basis.

5.25.5 Comparison of Potential for Construction-Related Noise Impacts

Table 5-22 summarizes the typical range of construction noise levels at 50 feet, the number of residential units within 50 feet of the limits of work for each option, and for context, the total number of residential units along each option.

Table 5-22: Summary of Typical Noise Ranges and Residential Units

	Typical Range of Sound Levels at 50 feet (dBA)	Distance from limit of work to nearest residence (feet)	# of Residential Units within 50 feet of limit of work[1]	Total # of Residential Units along Route
Project	60–98	34	16	315
Noticed Variation	60–98	11	93	315
Noticed Alternative Route	60–90	12	61	549

1 Along the Noticed Variation, The Coolidge at Sudbury development contains 64 units; this comprises the majority of the residential units within 50 feet of construction.

The range of typical construction sound levels is similar for all options. All options are within proximity to residences, with the Noticed Variation having the greatest number, primarily because of the extent of tree clearing required for safety clearances. The Project is located the furthest away from any residence.

5.26 Electric and Magnetic Fields ("EMF")

Electric fields ("EF") and magnetic fields ("MF'), collectively known as EMF, are forms of energy that surround an operating electrical device.

Electric fields are produced within an area surrounding the object (e.g., a wire) when a voltage is applied to it and are measured in units of kilovolts per meter ("kV/m"). The level of EF near an energized power line depends on the applied voltage, the distance between the conductors and the distance to the measurement location.

Magnetic fields are produced within the area surrounding the conductor or device that is carrying an electric current and are measured in units of milligauss ("mG"). The level of MF near transmission line conductors depends on the magnitude of the current, the distance between conductors and the distance to the measurement location. MF levels can vary moment to moment, depending on current flow, and so calculations to predict levels of MF generated from a specific source, in this case a new 115-kV transmission line, are based on predicted annual average and peak line loadings. The best estimate of the MF on any day is provided by calculations based on the annual average load.

Both electric and magnetic fields decrease rapidly as the distance from the source increases, and even more rapidly from electric equipment and underground transmission lines in comparison to overhead transmission lines. EF levels are further weakened by obstructions such as vegetation (trees), buildings or walls, while MF levels are not blocked by most materials. Where powerlines run in parallel, the levels of EF and MF also depend on the phasing of the conductors.

The effect of the Project on electric and magnetic fields along the route has been evaluated for all options.

Status of EMF Health Research

Research into the extremely low frequency ("ELF") EMF, which are associated with transmission lines and other electrical sources, has been ongoing for more than 40 years, with most of the focus on magnetic fields. In 2007, the World Health Organization ("WHO") published a comprehensive review of the research and reached conclusions similar to earlier reviews. While some epidemiology studies have reported statistical associations between MF and various health conditions, no health agency has determined that there is a causal relationship because of uncertainties in the epidemiology studies, and long-term studies do not show that even very high levels of MF increase cancer in animals. Finally, there is no confirmed biophysical mechanism for any adverse effect at MF at environmental levels. The perspective of the WHO is "that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields." Other national and international agencies have evaluated the scientific evidence and their conclusions are completely in line with those of the WHO, including the National Institute for Environmental and Health Sciences in 1999, the International Agency for Research on Cancer in 2002, the Australian Radiation Protection and Nuclear Safety Agency in 2003, the National Radiological Protection Board of Great Britain in 2004, and the Health Council of the Netherlands in 2005.

To update the Siting Board and the public on the status of research on magnetic fields and health, Exponent has summarized the conclusions of these national and international health and scientific agencies and evaluated new, relevant human and animal studies published between August 1, 2012 and August 31, 2016. This summary report *Research on Extremely Low Frequency Electric and Magnetic Fields and Health* is provided as Appendix 5-8. The report concludes with the current position of WHO and other agencies: that the state of the research supports the conclusion that ELF EMF at the levels encountered in an everyday environment, including those near electric power lines, do not lead to negative health impacts.

Calculated EMF Levels for the Project, Noticed Variation and Noticed Alternative Route.

The attached report, *Sudbury to Hudson Transmission Line Project – Electric and Magnetic Field Assessment* (Appendix 5-9) summarizes Exponent's calculations of the electric and magnetic fields for the proposed line along the route used for the Project, the Noticed

Variation, and the Noticed Alternative Route. Calculations were made for the specific line configurations for system operation at projected annual average and peak loadings in 2023.

For the underground portions of the Noticed Variation and for the entirety of the Project and Noticed Alternative Route, the underground transmission line is not a source of electric fields above ground, as the electric field is totally shielded by the duct bank, back fill material, and surrounding earth. As a result, electric fields from the line only will be present where the line is proposed to be constructed above ground within the MBTA ROW in the Noticed Variation. Along this portion of the route, the highest calculated electric field will be 1.2 kV/m on the ROW and 0.3 kV/m or less at the edge of the ROW.

MF levels will vary along different portions of the line consistent with the type of proposed construction (e.g., overhead, underground, and splice vault). As mentioned above, MF levels will vary with line loading (current flow) levels in response to customers' electricity use.

The calculated MF levels for the underground design at a distance of 25 feet from the center of the phase conductors at annual average loading are listed below in Table 5-23. On the overhead portion within the MBTA ROW, MF levels at the edge of the ROW are shown below in
Table 5-24. The maximum magnetic field on the ROW (or above the duct bank), as well as MF levels at peak loading, are detailed in Tables A-1, A-2 and A-3, as well in Figures B-1 to B-8 in the Exponent report.

Table 5-23: Magnetic-field levels (mG) at annual average loading for underground portions of the new line[1]

Design Option	Configuration	Location	
		–25 ft.	+25 ft.
Project	Underground - Inverted Delta	3.4	1.8
	Underground – Manhole	4.4	4.4
Noticed Variation	Underground - Inverted Delta	1.8	1.0
	Underground - Manhole	2.3	2.4
Noticed Alternative	Underground - Inverted Delta	3.6	1.9
	Underground - Manhole	4.7	4.7

[1] Calculated levels may vary based upon determination of final burial depth.

Table 5-24: Electric field levels (kV/m) and magnetic-field levels (mG) at annual average loading for the overhead portion of the Noticed Variation[1]

Calculated Field	Location	
	–ROW Edge	+ROW Edge
Electric Field (kV/m)	0.3	<0.1
Magnetic Field (mG)	3.8	2.1

[1]For reference, the MF at a distance of 25 feet from the conductors of the overhead line is approximately 4.4 mG.

EMF Exposure Guidelines and Public Policy

There are no federal or state laws or regulations in Massachusetts that limit human exposure to EMF. There are international exposure guidelines that have been developed by the International Commission on Non-Ionizing Radiation Protection ("ICNIRP") and the

International Committee on Electromagnetic Safety ("ICES") to protect workers and the general public from known adverse effects at very high levels of EMF.[37]

The WHO has recommended the EMF guidelines above as protective of public health and further recommended that in light of the evidence reviewed (see conclusions of that review above) implementing very low-cost measures to reduce exposure to magnetic fields is reasonable when constructing new facilities (WHO, 2007).

The Siting Board has stated that "the Board has recognized public concern about EMF and has encouraged the use of practical and cost-effective design to minimize magnetic fields along transmission ROW,"[38] an approach consistent with the recommendations of the WHO.

5.26.1 Comparison of EMF

The magnetic field levels associated with the Project are slightly lower than those calculated for the Noticed Alternative Route due to the shorter length of the Project route. Magnetic field levels for the Project beneath city streets in Hudson (approximately 2.0 miles) would be somewhat higher than for the Noticed Variation over the same portion of the route due to higher expected loading. However, the magnetic field levels associated with the underground portion of the Project within the MBTA ROW (approximately 7 miles) will decrease more quickly with distance than those of the overhead portion of the Noticed Variation. In addition, there will be no electric field associated with the Project while the overhead construction of the Noticed Variation on the MBTA ROW would have a small, but non-zero nominal electric field.

All project options presented are consistent with the recommendations of the WHO and the Siting Board to take low-cost measures of reducing magnetic-field levels. The Project will have reduced field levels at property lines along the route. In the Notice Variation, the line is proposed to be constructed underground beneath city streets in Hudson, where the density of nearby residences is greatest, and overhead for the remainder of the route along the MBTA ROW. Where the transmission line is proposed to be constructed overhead, the height of conductors above ground exceeds National Electrical Safety Code standards for conductor clearance of 115-kV lines, which provides greater protection against inadvertent contact with

[37] The ICNIRP reference levels are 2,000 mG and 4.2 kV/m (ICNIRP, 2010); the ICES maximum permissible exposure levels are 9,040 mG and 5 kV/m (ICES, 2002).

[38] Decision on Greater Springfield Reliability Project, EFSB 08-2/D.P.U. 08-105/08-106, 2010.

conductors, and also results in lower magnetic-field levels. In addition, the routing of the proposed line on an existing MBTA ROW reduces the length of the route and also minimizes the number of residences adjacent to the proposed line as compared to a line along the Noticed Alternative Route. These measures have the effect of minimizing exposure to the magnetic field from the line to levels commonly associated with the operation of low-voltage distribution lines that distribute power locally within communities.

The magnetic field levels for the Project, the Noticed Variation and the Noticed Alternative Route are all similar and are all far below national and international guidelines for public exposure to EMF.

5.27 Summary of Environmental Impact

The Project has the lowest potential for impacts to five out of the ten developed environmental resources: residential land uses, commercial/industrial land uses, sensitive receptors, potential for traffic congestion and construction noise. The Noticed Alternative Route has the lowest potential for impacts to two out of the ten developed resources (cultural resources and visual impacts), but would have the highest potential for impacts for the categories of traffic congestion, residential land uses, commercial/industrial land uses and impacts to sensitive receptors. The Noticed Variation would have the highest potential impacts to cultural resources and visual impacts given that this option requires the most vegetation clearing for construction.

As presented in Section 5.21, all of the project options traverse areas documented within the MassDEP database of disposal sites identified under the Massachusetts Contingency Plan and, therefore, have the potential to encounter subsurface contamination. However, through the implementation of the best management practices previously discussed, the Company concludes that the Project, Noticed Variation and the Noticed Alternative would have equal potential to encounter subsurface contamination.

As presented in Section 5.26, the MF levels for the Project, the Noticed Variation and the Noticed Alternative Route are all similar and are all far below national and international guidelines for public exposure to EMF.

Lastly, each of the project options is located adjacent to the same number of recreational uses and as such the Company concludes that the Project, Noticed Variation, and Noticed Alternative Route would have equal potential to impact recreational land uses.

The Noticed Alternative Route has the lowest potential for impacts to five out of the six natural environmental resources compared: public shade trees, wetland resource areas, coldwater fisheries/wildlife habitat, rare species habitat, and conservation lands. All of the routing options traverse areas identified as public water supply protection areas; however, as explained previously, no impacts to public water supplies are anticipated and all three options are equal for the potential to impact public water supplies.

The Noticed Alternative Route is entirely within public roadways or previously developed areas and would not require substantial removal of vegetation to facilitate construction. Within the MBTA ROW, the Noticed Variation would require the greatest amount of vegetation removal to facilitate installation, resulting in the greatest amount of impact to the natural environment. The Project would result in less impacts to the natural environment along the MBTA ROW, given the reduced amount of area needed for construction and on-going operations and maintenance of an underground transmission line.

Both the Project and the Noticed Variation reuse an existing linear transportation corridor, the inactive MBTA ROW. Moreover, the Project and the Noticed Variation provide an opportunity for the Company to partner with the MBTA and DCR by coupling construction with the development of the planned regional Mass Central Rail Trail, a multi-use path that will be managed by DCR. The multi-use path will bring a number of advantages to users, surrounding communities and the Commonwealth as a whole. In addition, the MCRT traverses the state from west to east and will advance region-wide trail network connections. Cost efficiencies and environmental benefits will be achieved by constructing the Project's access road to serve as the base of the multi-use path and by repurposing the existing bridges.[39] Impacts to the natural environment resulting from construction of the Project would be similar to the impacts resulting from the construction and operation of the planned multi-use path proposed by DCR.

As the Project advances from preliminary design to a final design phase and then transitions into the construction phase, the Company will continue to minimize potential impacts to the natural and developed environments affected. The Project will be designed and constructed to incorporate all necessary best management practices; comply with federal, state, and local rules and regulations; and provide mitigation for any impacts that cannot be avoided.

[39] The Noticed Variation would not include rehabilitation of these bridges.

5.28 Comparison of Costs

The cost estimates for all three options are classified as conceptual grade estimates with an accuracy of -25% to +50%. Conceptual grade estimates include key Project elements, but do not include final engineering detail. Conceptual grade estimates are calculated using recent costs of similar materials and construction activities, and include overheads such as costs related to design and permitting, and allowance for funds used during construction, but do not incorporate possible future variances in commodity or labor costs. The cost comparisons of the project options are provided below in Table 5-25.

Table 5-25: Total Estimated Cost (millions)

Route	Sudbury Substation	Transmission Line	Total Project Cost
Project	**$ 6.7**	**$ 84.3**	**$ 91.0**
Noticed Variation	**$ 4.2**	**$ 40.0**	**$ 44.2**
Noticed Alternative Route	**$ 6.8**	**$ 103.6**	**$ 110.4**

The total cost consists of the construction of the new transmission line and associated construction at Sudbury Substation.[40] Table 5-25 shows that the cost differentials between transmission line construction for each route and design contribute substantially to the differences in total Project costs, though there is some increase in the cost of construction at Sudbury Substation with an all underground design.

5.29 Comparison of Reliability

The Company considered reliability of the Project, Noticed Variation, and Noticed Alternative Route and determined that there was no meaningful difference between the operating characteristics for the routes or design variations under consideration. Accordingly, reliability was not a determining factor for route selection.

[40] The Project cost does not include the cost of the work at Hudson Substation, which is estimated to be $5 million.

5.30 Overall Comparison and Conclusion

The Noticed Alternative Route would result in fewer impacts to the natural environment, but a greater degree of impacts to developed environments, as construction would affect a greater number of residences and businesses and result in significant traffic disruption. The Noticed Alternative Route also would be the most expensive of the three alternatives.

The Noticed Variation is estimated to have the lowest cost, but it would have the highest degree of impacts to the natural environment.

For these reasons, the Company concludes that the Project provides the best balance of impacts to the natural and developed environments by making primary use of a previously developed MBTA ROW, at a cost approximately $19.4 million lower than the Noticed Alternative Route, while meeting the identified transmission system need. Further, the Project provides an additional public benefit by advancing the vision of DCR's Mass Central Rail Trail, saving Commonwealth funds to construct the multi-use path and reducing the overall cumulative environmental impact.

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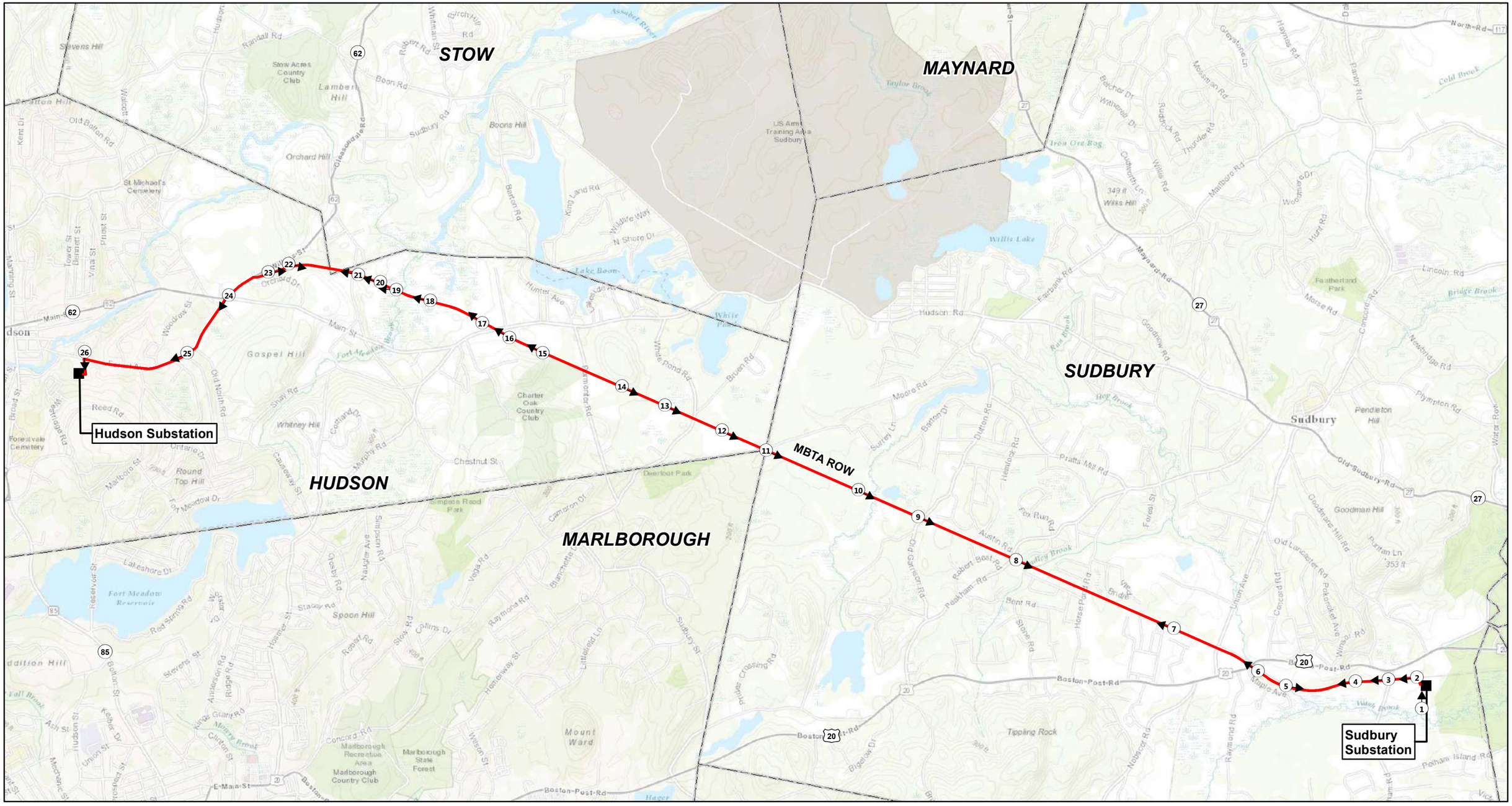

Project and Noticed Variation

Photo Location and Direction

Municipal Boundary

N

Source:
MassGIS, VHB

4/12/2017

0 3,000 6,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-1: Photo Locations - Project and Noticed Variation

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Photo 1 View north of Sudbury Substation in Sudbury, MA

Photo 2 View west of MBTA ROW to the west of Sudbury Substation in Sudbury, MA

Photo 3 View west of MBTA ROW below the Landham Road overpass in Sudbury, MA

Photo 4 View west of MBTA ROW to the west of Landham Road in Sudbury, MA

Photo 5 View east of MBTA ROW at Hop Brook in Sudbury, MA

Photo 6 View west of MBTA ROW east of Route 20 in Sudbury, MA

Photo 7 View west of MBTA ROW between Union Avenue and Horse Pond Road in Sudbury, MA

Photo 8 View east of MBTA ROW to the west of Peakham Road in Sudbury, MA

Photo 9 View east of MBTA ROW between Dutton Road and Hop Brook in Sudbury, MA

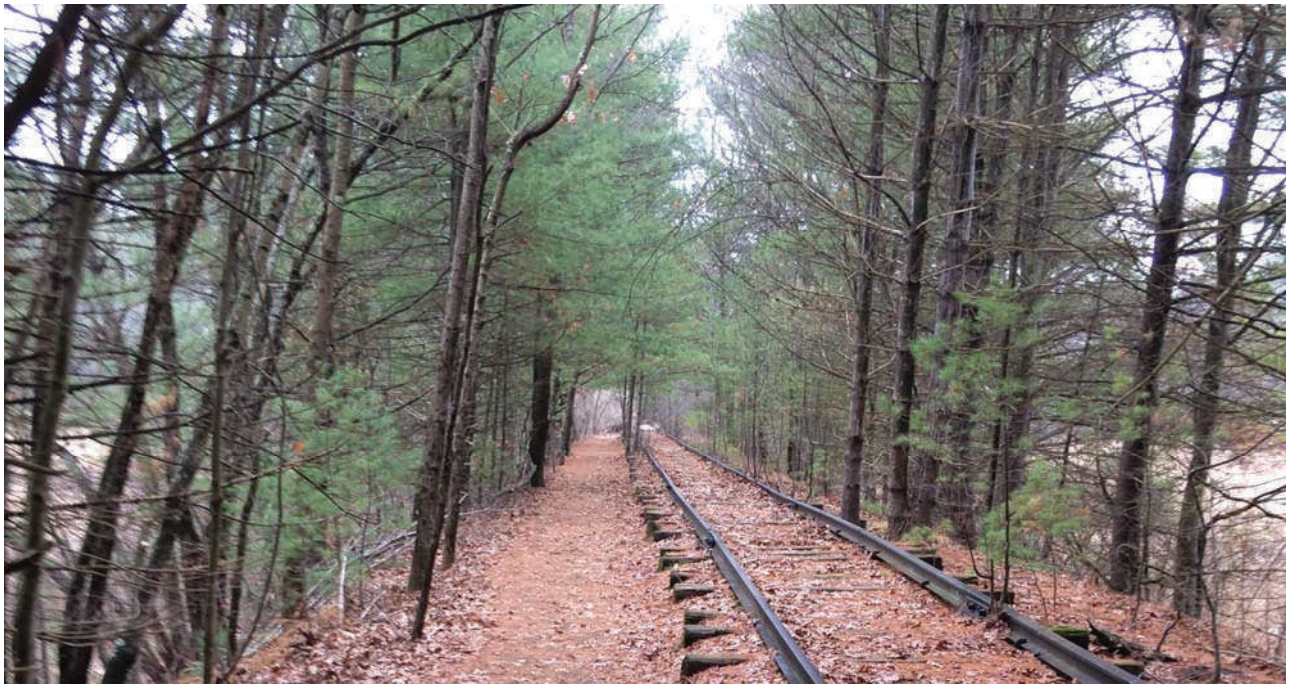

Photo 10 View east of MBTA ROW west of Hop Brook in Sudbury, MA

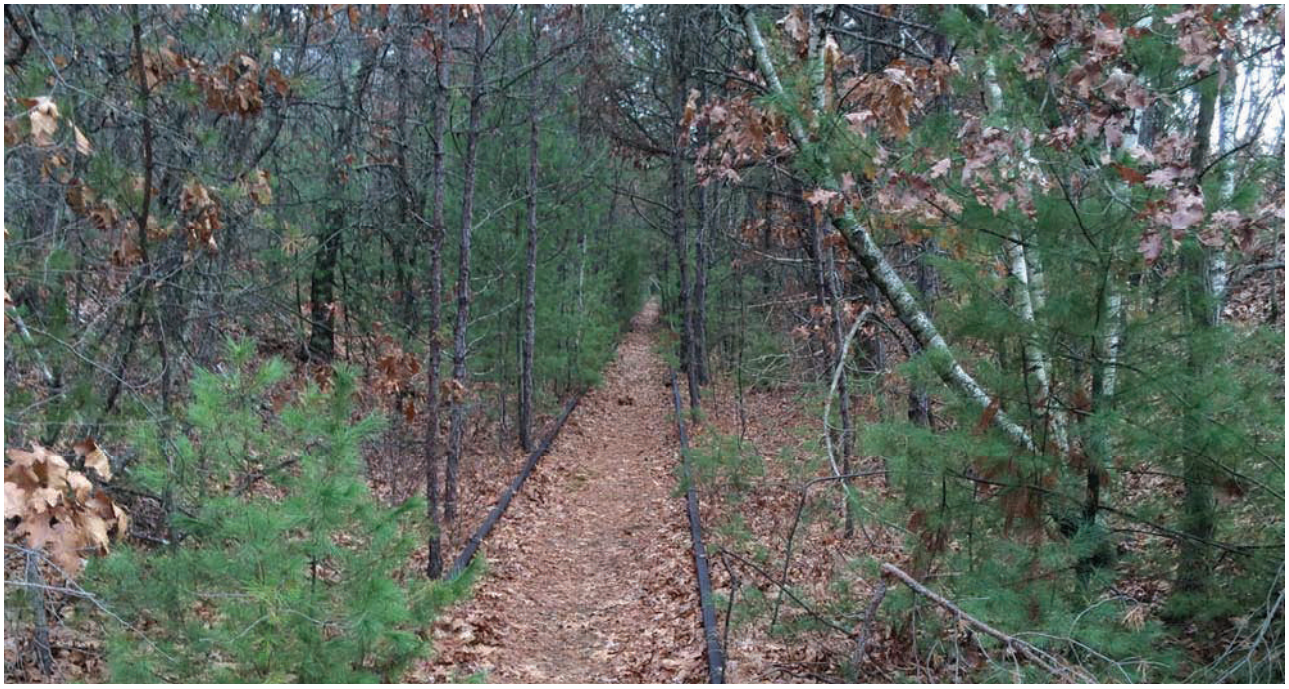

Photo 11 View east of MBTA ROW at the borders of Hudson and Marlborough in Sudbury, MA

Photo 12 View east of MBTA ROW between the border of Sudbury and White Pond Road in Hudson, MA

Photo 13 View east of MBTA ROW to the west of White Pond Road in Hudson, MA

Photo 14 View east of MBTA ROW to the east of Parmenter Road in Hudson, MA

Photo 15 View west of MBTA ROW between Parmenter Road and Main Street in Hudson, MA

Photo 16 View northwest of MBTA ROW at the intersection of Main Street in Hudson, MA

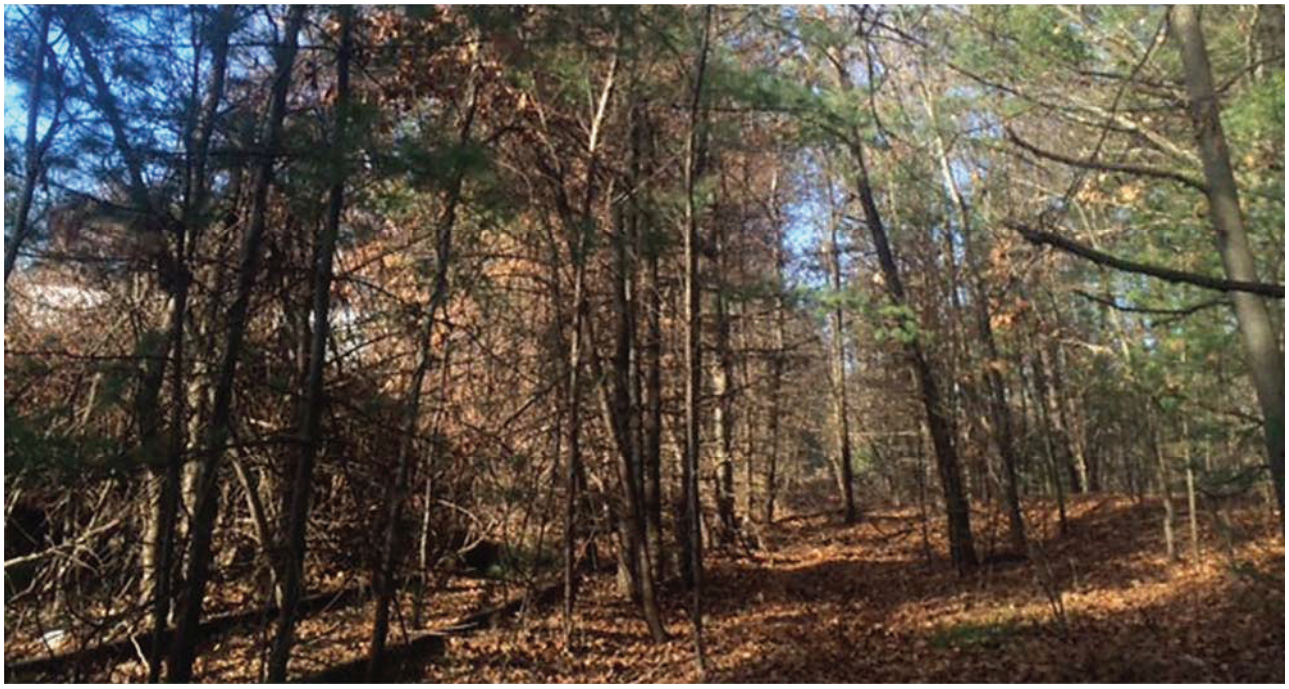

Photo 17 View northwest of MBTA ROW to the west of Main Street in Hudson, MA

Photo 18 View west of MBTA ROW to the east of Fort Meadow Brook in Hudson, MA

Photo 19 View west of MBTA ROW to the west Fort Meadow Brook in Hudson, MA

Photo 20 View west of MBTA ROW at the intersection of a private access road in Hudson, MA

Photo 21 View west of MBTA ROW to the west of Chestnut Street in Hudson, MA

Photo 22 View east of MBTA ROW to the north of agricultural fields in Hudson, MA

Photo 23 View east of MBTA ROW to the east of Wilkins Street in Hudson, MA

Photo 24 View southwest of Wilkins Street to the north of Main Street in Hudson, MA

Photo 25 View west of Forest Avenue to the south of Forest Avenue Elementary School in Hudson, MA

Photo 26 View south of Hudson Substation, located behind the Light & Power Department in Hudson, MA

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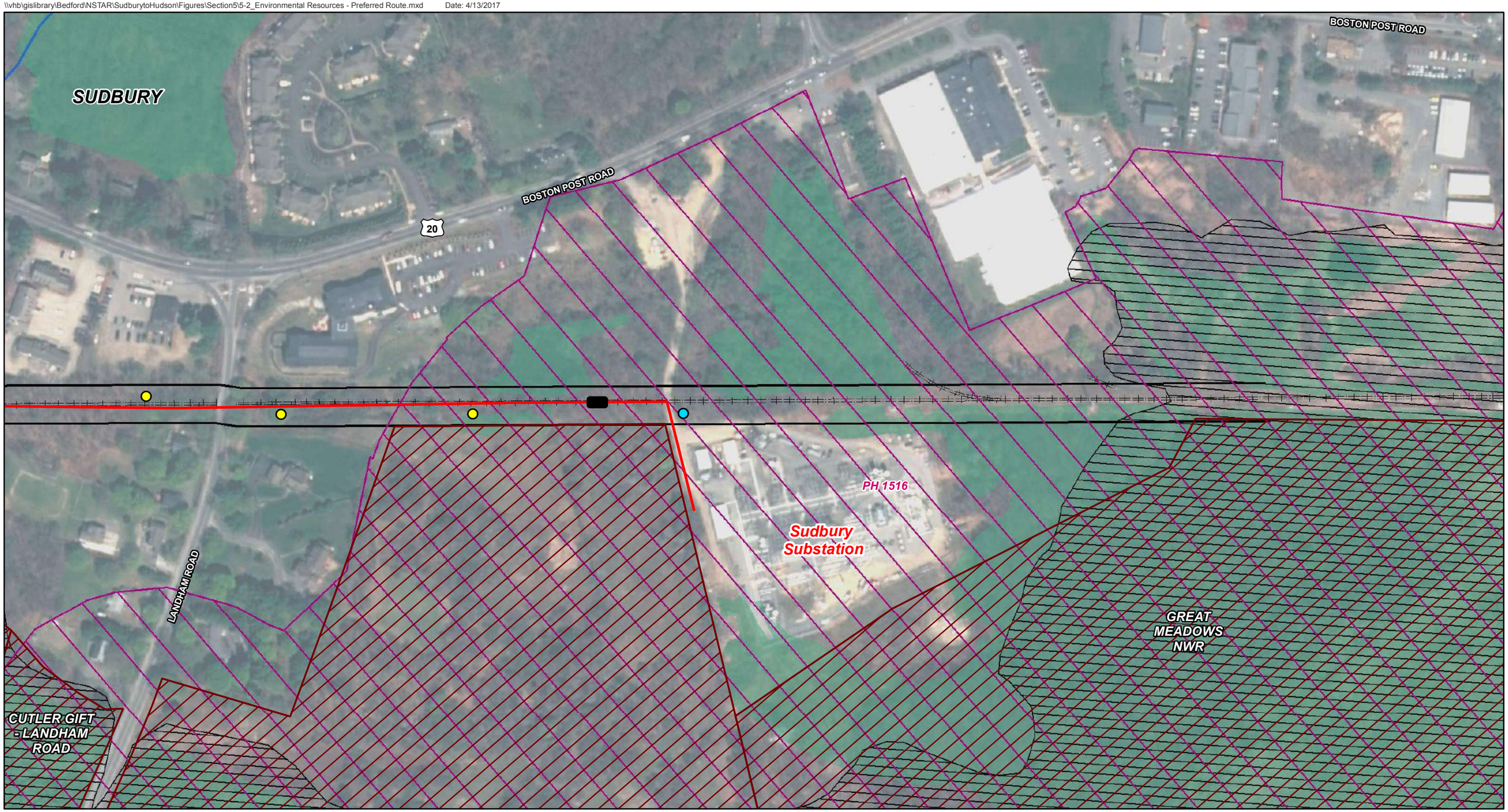

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- Stream
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- FEMA 100-year Floodplain
- Protected and Recreational Open Space
- Existing Rails
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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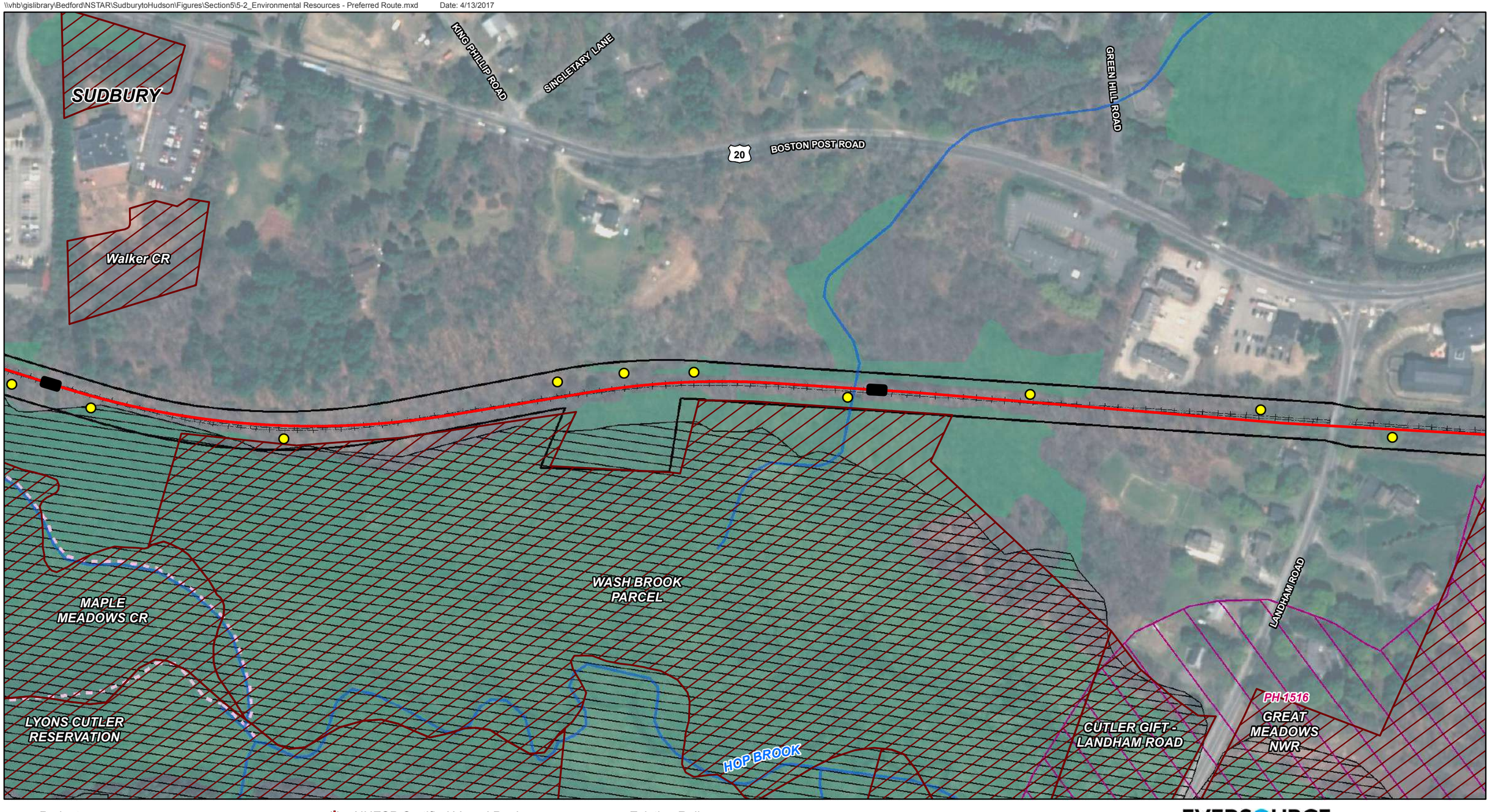

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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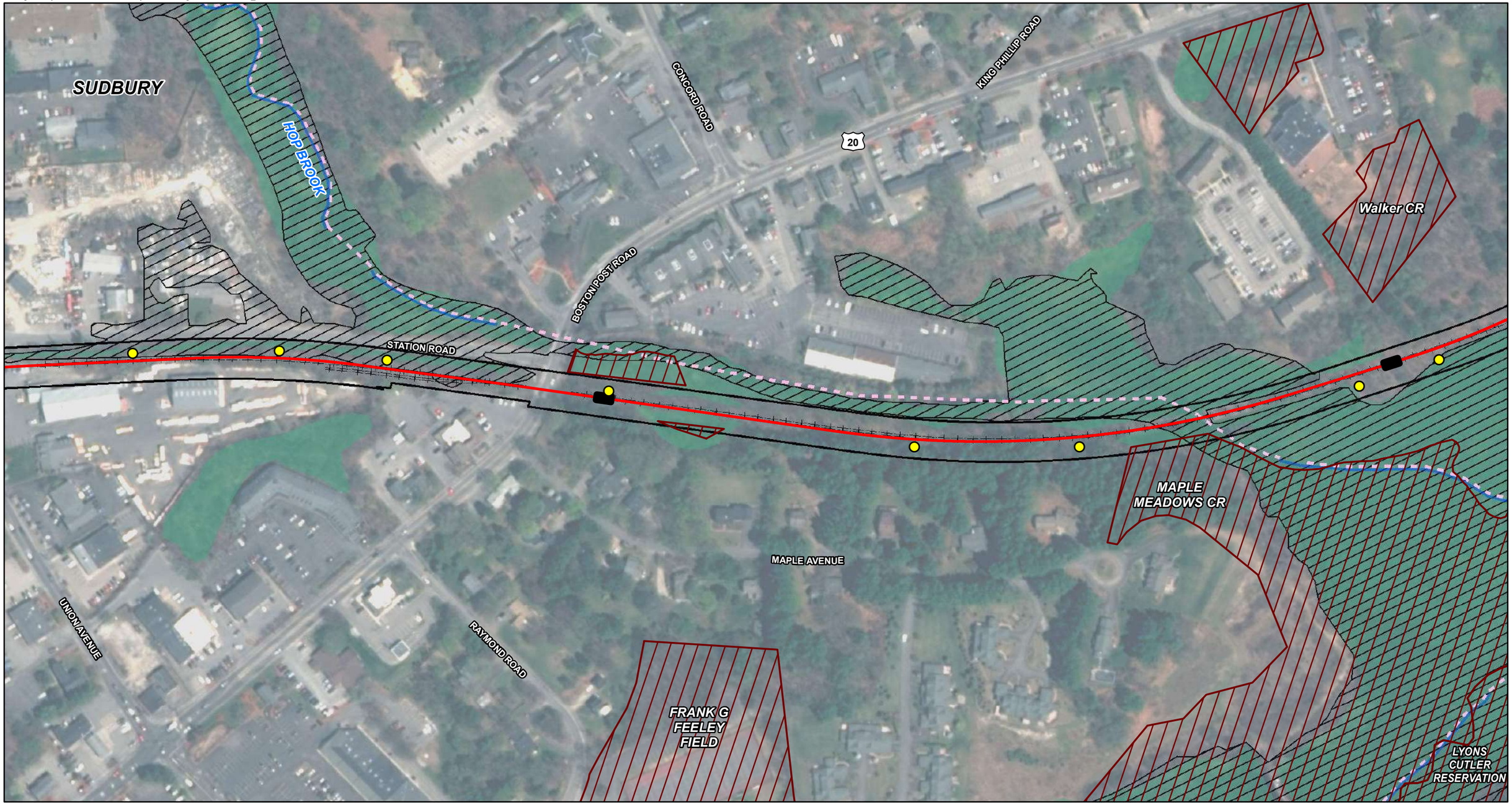

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MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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- Project
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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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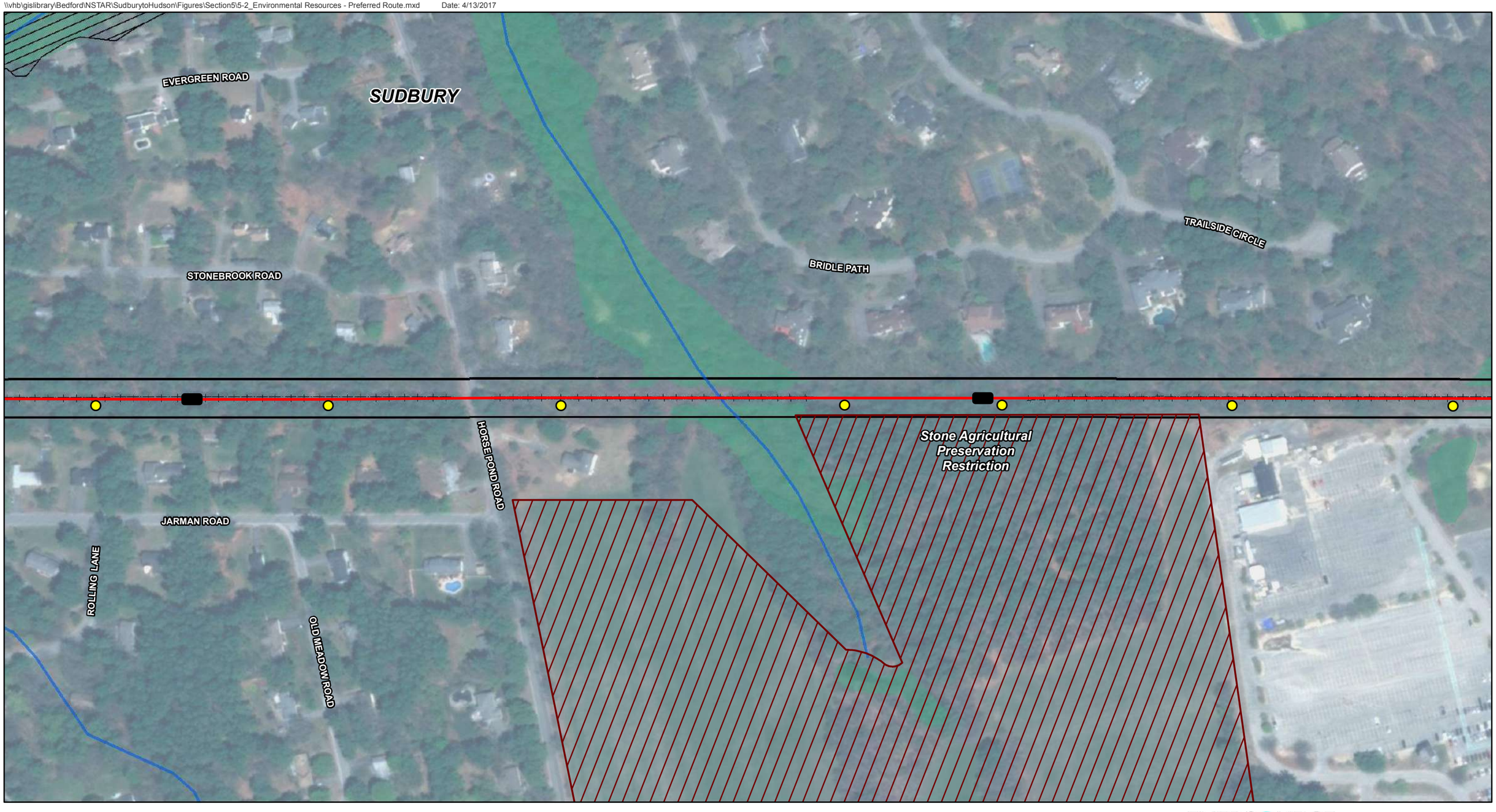

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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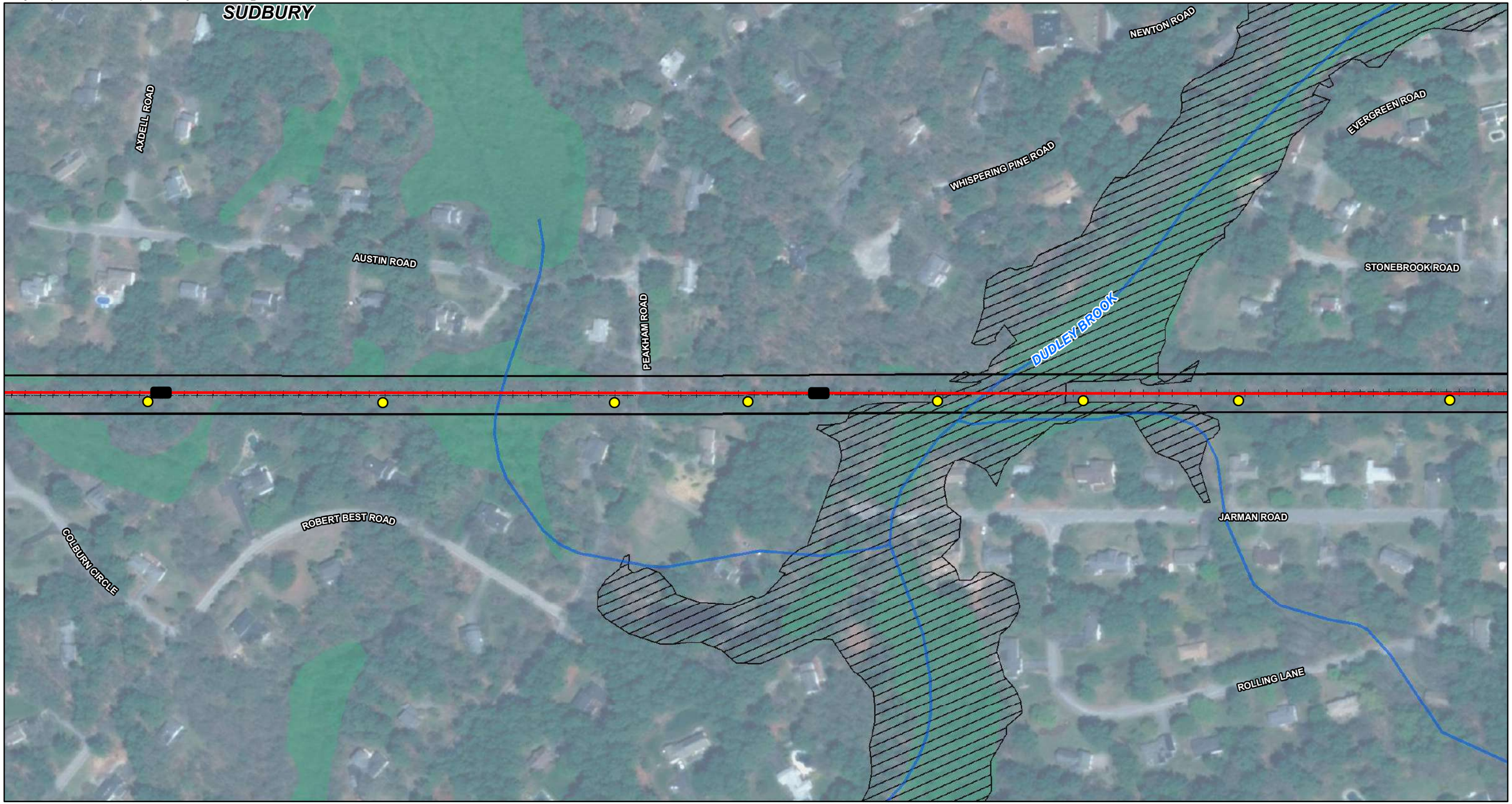

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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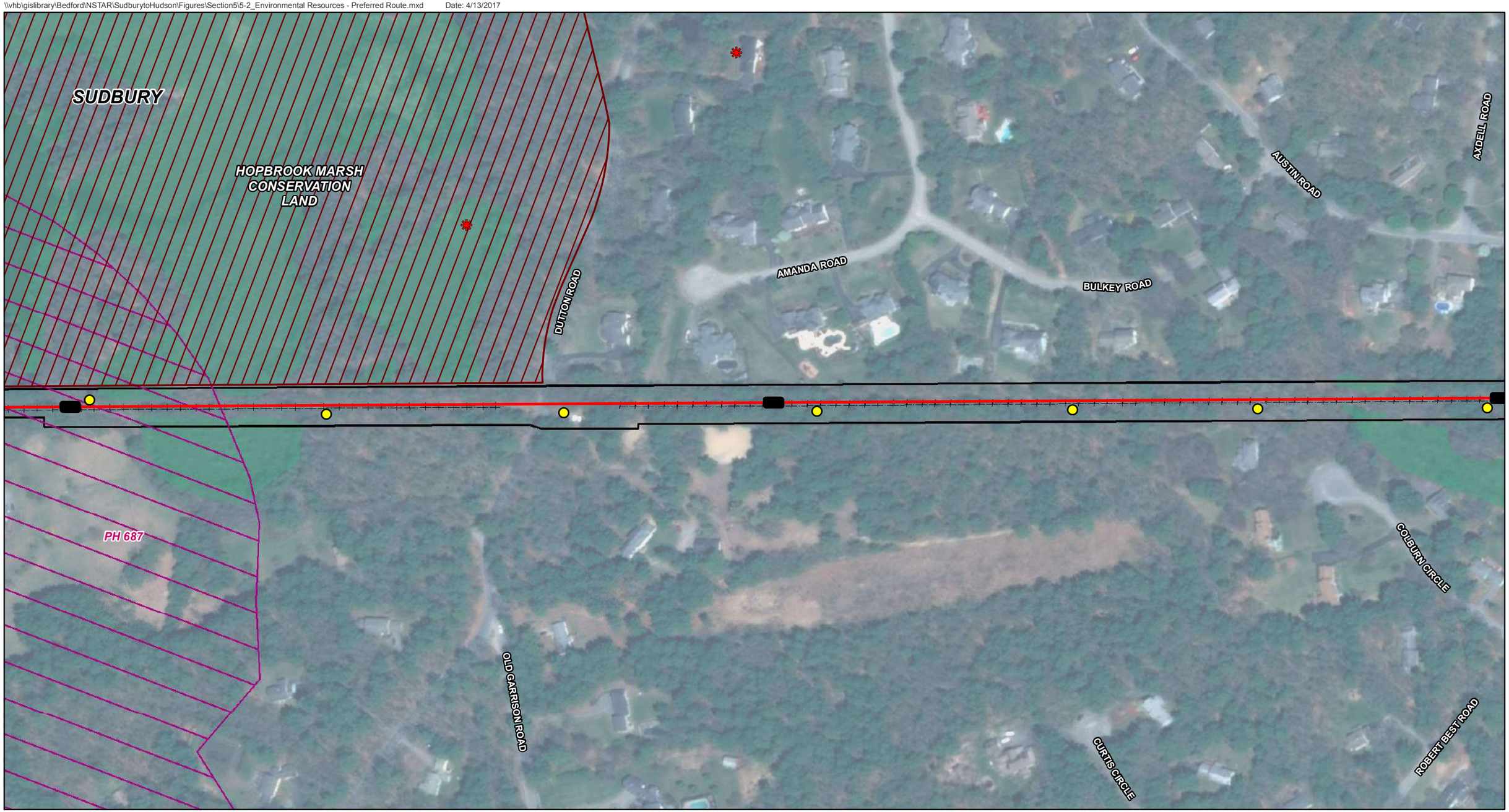

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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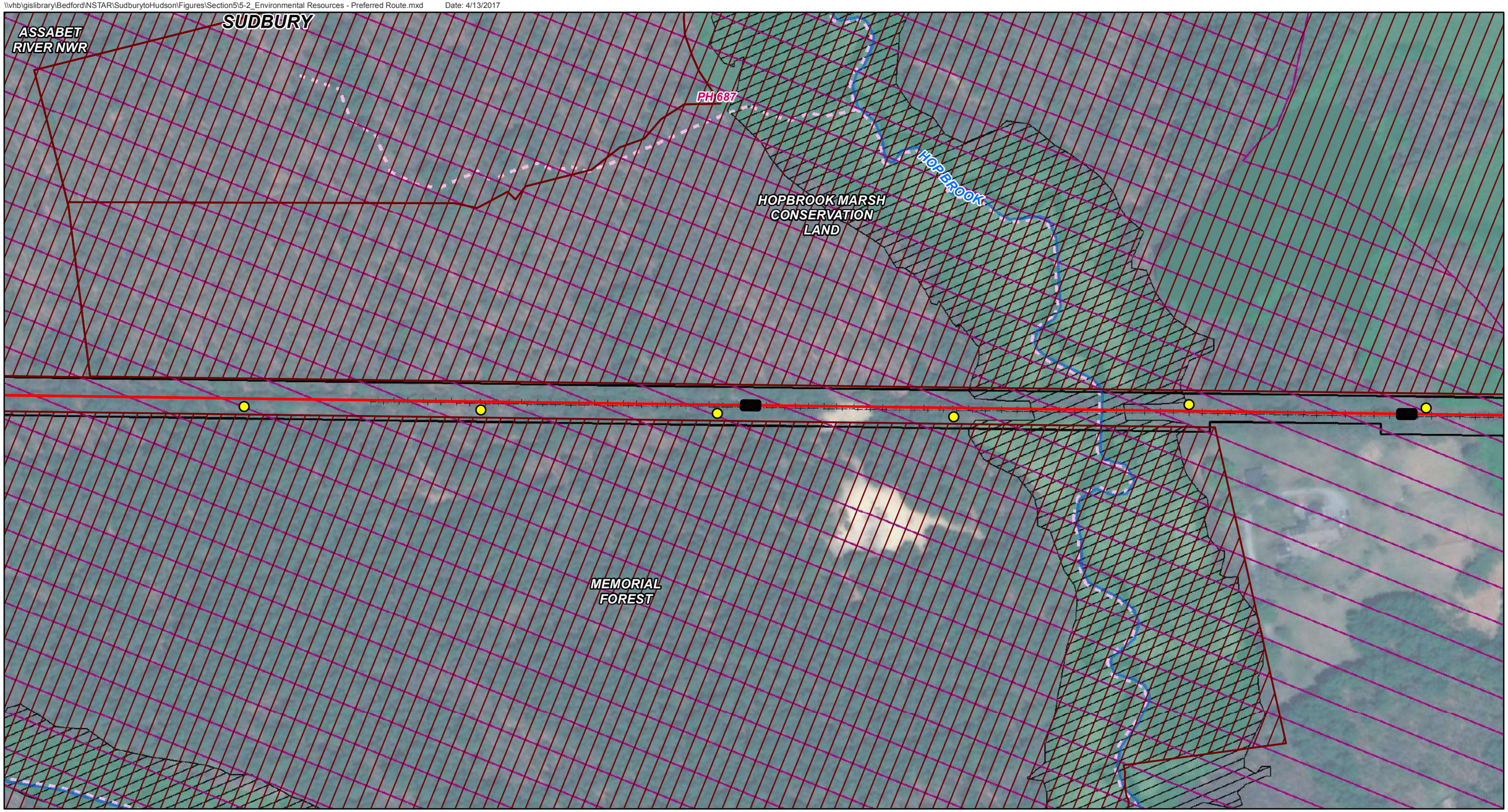

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MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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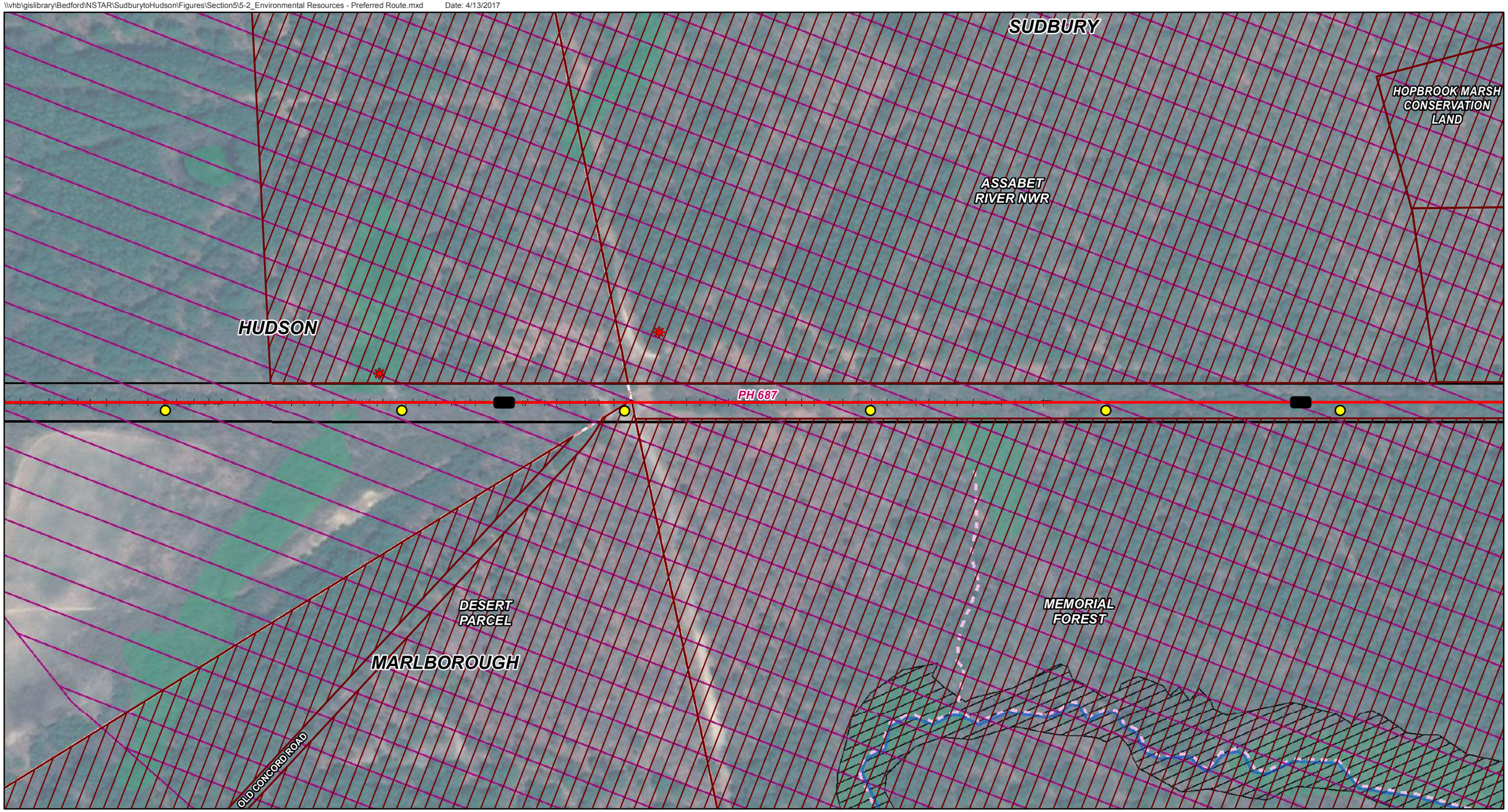

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MassGIS, 2015
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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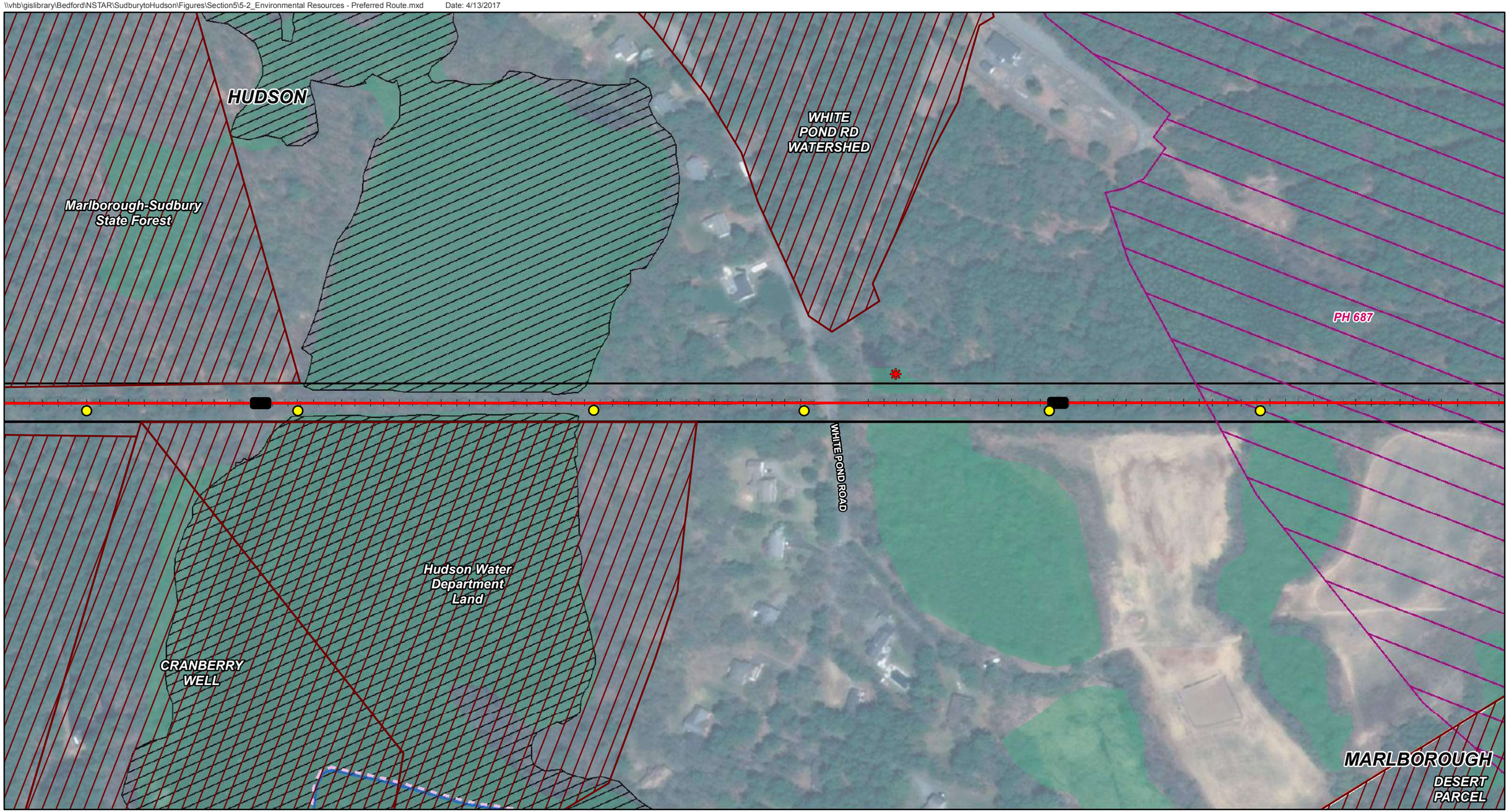

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MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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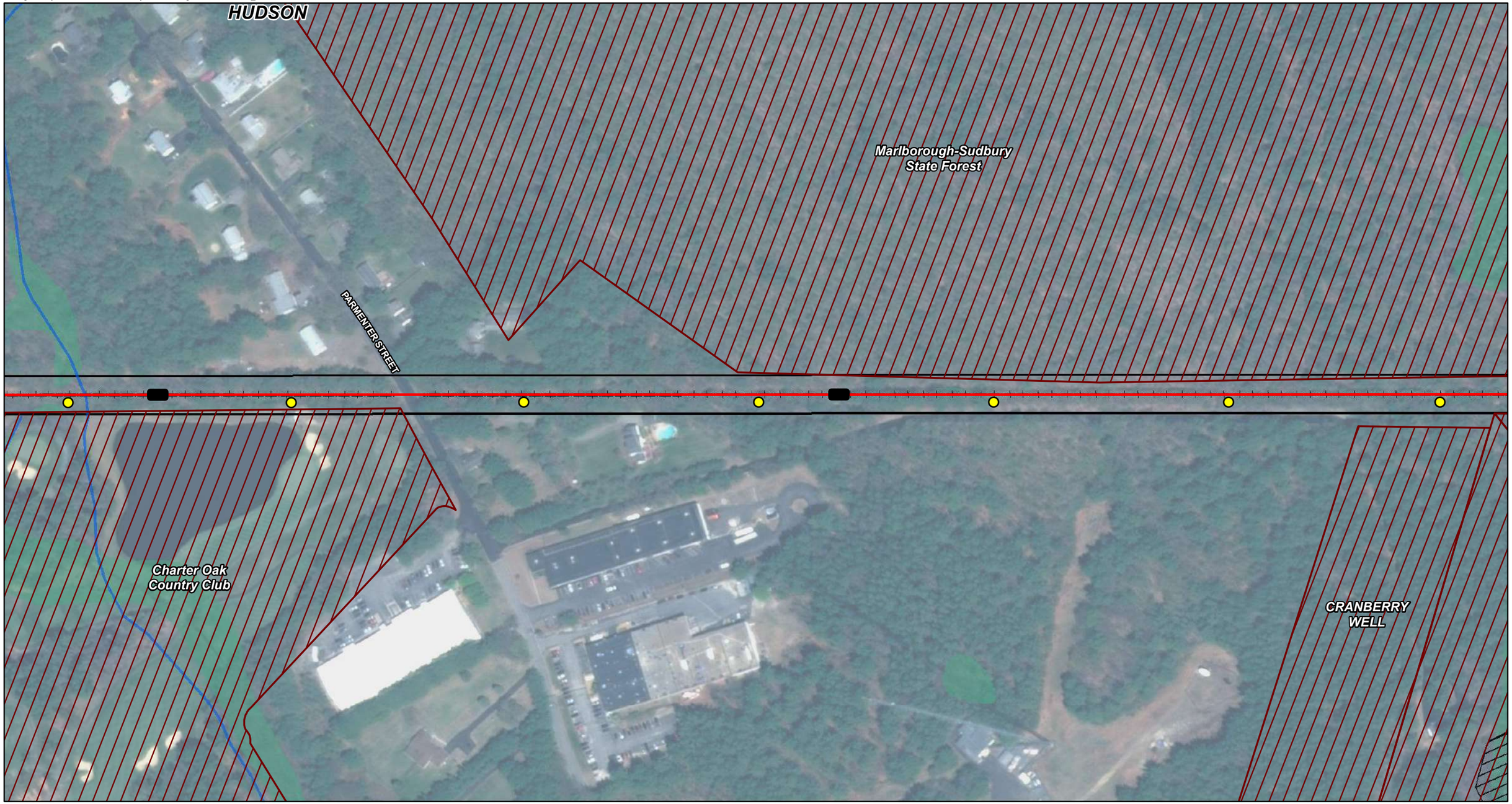

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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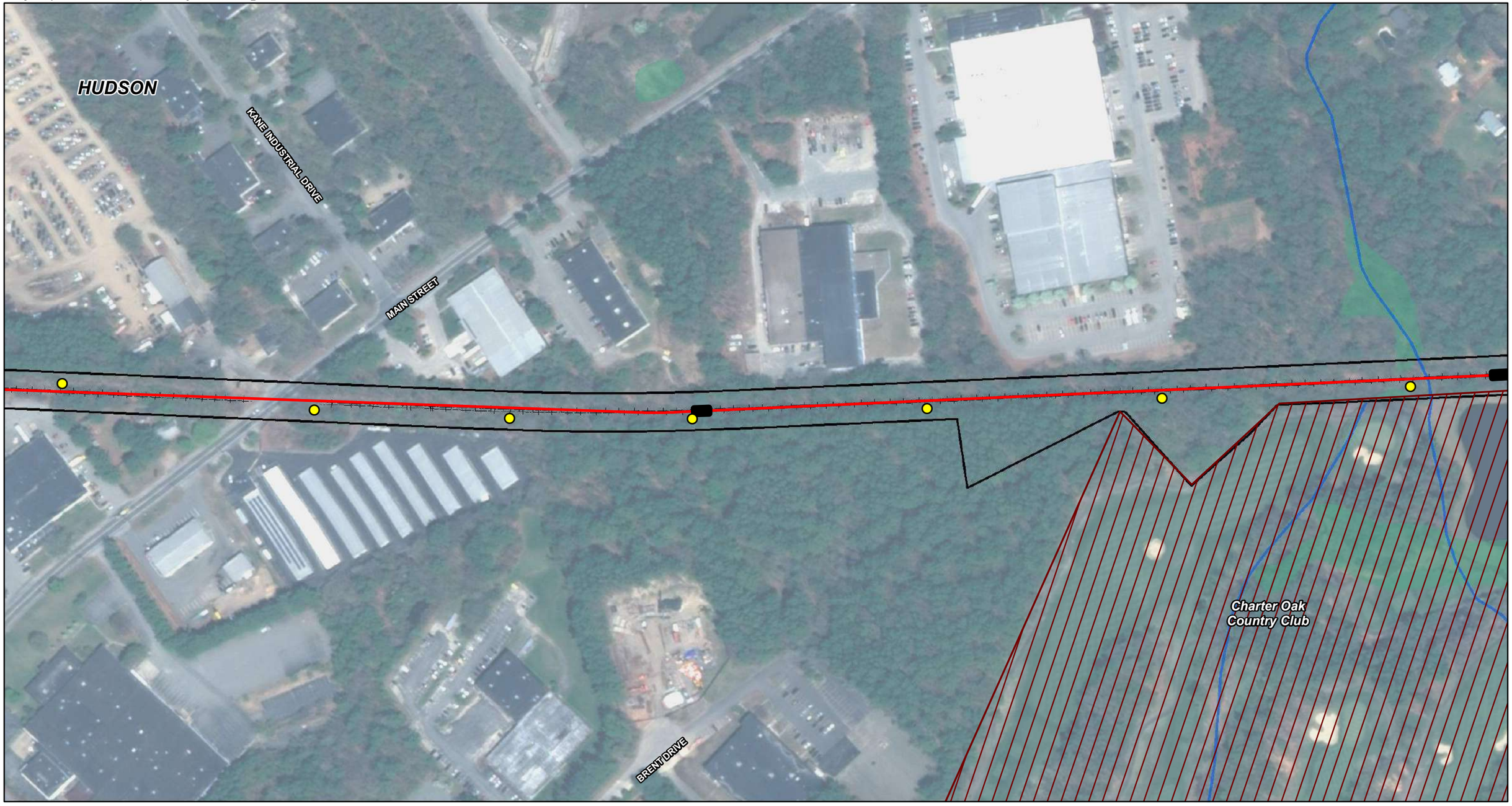

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MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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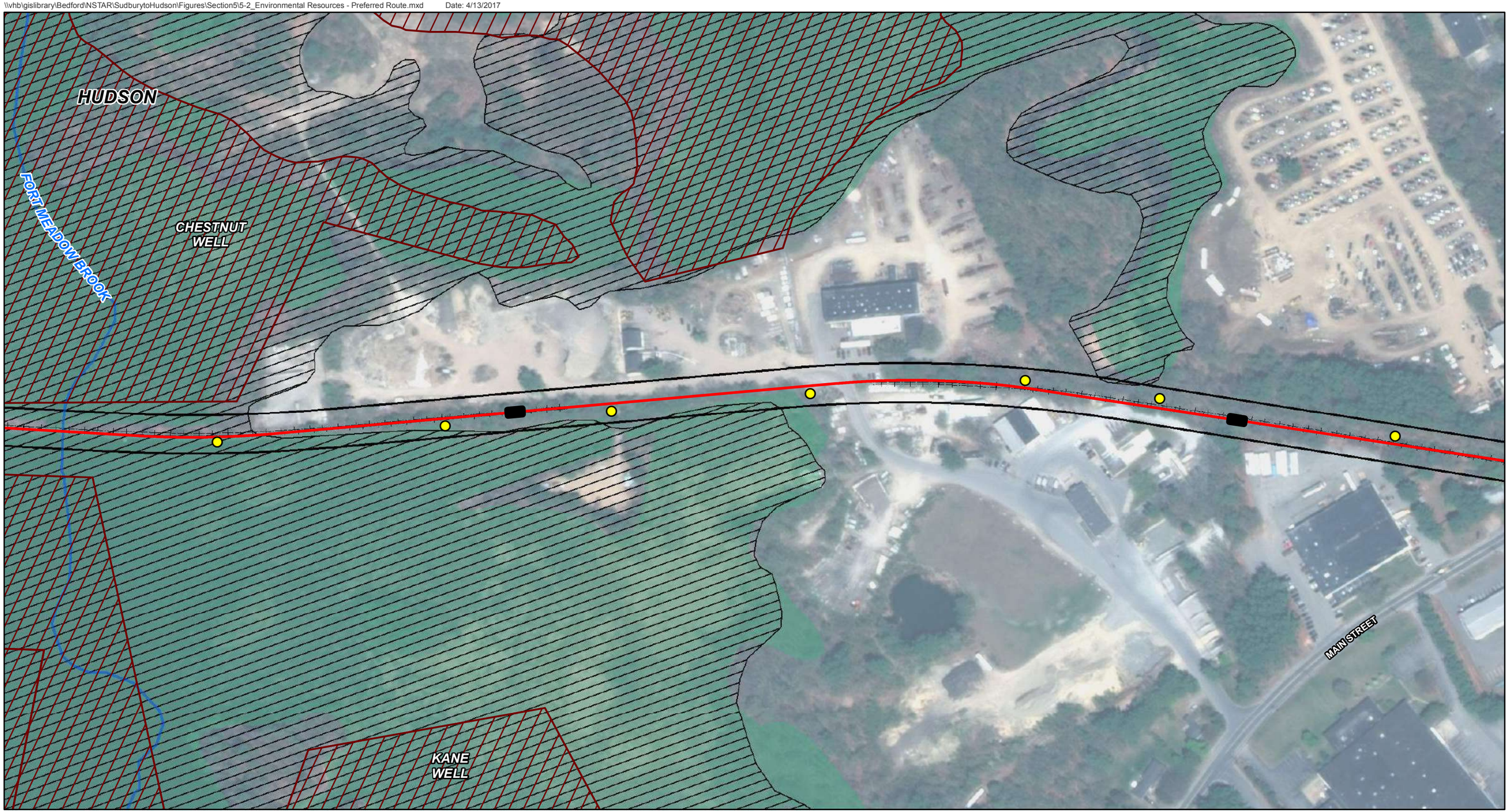

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MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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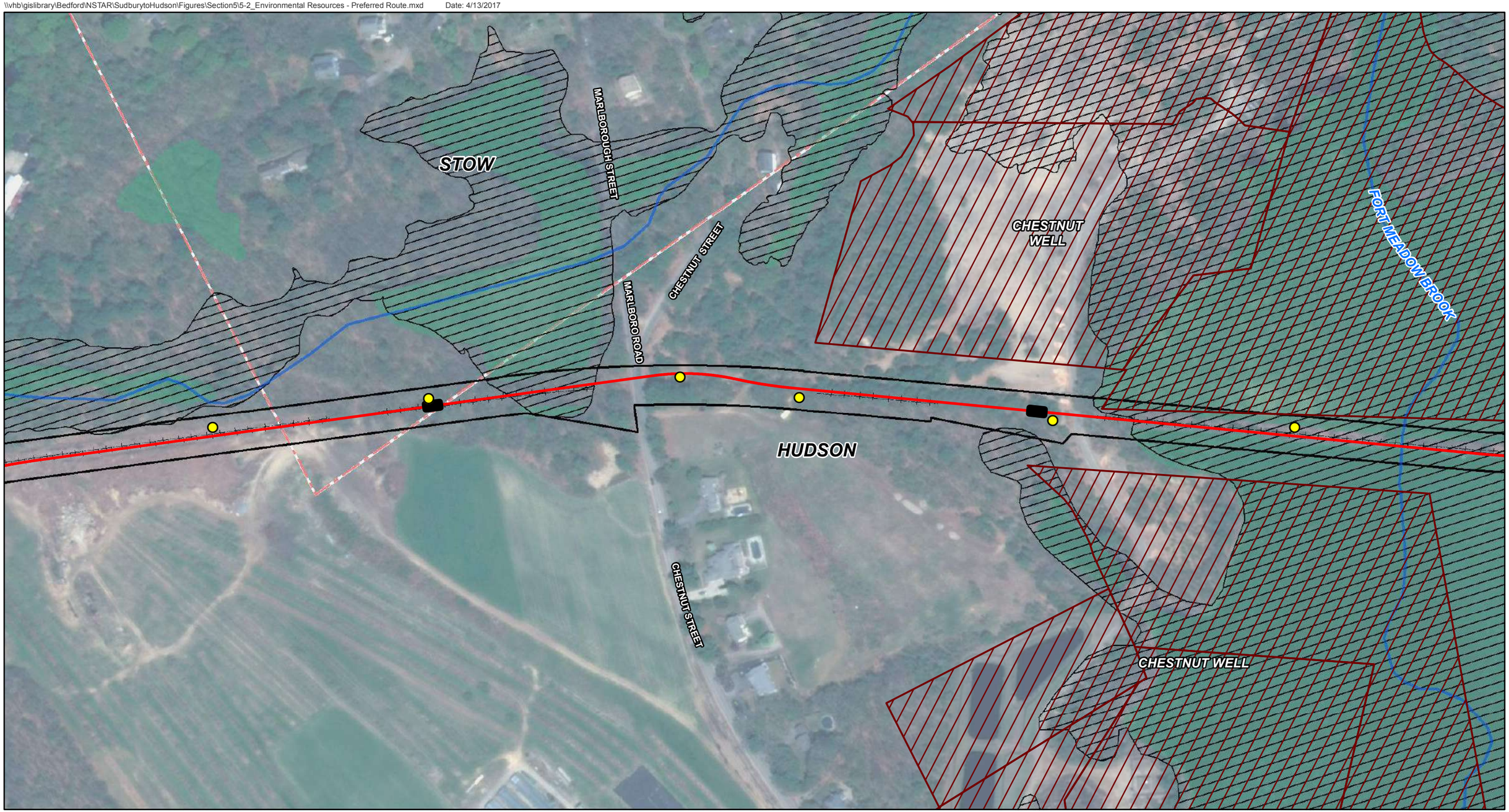

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Source:
MassGIS, 2015
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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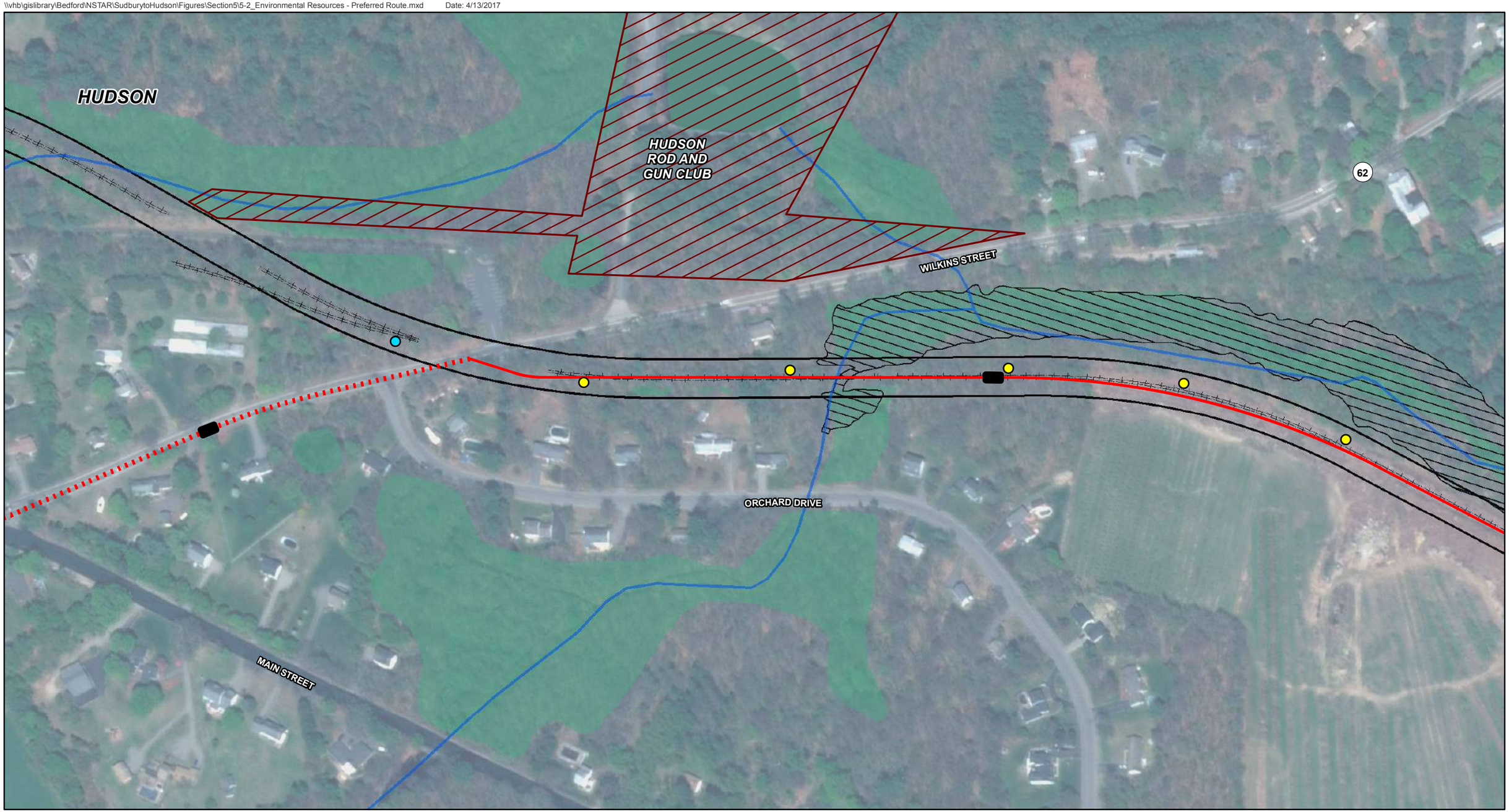

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Source:
MassGIS, 2015
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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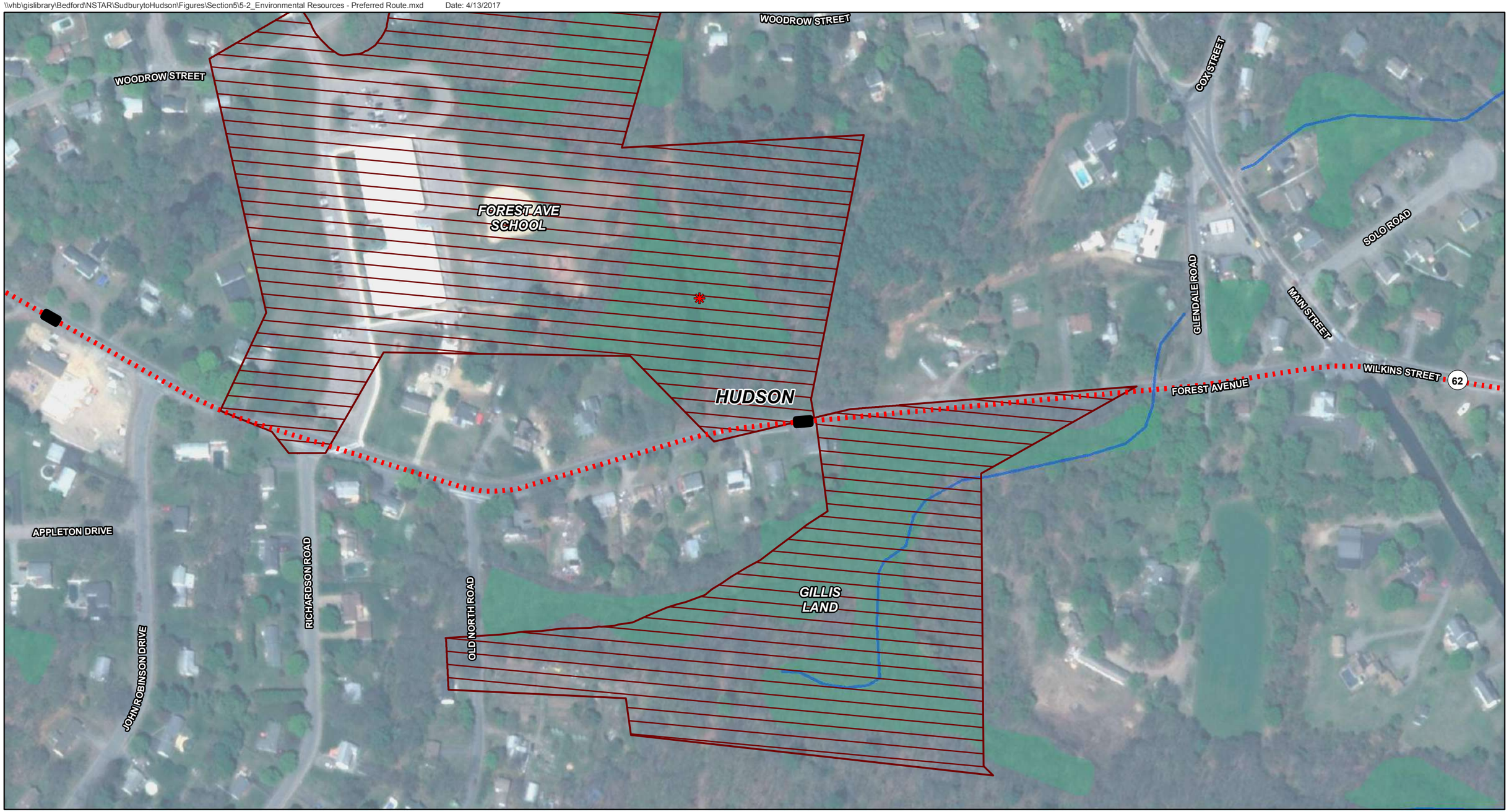

Project
Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
Noticed Variation Structure Locations
Noticed Variation Transition Structure Locations
Project Splice Vault Locations

NHESP Certified Vernal Pool
Coldwater Fishery
Stream
Wetland Resource Area
NHESP Priority & Estimated Habitat
FEMA 100-year Floodplain
Protected and Recreational Open Space

Existing Rails
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-2: Environmental Resources - Project and Noticed Variation

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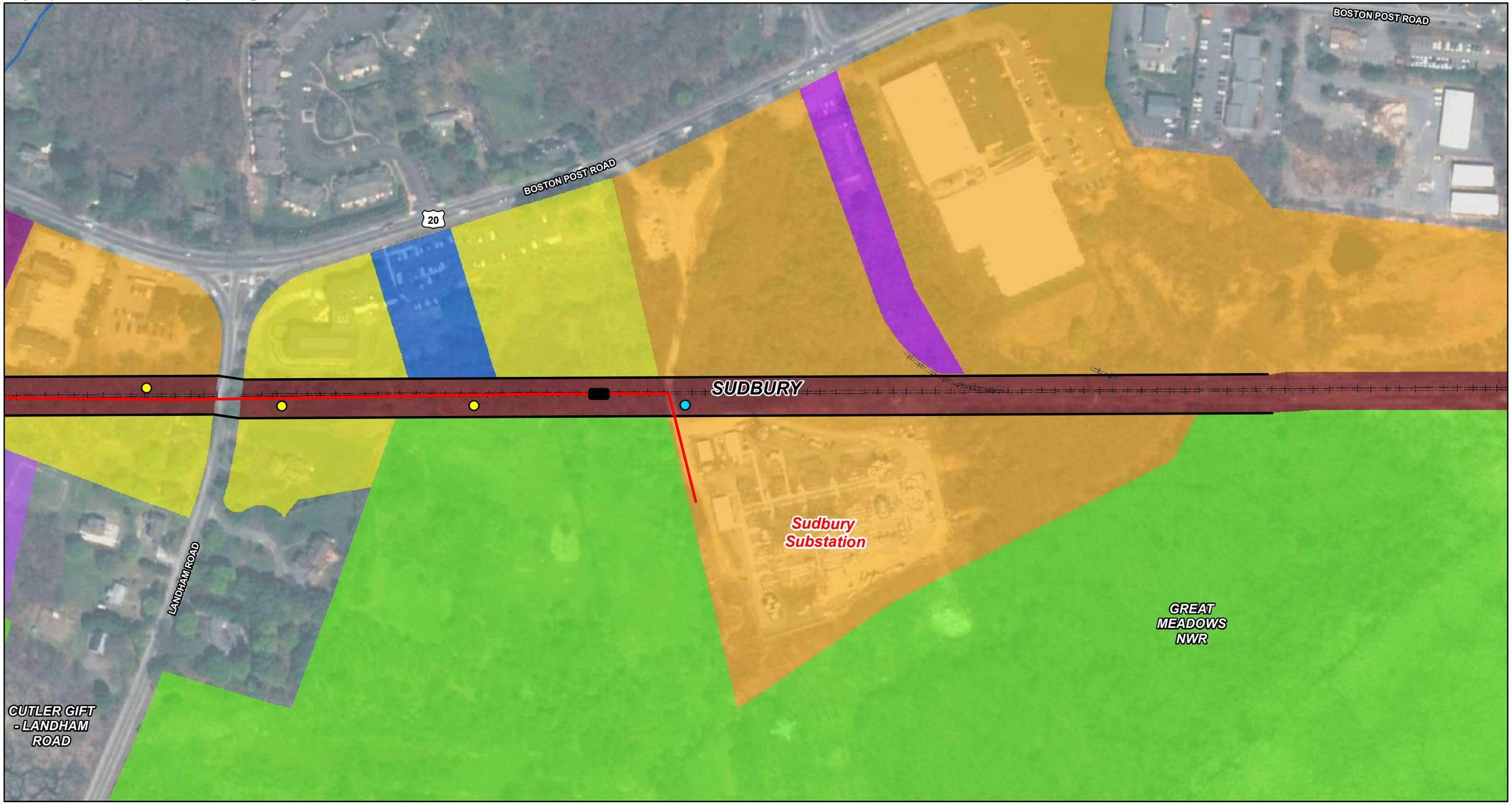

- Project
- Project and Noticed Variation (UG on Wilkins)
- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations

- Charitable
- Commercial/Industrial
- Conservation
- Government
- Mixed Use
- Religious
- Residential
- Vacant Land

- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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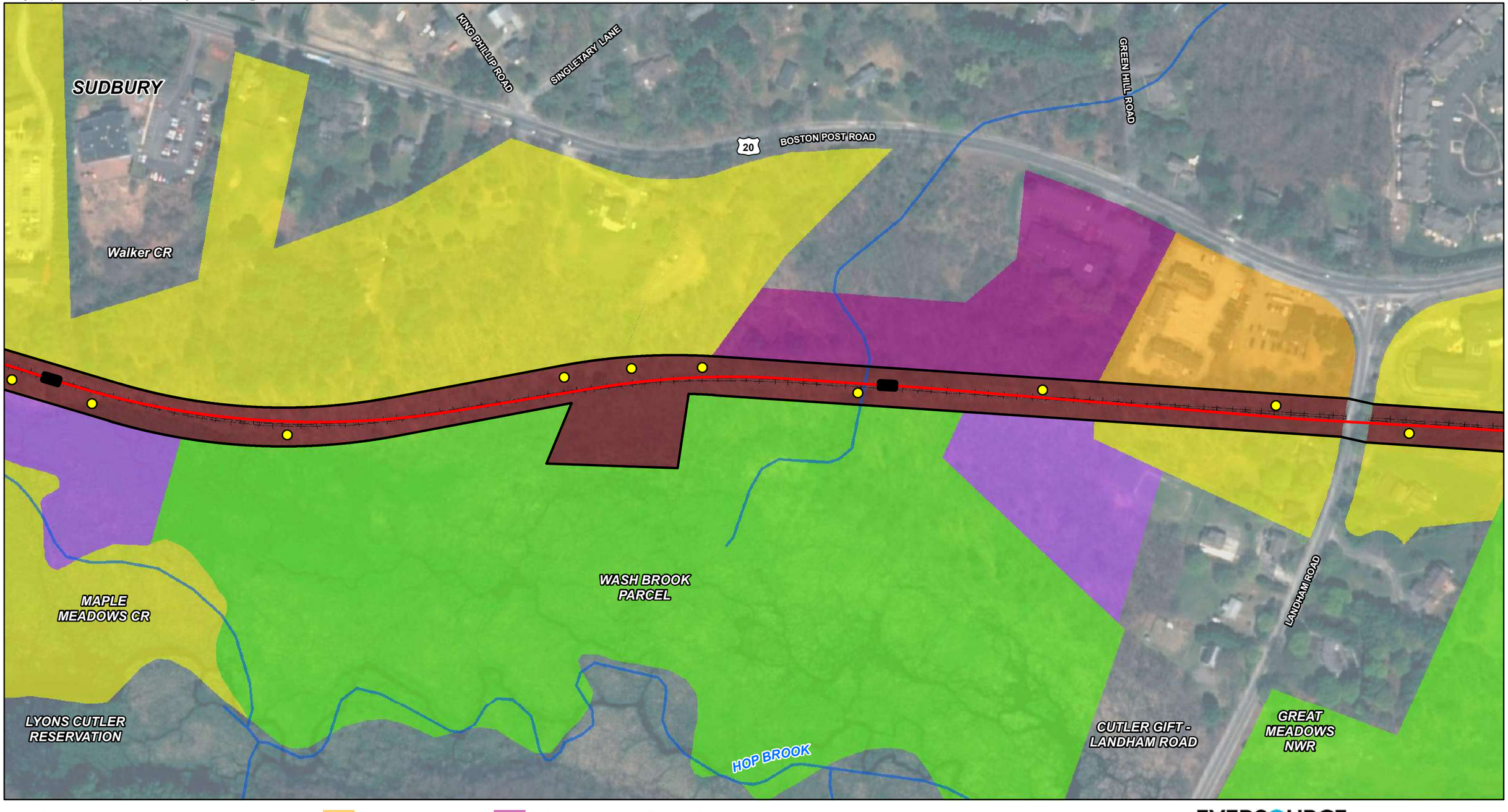

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- Commercial/Industrial
- Conservation
- Government
- Religious
- Residential
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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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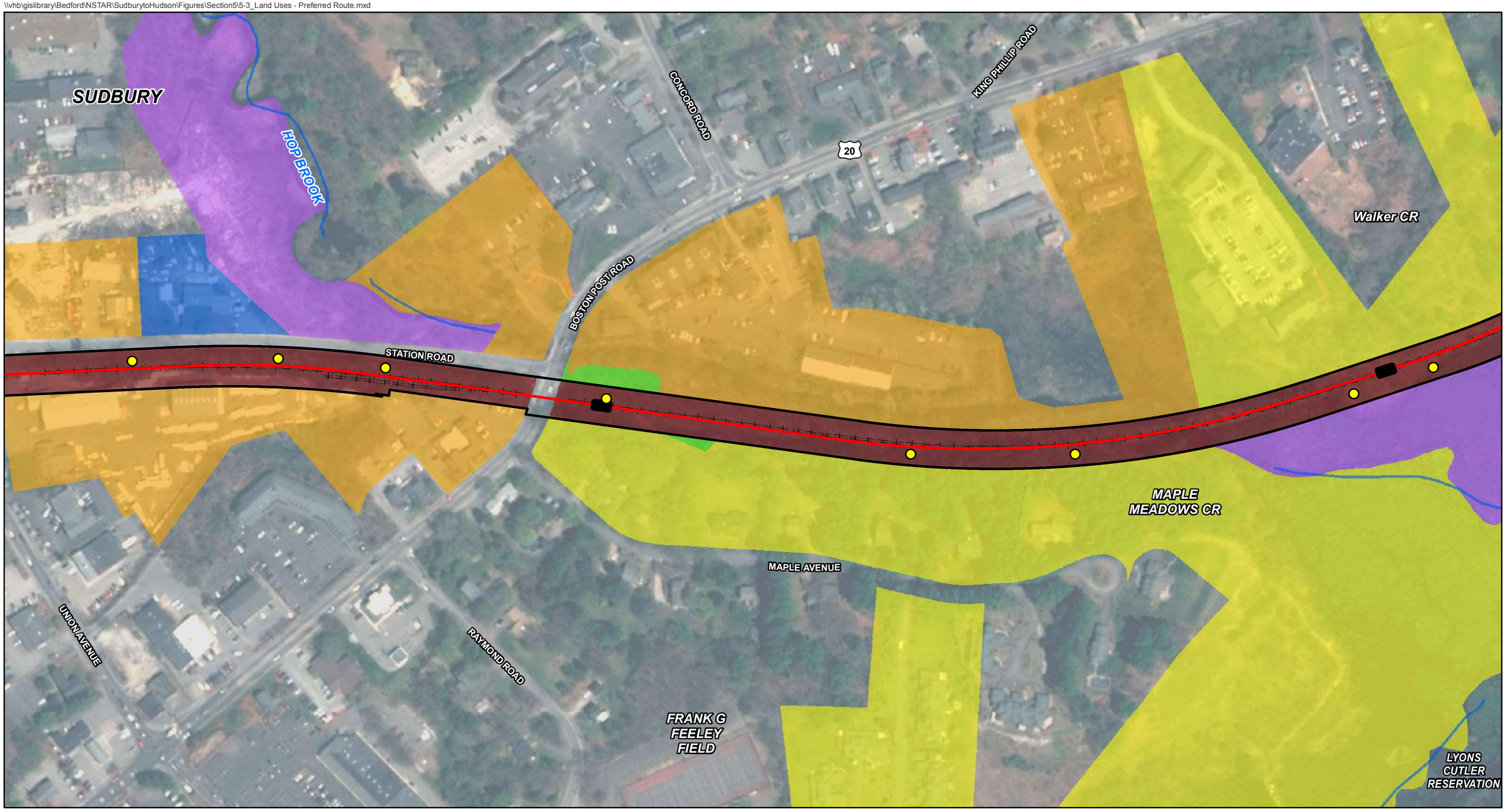

- Project
- Project and Noticed Variation (UG on Wilkins)
- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations

- Commercial/Industrial
- Conservation
- Government
- Mixed Use
- Residential
- Vacant Land
- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 5-3: Land Uses -
Project and Noticed Variation**

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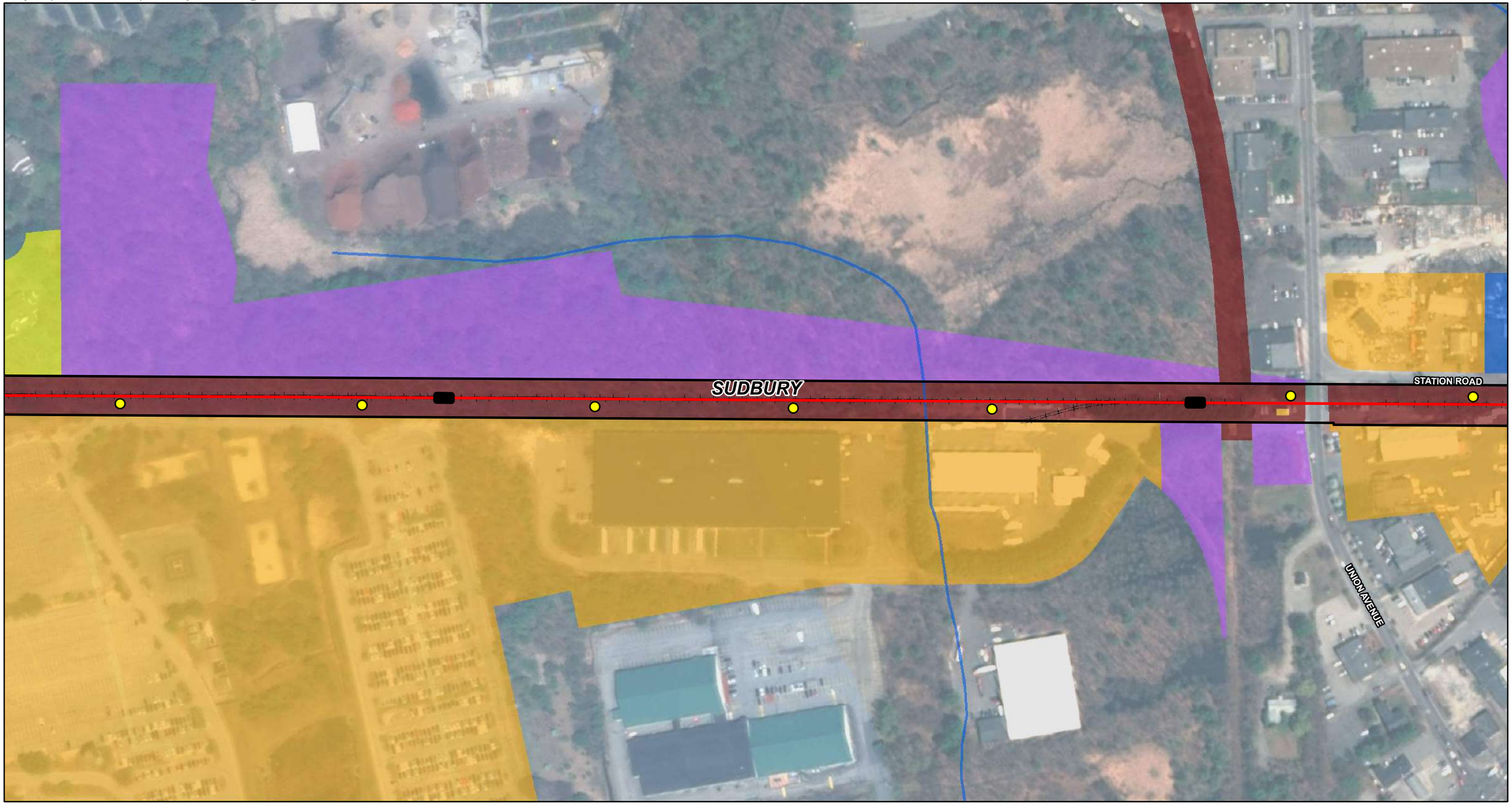

- Project
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- Government
- Mixed Use
- Residential
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- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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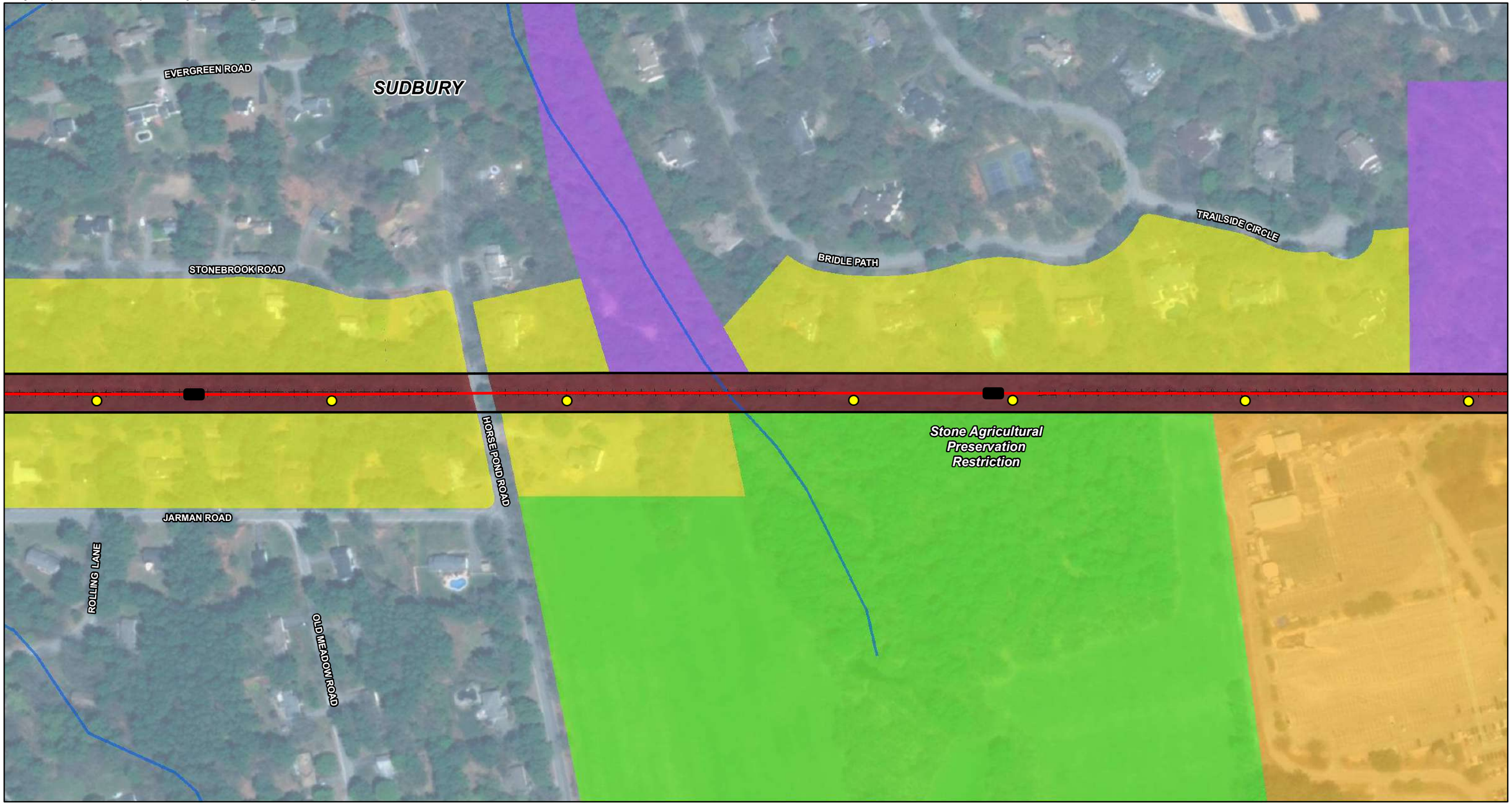

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- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations
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- Government
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- Existing Rail
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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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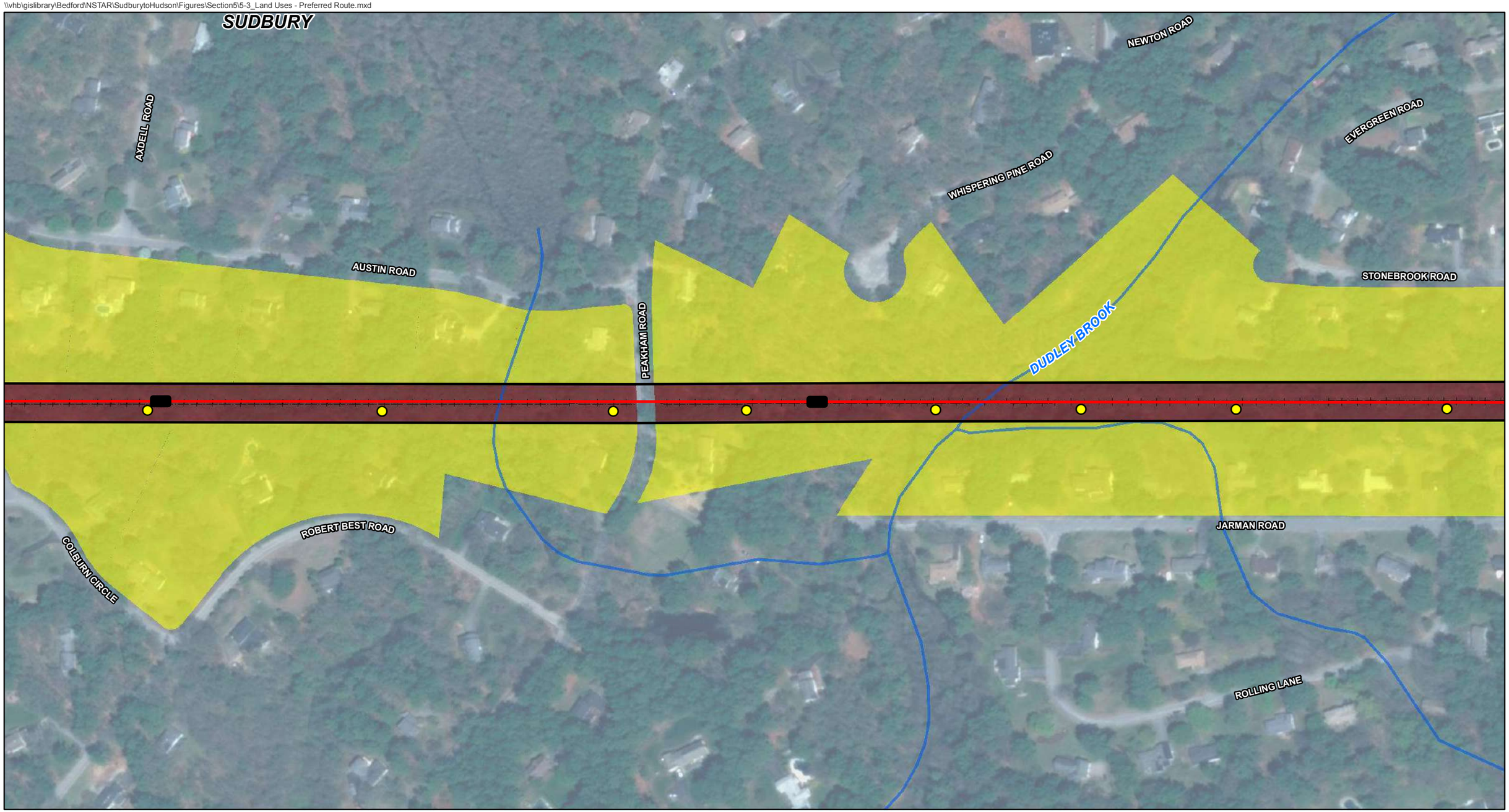

Project
Project and Noticed Variation (UG on Wilkins)
Approximate Limits of MBTA ROW
Noticed Variation Structure Locations
Noticed Variation Transition Structure Locations
Project Splice Vault Locations

Government
Residential
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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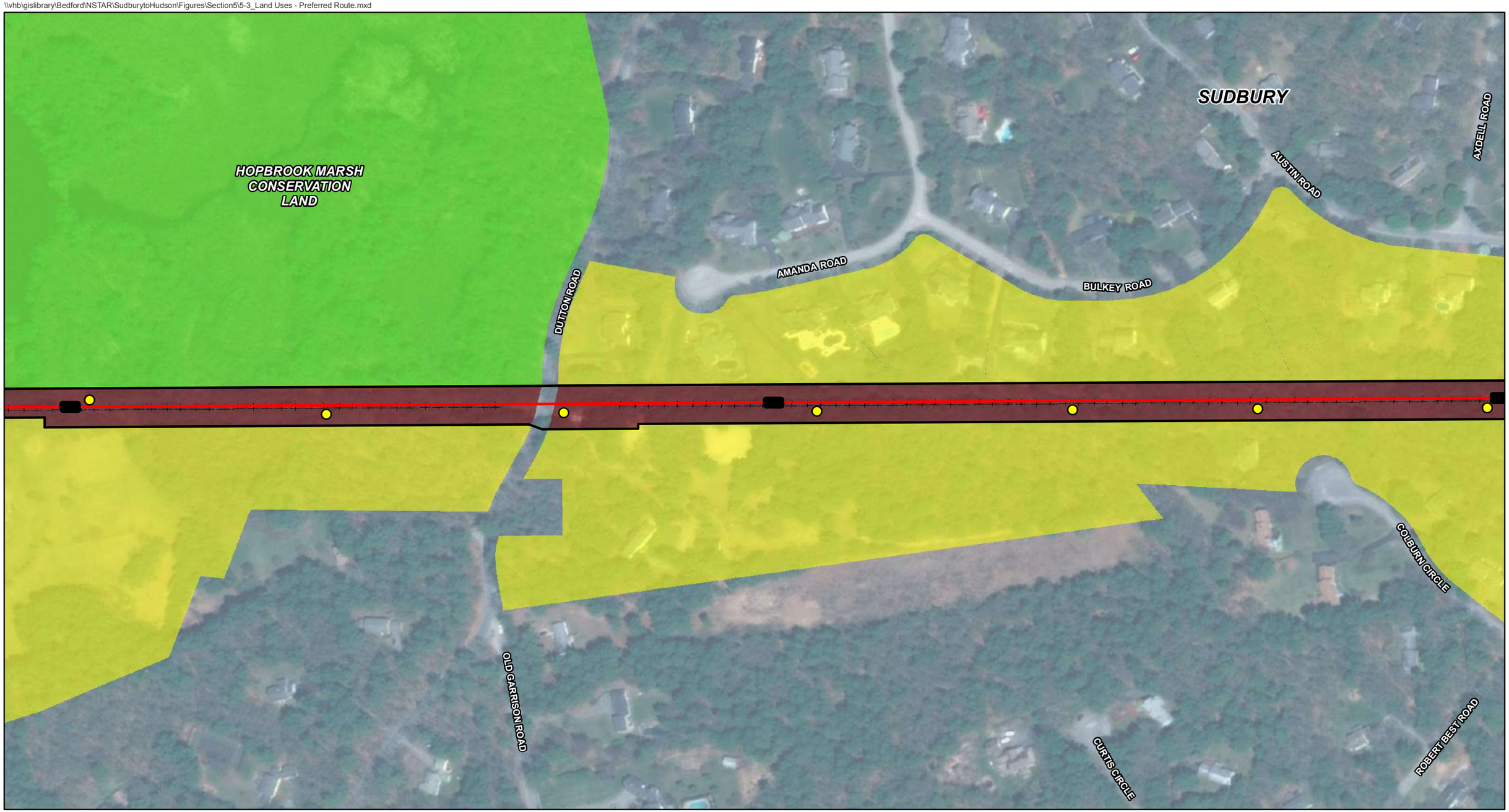

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- Project and Noticed Variation (UG on Wilkins)
- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
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- Conservation
- Government
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- Town Boundaries

Source:
MassGIS, 2015
Ortholmagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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Project
Project and Noticed Variation (UG on Wilkins)
Approximate Limits of MBTA ROW
Noticed Variation Structure Locations
Noticed Variation Transition Structure Locations
Project Splice Vault Locations

Conservation
Government
Residential

Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 5-3: Land Uses -
Project and Noticed Variation**

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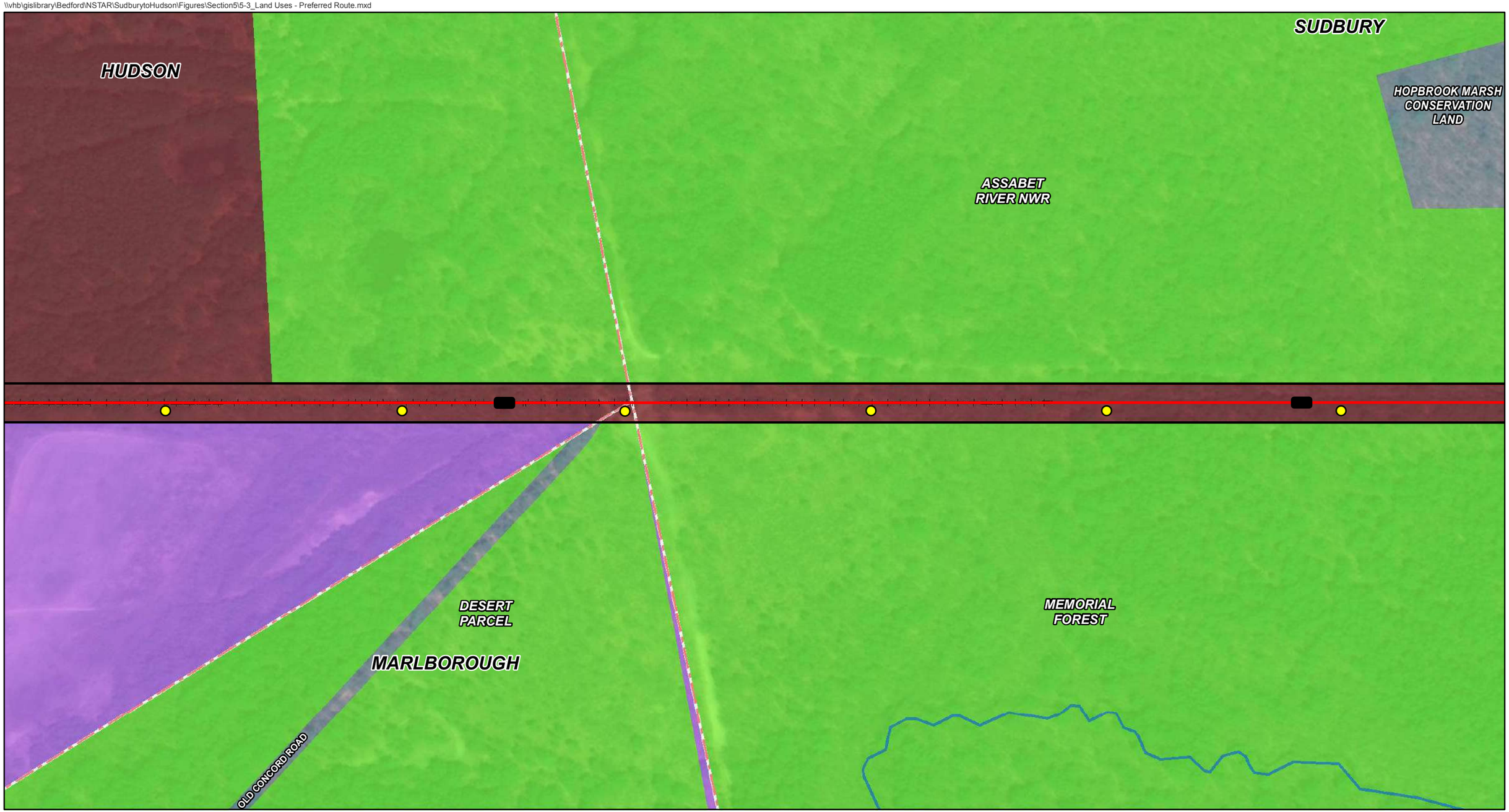

- Project
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- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations
- Conservation
- Government
- Vacant Land
- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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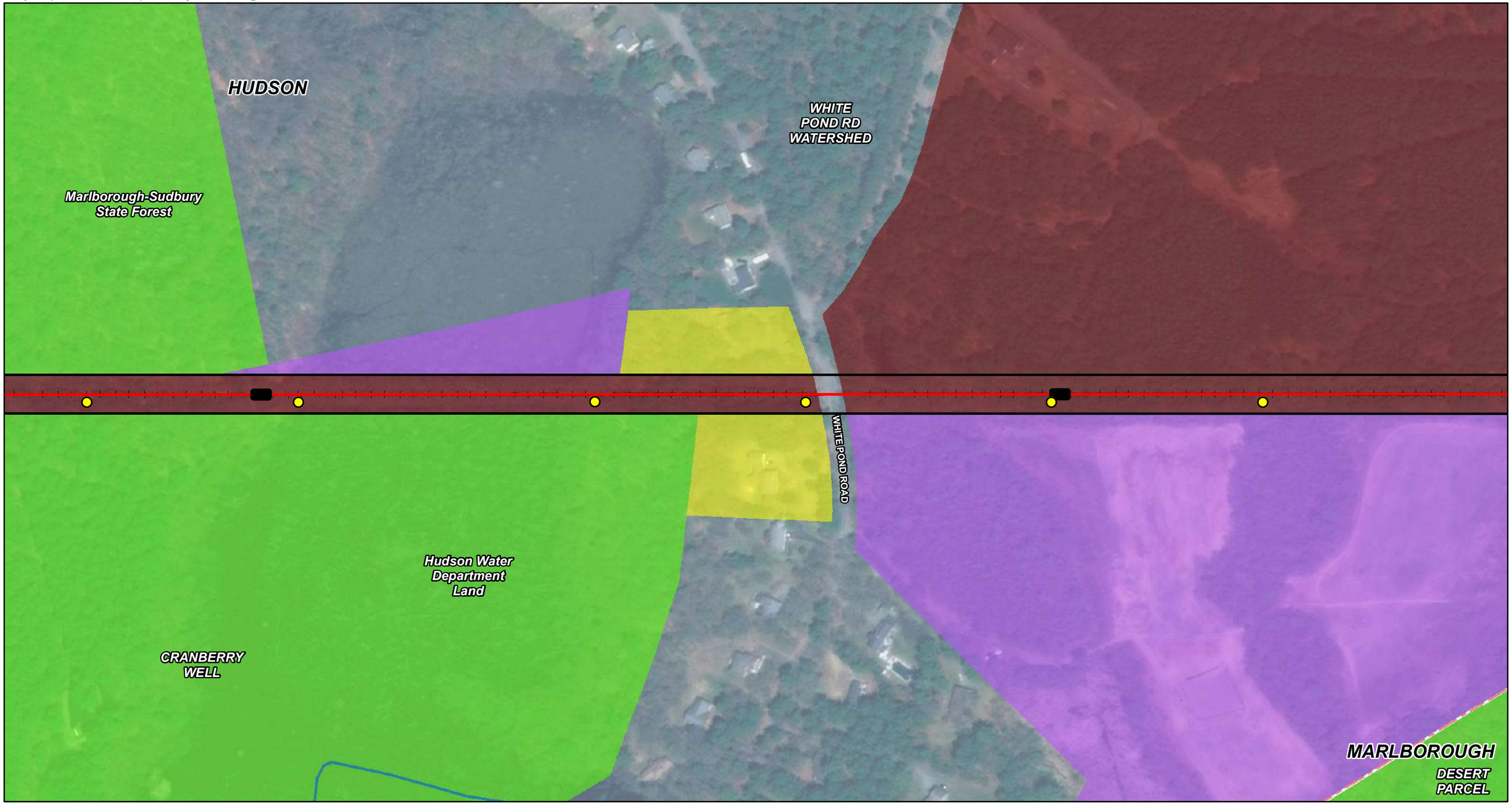

- Project
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- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations
- Commercial/Industrial
- Conservation
- Government
- Residential
- Vacant Land
- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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- Project
- Project and Noticed Variation (UG on Wilkins)
- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations
- Commercial/Industrial
- Conservation
- Government
- Residential
- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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Sudbury-Hudson Transmission Reliability Project

**Figure 5-3: Land Uses -
Project and Noticed Variation**

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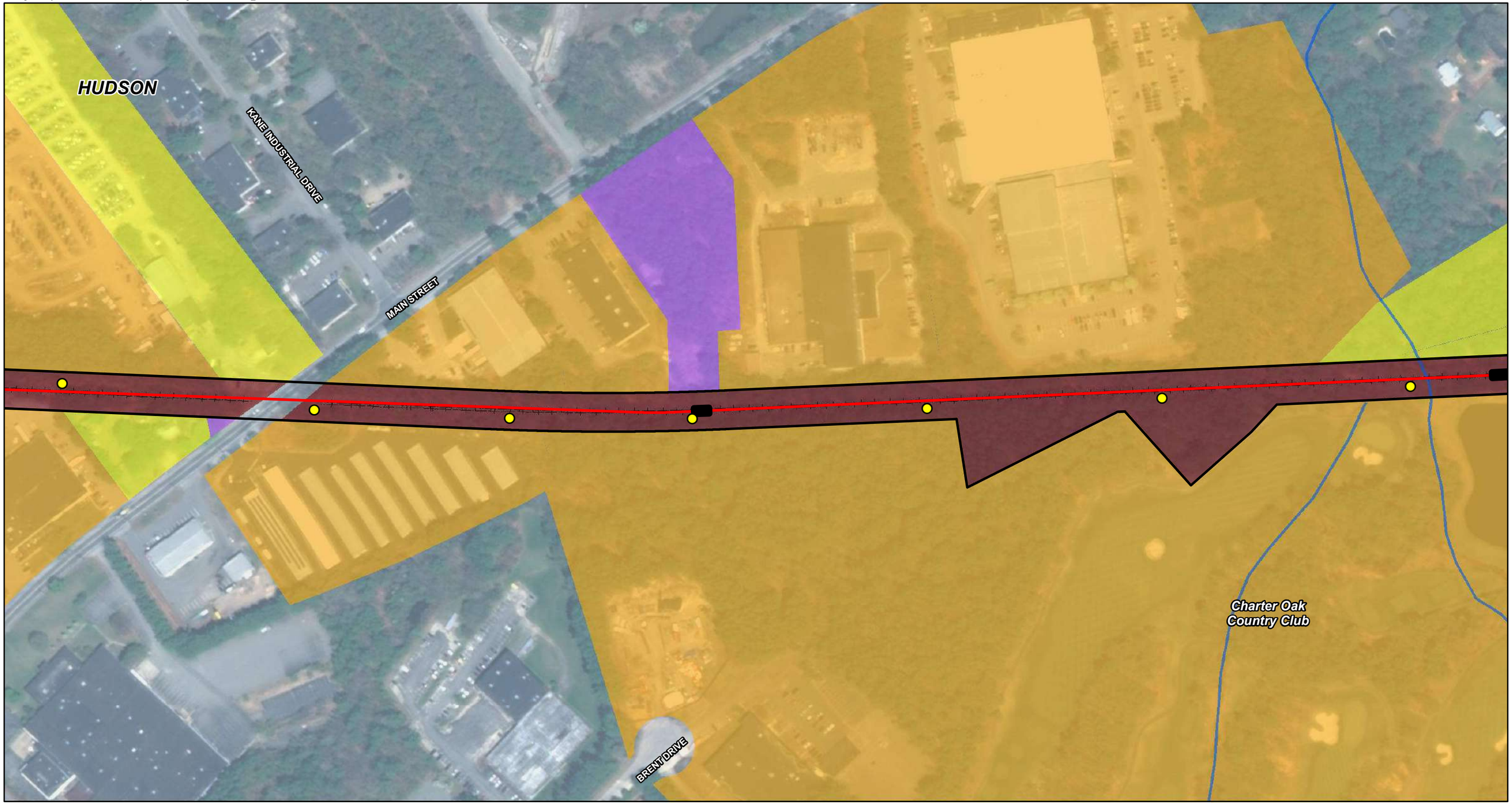

- Project
- Project and Noticed Variation (UG on Wilkins)
- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations
- Commercial/Industrial
- Government
- Residential
- Vacant Land
- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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Sudbury-Hudson Transmission Reliability Project

**Figure 5-3: Land Uses -
Project and Noticed Variation**

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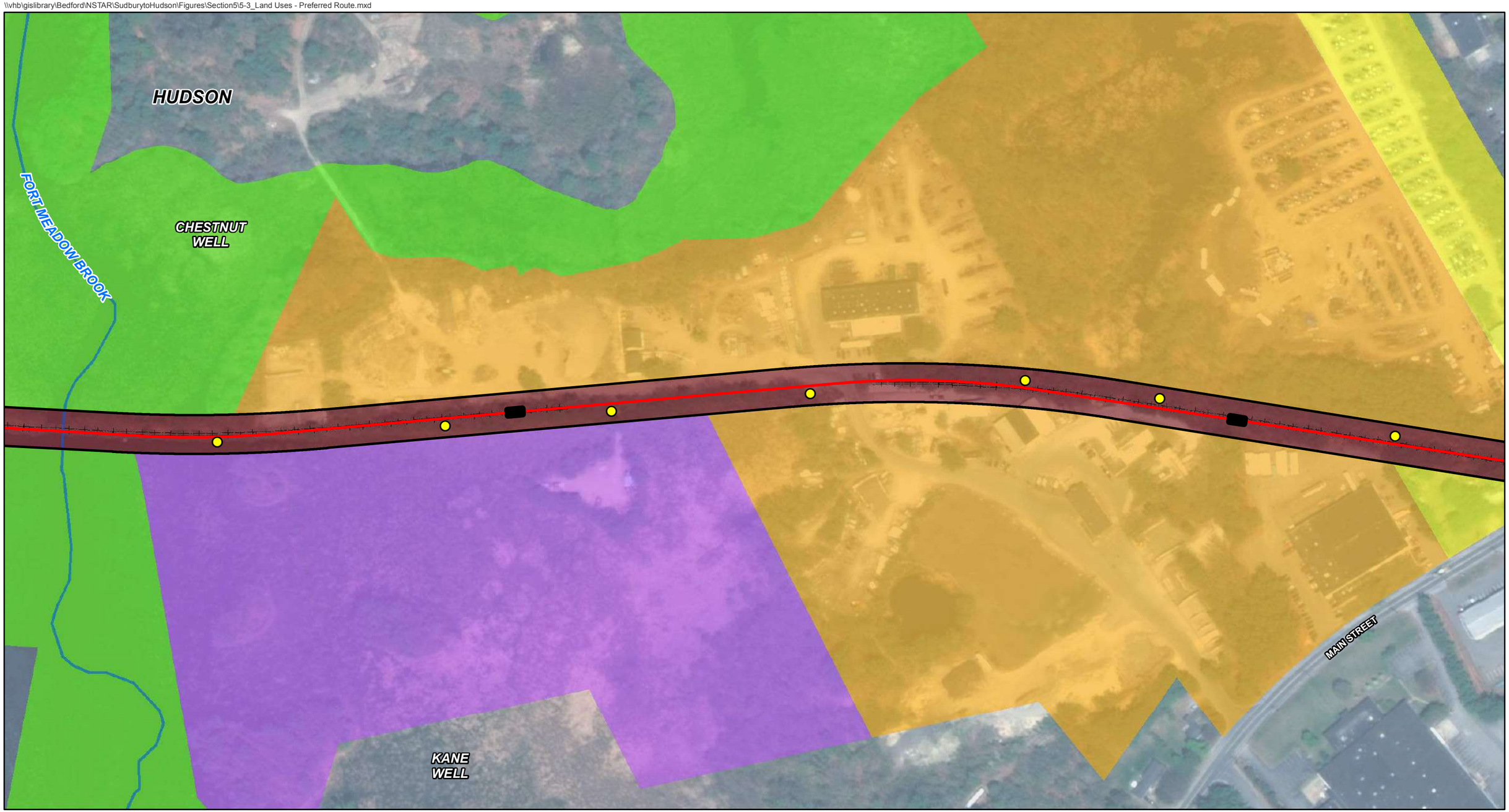

- Project
- Project and Noticed Variation (UG on Wilkins)
- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations

- Commercial/Industrial
- Conservation
- Government
- Residential
- Vacant Land

- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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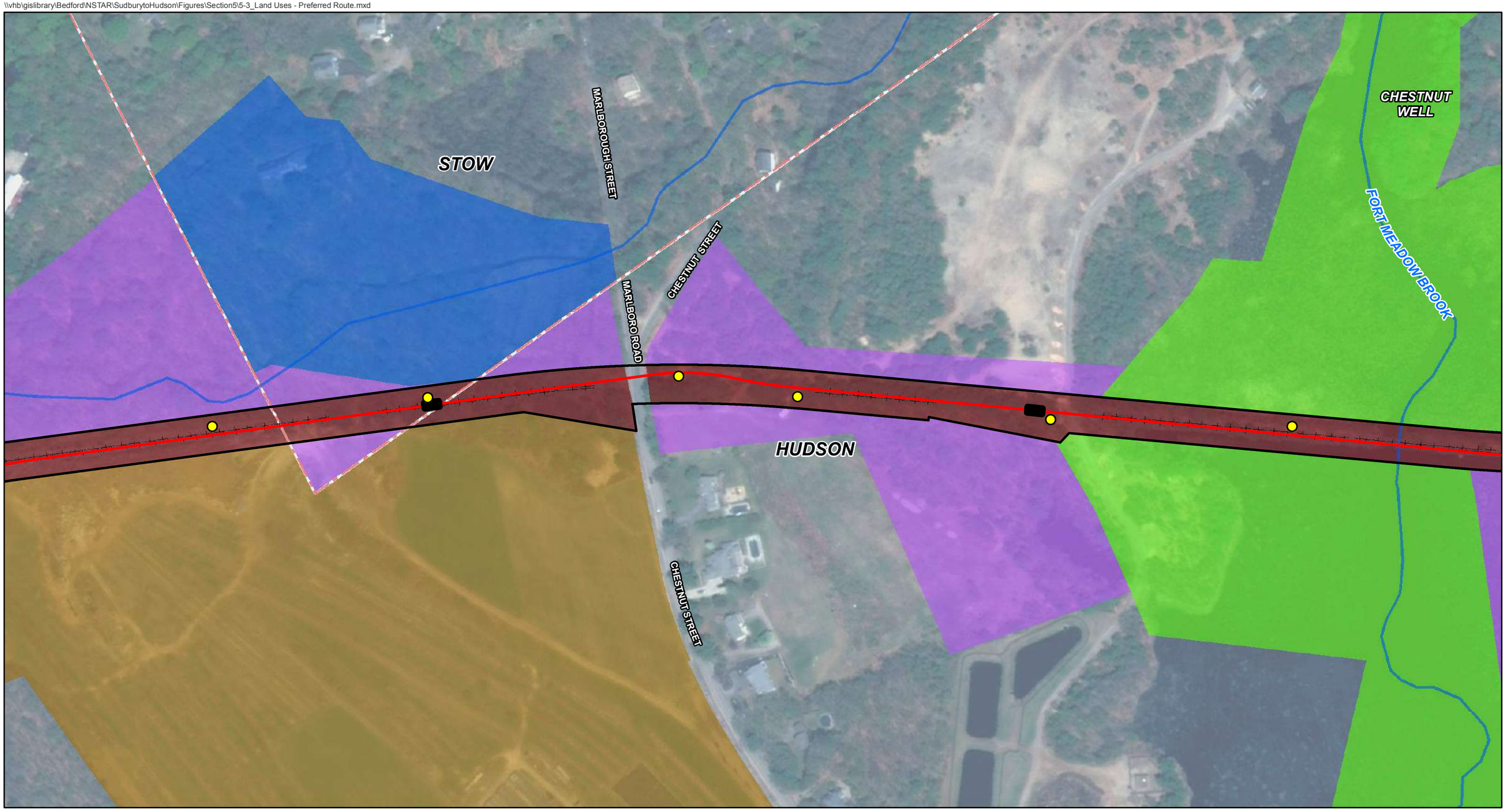

- Project
- Project and Noticed Variation (UG on Wilkins)
- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations
- Agricultural/Horticultural
- Conservation
- Government
- Mixed Use
- Vacant Land
- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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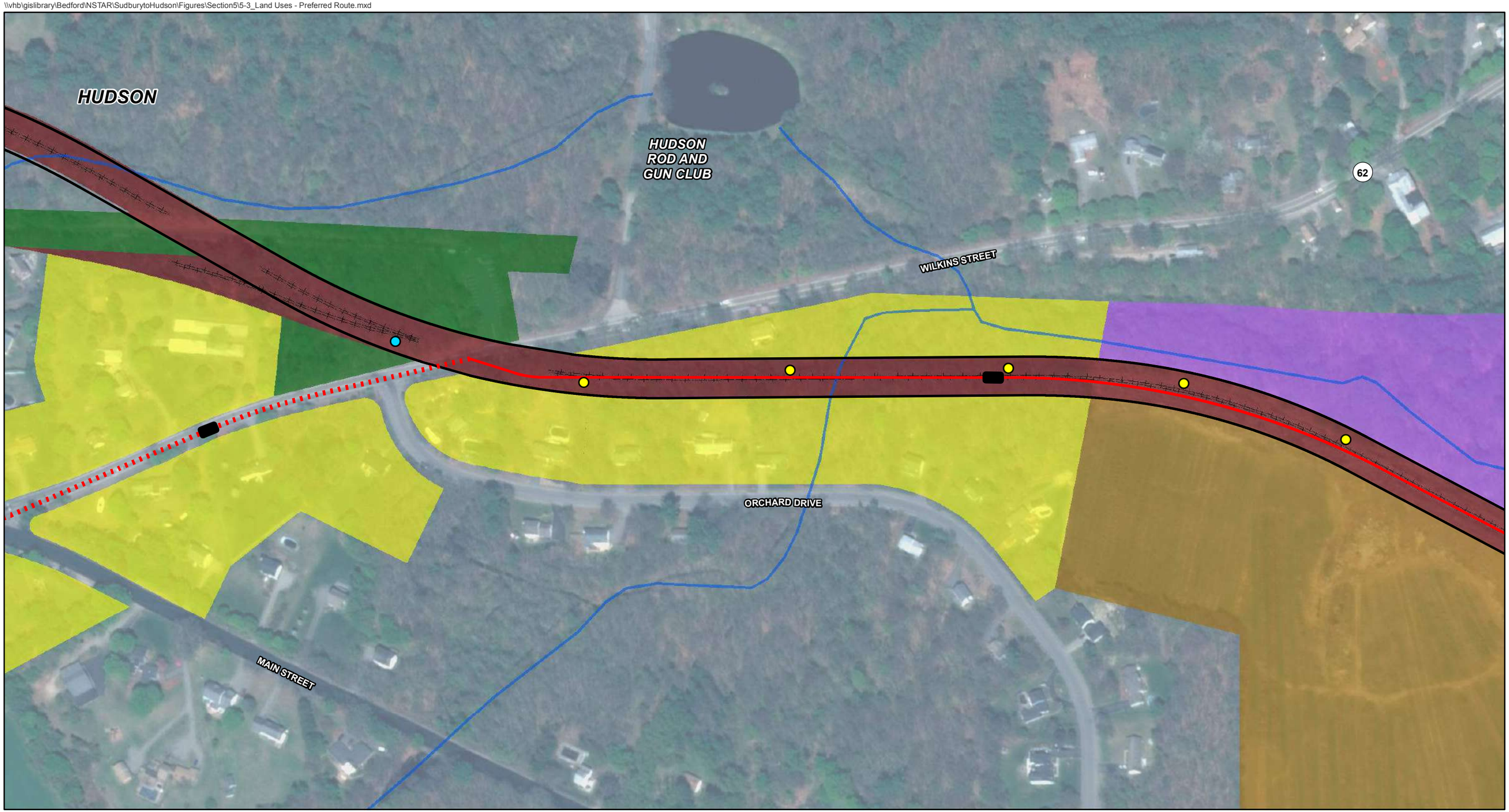

- Project
- Project and Noticed Variation (UG on Wilkins)
- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations
- Agricultural/Horticultural
- Government
- Recreational
- Residential
- Vacant Land
- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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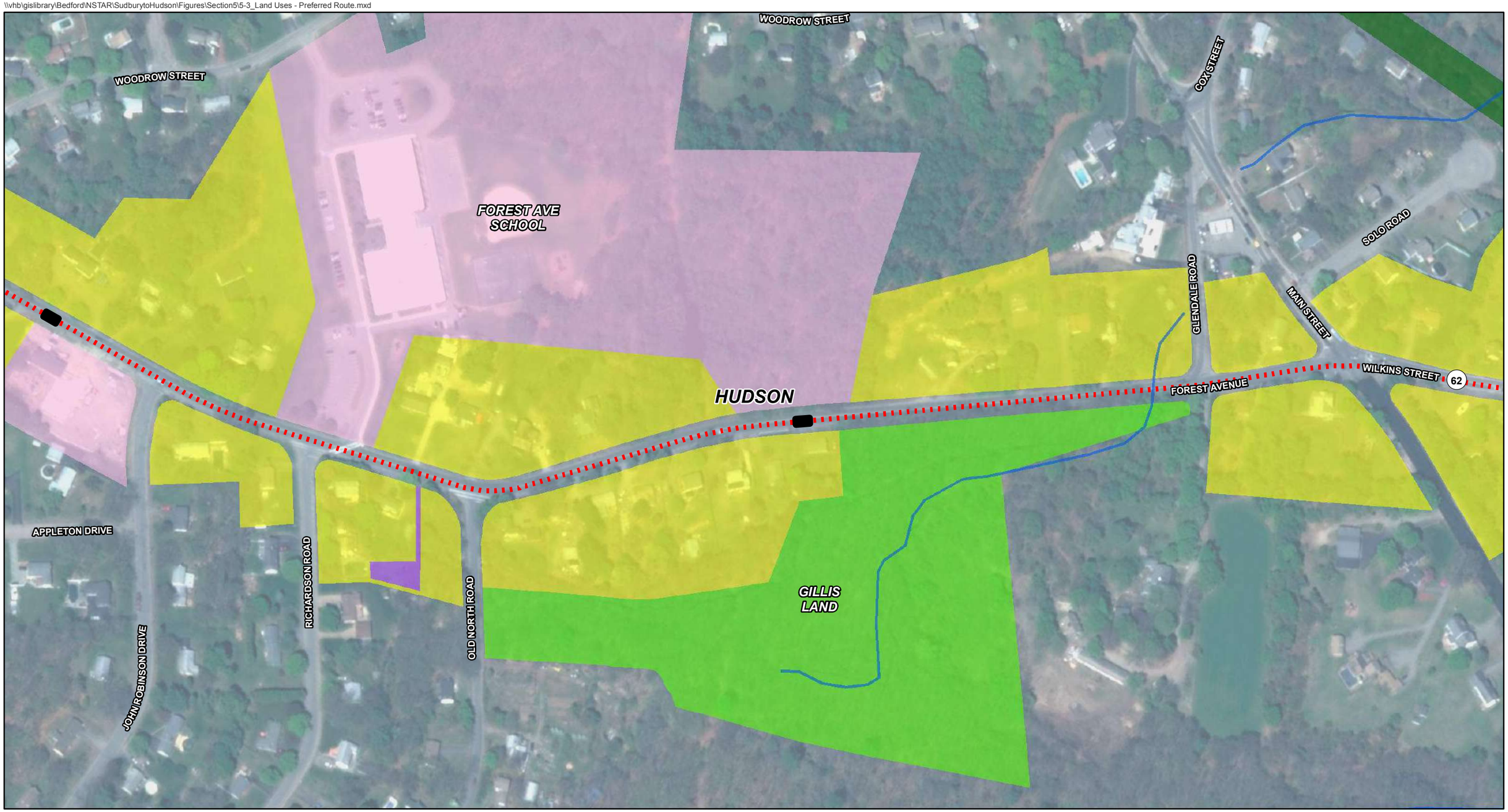

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- Project and Noticed Variation (UG on Wilkins)
- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations
- Conservation
- Educational
- Recreational
- Residential
- Vacant Land
- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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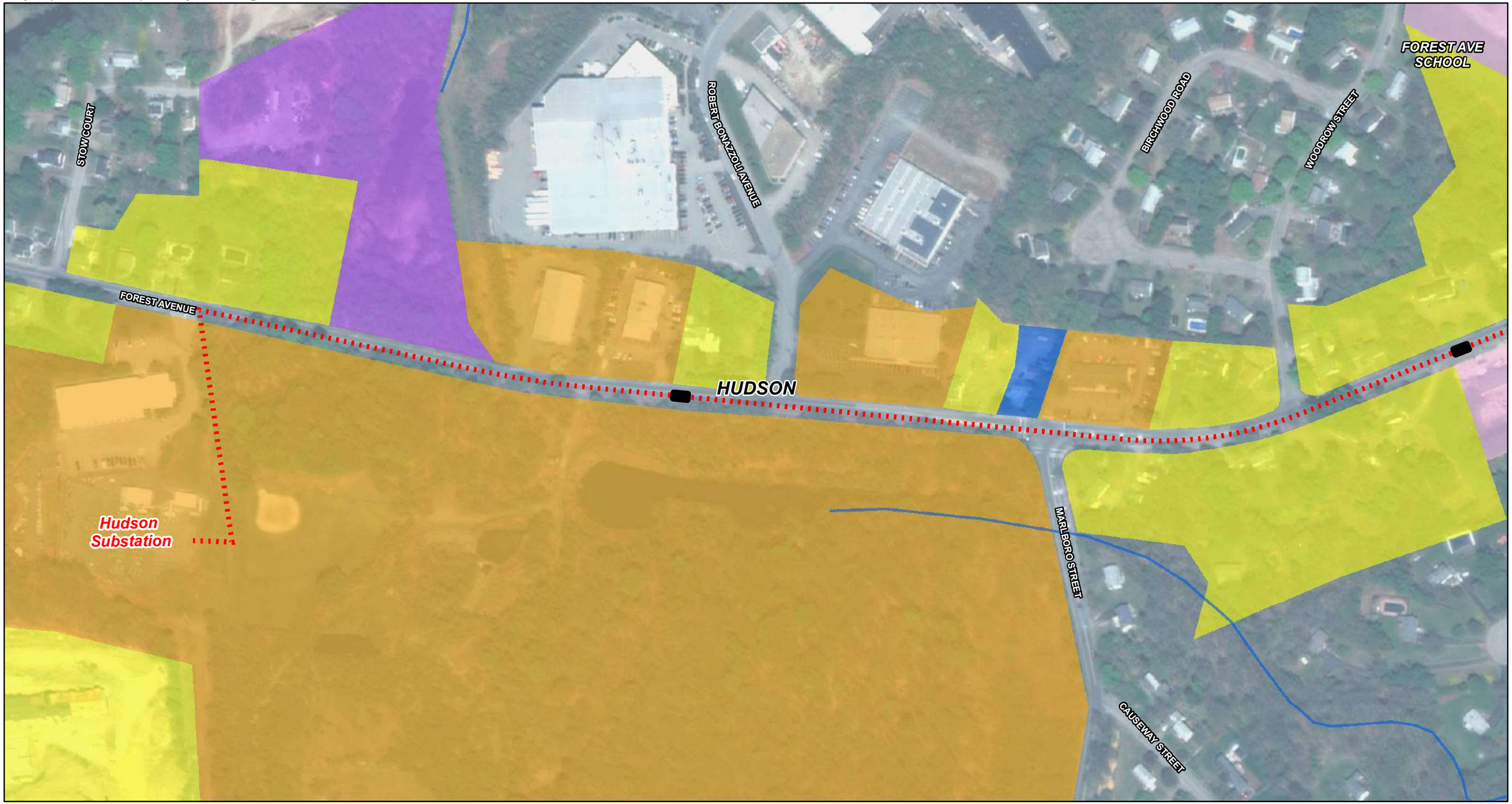

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- Approximate Limits of MBTA ROW
- Noticed Variation Structure Locations
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- Project Splice Vault Locations
- Commercial/Industrial
- Educational
- Mixed Use
- Residential
- Vacant Land
- Existing Rail
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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Sudbury-Hudson Transmission Reliability Project

Figure 5-3: Land Uses - Project and Noticed Variation

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- Project
- Project and Notice Variation (UG on Wilkins)
- MBTA ROW Boundary
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
- Project Splice Vault Locations
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Property
- Unregistered Local Historic Site
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Area
- Unregistered Local Historic Area
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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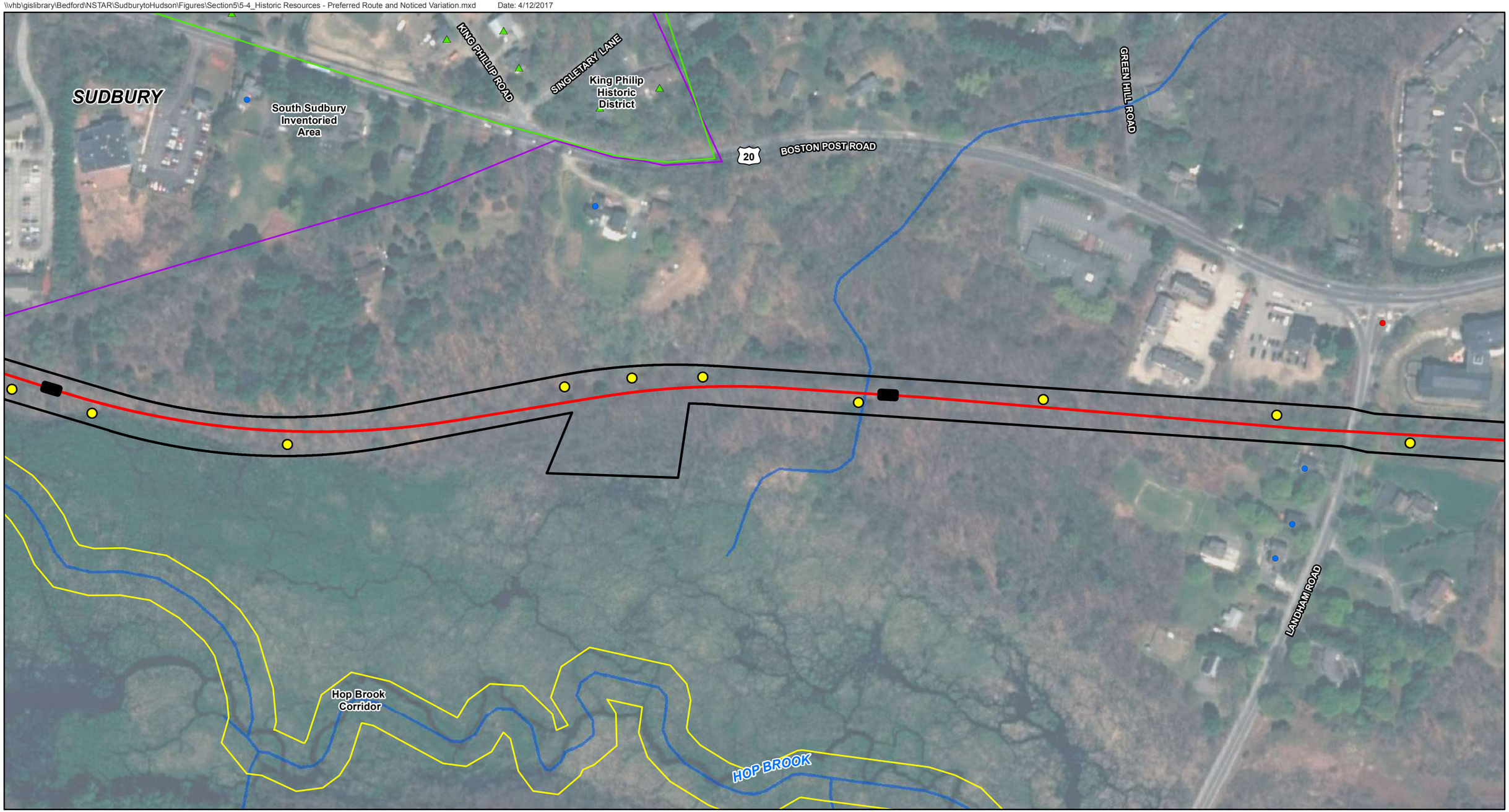

- Project
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- Noticed Variation Transition Structure Locations
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- Inventoried Area
- Unregistered Local Historic Area
- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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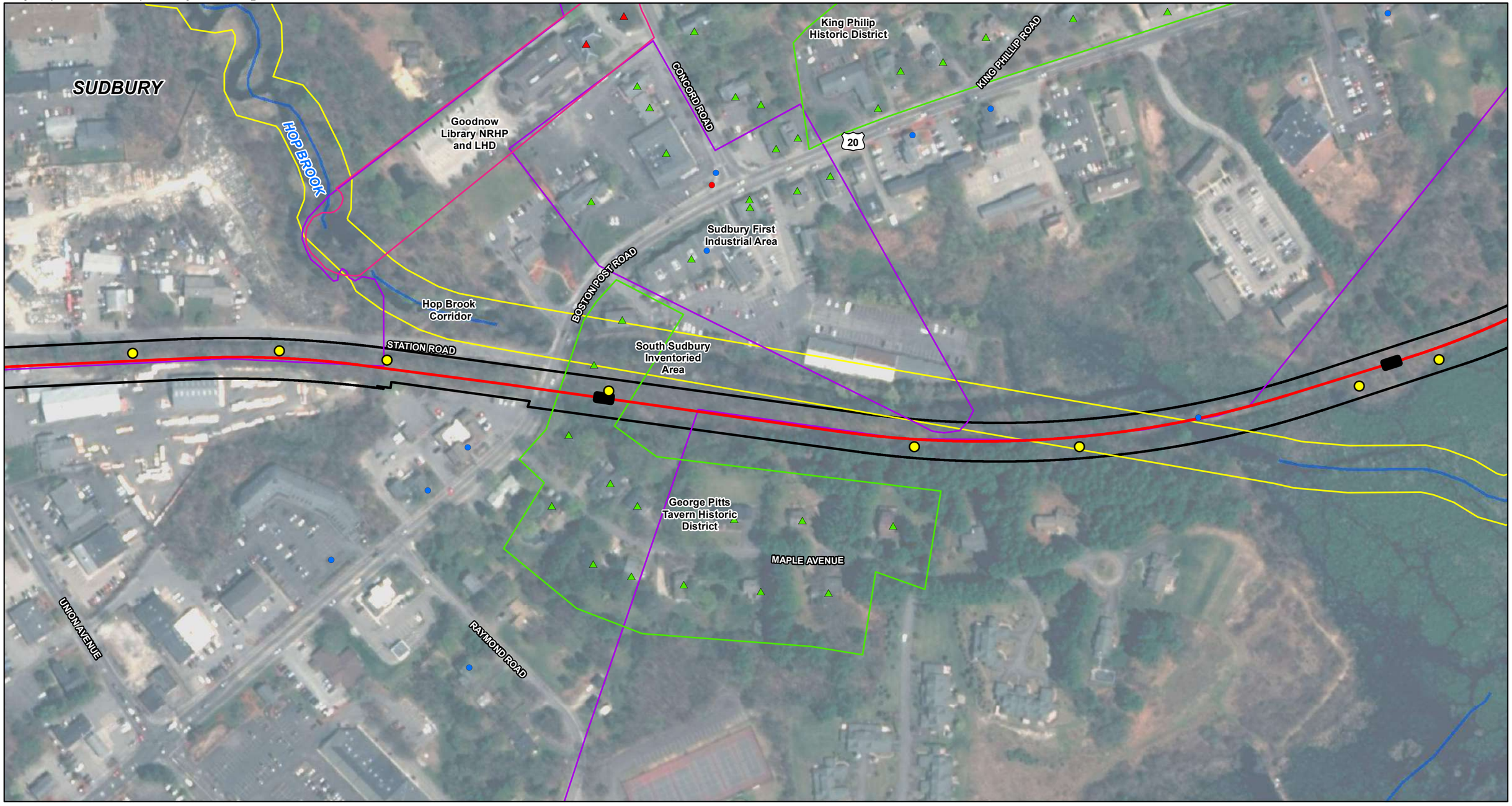

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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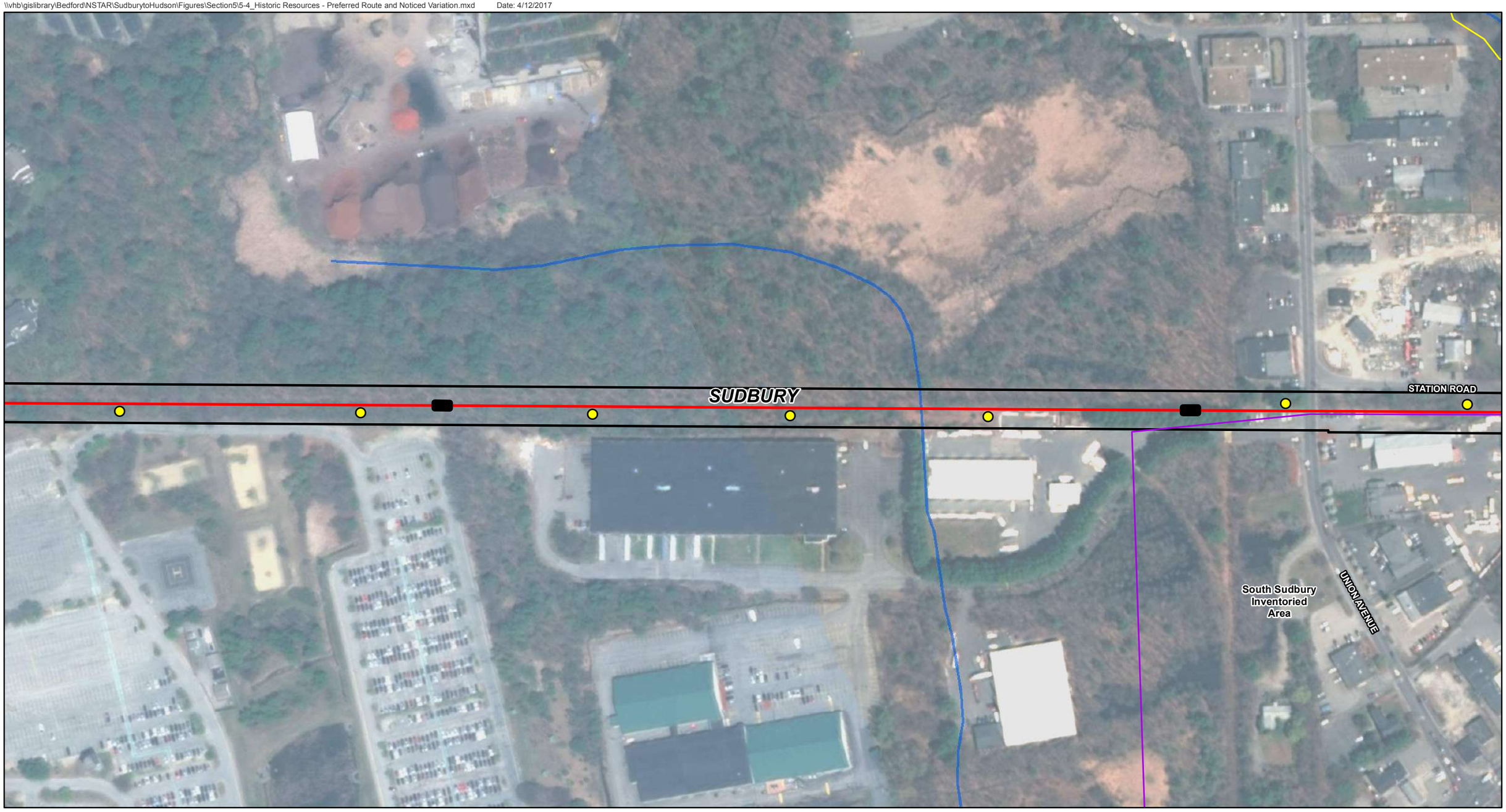

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- Local Historic District
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- Town Boundaries

Source:
MassGIS, 2015
Ortholmagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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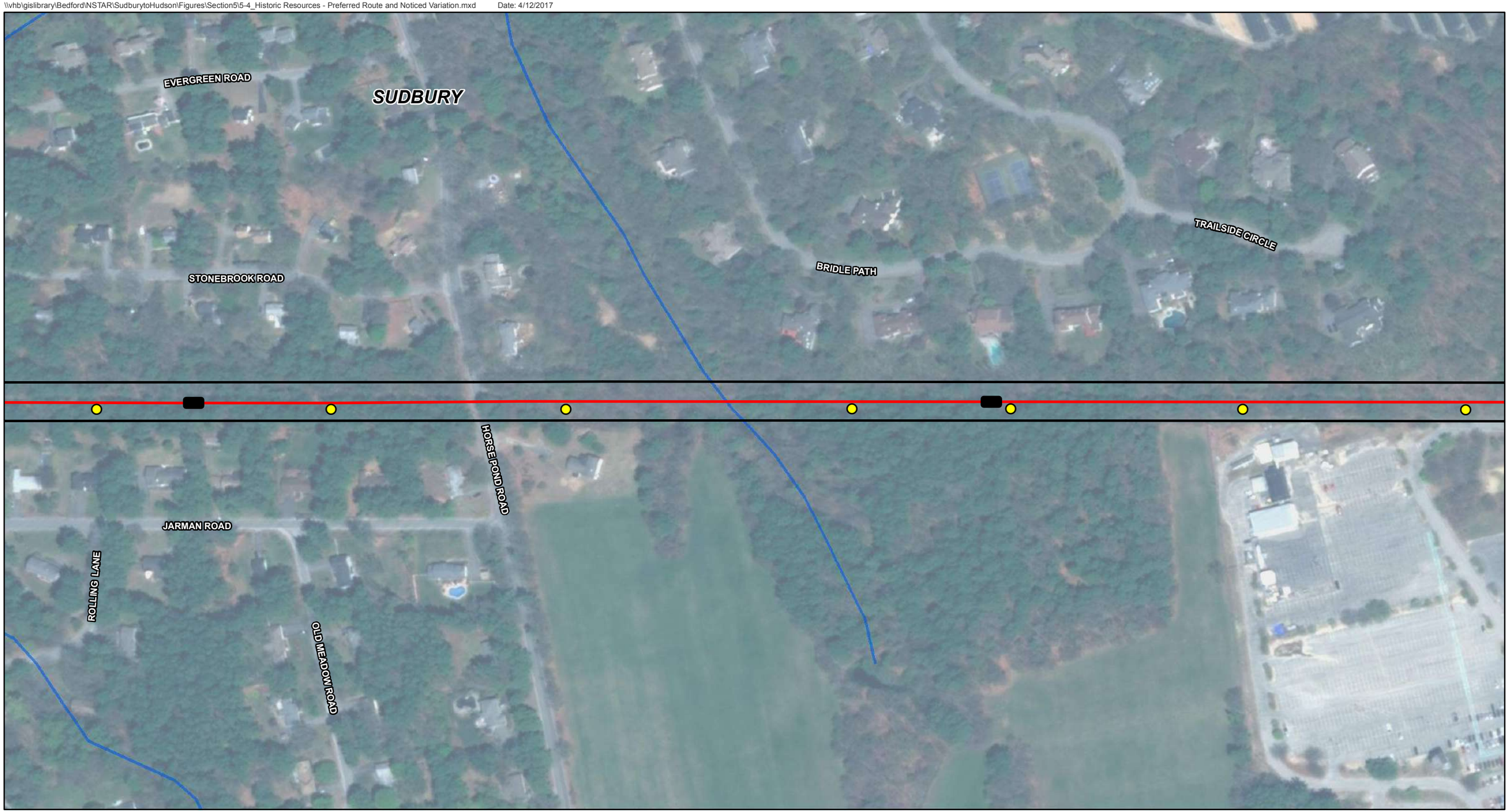

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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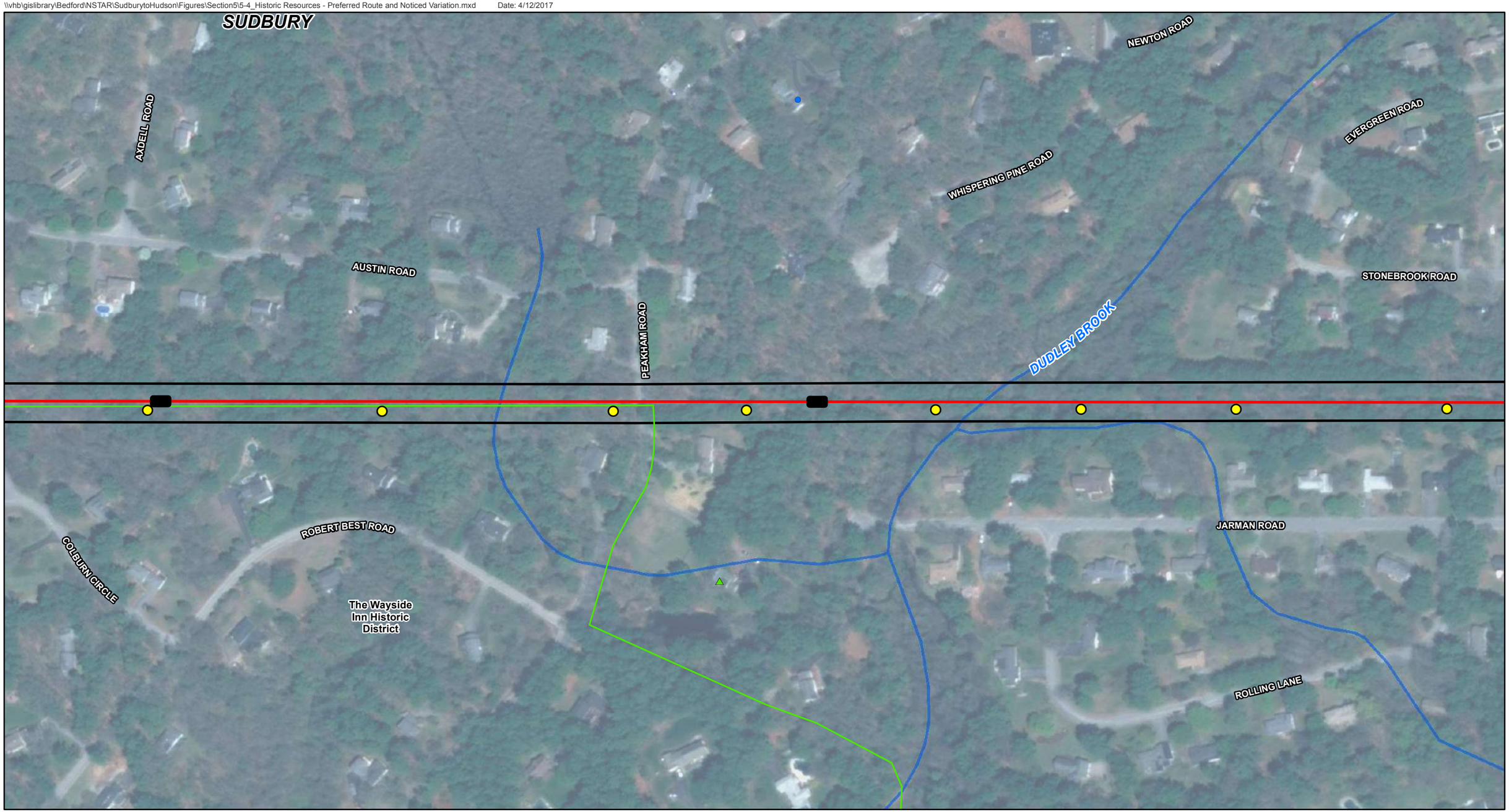

Project
Project and Notice Variation (UG on Wilkins)
MBTA ROW Boundary
Noticed Variation Structure Locations
Noticed Variation Transition Structure Locations
Project Splice Vault Locations

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Property
Unregistered Local Historic Site

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Area
Unregistered Local Historic Area

Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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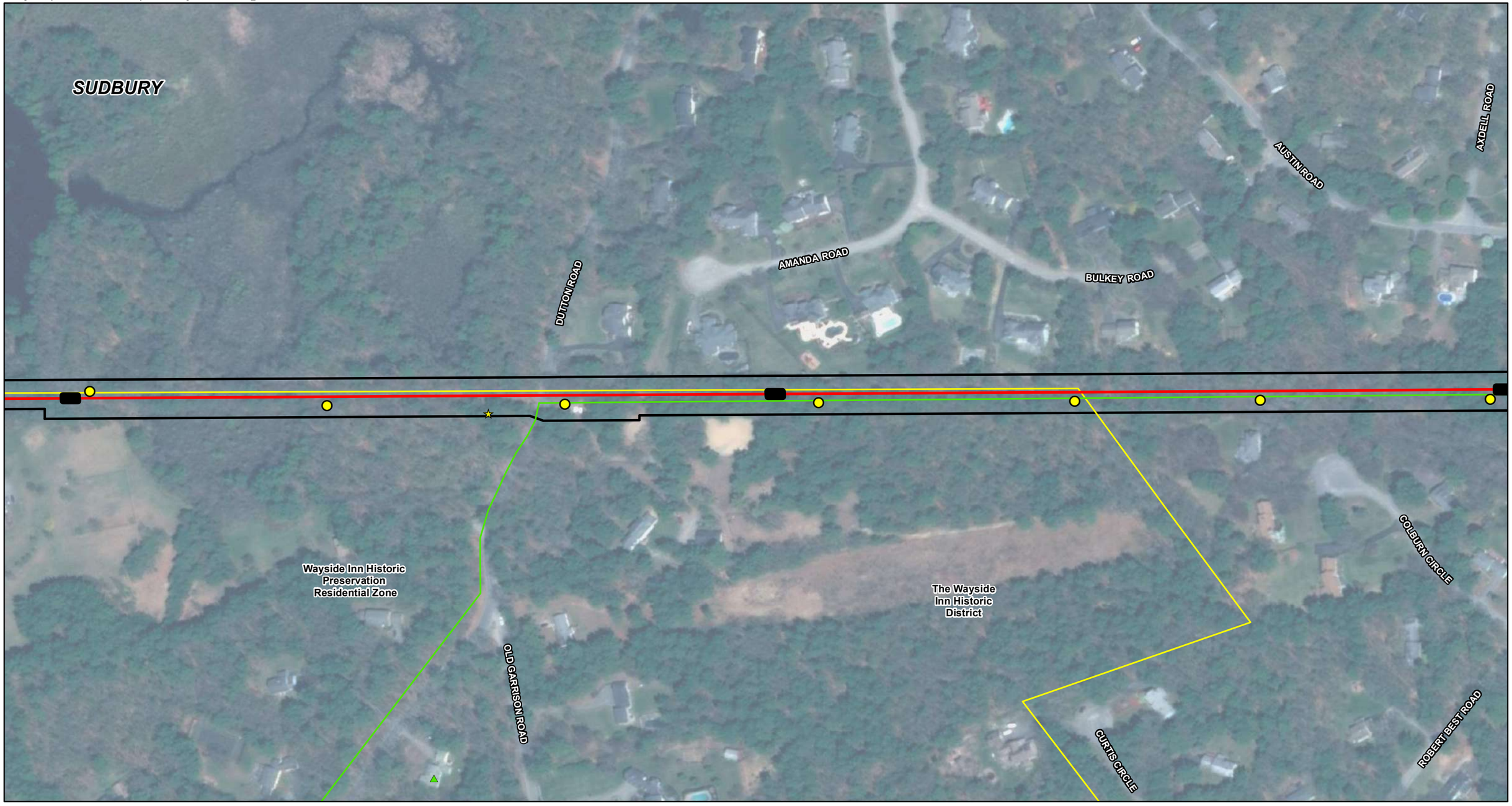

- Project
- Project and Notice Variation (UG on Wilkins)
- MBTA ROW Boundary
- Noticed Variation Structure Locations
- Noticed Variation Transition Structure Locations
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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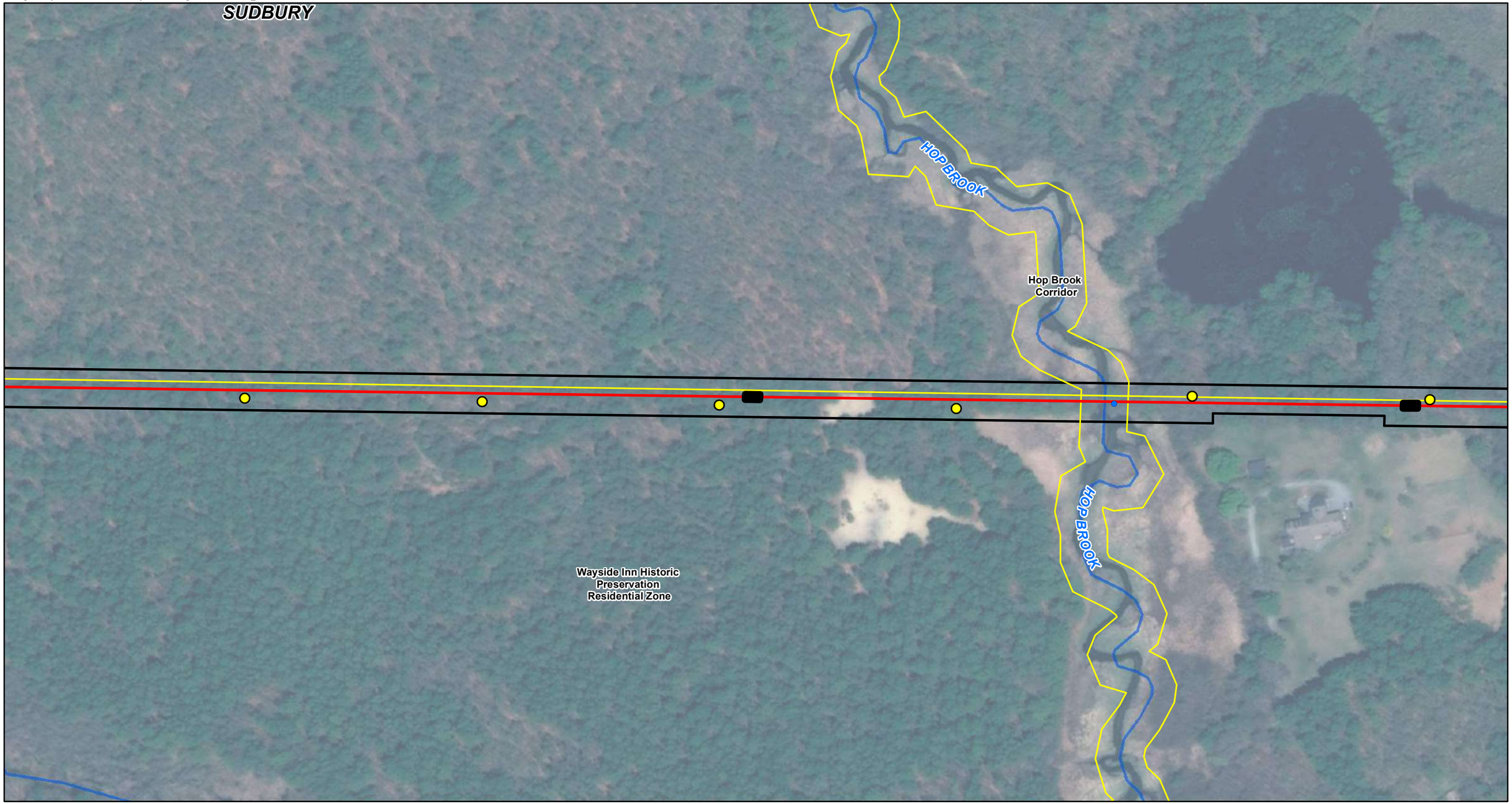

- Project
- Project and Notice Variation (UG on Wilkins)
- MBTA ROW Boundary
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- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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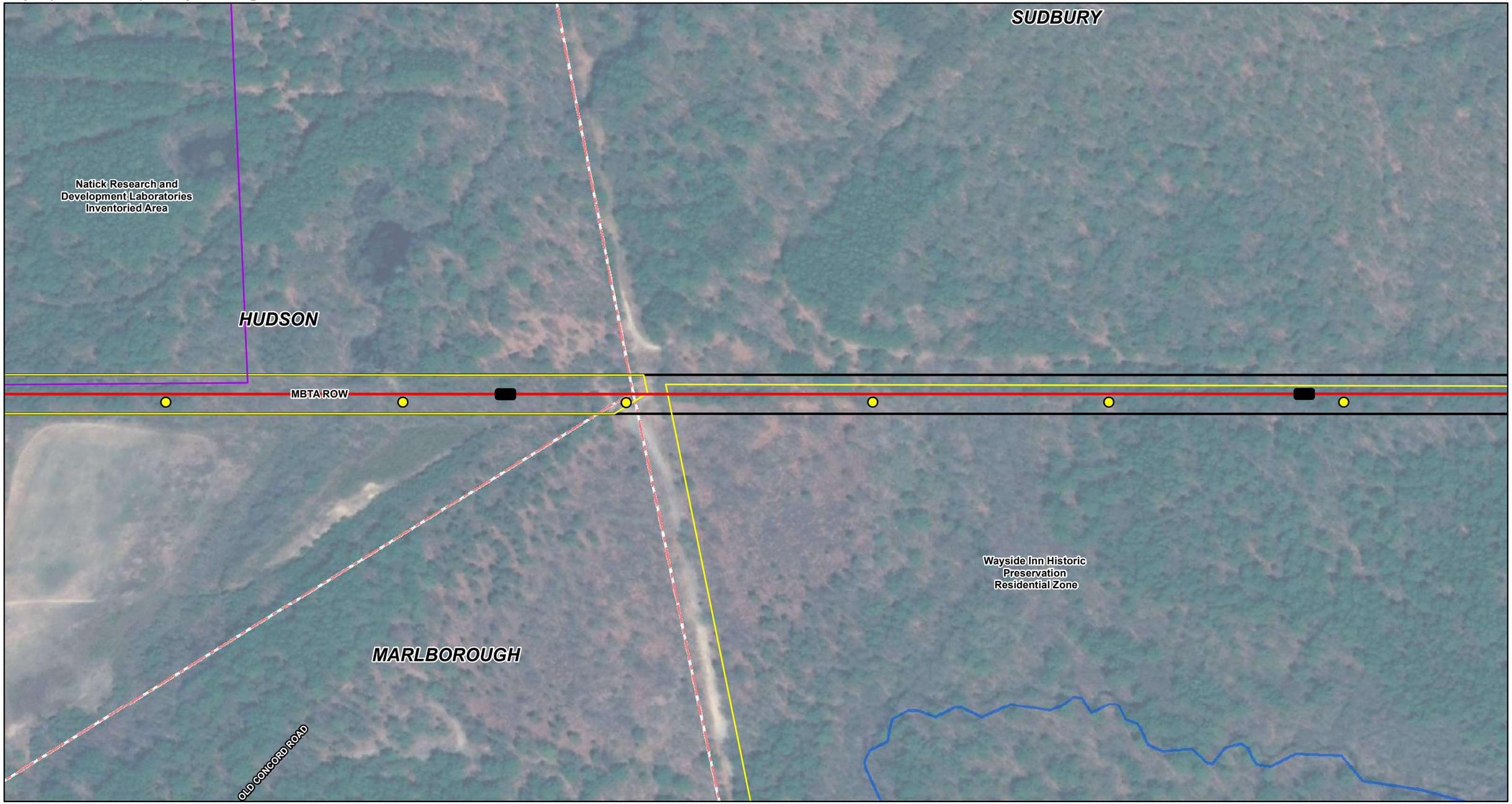

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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Sheet 9 of 17

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Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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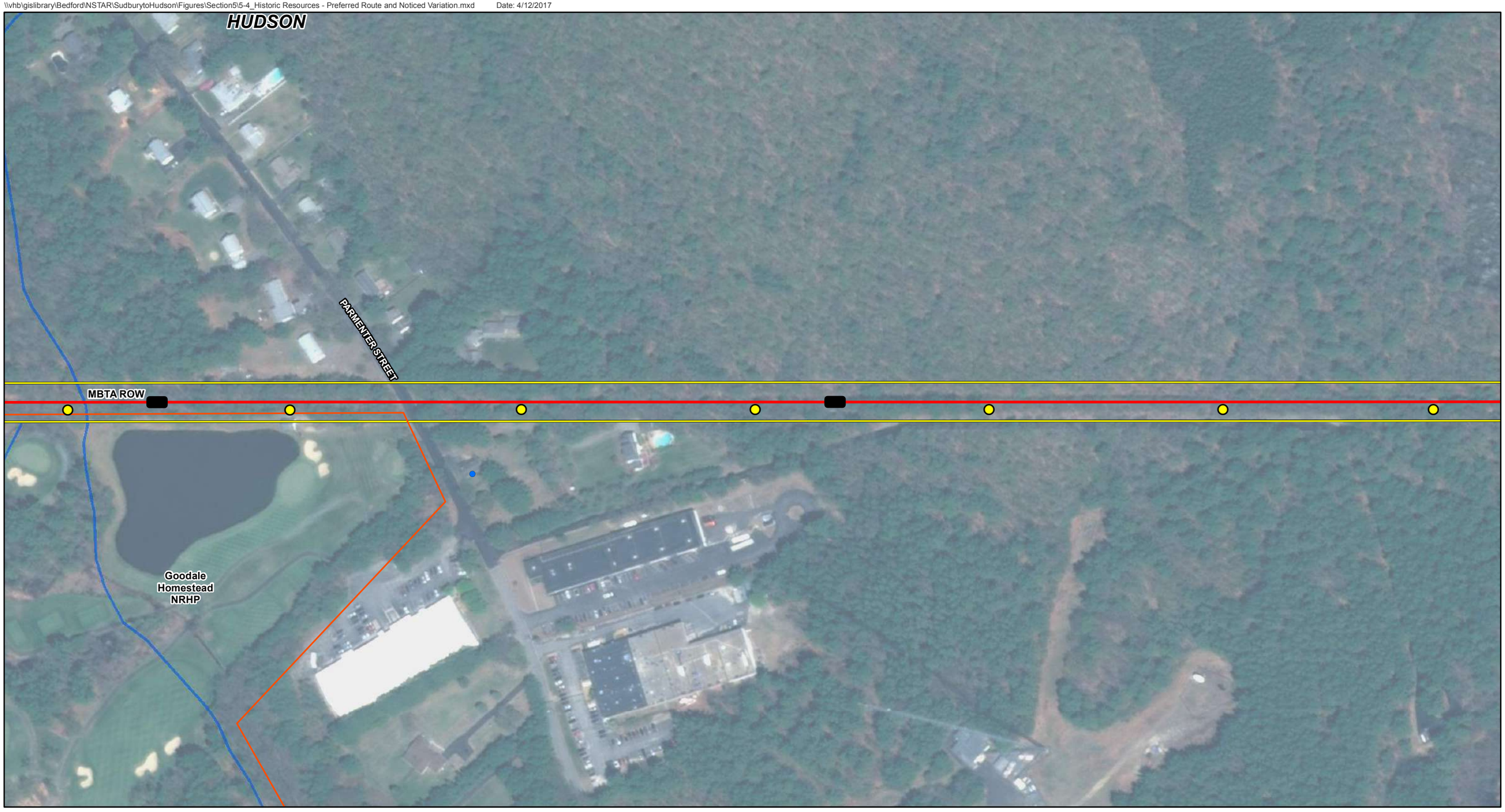

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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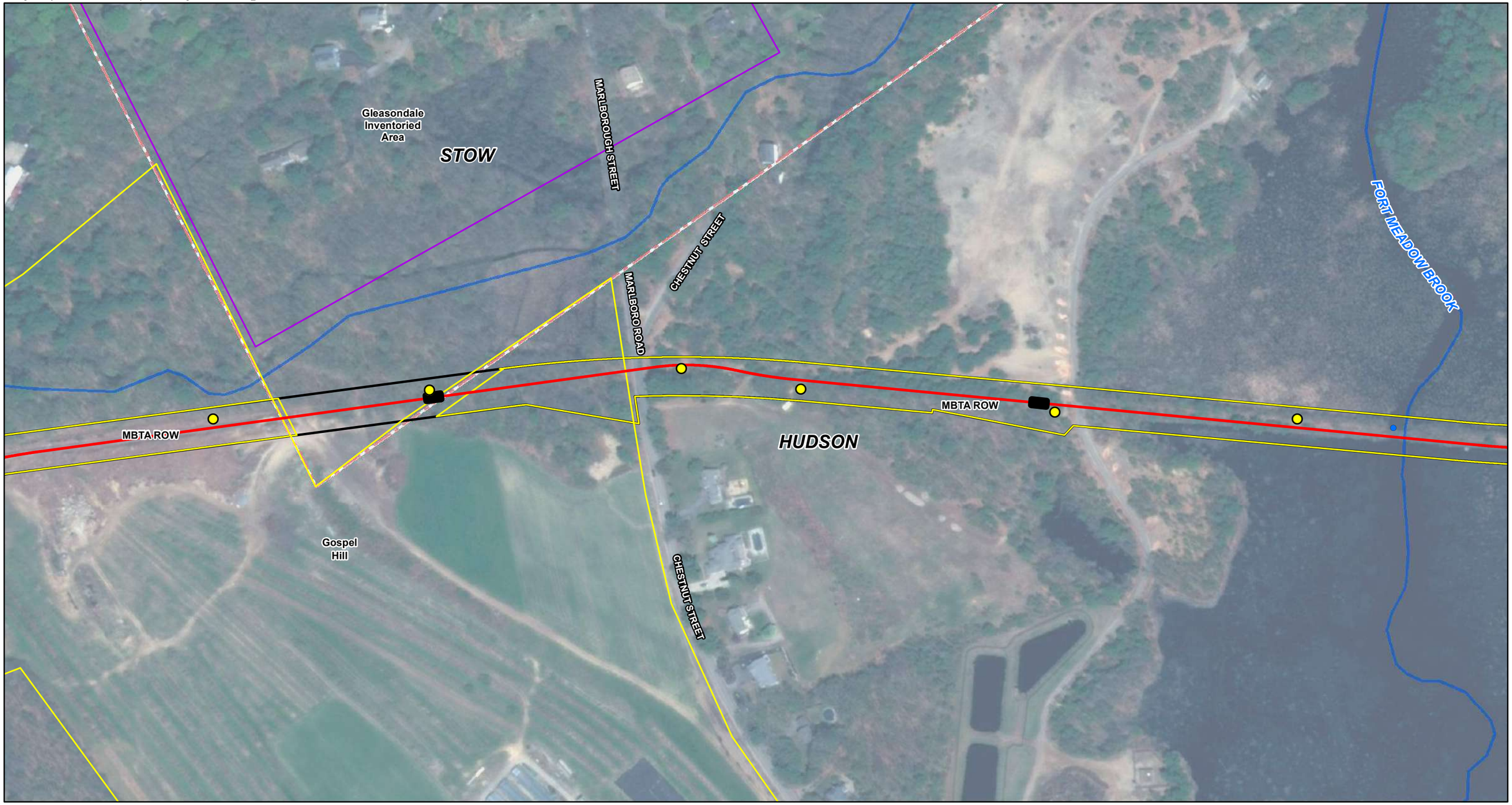

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Source:
MassGIS, 2015
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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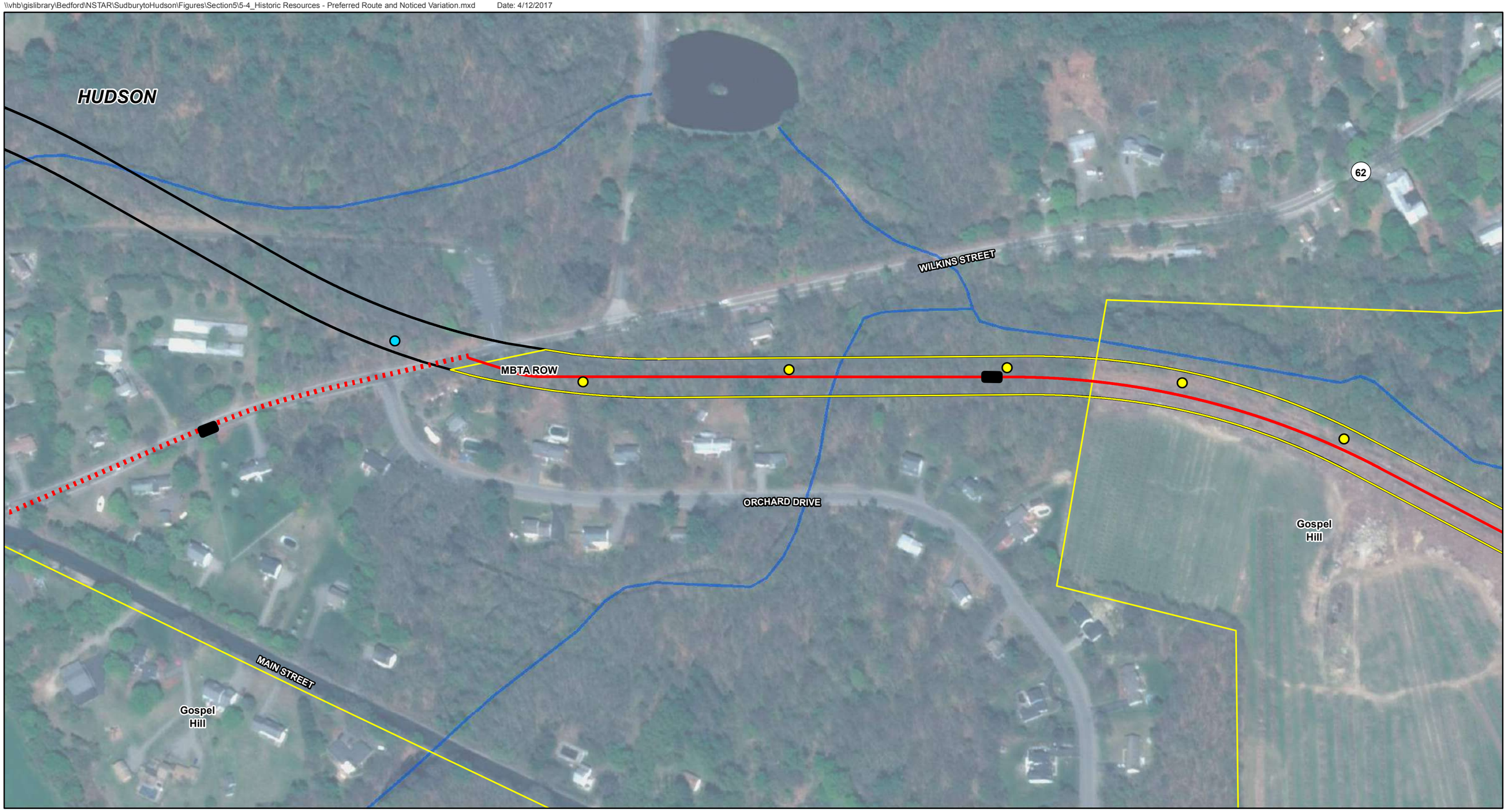

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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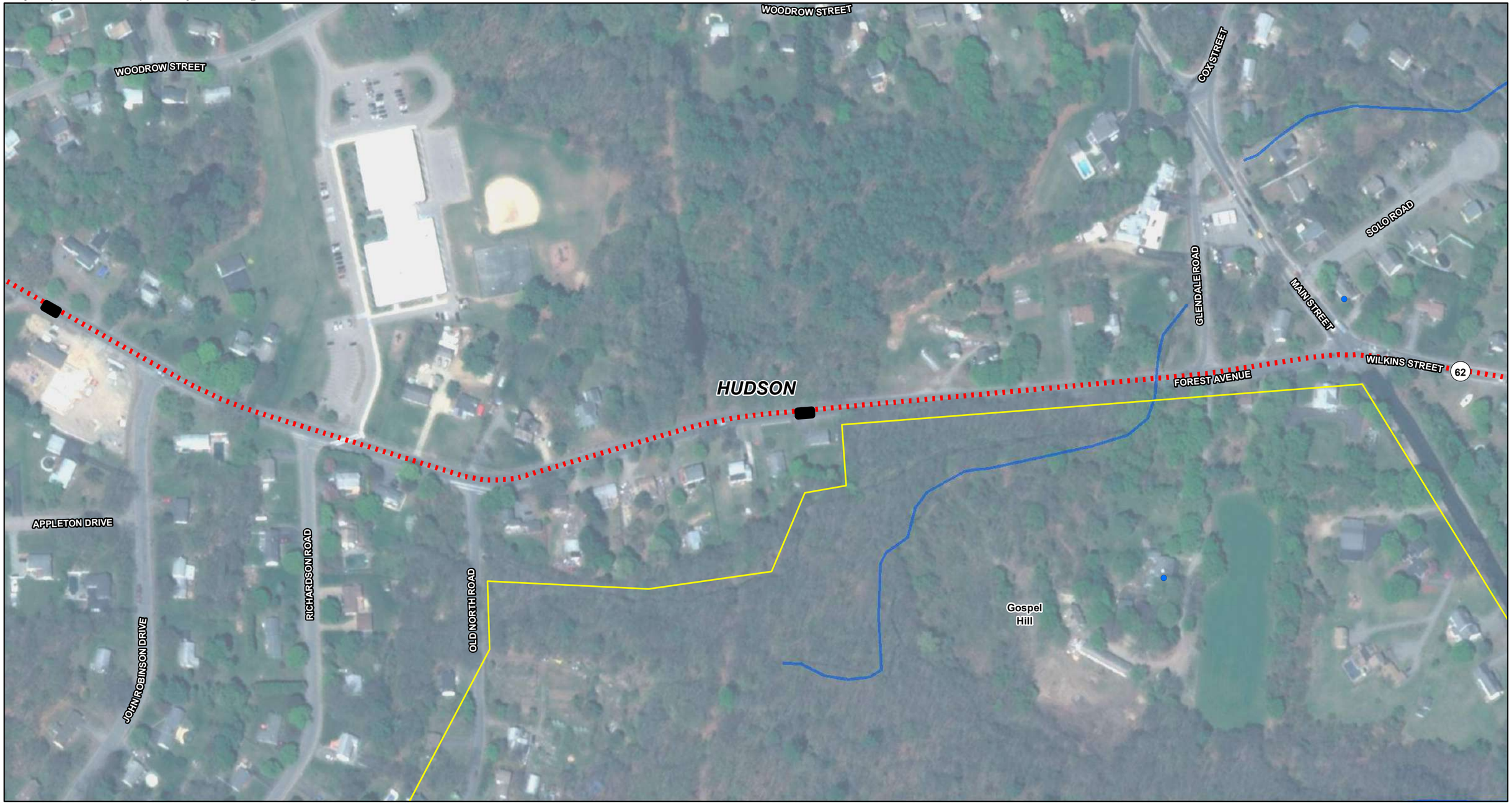

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Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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- Stream
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-4: Historic Resources - Project and Noticed Variation

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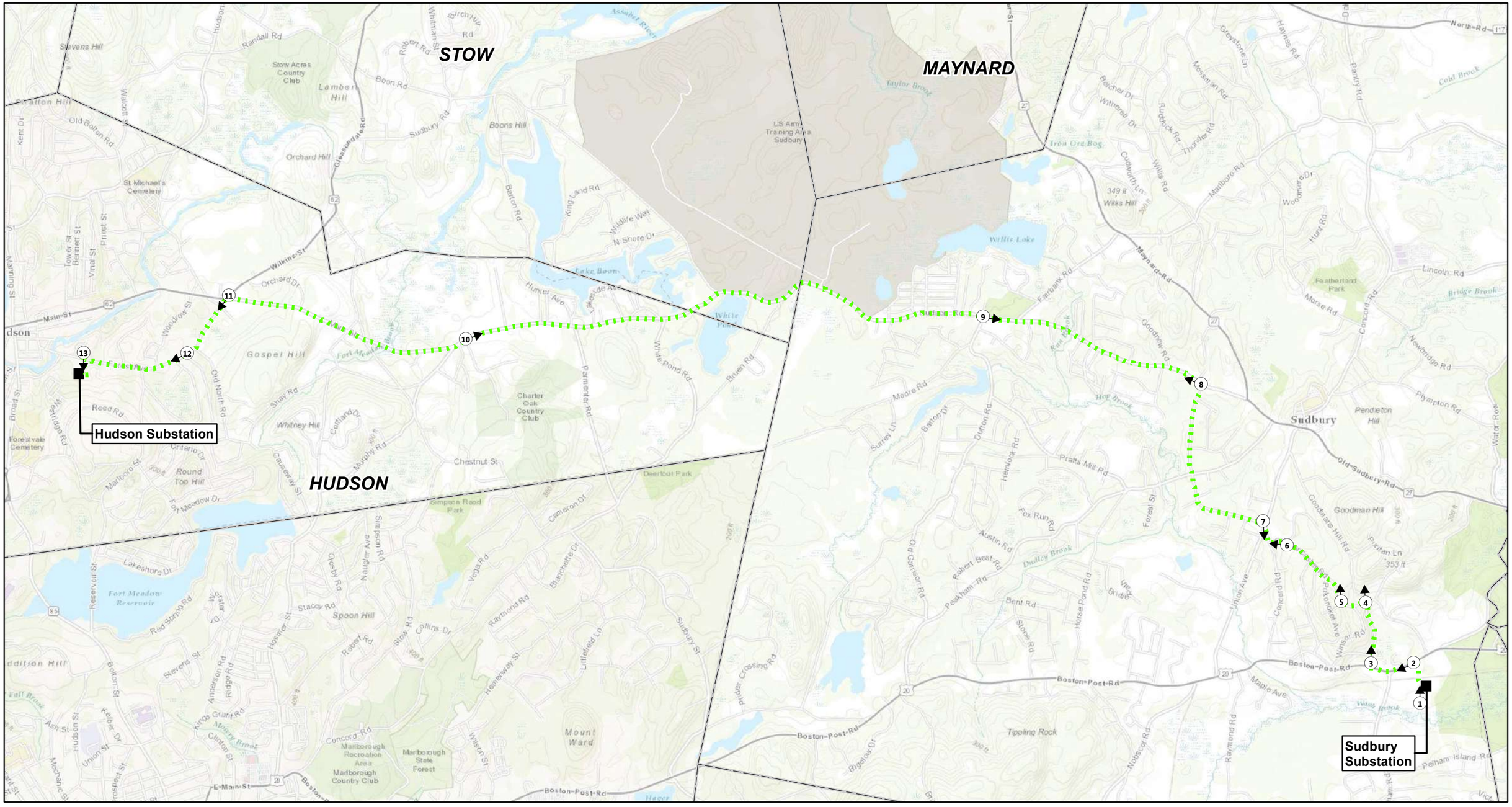

Noticed Alternative Route

Photo Location and Direction

Municipal Boundary

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Source:
MassGIS, VHB

4/12/2017

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-5: Photo Locations - Noticed Alternative Route

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Photo 1 View north of Sudbury Substation in Sudbury, MA

Photo 2 View west of Route 20 from the driveway of Sudbury Substation in Sudbury, MA

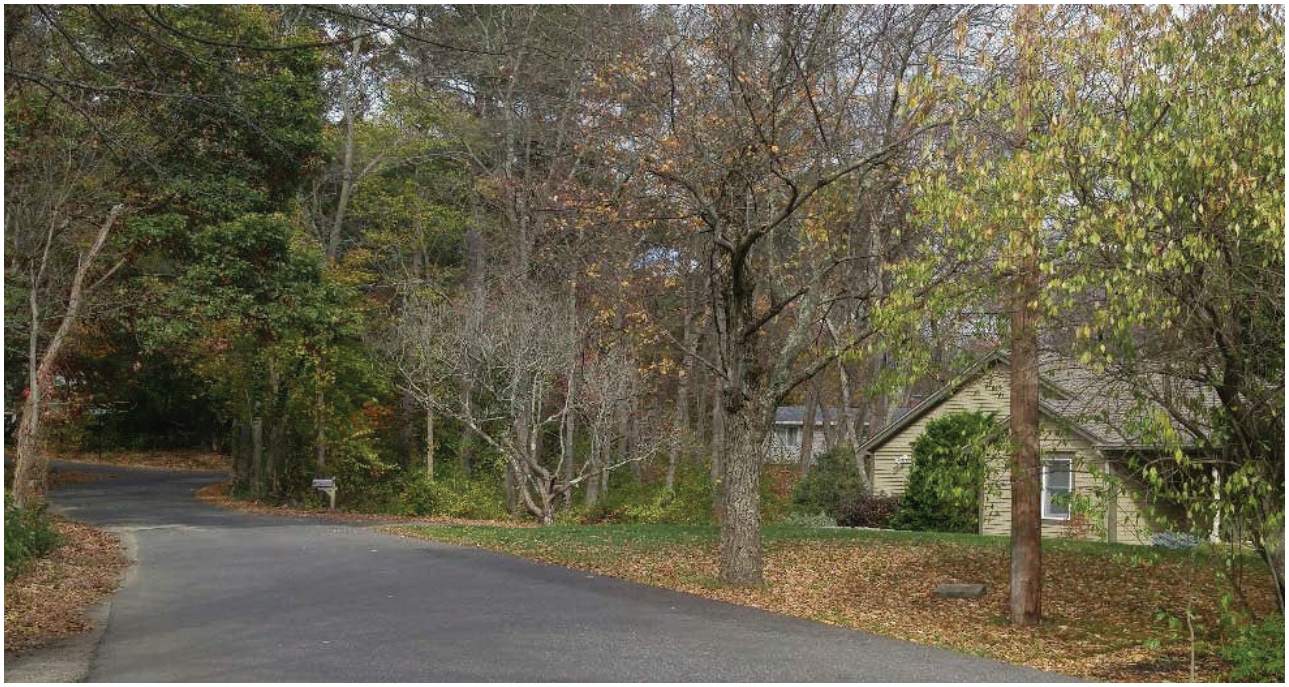

Photo 3 View north of Greenhill Road to the north of Route 20 in Sudbury, MA

Photo 4 View north of Greenhill Road at the intersection of Old Lancaster Road in Sudbury, MA

Photo 5 View north of Old Lancaster Road to the north of Winsor Road in Sudbury, MA

Photo 6 View west of Old Lancaster Road at the intersection of Concord Road in Sudbury, MA

Photo 7 View south of Concord Road at the intersection of Union Ave in Sudbury, MA

Photo 8 View west of Hudson Road at the intersection of Old Lancaster Road in Sudbury, MA

Photo 9 View east of Hudson Road at the intersection of Dutton Road in Sudbury, MA

Photo 10 View east of Main Street at the intersection of Brent Drive in Hudson, MA

Photo 11 View southwest of Wilkins Street to the north of Main Street in Hudson, MA

Photo 12 View west of Forest Avenue to the south of Forest Avenue Elementary School in Hudson, MA

Photo 13 View south of Hudson Substation, located behind the Light & Power Department in Hudson, MA

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- Noticed Alternative Route
- NHESP Certified Vernal Pool
- Coldwater Fishery
- Stream
- Wetland Resource Area
- NHESP Priority & Estimated Habitat
- FEMA 100-year Floodplain
- Protected and Recreational Open Space
- Existing Rails
- Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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Sheet 1 of 17

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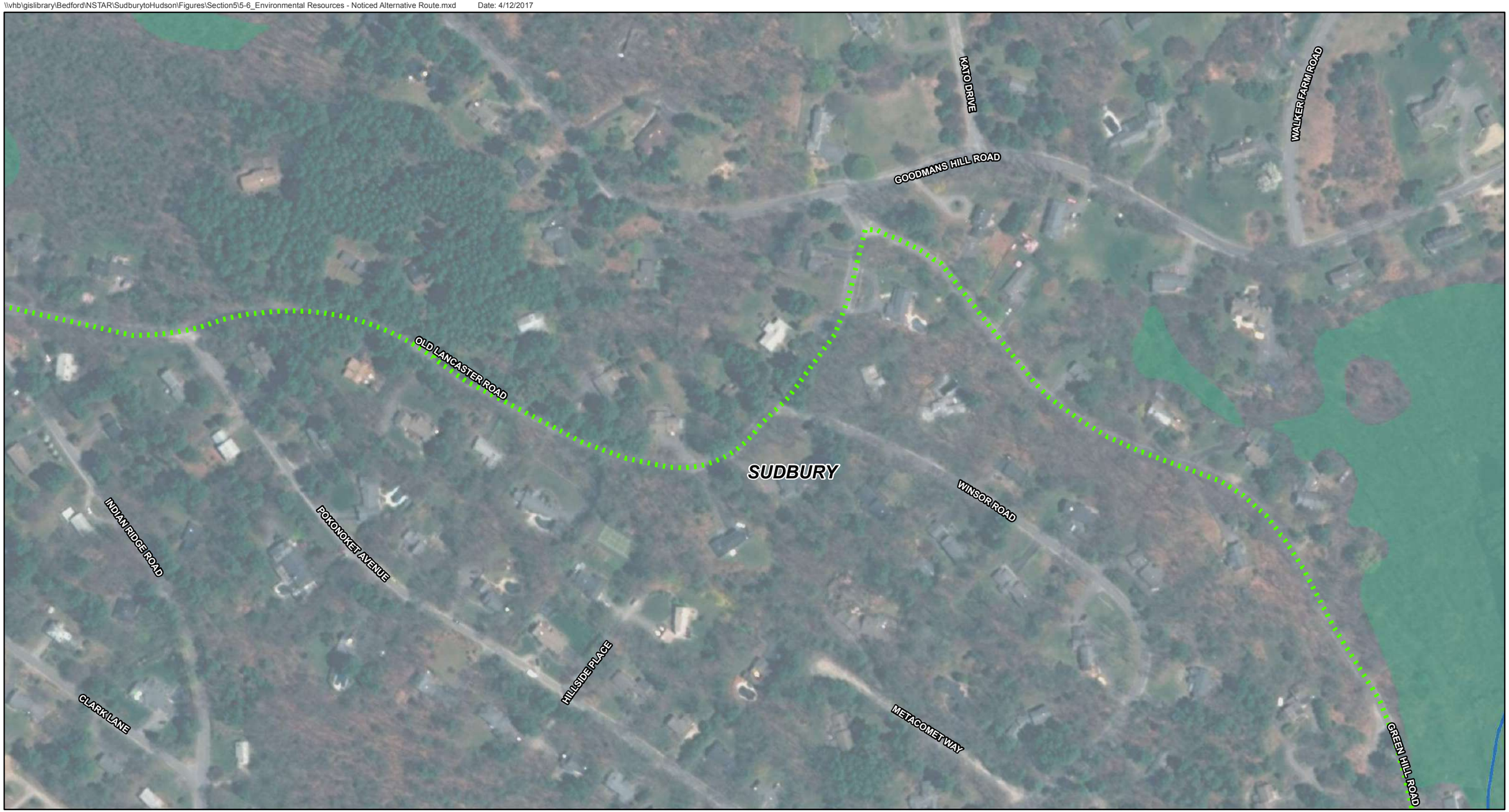

Noticed Alternative Route
NHESP Certified Vernal Pool
Coldwater Fishery
Stream
Wetland Resource Area
NHESP Priority & Estimated Habitat
FEMA 100-year Floodplain
Protected and Recreational Open Space
Existing Rails
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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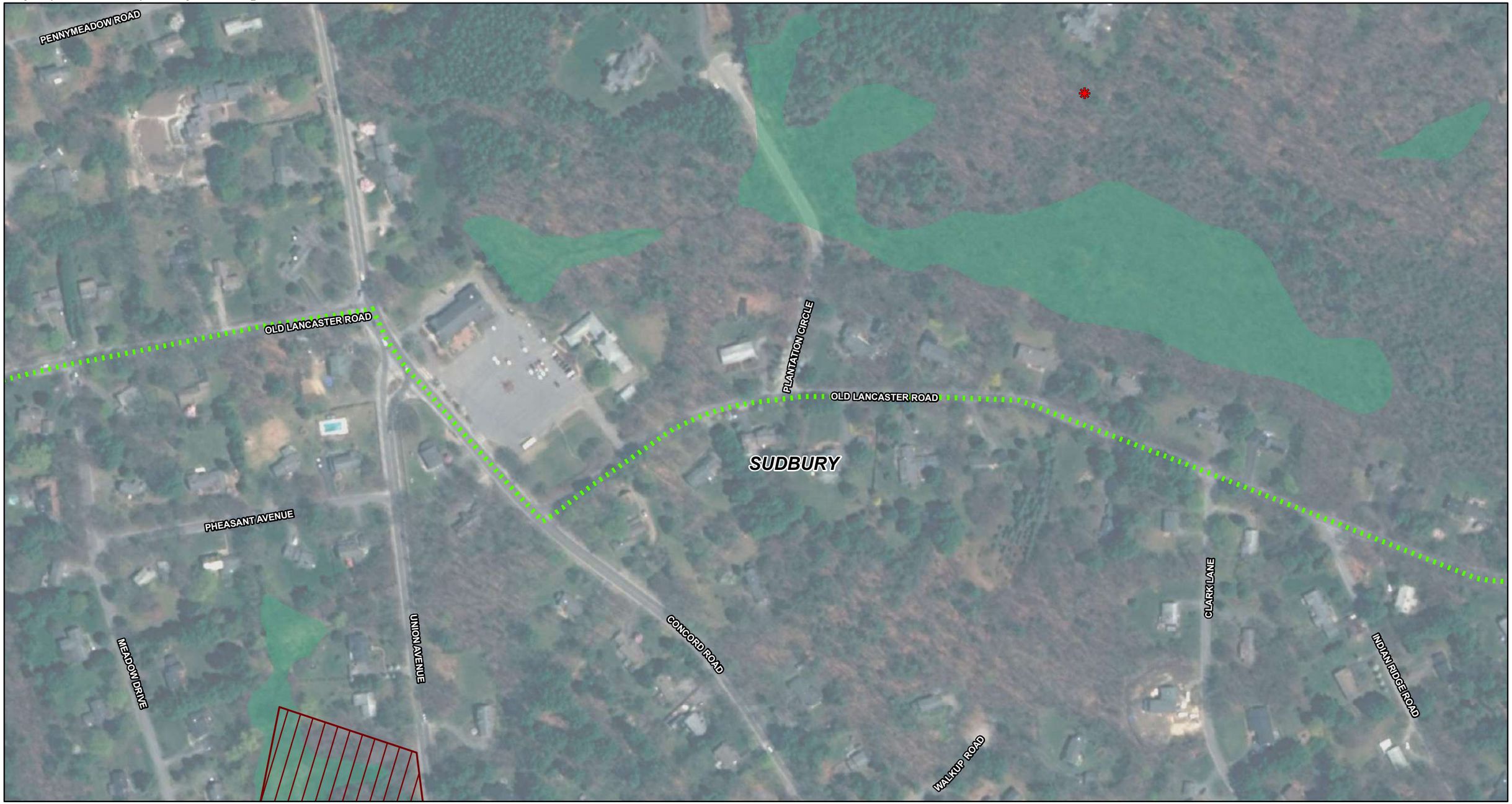

Noticed Alternative Route
NHESP Certified Vernal Pool
Coldwater Fishery
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NHESP Priority & Estimated Habitat
FEMA 100-year Floodplain
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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Noticed Alternative Route
NHESP Certified Vernal Pool
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MassGIS, 2015
OrthoImagery, VHB

4/12/2017

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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Sheet 4 of 17

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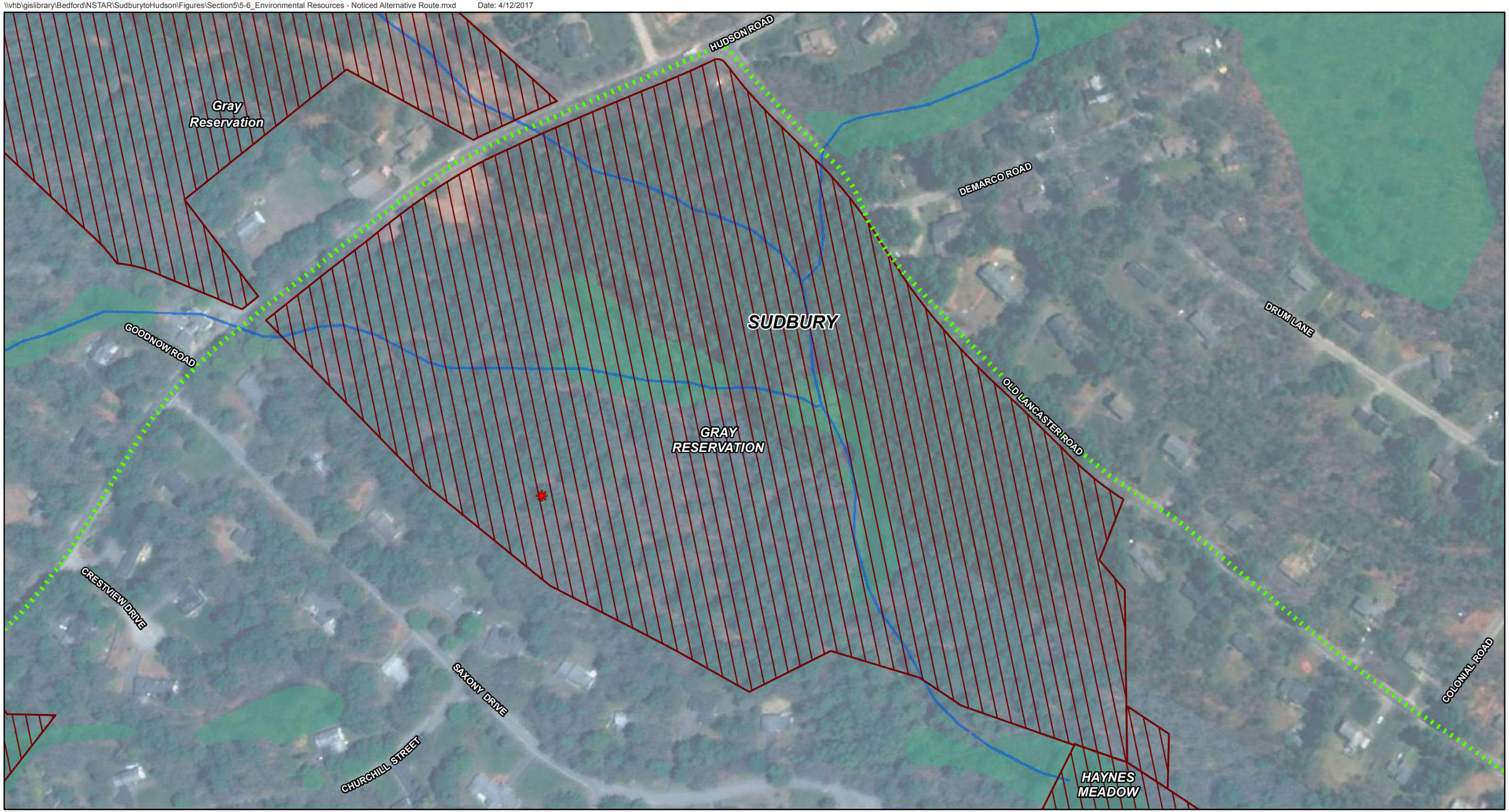

Noticed Alternative Route
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OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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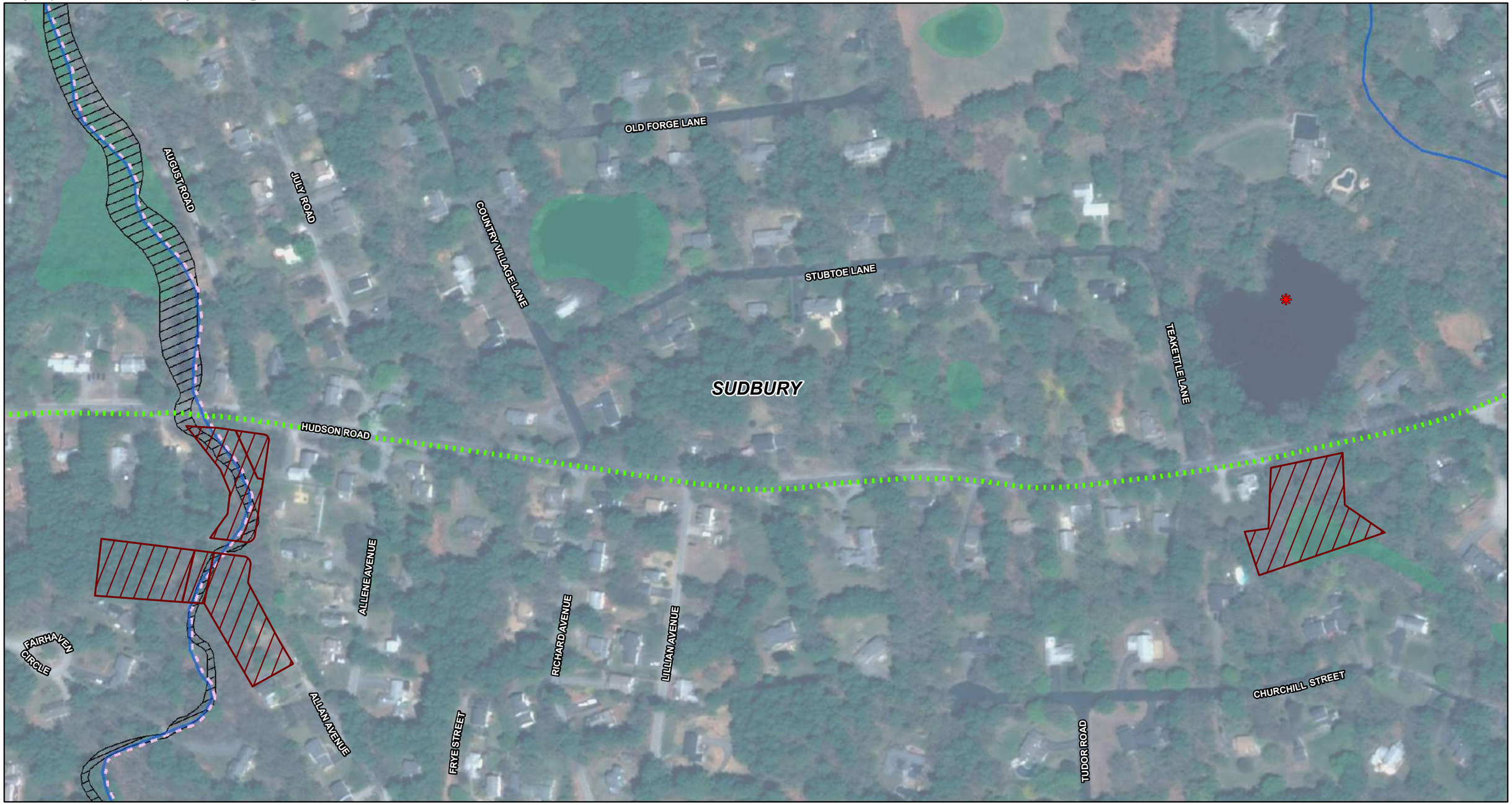

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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NHESP Certified Vernal Pool
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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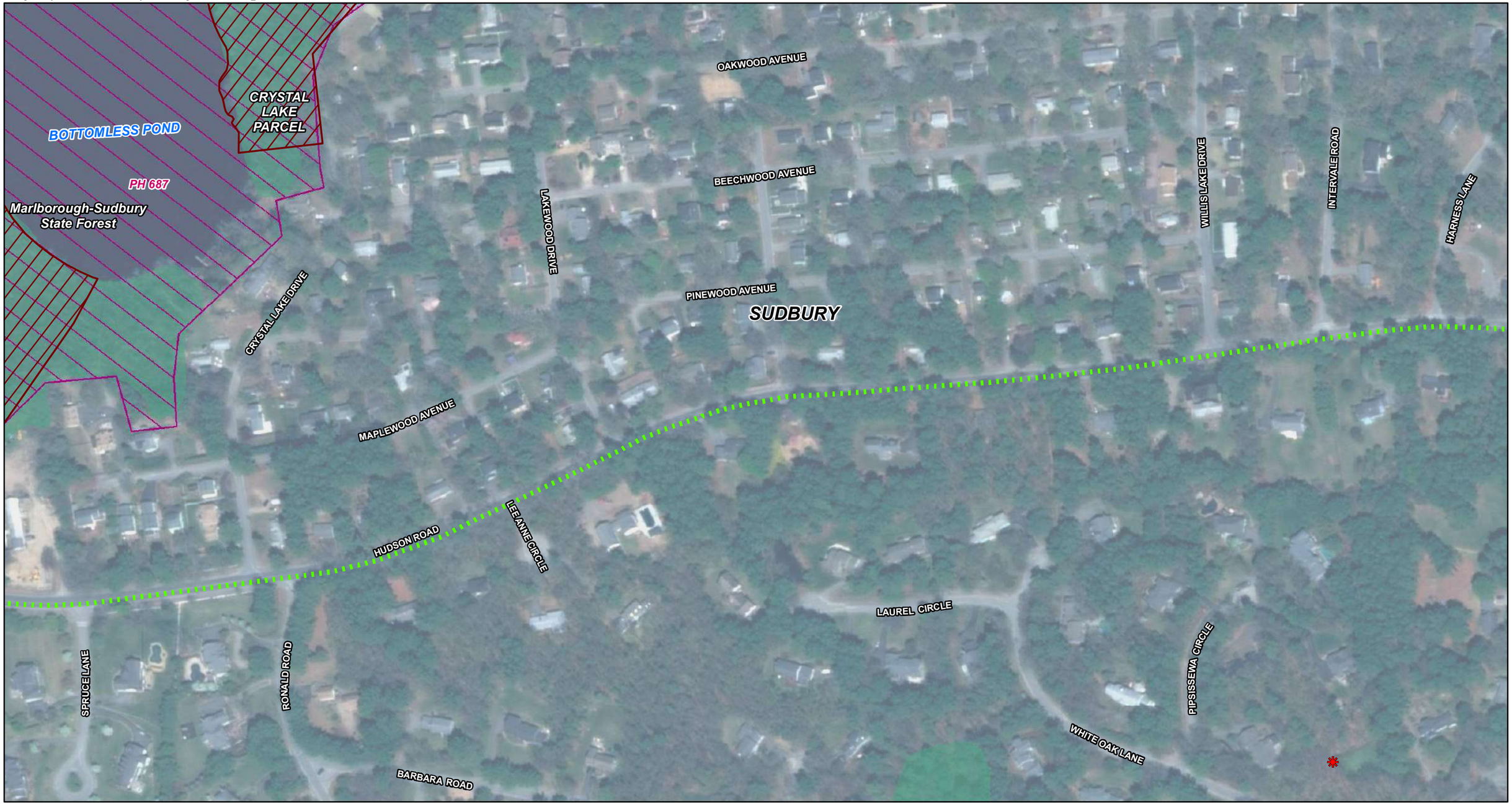

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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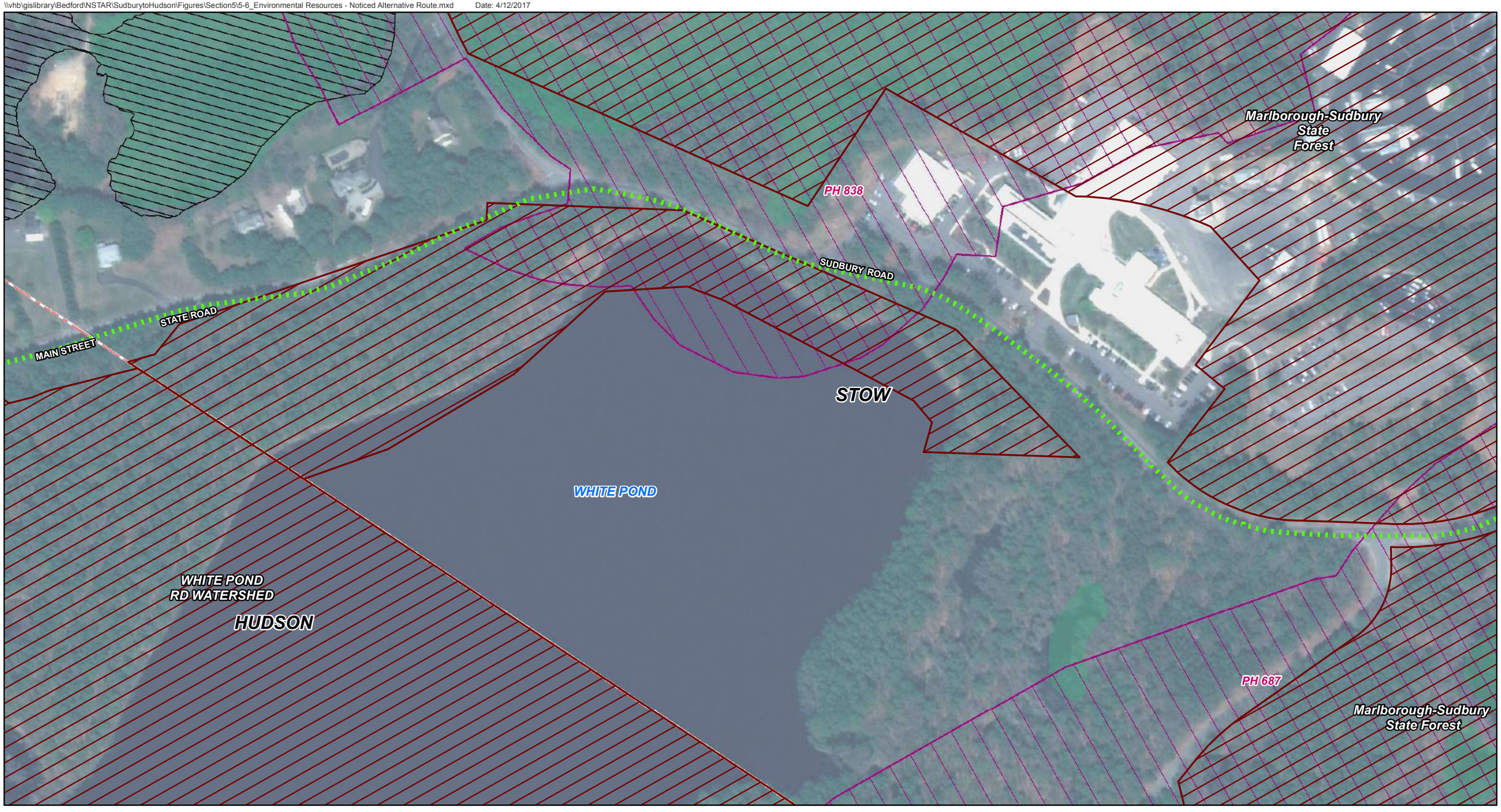

Noticed Alternative Route
NHESP Certified Vernal Pool
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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NHESP Certified Vernal Pool
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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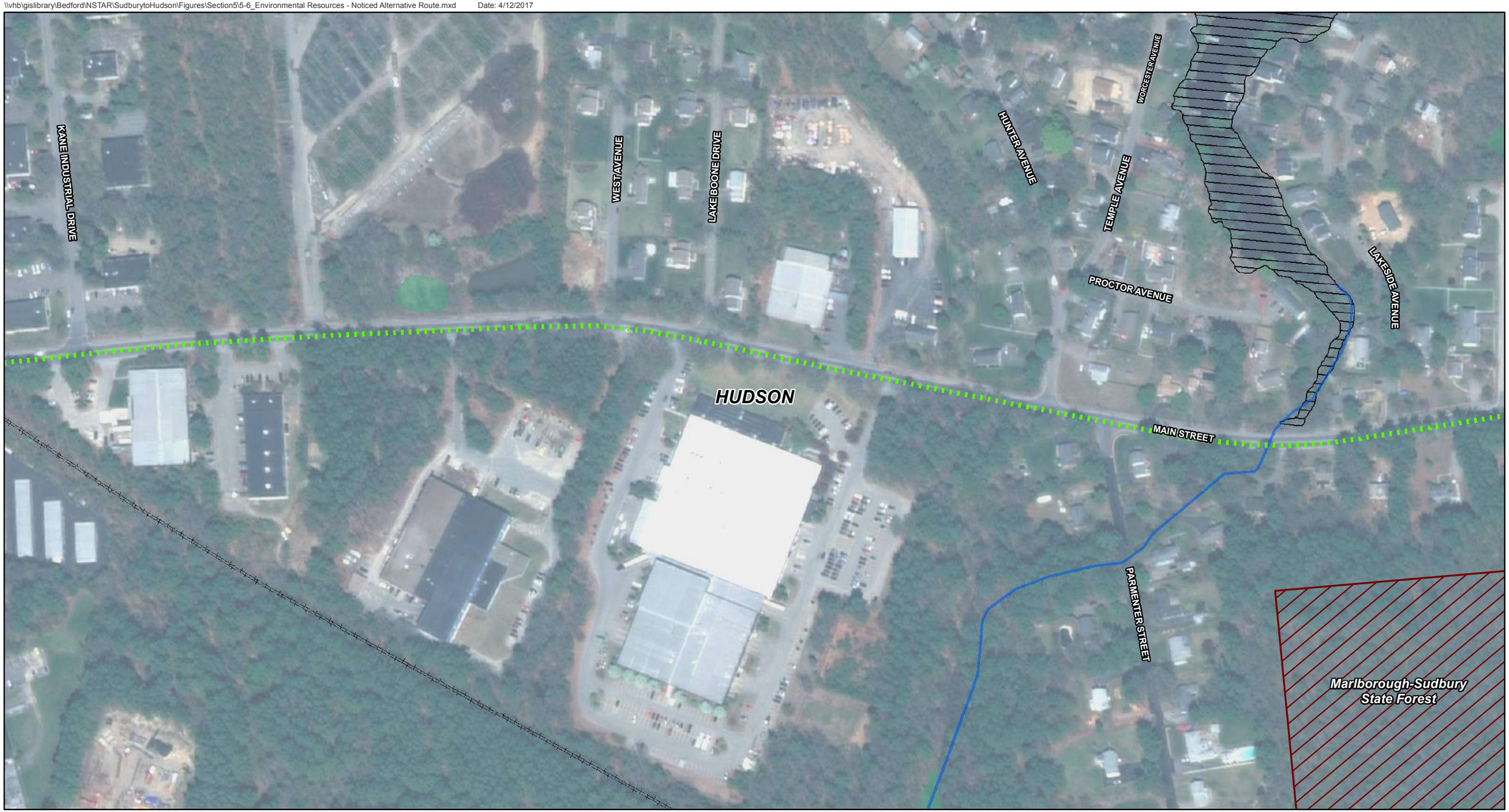

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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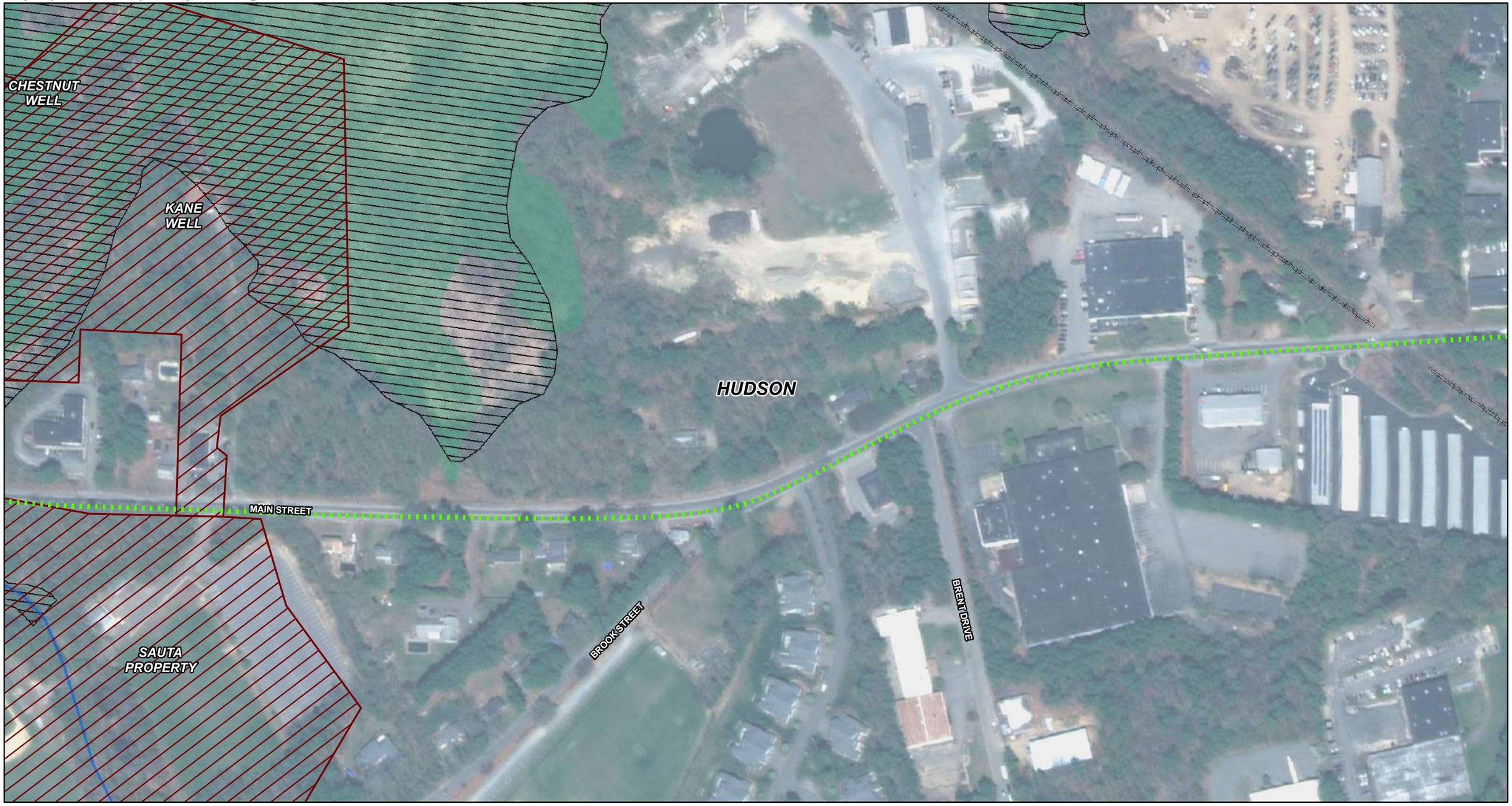

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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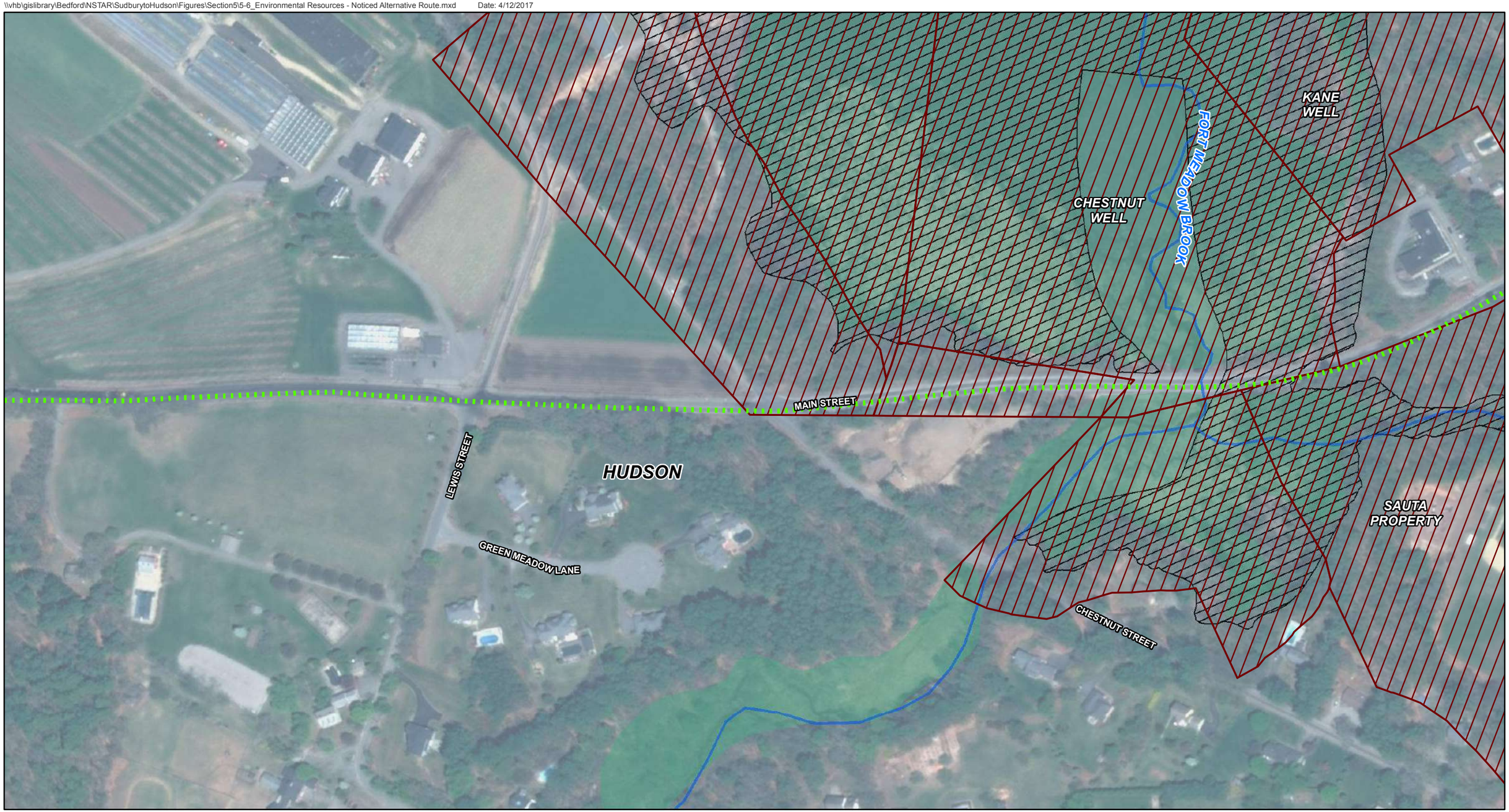

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NHESP Priority & Estimated Habitat
FEMA 100-year Floodplain
Protected and Recreational Open Space
Existing Rails
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

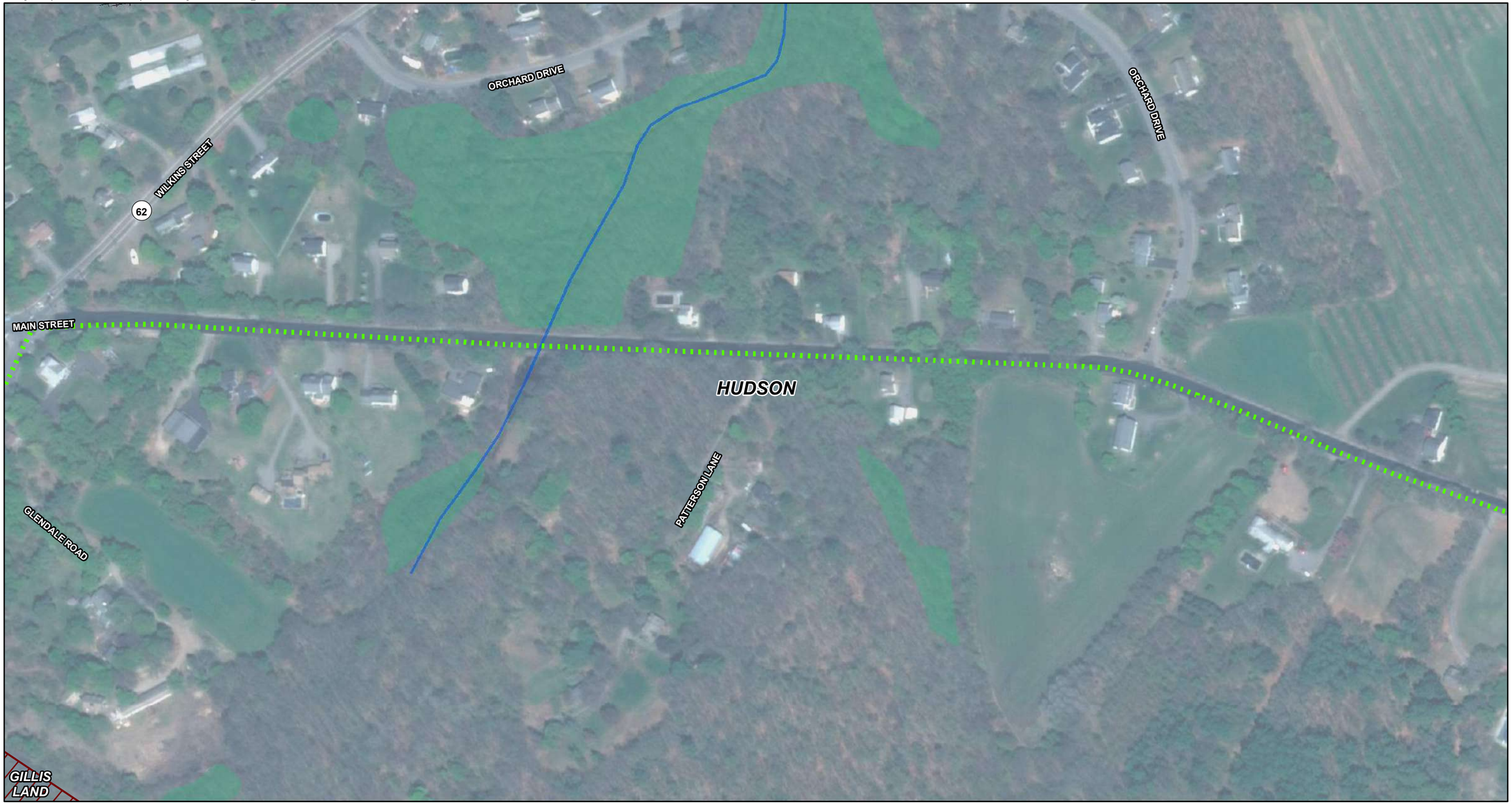
Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

vhb

Sheet 14 of 17

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-6_Environmental Resources - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
NHESP Certified Vernal Pool
Coldwater Fishery
Stream
Wetland Resource Area
NHESP Priority & Estimated Habitat
FEMA 100-year Floodplain
Protected and Recreational Open Space
Existing Rails
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

vhb

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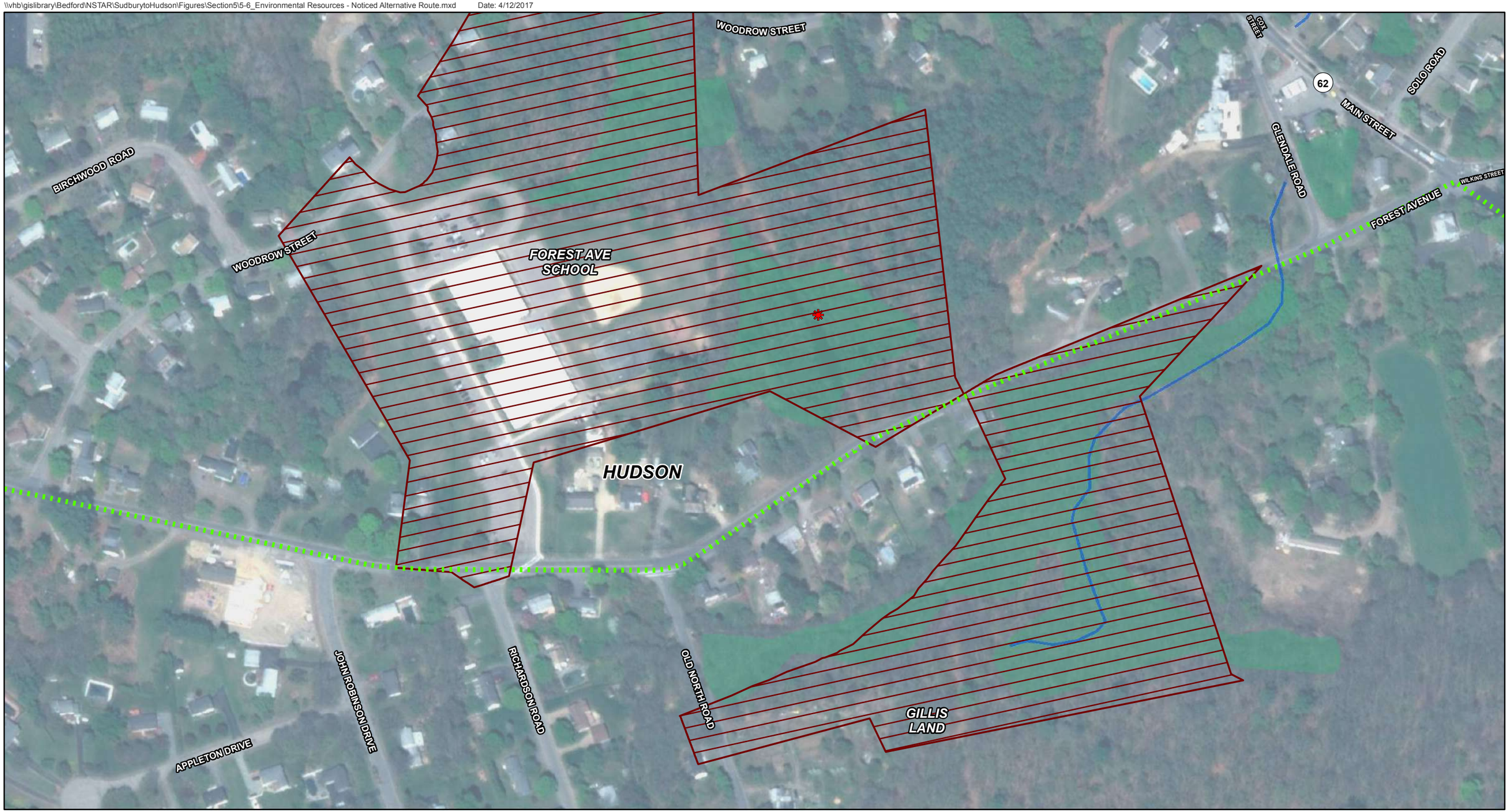

Noticed Alternative Route
NHESP Certified Vernal Pool
Coldwater Fishery
Stream
Wetland Resource Area
NHESP Priority & Estimated Habitat
FEMA 100-year Floodplain
Protected and Recreational Open Space
Existing Rails
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

vhb

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Noticed Alternative Route

NHESP Certified Vernal Pool
Coldwater Fishery
Stream
Wetland Resource Area
NHESP Priority & Estimated Habitat
FEMA 100-year Floodplain
Protected and Recreational Open Space

Existing Rails
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-6: Environmental Resources - Noticed Alternative Route

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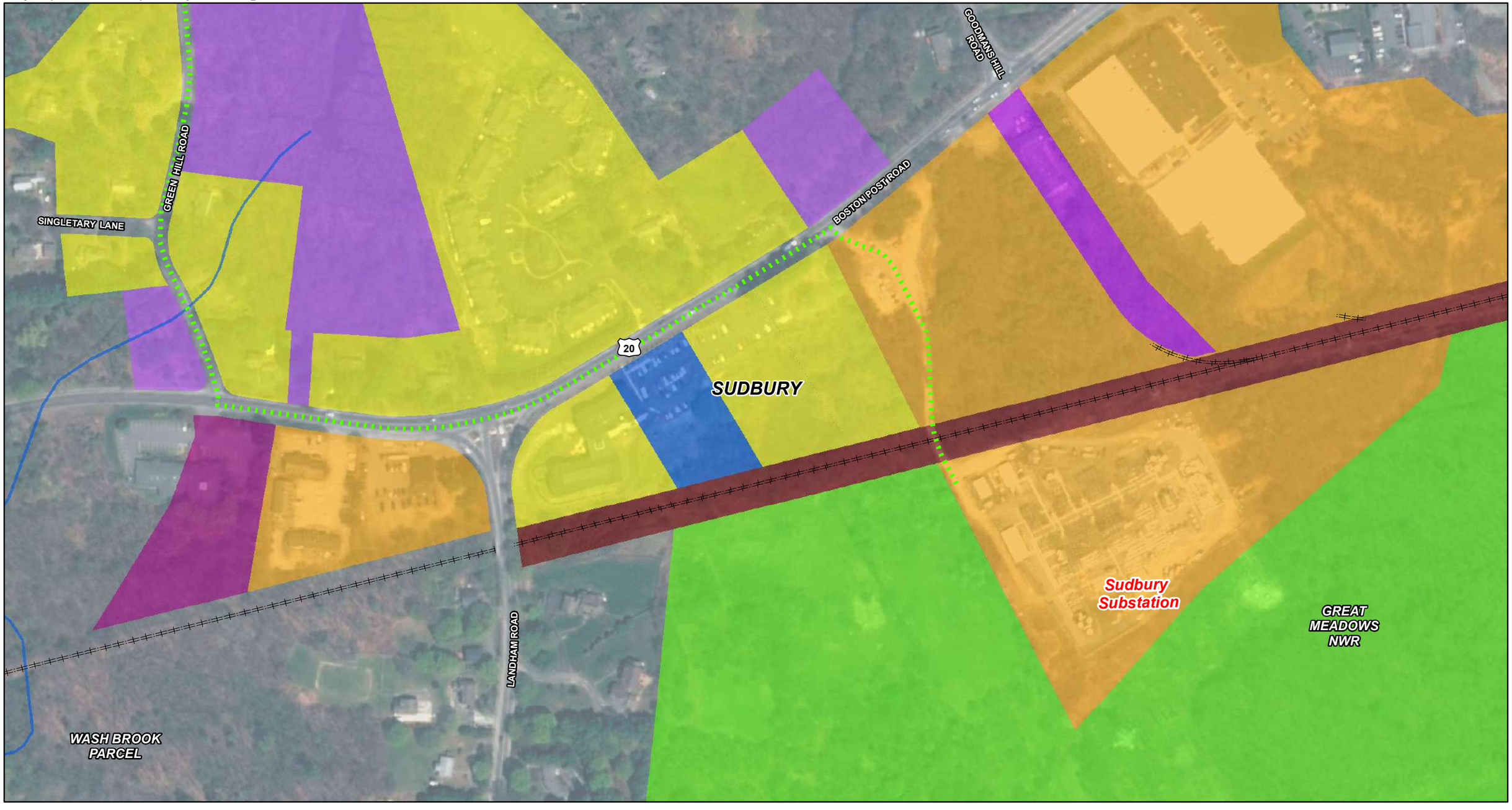
vhb

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route

Charitable
Commercial/Industrial
Conservation
Government
Mixed Use
Religious
Residential
Vacant Land

Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

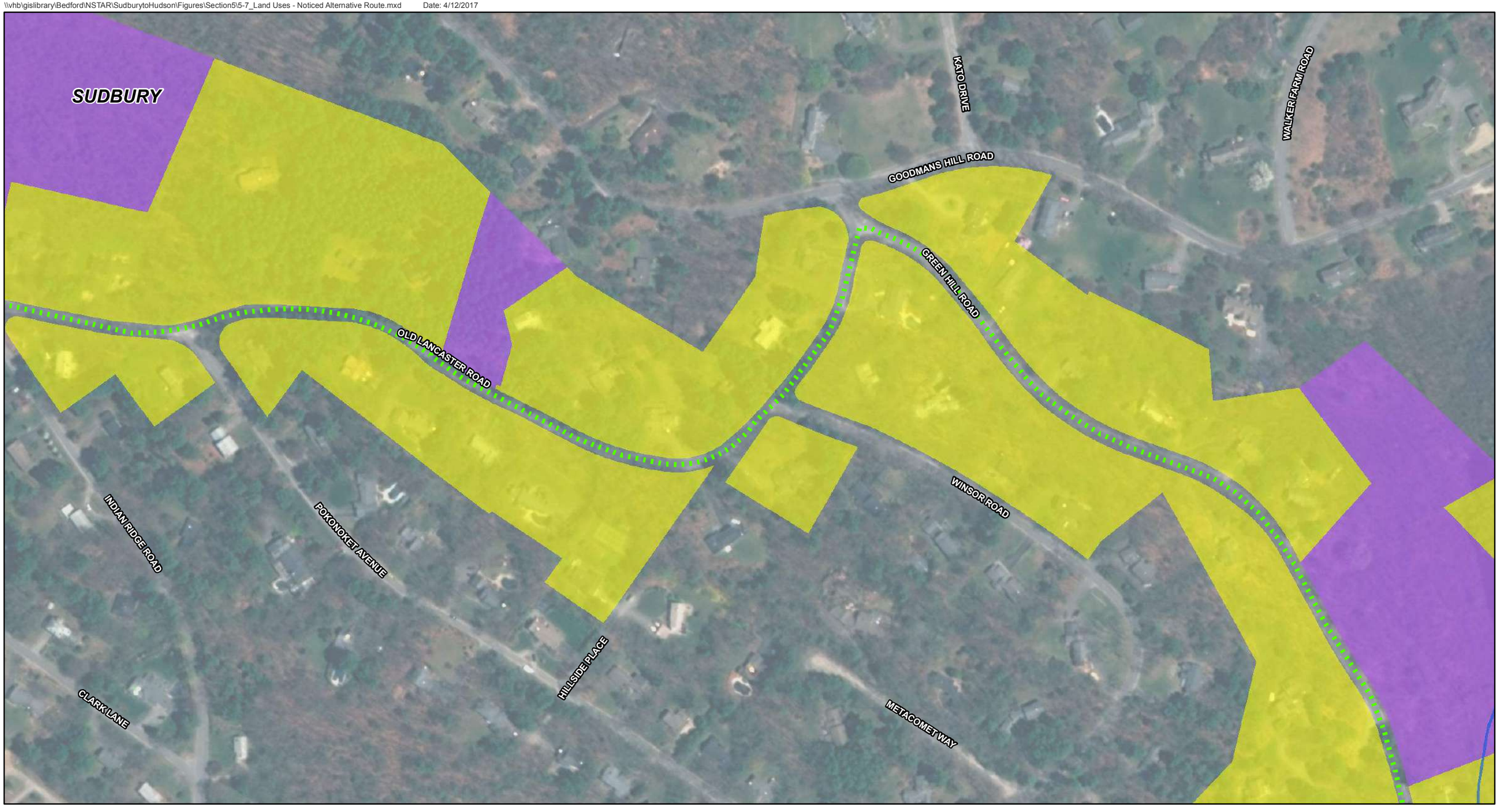
Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

vhb

Sheet 1 of 17

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

vhb

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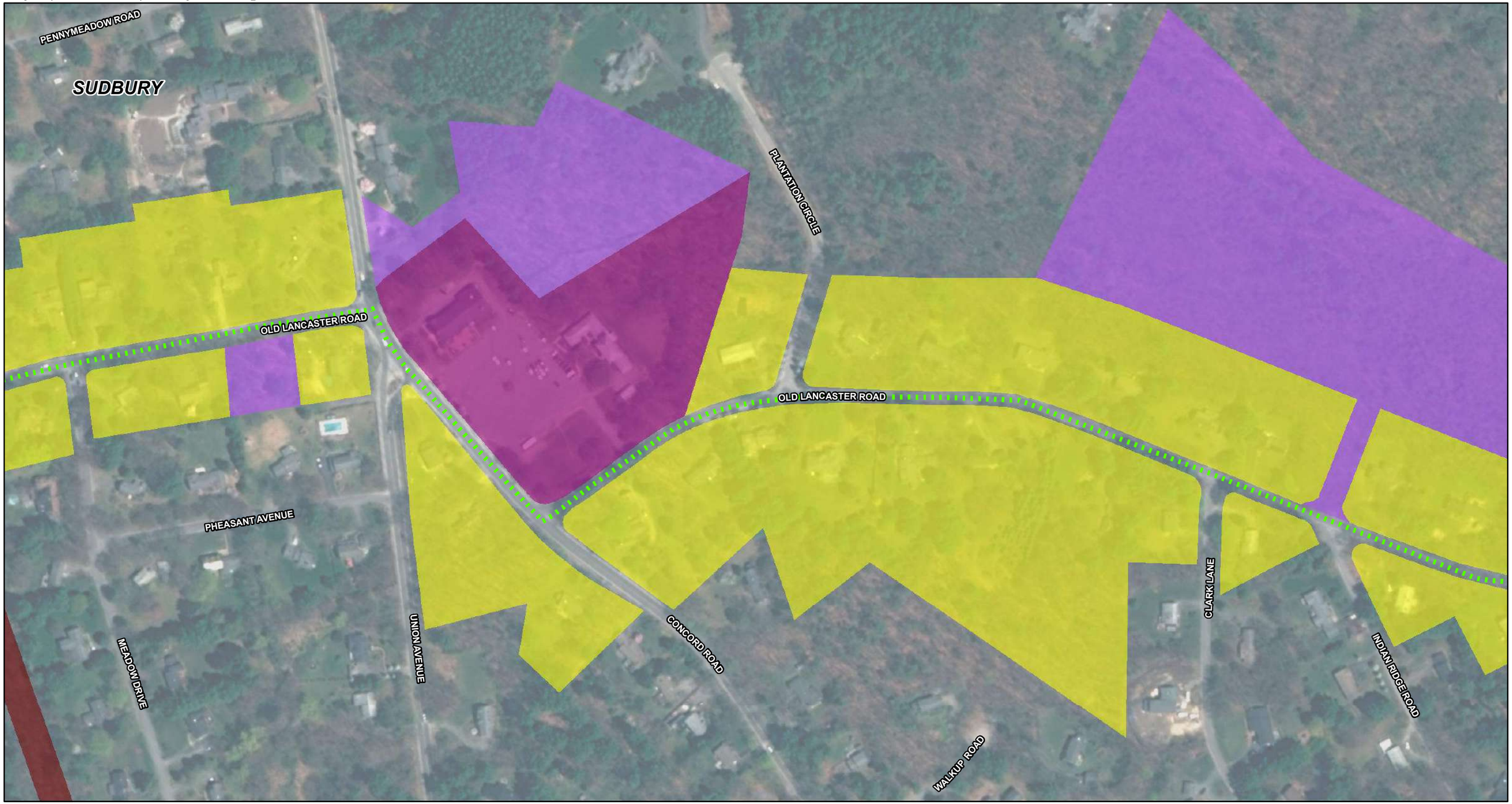
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
Government
Religious
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

vhb

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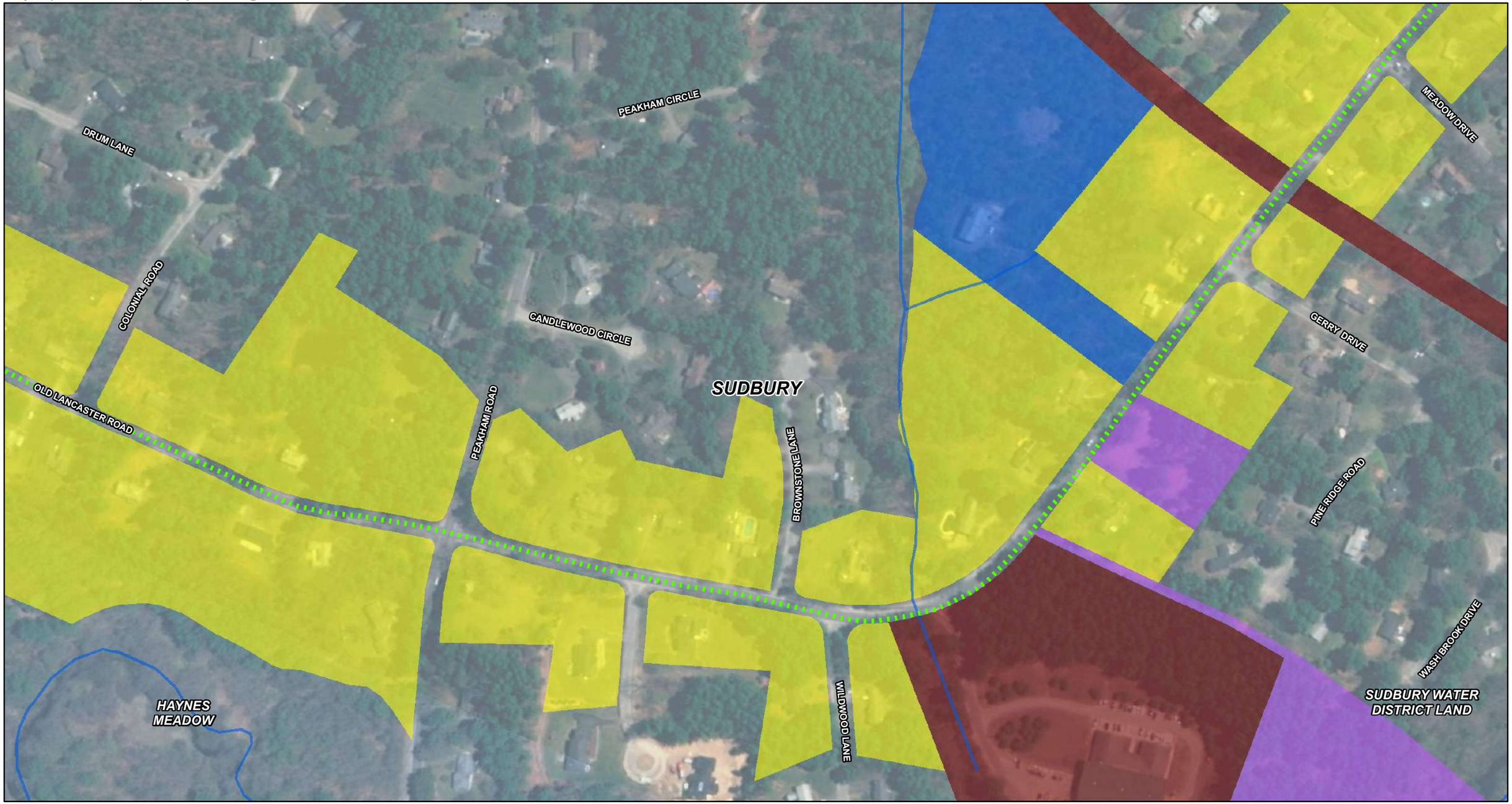
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
Government
Residential
Existing Rail
Mixed Use
Vacant Land
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

vhb

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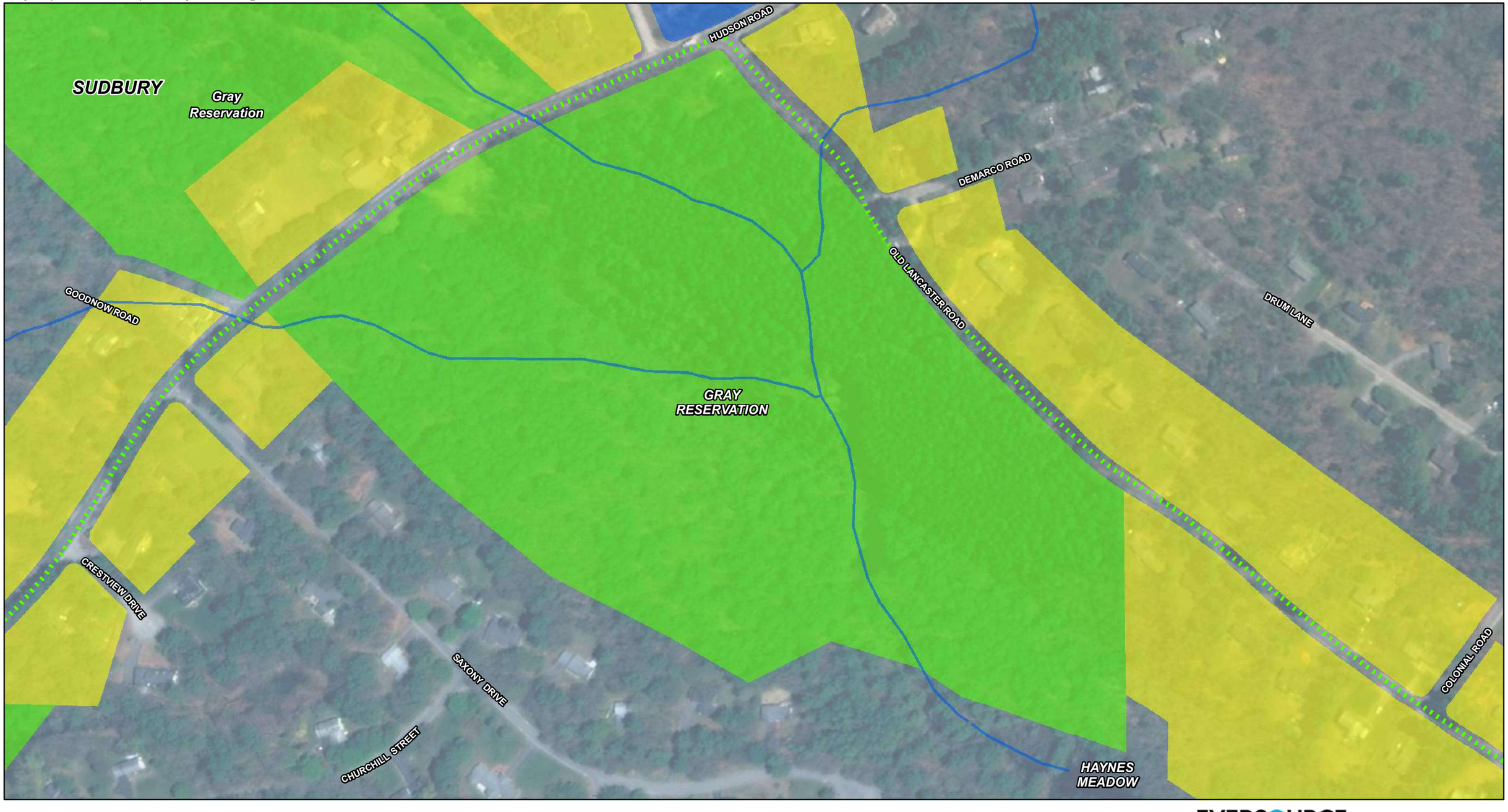

Noticed Alternative Route
Conservation
Mixed Use
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

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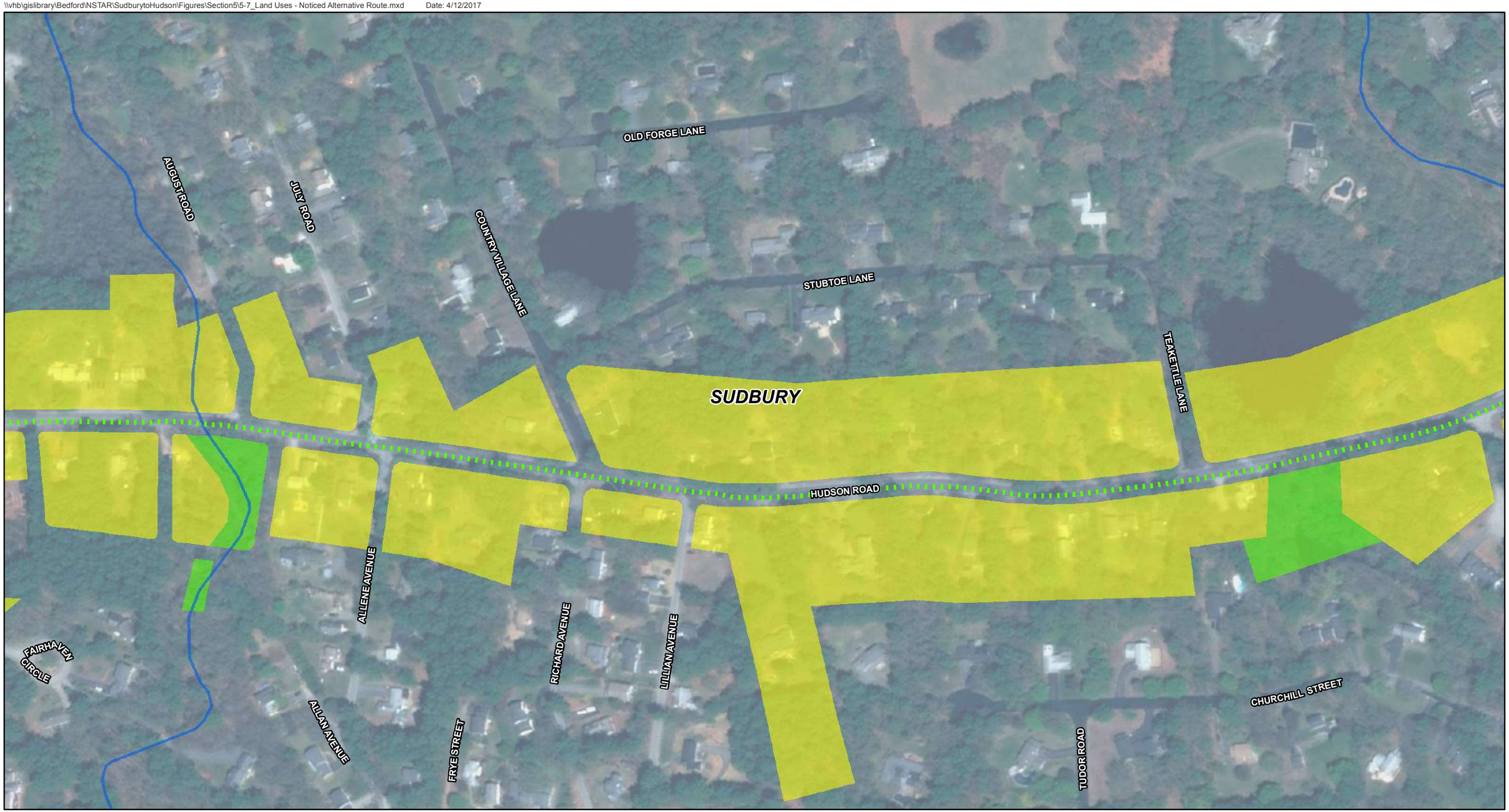
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
Conservation
Residential
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

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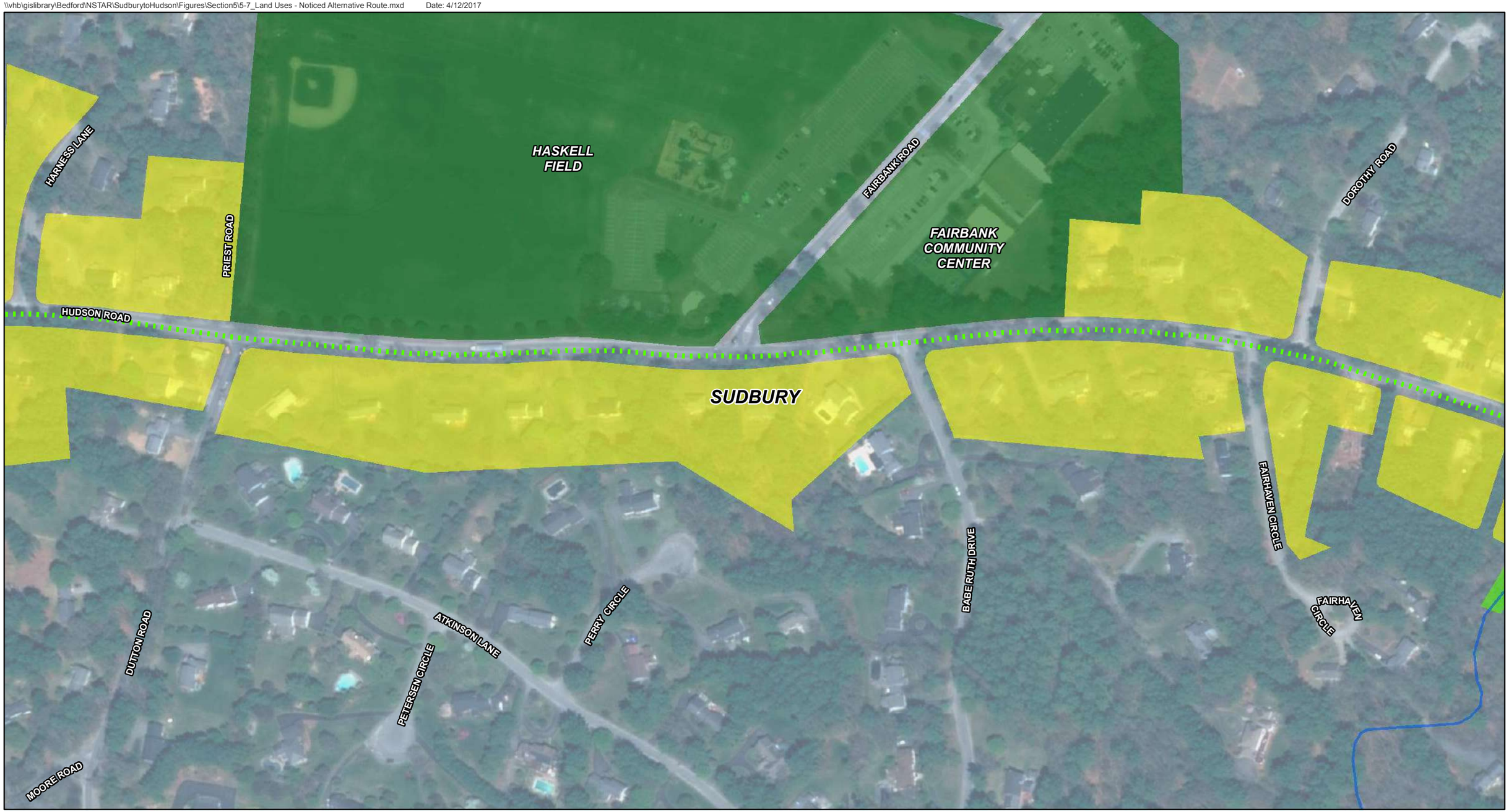
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
Conservation
Recreational
Residential
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

vhb

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\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017

Noticed Alternative Route
Commercial/Industrial
Residential
Existing Rail
Conservation
Vacant Land
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

vhb

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Noticed Alternative Route
Commercial/Industrial
Conservation
Government
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

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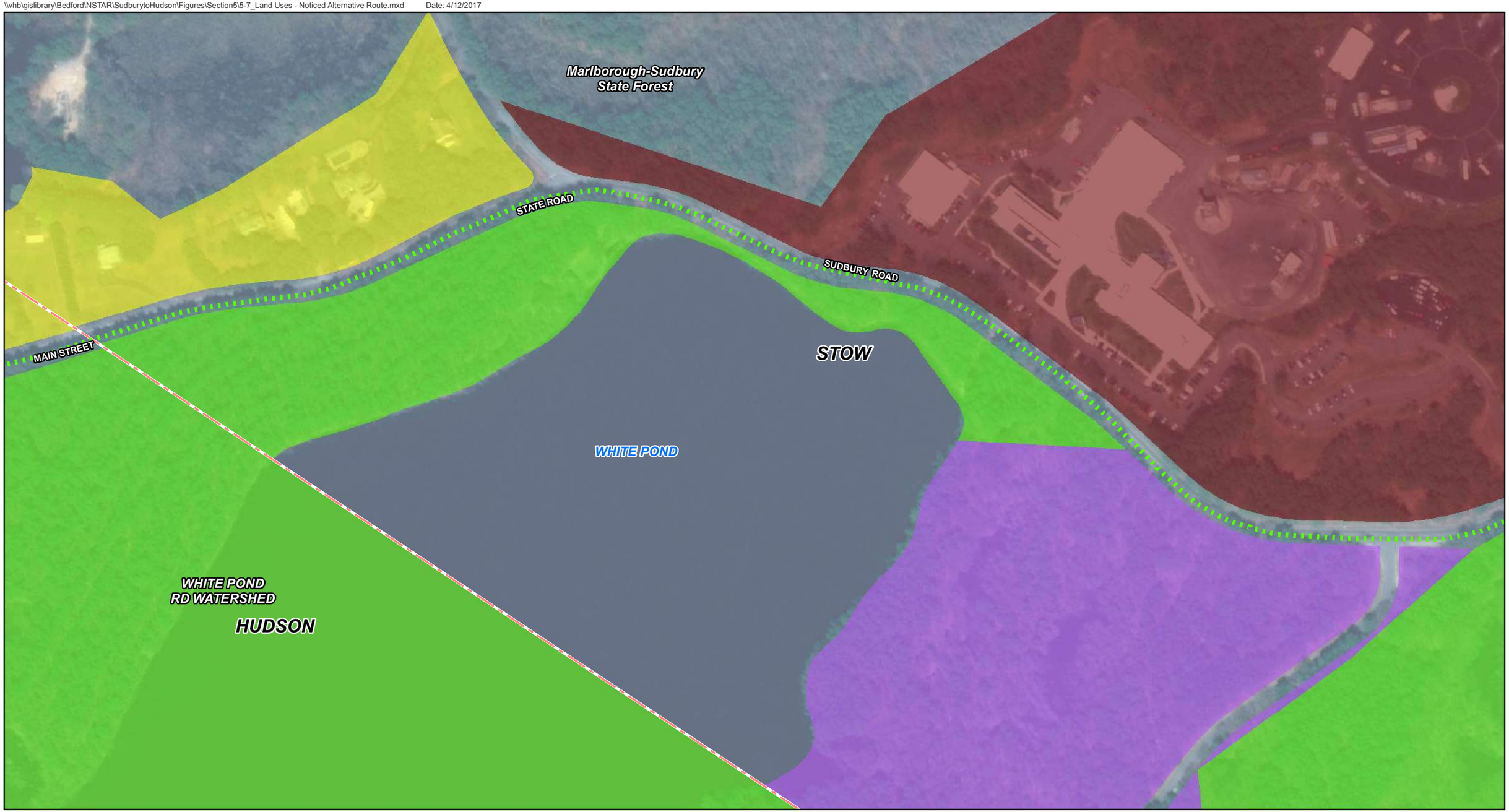
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
Conservation
Government
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

**Figure 5-7: Land Uses -
Noticed Alternative Route**

vhb

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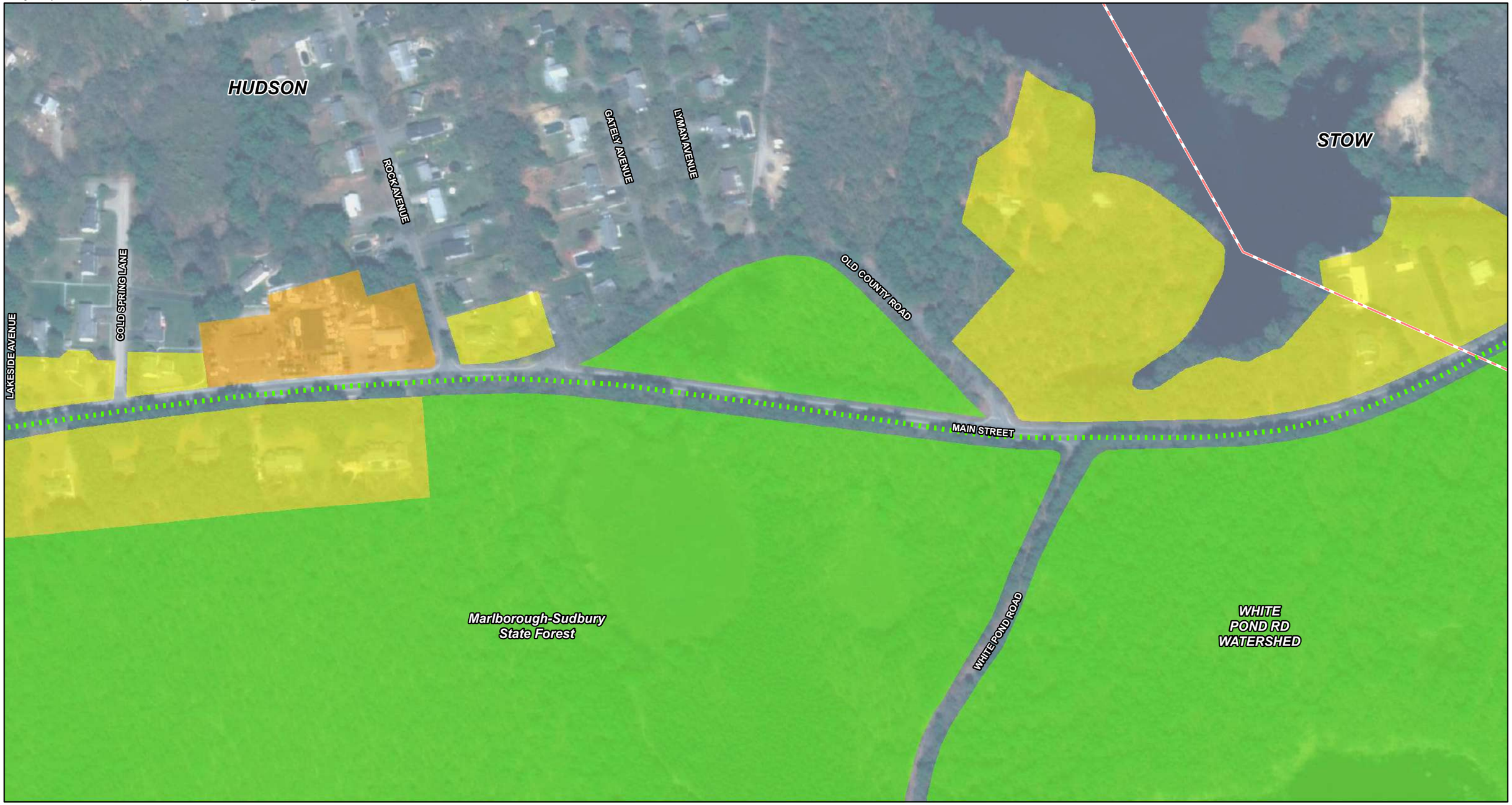
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
Commercial/Industrial
Residential
Existing Rail
Conservation
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

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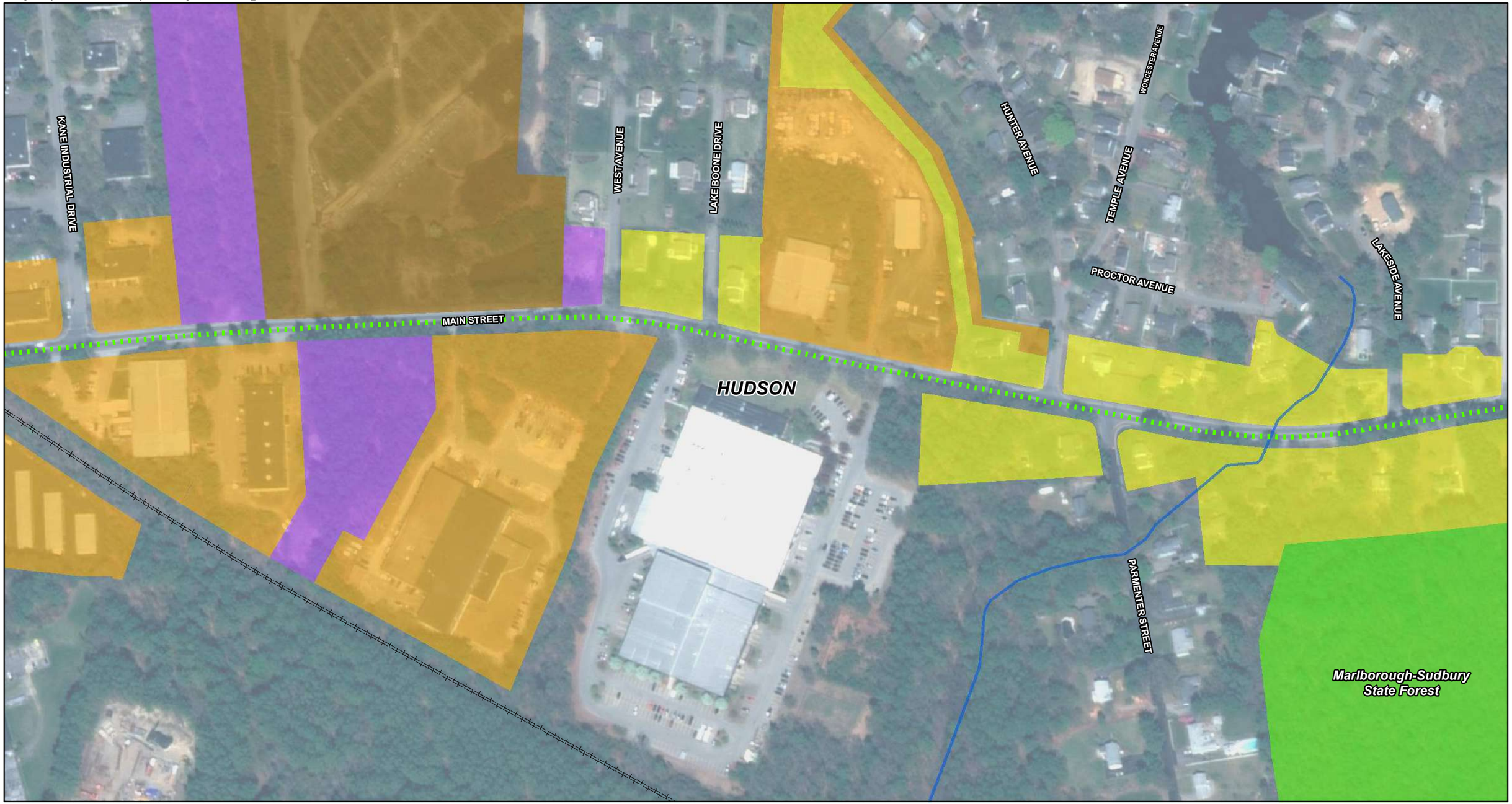

Noticed Alternative Route
Agricultural/Horticultural
Commercial/Industrial
Conservation
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

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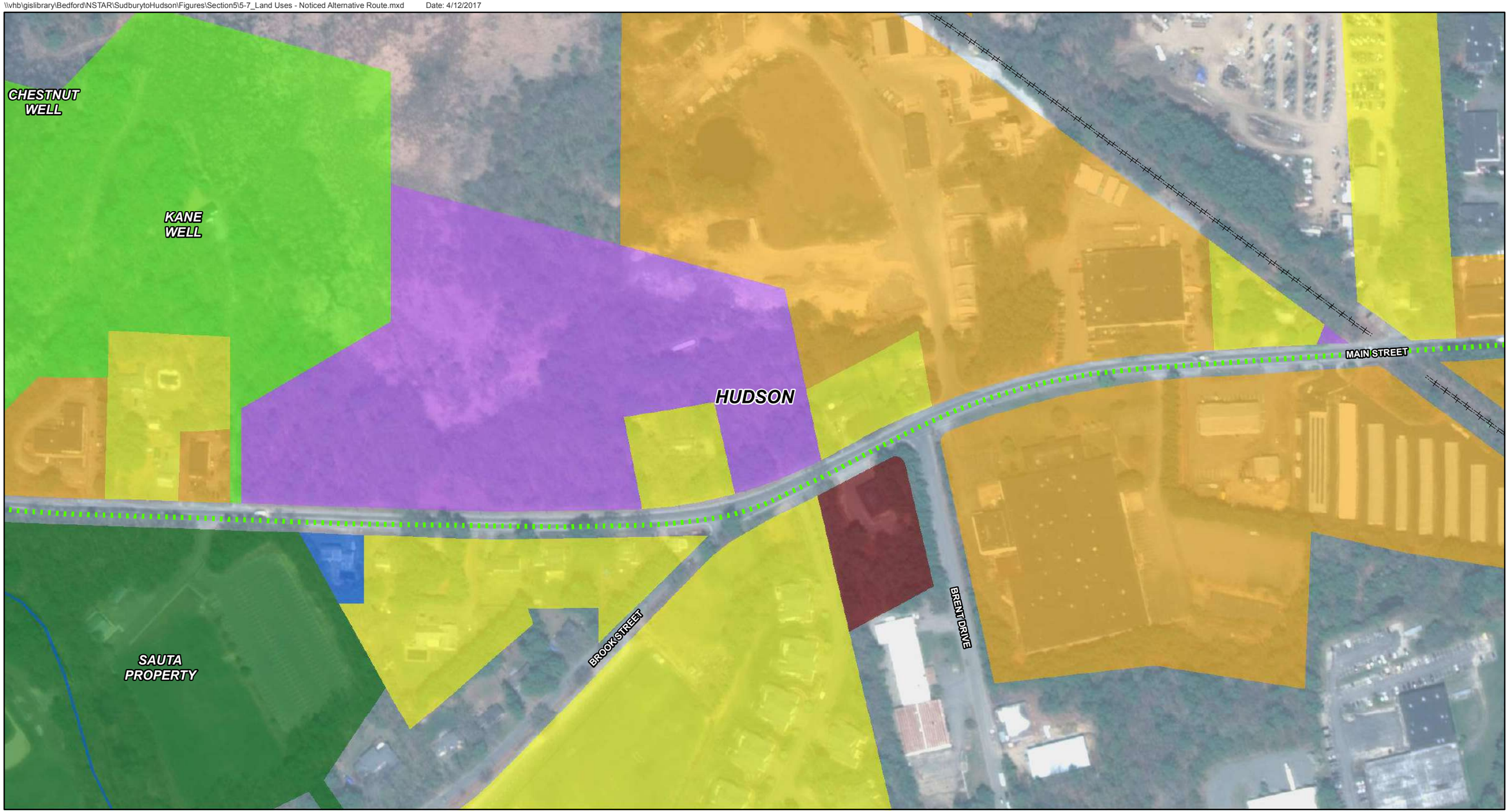
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-7_Land Uses - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
Commercial/Industrial
Conservation
Government
Mixed Use
Recreational
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

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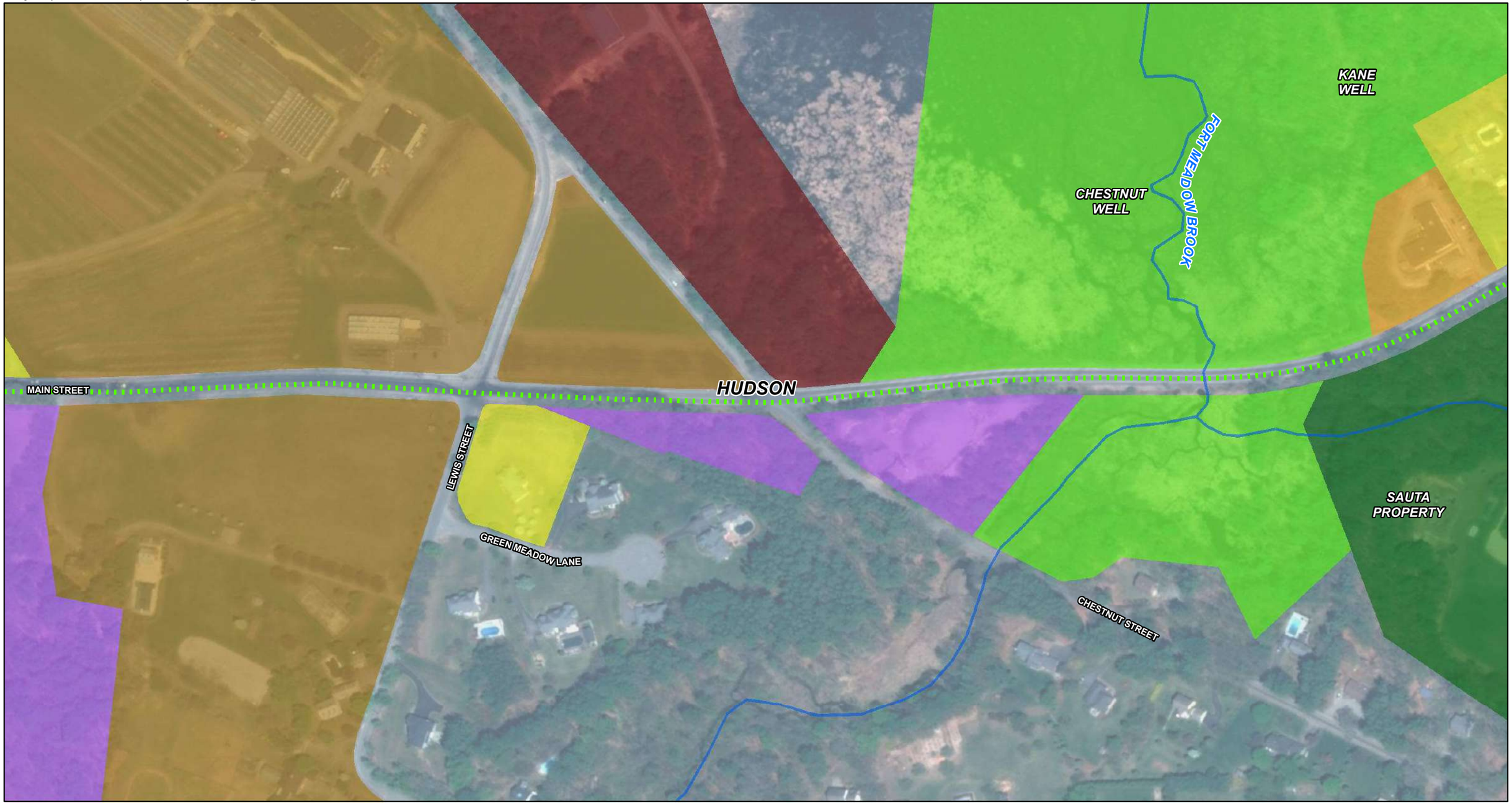


Noticed Alternative Route

Agricultural/Horticultural
Commercial/Industrial
Conservation
Government
Recreational
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

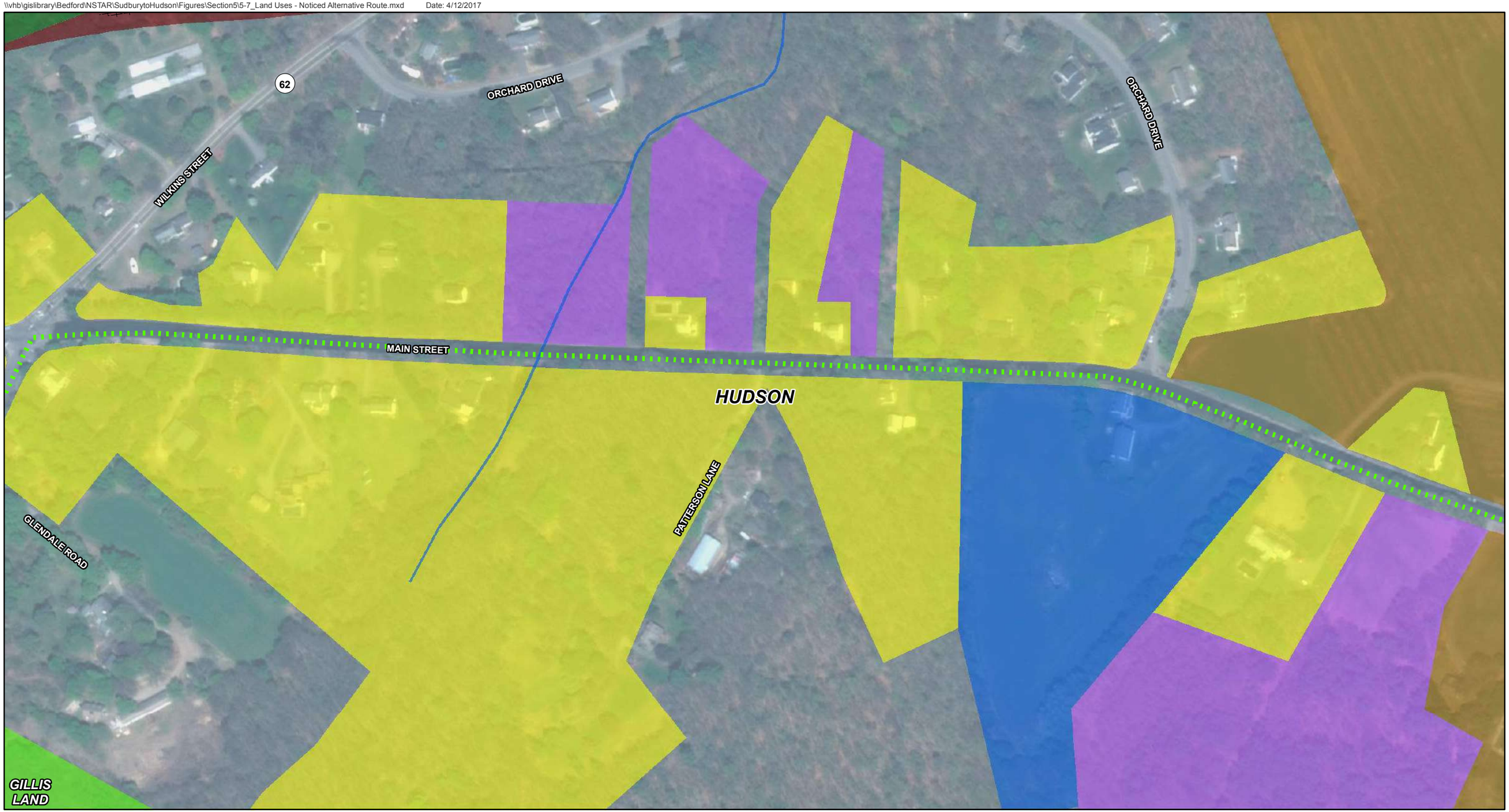
0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

vhb



Noticed Alternative Route

Agricultural/Horticultural
Conservation
Government
Mixed Use
Recreational
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

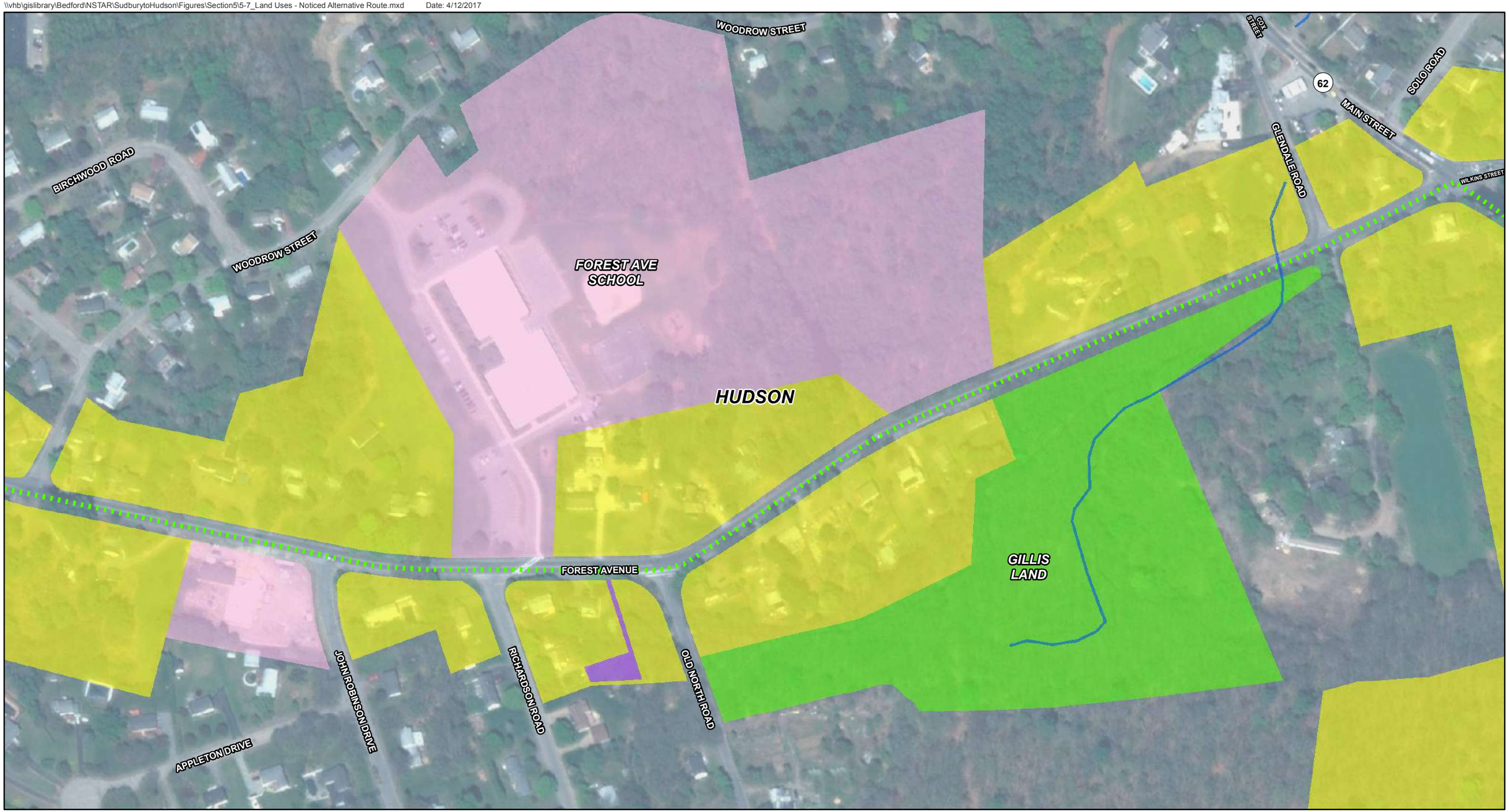
0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

vhb



Noticed Alternative Route
Conservation
Educational
Residential
Vacant Land
Existing Rail
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

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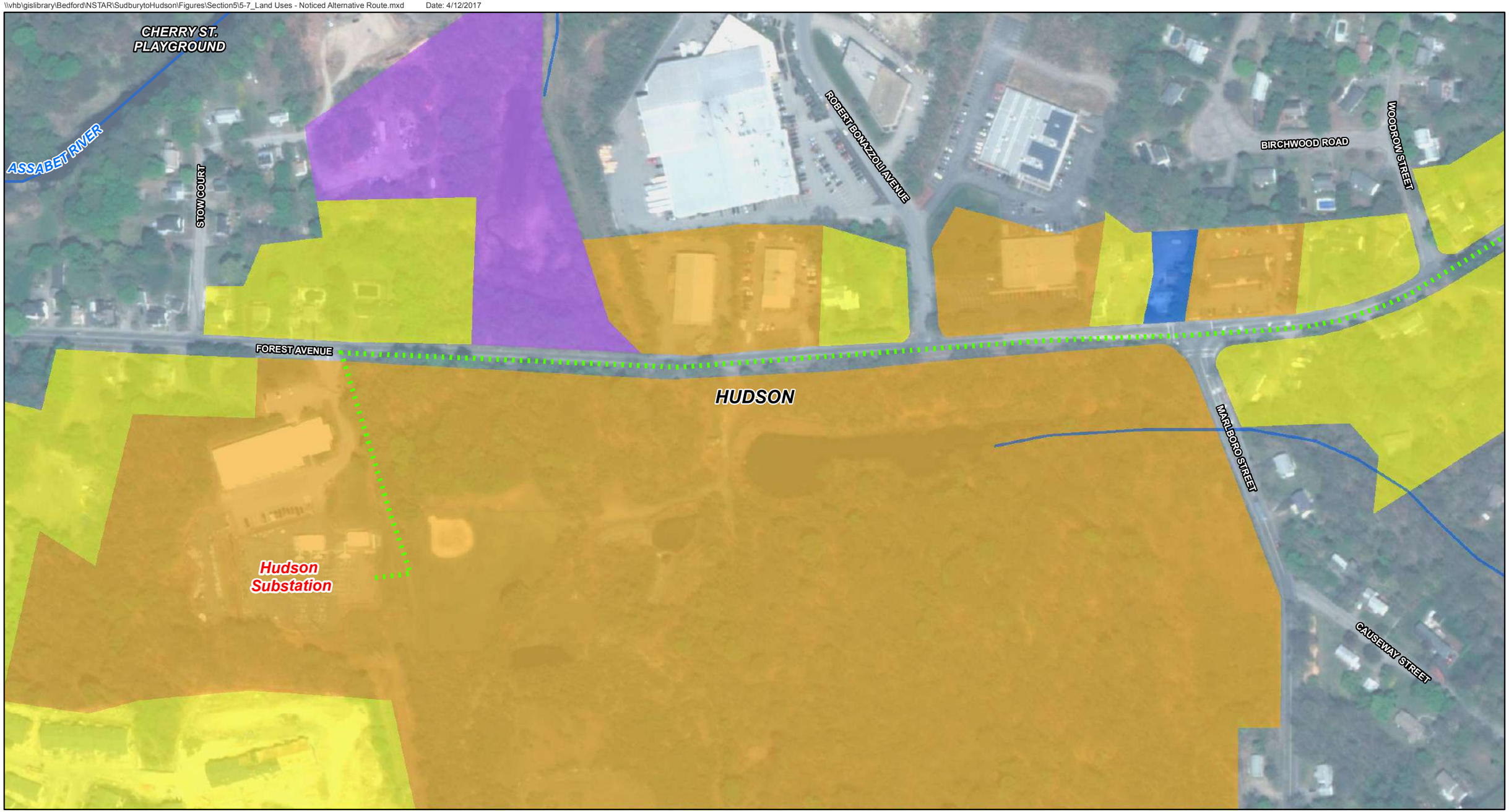

Noticed Alternative Route
Commercial/Industrial
Residential
Existing Rail
Mixed Use
Vacant Land
Stream
Town Boundaries

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-7: Land Uses - Noticed Alternative Route

vhb

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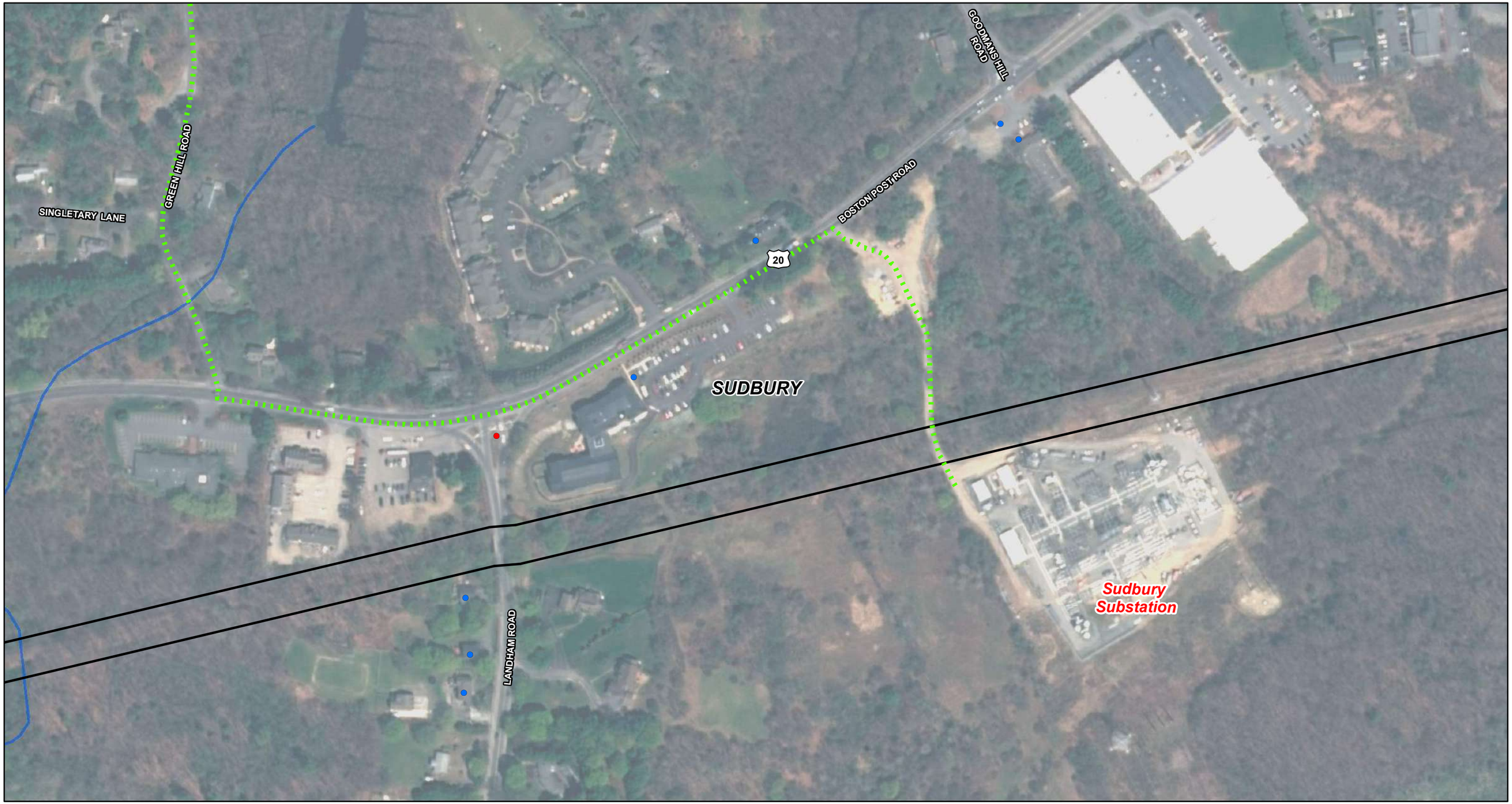
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-8_Historic Resources - Noticed Alternative Route.mxd Date: 4/12/2017



Noticed Alternative Route
MBTA ROW Boundary
Stream
Town Boundaries

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Property
Unregistered Local Historic Site

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Area
Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

Sheet 1 of 17

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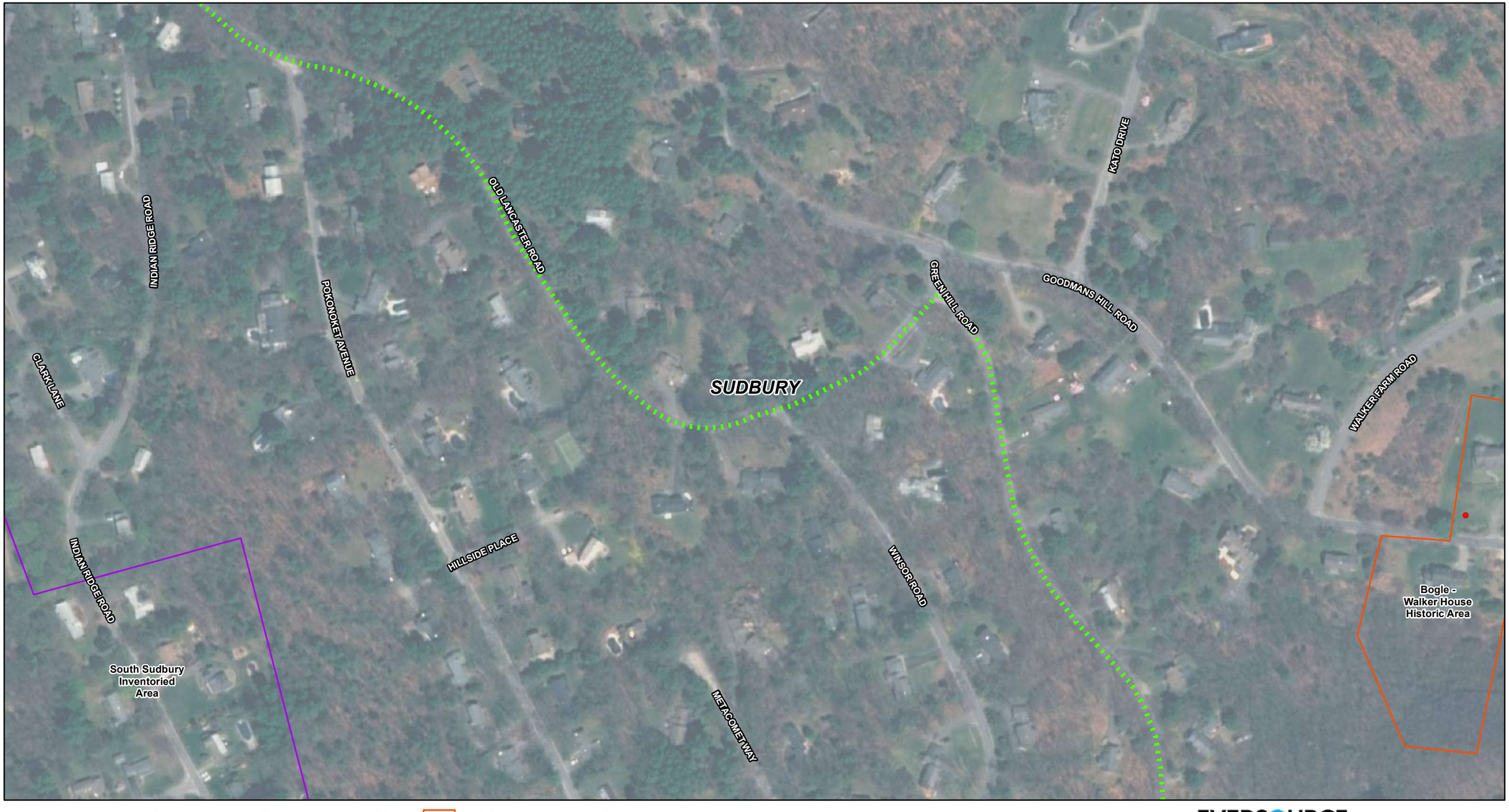

- Noticed Alternative Route
- MBTA ROW Boundary
- Stream
- Town Boundaries
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Property
- Unregistered Local Historic Site
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Area
- Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

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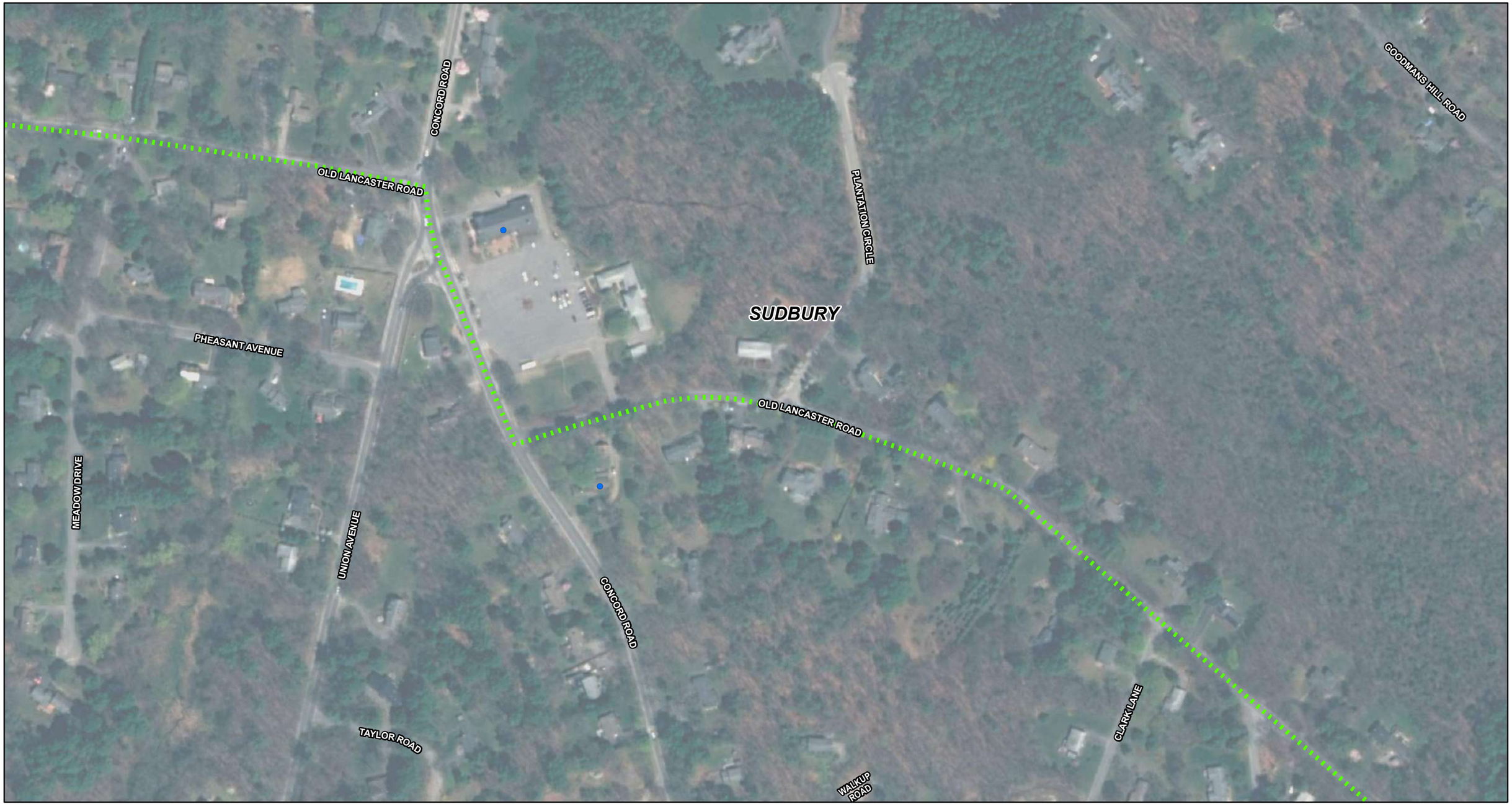
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-8_Historic Resources - Noticed Alternative Route.mxd Date: 4/12/2017



- Noticed Alternative Route
- MBTA ROW Boundary
- Stream
- Town Boundaries

Nat'l Register of Historic Places	Nat'l Register of Historic Places
Preservation Restriction	Preservation Restriction
Local Historic District	Local Historic District
NRHP and LHD	NRHP and LHD
Inventoried Property	Inventoried Area
Unregistered Local Historic Site	Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

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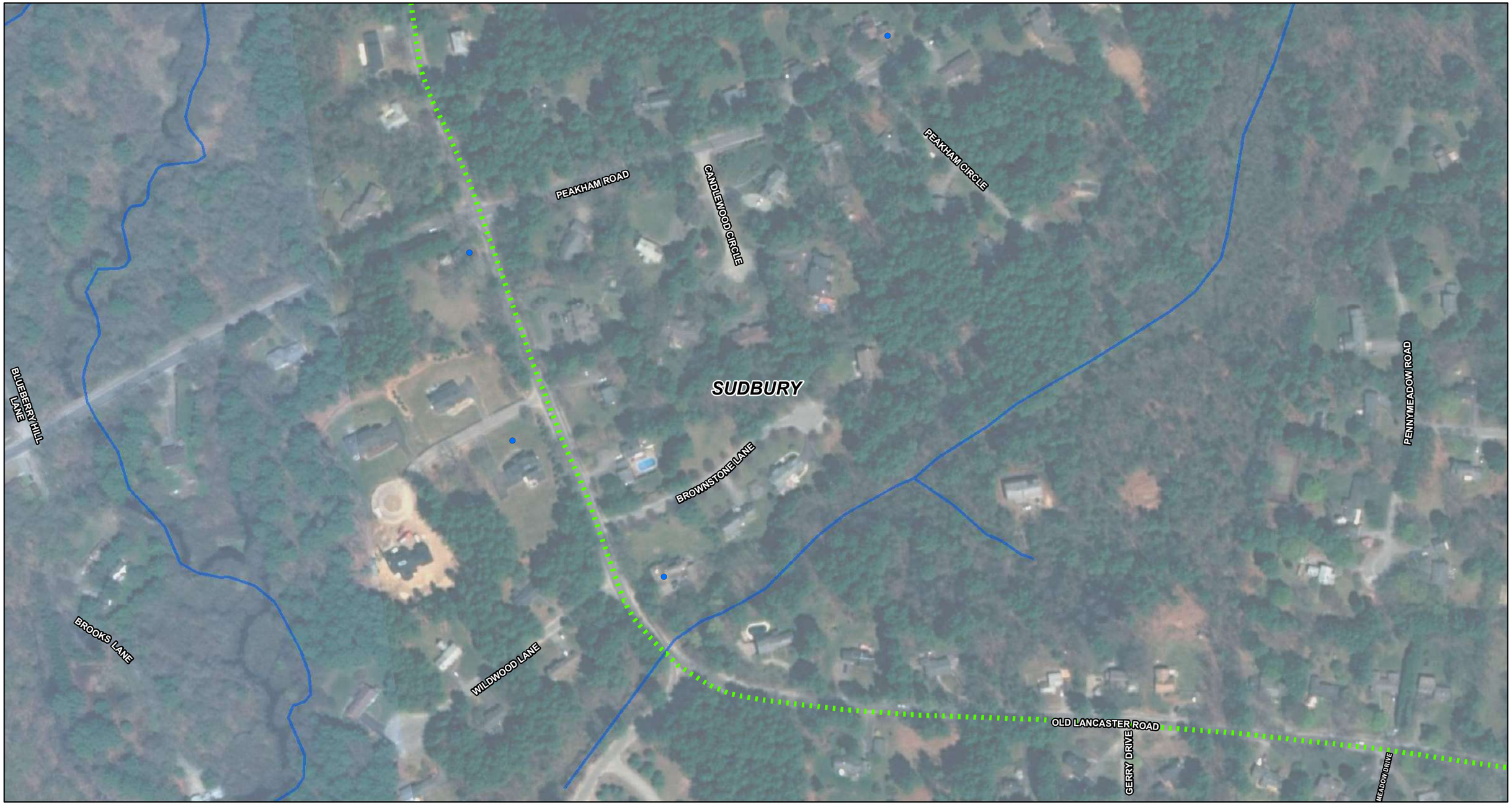
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-8_Historic Resources - Noticed Alternative Route.mxd Date: 4/12/2017



- Noticed Alternative Route
- MBTA ROW Boundary
- Stream
- Town Boundaries
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Property
- Unregistered Local Historic Site
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Area
- Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

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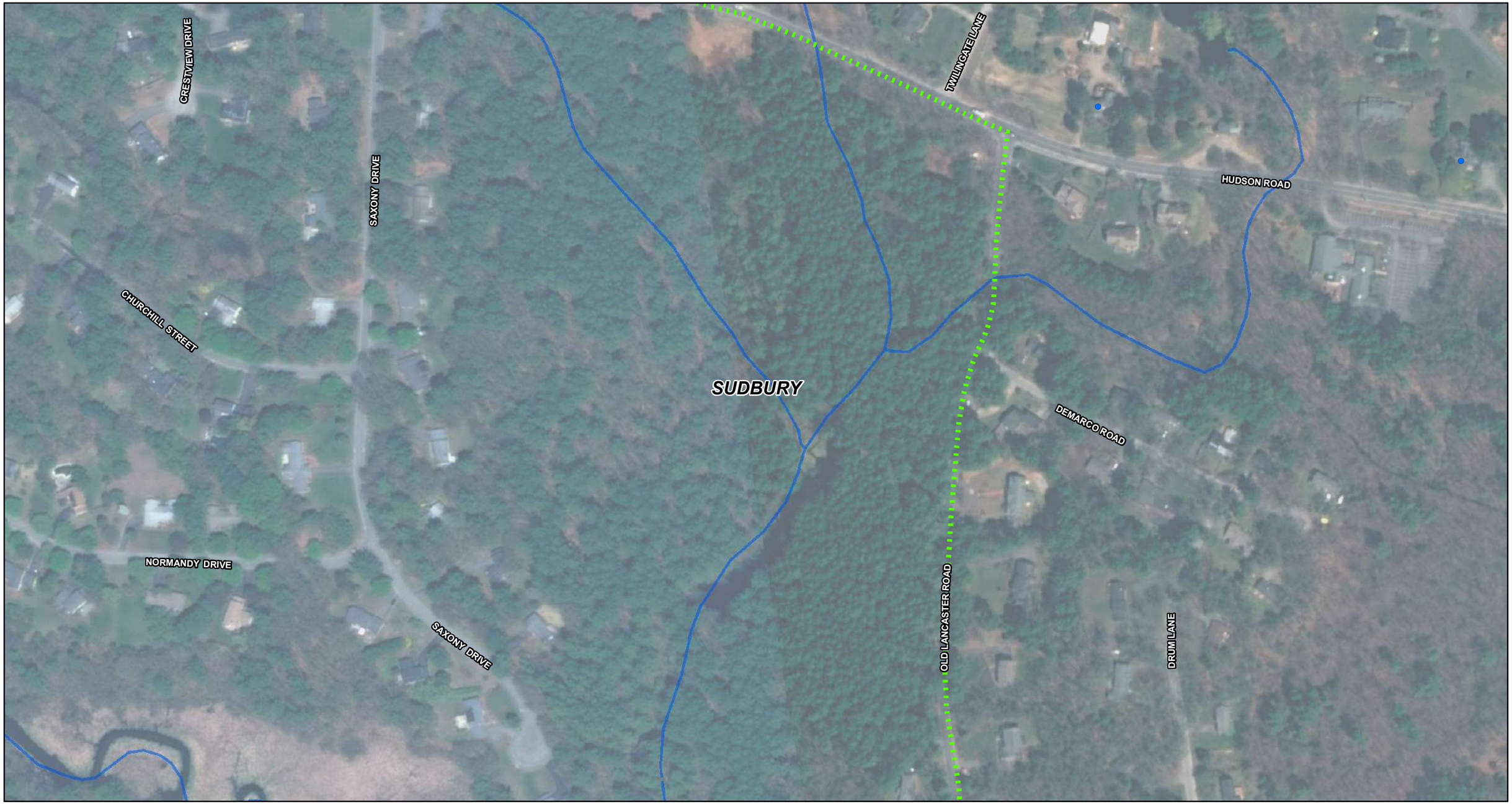
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-8_Historic Resources - Noticed Alternative Route.mxd Date: 4/12/2017



- Noticed Alternative Route
- MBTA ROW Boundary
- Stream
- Town Boundaries
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Property
- Unregistered Local Historic Site
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Area
- Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

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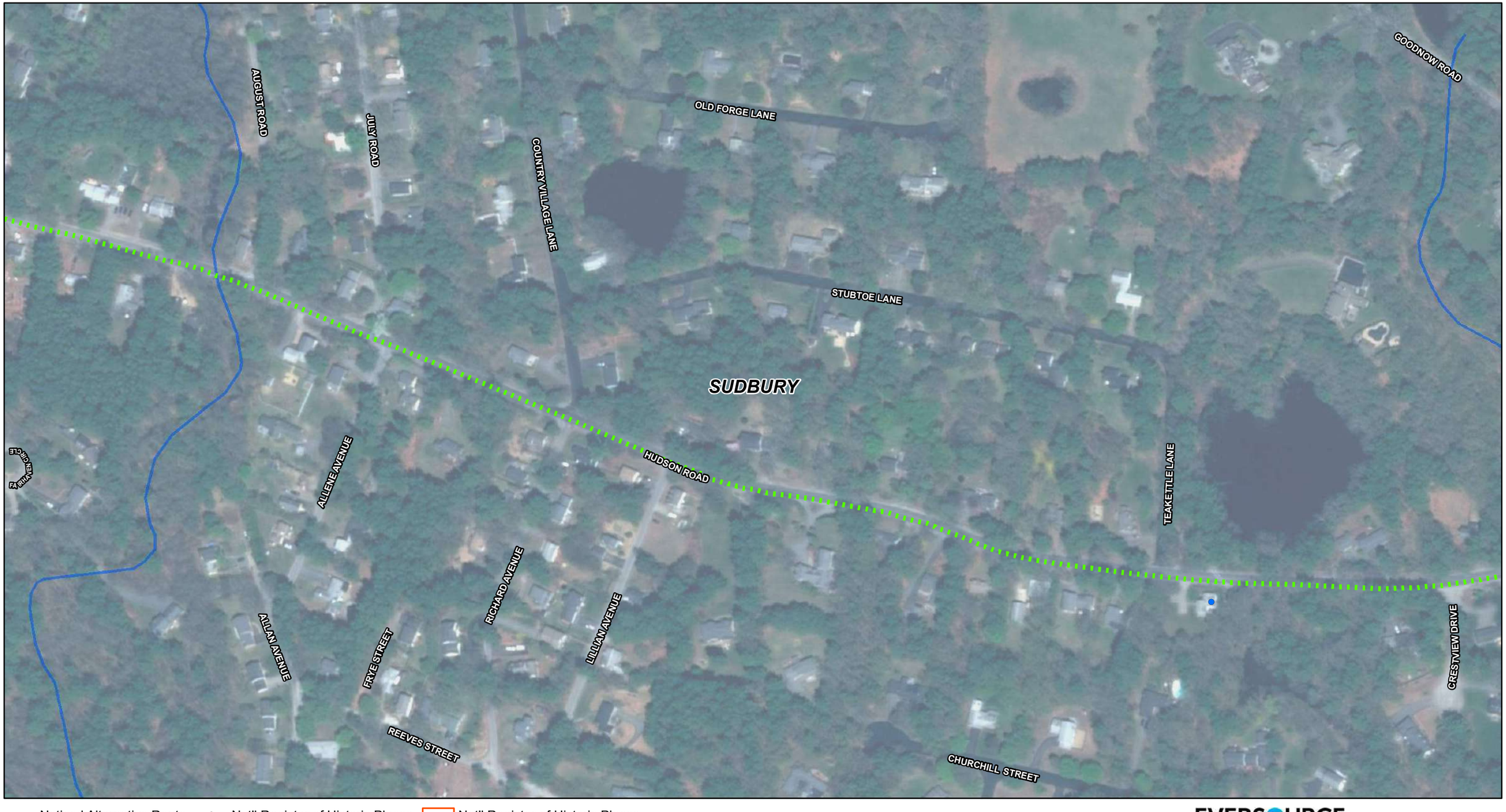
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-8_Historic Resources - Noticed Alternative Route.mxd Date: 4/12/2017



- Noticed Alternative Route
- MBTA ROW Boundary
- Stream
- Town Boundaries
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Property
- Unregistered Local Historic Site
- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Area
- Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

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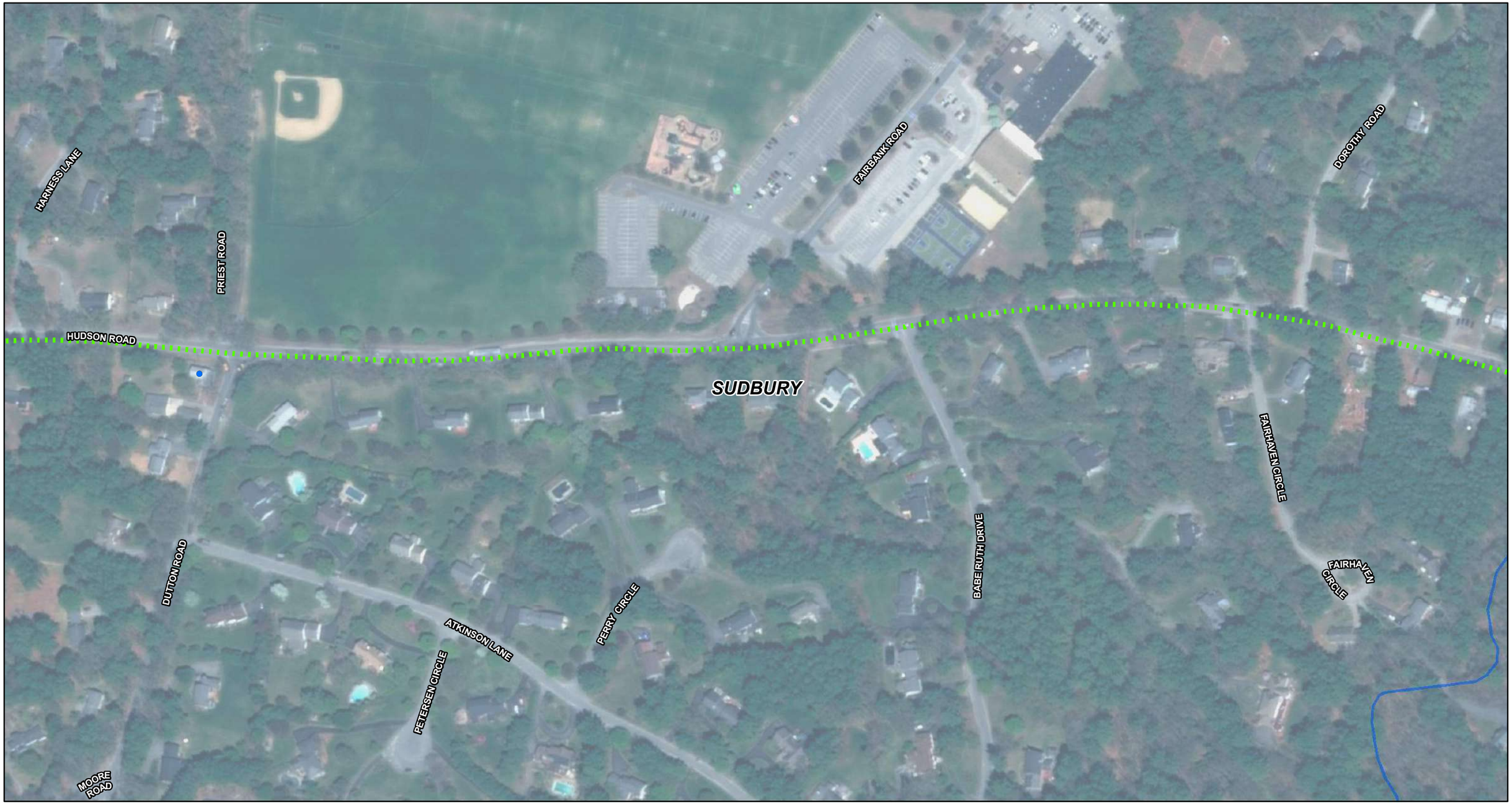

- Noticed Alternative Route
- MBTA ROW Boundary
- Stream
- Town Boundaries

- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Property
- Unregistered Local Historic Site

- Nat'l Register of Historic Places
- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Area
- Unregistered Local Historic Area

Source:
MassGIS, 2015
Ortholmagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

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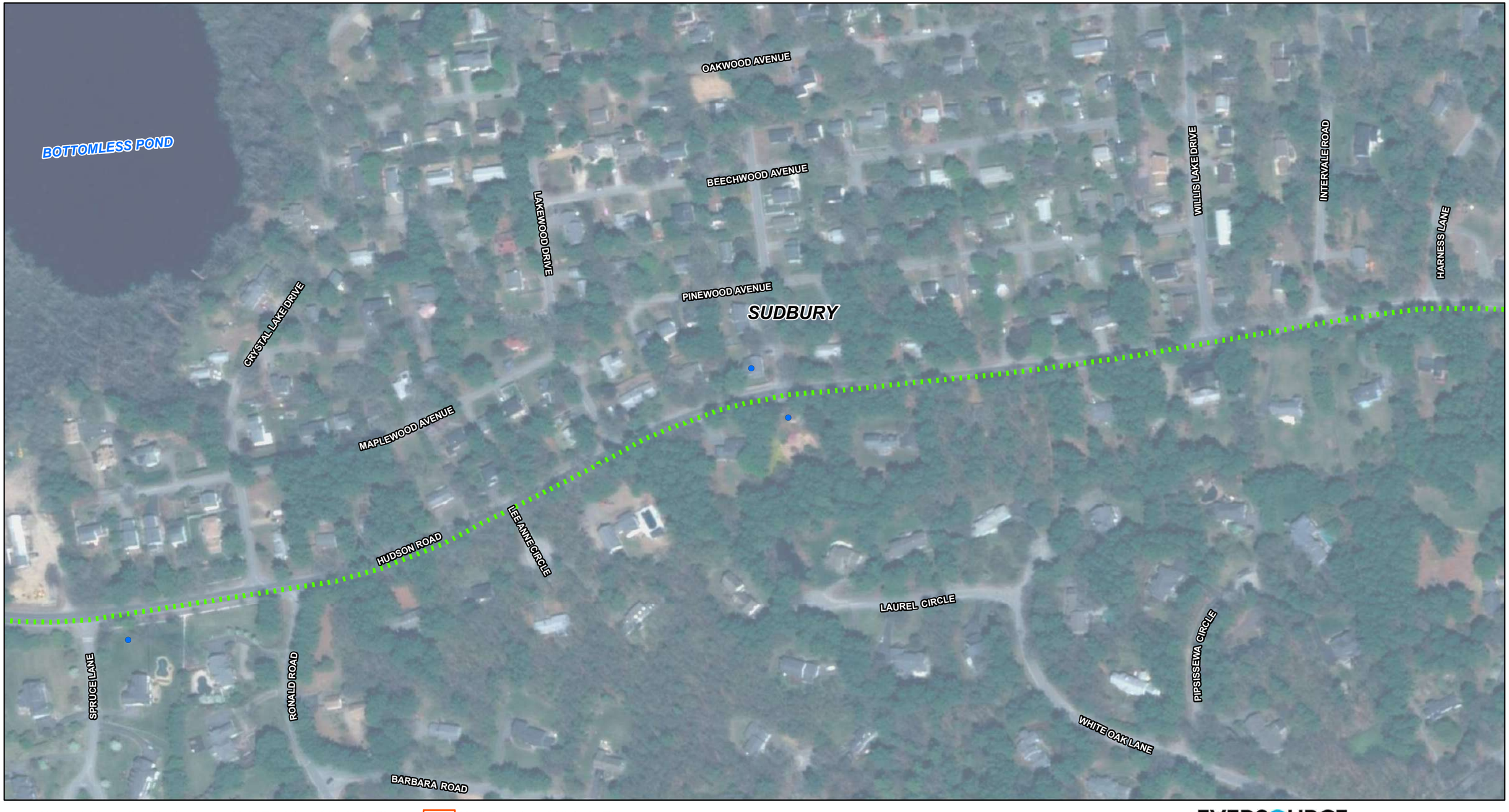

Noticed Alternative Route
MBTA ROW Boundary
Stream
Town Boundaries

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Property
Unregistered Local Historic Site

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Area
Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

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- Noticed Alternative Route
- MBTA ROW Boundary
- Stream
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- Preservation Restriction
- Local Historic District
- NRHP and LHD
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Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

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Noticed Alternative Route
MBTA ROW Boundary
Stream
Town Boundaries

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Property
Unregistered Local Historic Site

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Area
Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

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N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

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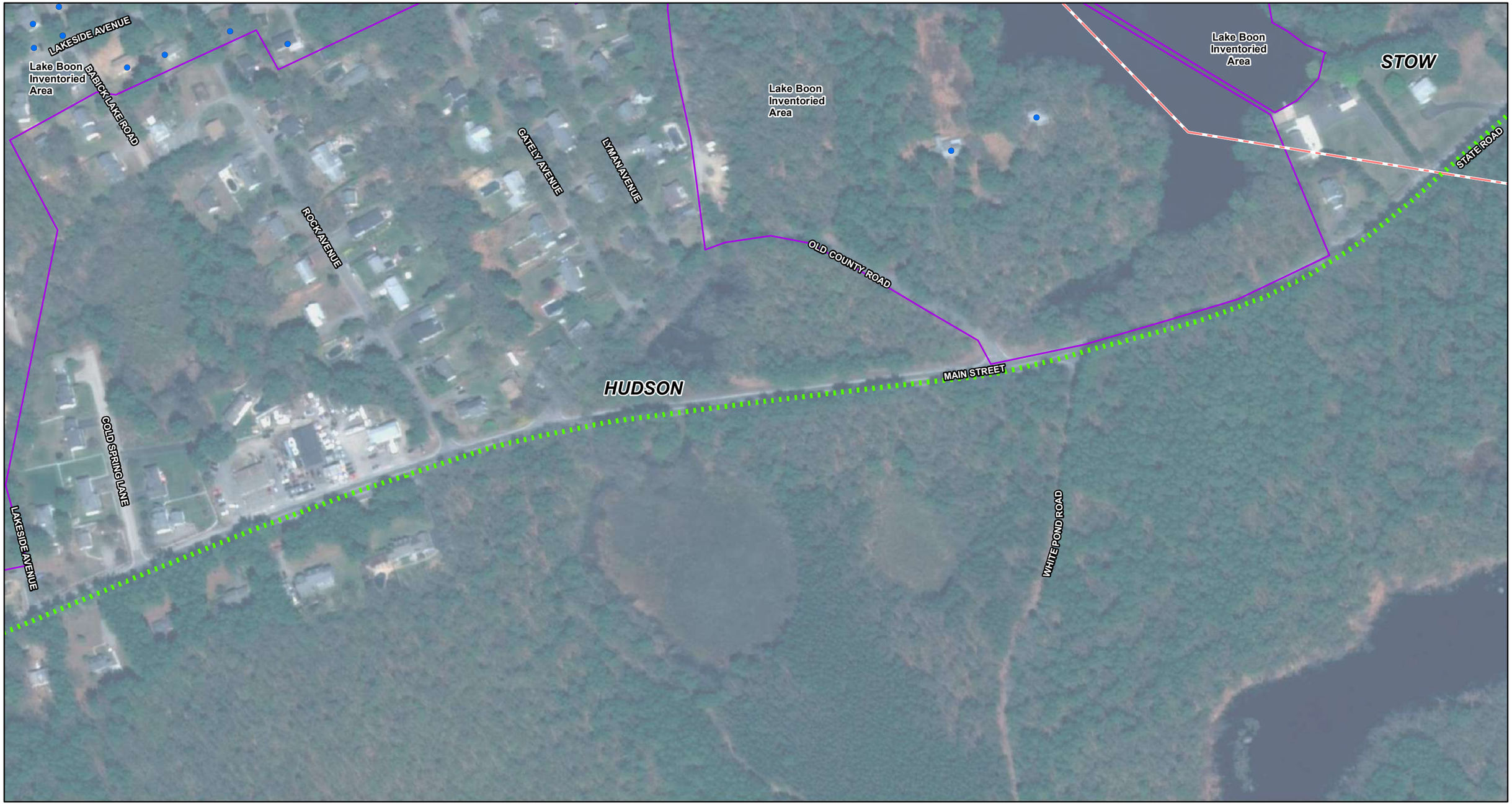

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- Town Boundaries
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- Local Historic District
- NRHP and LHD
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Source:
MassGIS, 2015
OrthoImagery, VHB

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N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

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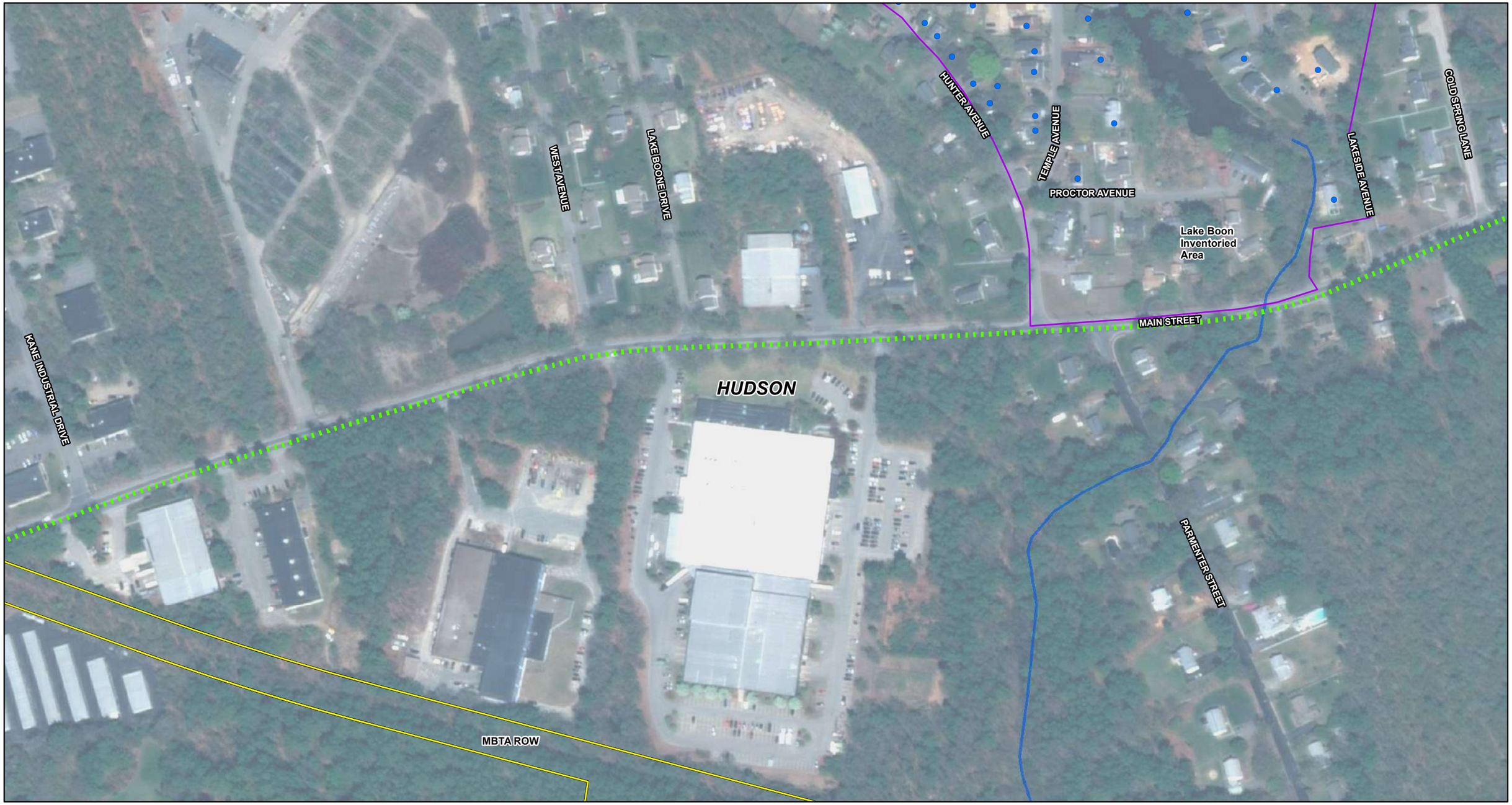

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- Preservation Restriction
- Local Historic District
- NRHP and LHD
- Inventoried Property
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- NRHP and LHD
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Source:
MassGIS, 2015
OrthoImagery, VHB

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N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

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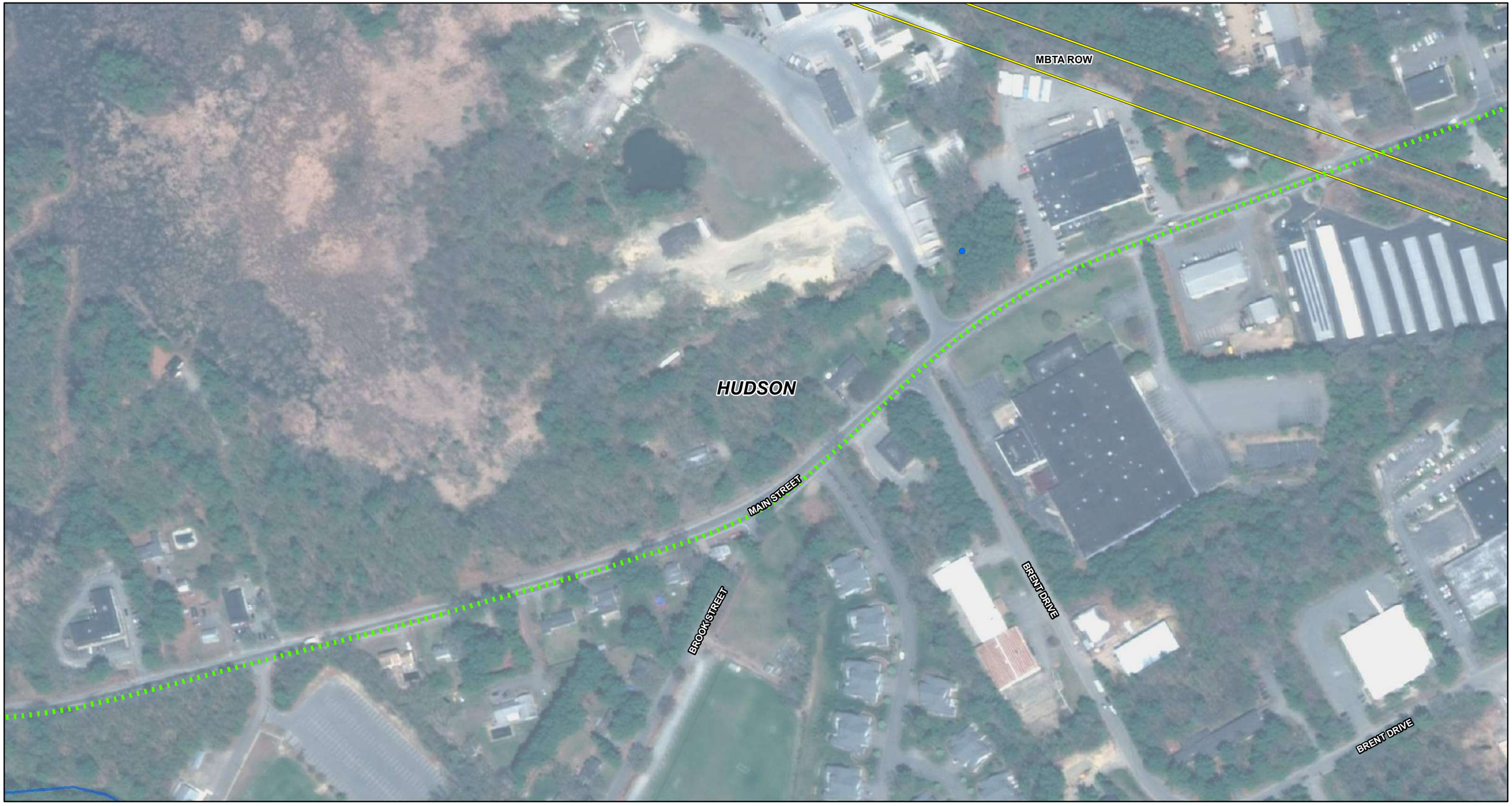

Noticed Alternative Route
MBTA ROW Boundary
Stream
Town Boundaries

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Property
Unregistered Local Historic Site

Nat'l Register of Historic Places
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Local Historic District
NRHP and LHD
Inventoried Area
Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

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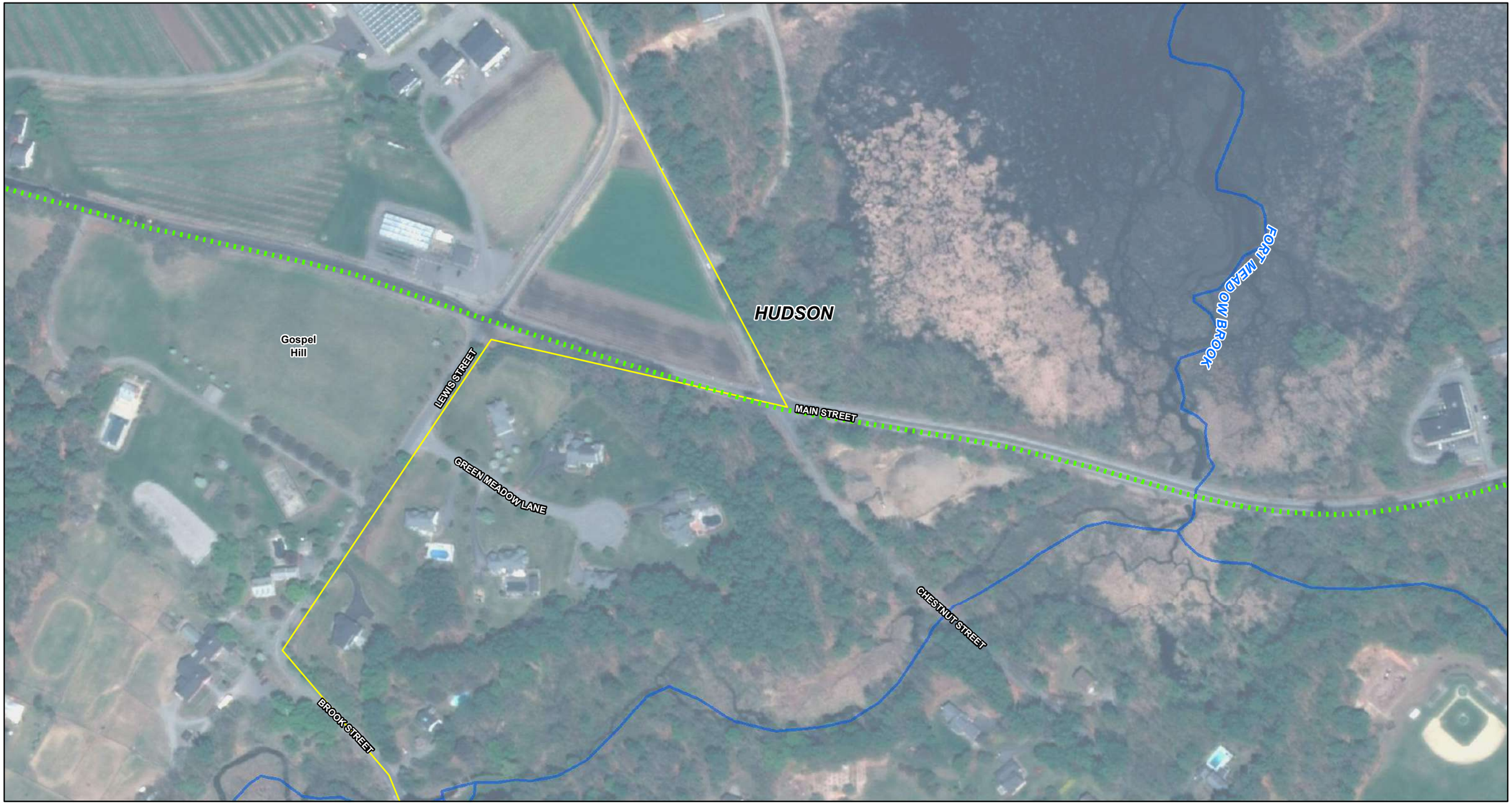

Noticed Alternative Route
MBTA ROW Boundary
Stream
Town Boundaries

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
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Unregistered Local Historic Site

Nat'l Register of Historic Places
Preservation Restriction
Local Historic District
NRHP and LHD
Inventoried Area
Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

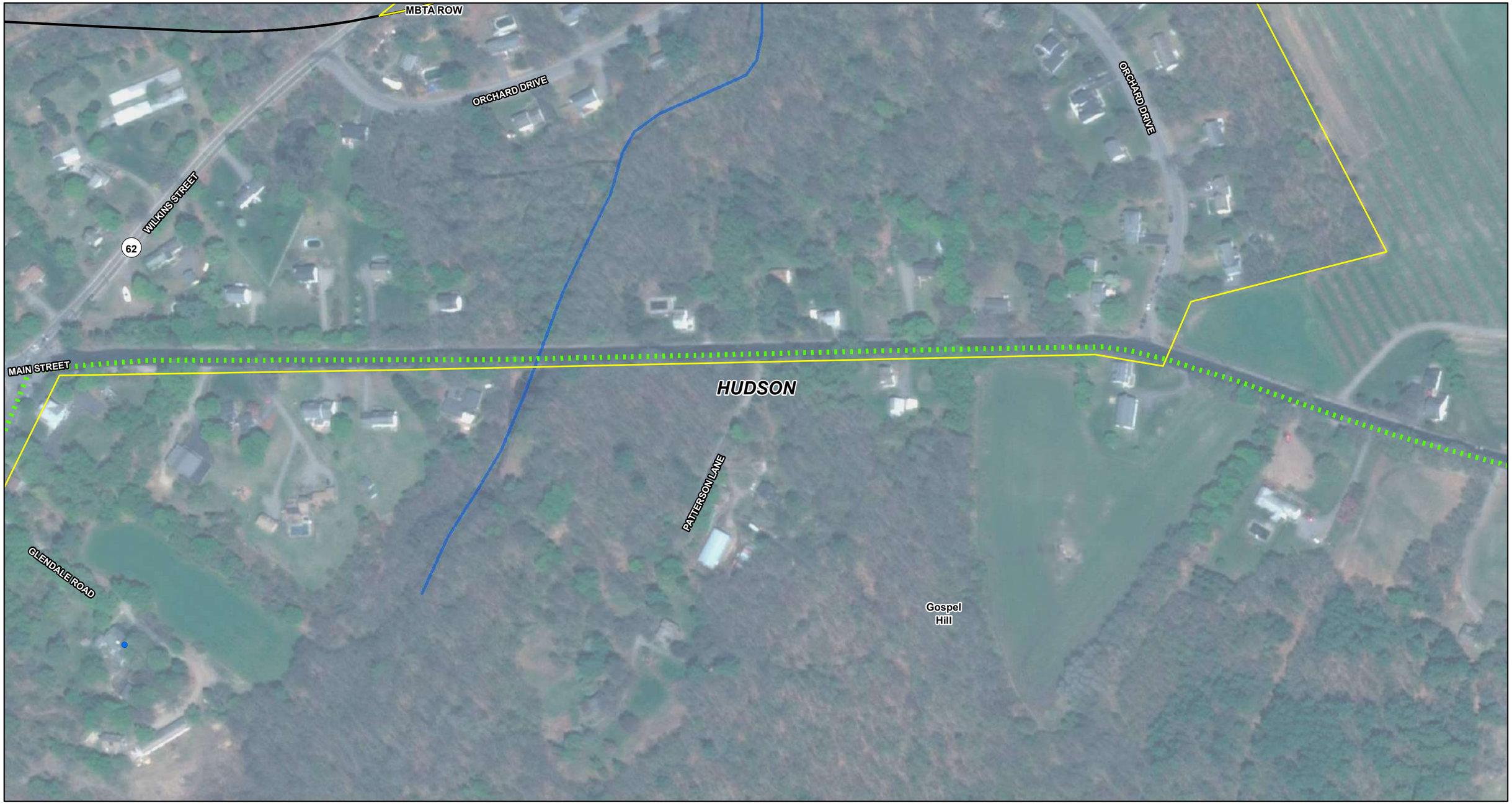
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

Sheet 14 of 17



Noticed Alternative Route
MBTA ROW Boundary
Stream
Town Boundaries

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Unregistered Local Historic Site

Nat'l Register of Historic Places
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Local Historic District
NRHP and LHD
Inventoried Area
Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

vhb

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Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

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Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

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- Inventoried Area
- Unregistered Local Historic Area

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

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Sudbury-Hudson Transmission Reliability Project

Figure 5-8: Historic Resources - Noticed Alternative Route

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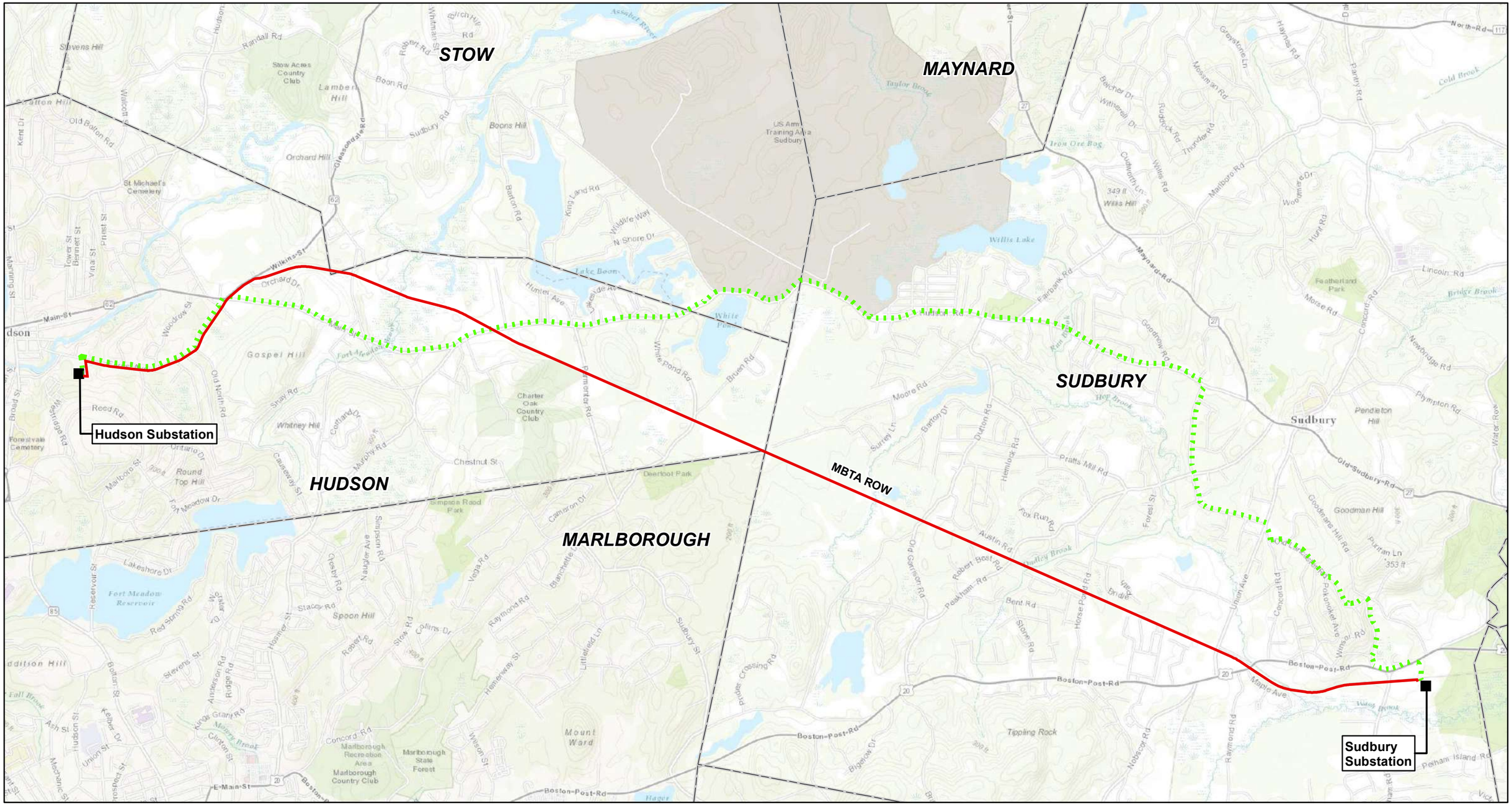


Project and Noticed Variation
Noticed Alternative Route
Substation Location
Municipal Boundary

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-9: Substation Locus Map

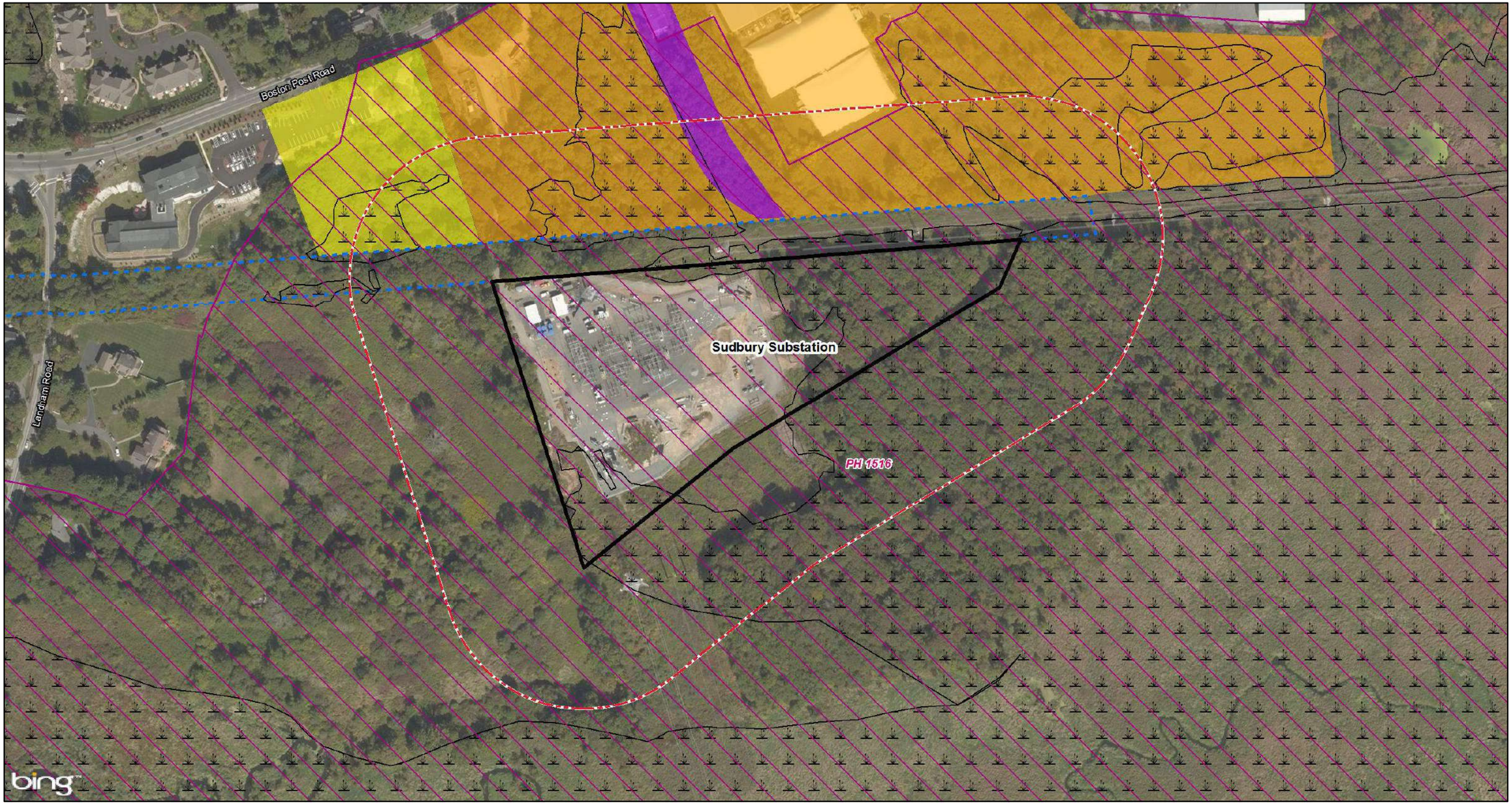
N

Source:
MassGIS, VHB

4/12/2017

0 3,000 6,000 Feet

vhb



Sudbury Substation Parcel Boundary
MBTA ROW Surveyed Boundary
300-ft Buffer of Sudbury Substation Parcel
NHESP Priority & Estimated Habitat
Wetland Resource Area

Land Use Within 300 Ft of Substation
Charitable
Commercial/Industrial
Residential

Source:
Eversource, 2013
Bing Imagery, VHB
MassGIS

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-10: Sudbury Substation
Land Use and Environmental Resources

vhb

New Equipment
Existing Equipment

Source:
Eversource, 2013
Bing Imagery

4/12/2017

N

0 80 160 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-11: Existing Sudbury Substation and Proposed Improvements for Project and Noticed Alternative Route

vhb

New Equipment
Existing Equipment

Source:
Eversource, 2013
Bing Imagery

4/12/2017

N

0 80 160 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-12: Existing Sudbury Substation and Proposed Improvements for Noticed Variation

vhb

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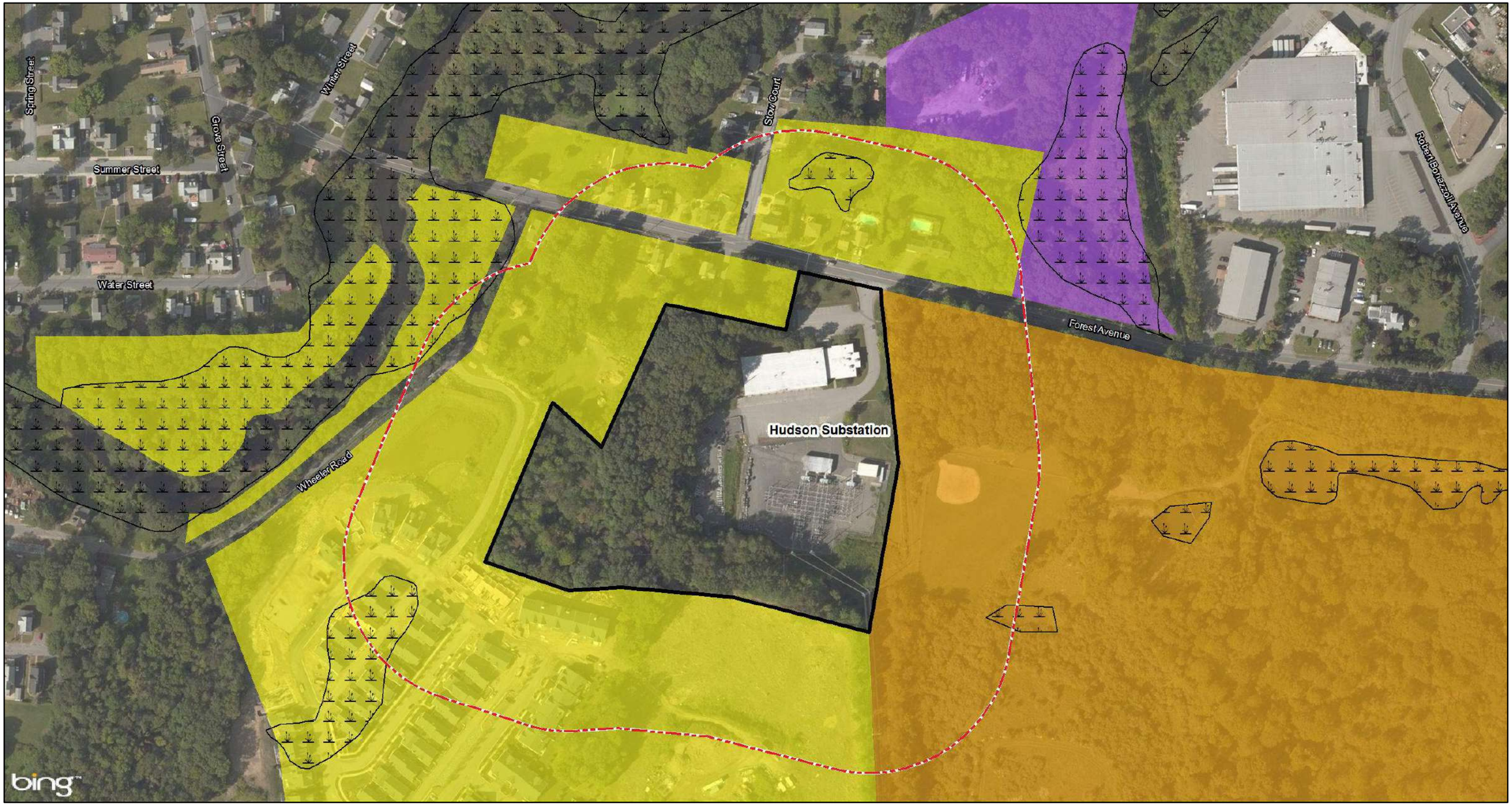


Hudson Substation Parcel Boundary
300-ft Buffer of Hudson Substation
Wetland Resource Area

Land Use Within 300 Ft of Substation
Commercial/Industrial
Residential
Vacant Land

Source:
Eversource, 2013
Bing Imagery, VHB, MassGIS

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-13: Hudson Substation
Land Use and Environmental Resources

vhb

Source:
Eversource, 2013
Bing Imagery

4/12/2017

N

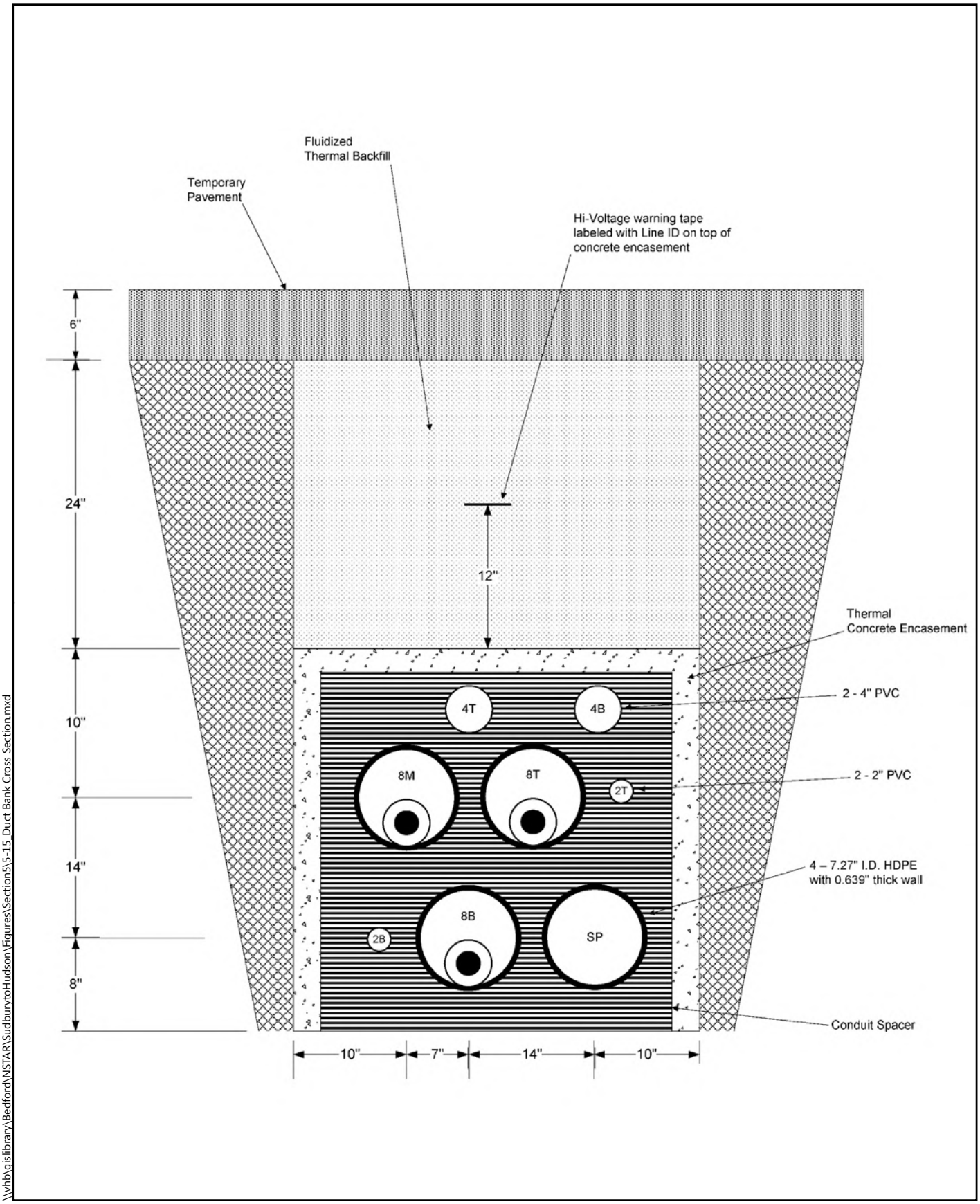
0 35 70 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-14: Existing Hudson Substation and Proposed Improvements for All Options

vhb



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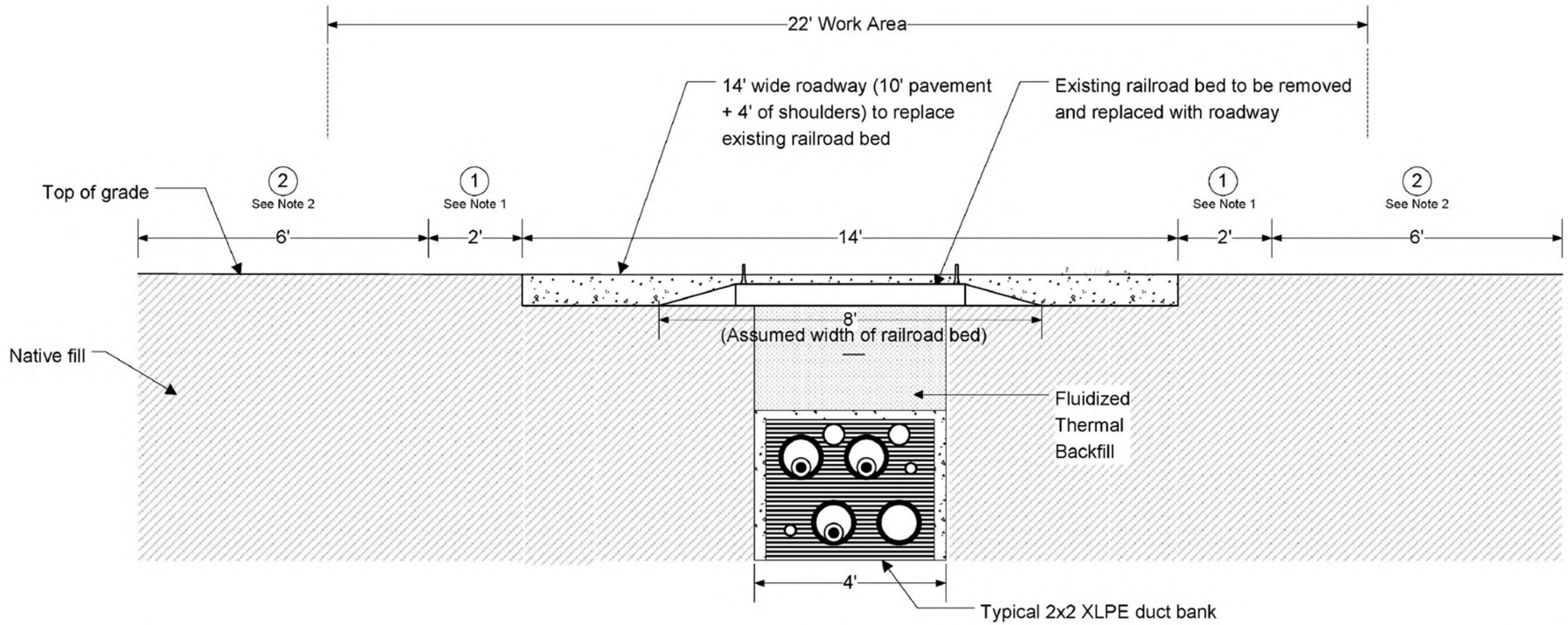
Not To Scale

Source: Eversource

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-15: Duct Bank Cross Section



Notes
1. No woody vegetation; slope to be determined.
2. Plantings to be allowed, limited wood vegetation.
3. Not to scale.
4. XLPE duct bank installation location to vary across the entire route.

Rev.	Date	Description
2	2/1/17	Roadway Update
1	1/4/17	Update Layout and Notes
0	10/17/16	Typical Layout

Not To Scale

EVERSOURCE ENERGY

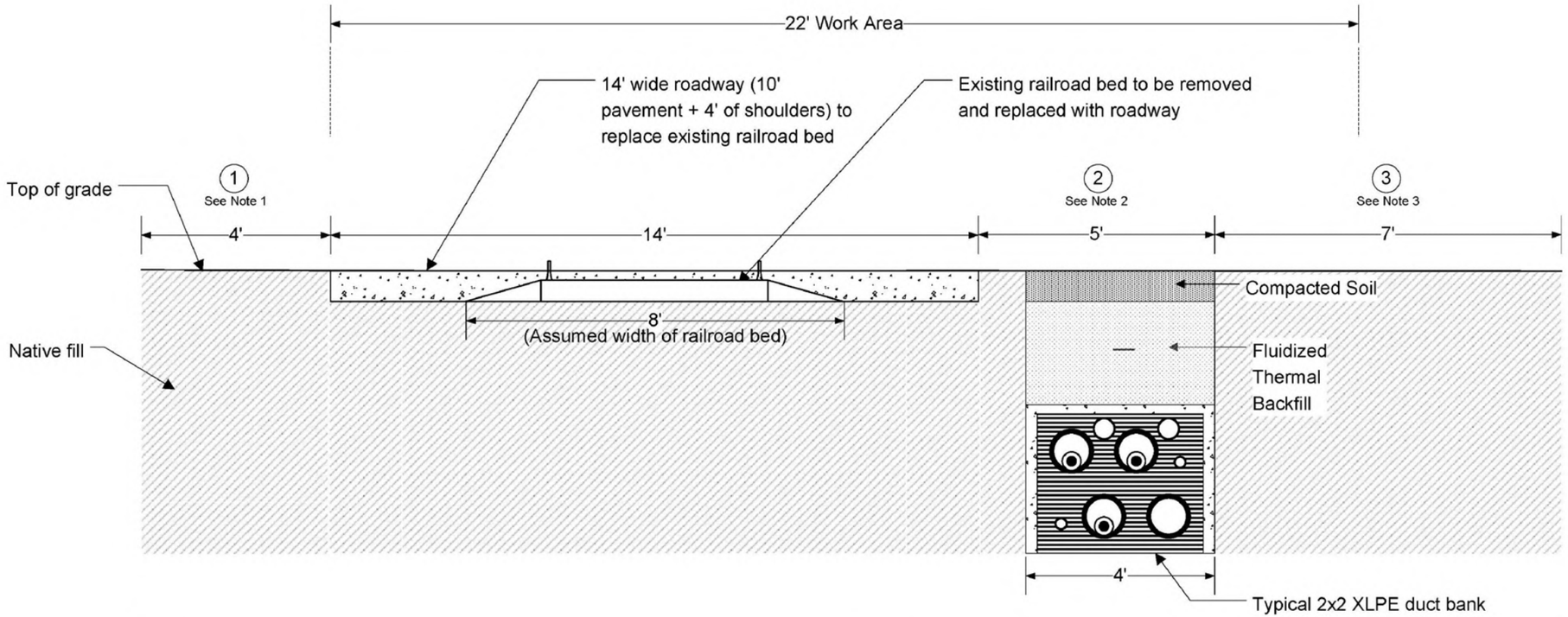
Sudbury-Hudson Transmission Reliability Project

Figure 5-16: Road and Duct Bank Locations for Project

Source:
Eversource

4/12/2017

vhb



Notes
1. Plantings to be allowed, limited wood vegetation; slope to be determined.
2. No woody vegetation.
3. No woody vegetation; slope to be determined.
4. Not to scale.
5. XLPE duct bank installation location to vary across the entire route.

Rev.	Date	Description
2	2/1/17	Roadway Update
1	1/4/17	Update Layout and Notes
0	10/17/16	Typical Layout

Not To Scale

EVERSOURCE ENERGY

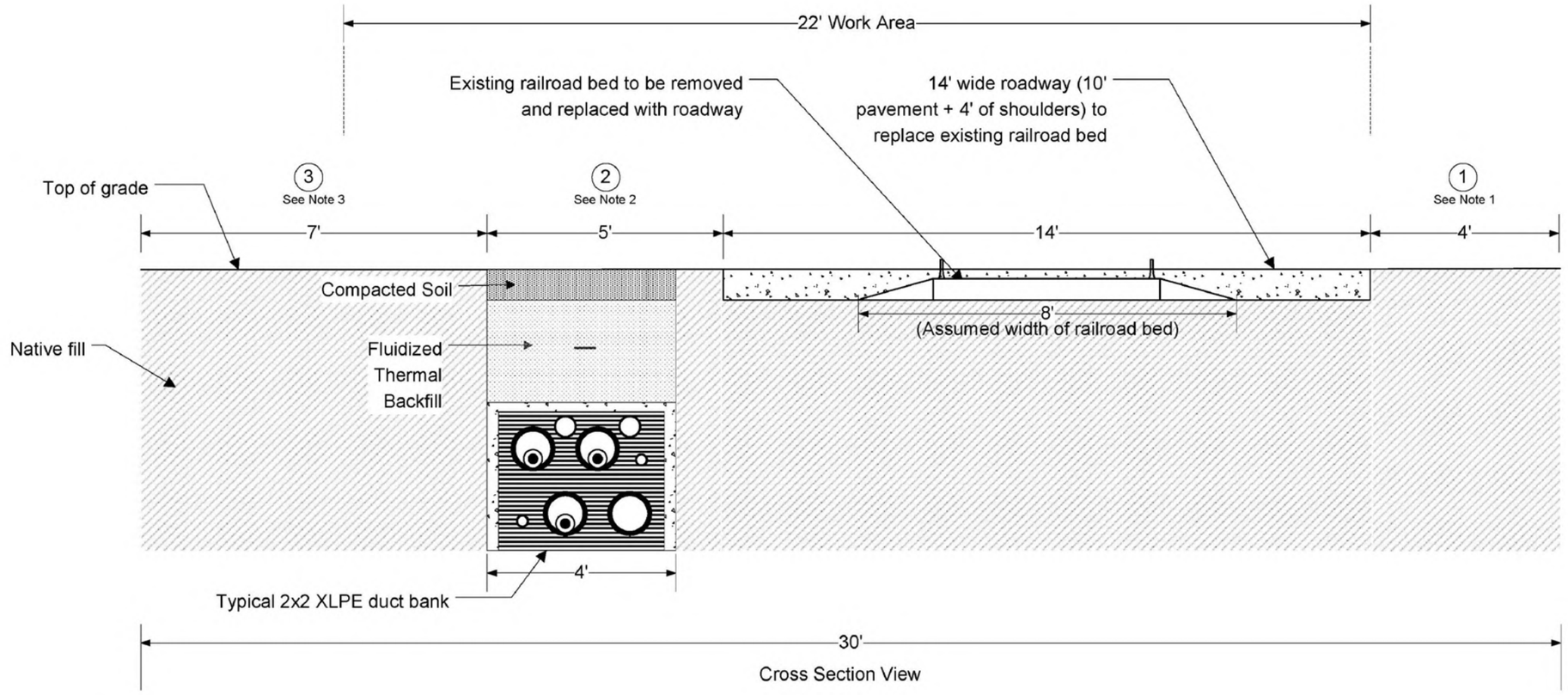
Sudbury-Hudson Transmission Reliability Project

Figure 5-16: Road and Duct Bank Locations for Project

Source:
Eversource

4/12/2017

vhb



Notes
1. Plantings to be allowed, limited wood vegetation; slope to be determined.
2. No woody vegetation.
3. No woody vegetation; slope to be determined.
4. Not to scale.
5. XLPE duct bank installation location to vary across the entire route.

Rev.	Date	Description
2	2/1/17	Roadway Update
1	1/4/17	Update Layout and Notes
0	10/17/16	Typical Layout

Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-16: Road and Duct Bank Locations for Project

Source:
Eversource

4/12/2017

Sheet 3 of 3

vhb

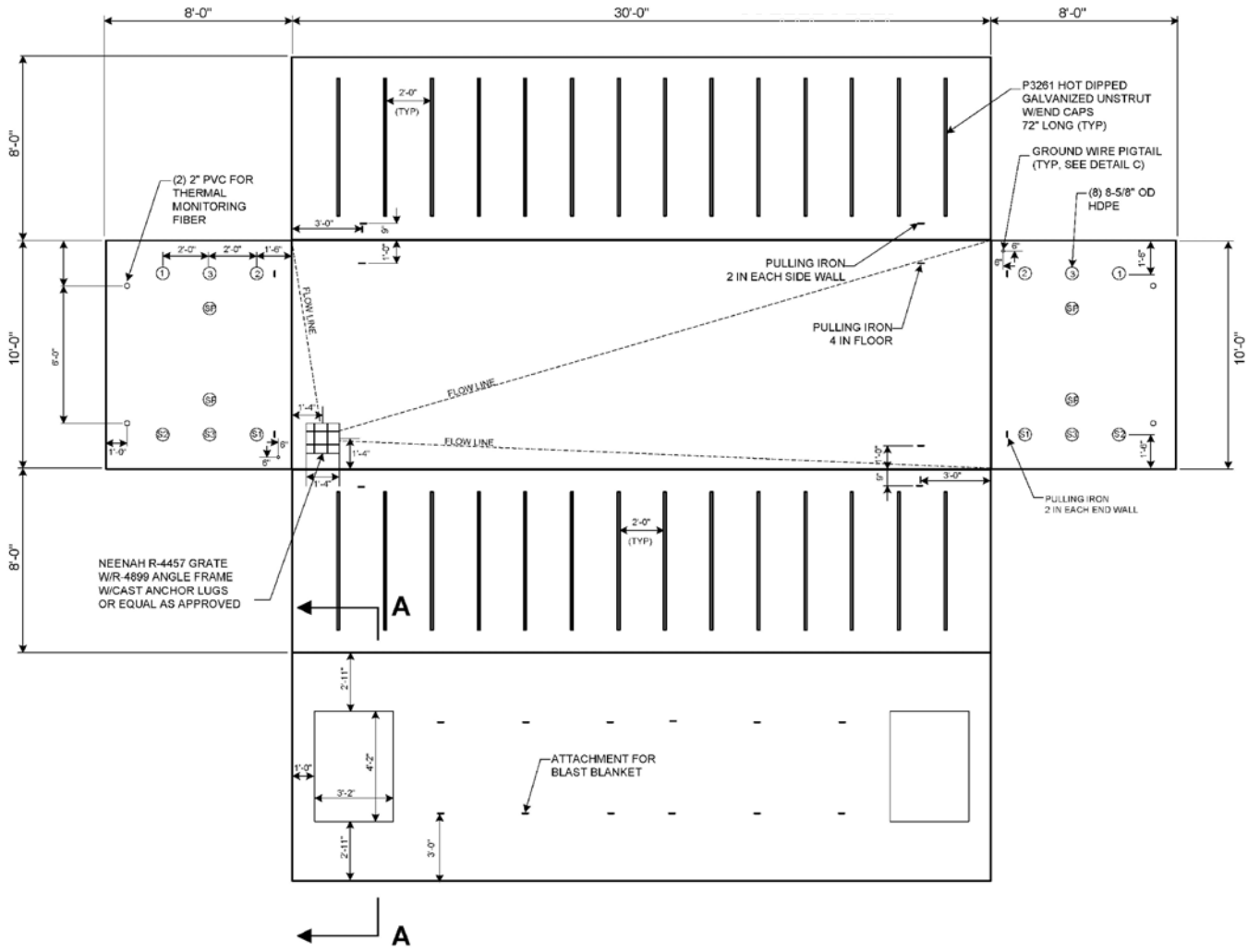


Figure 1
Typical XLPE 30' Manhole
Plan

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Not To Scale

Source: Eversource

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Sudbury-Hudson Transmission Reliability Project

Figure 5-17: Splice Vault Cross Section

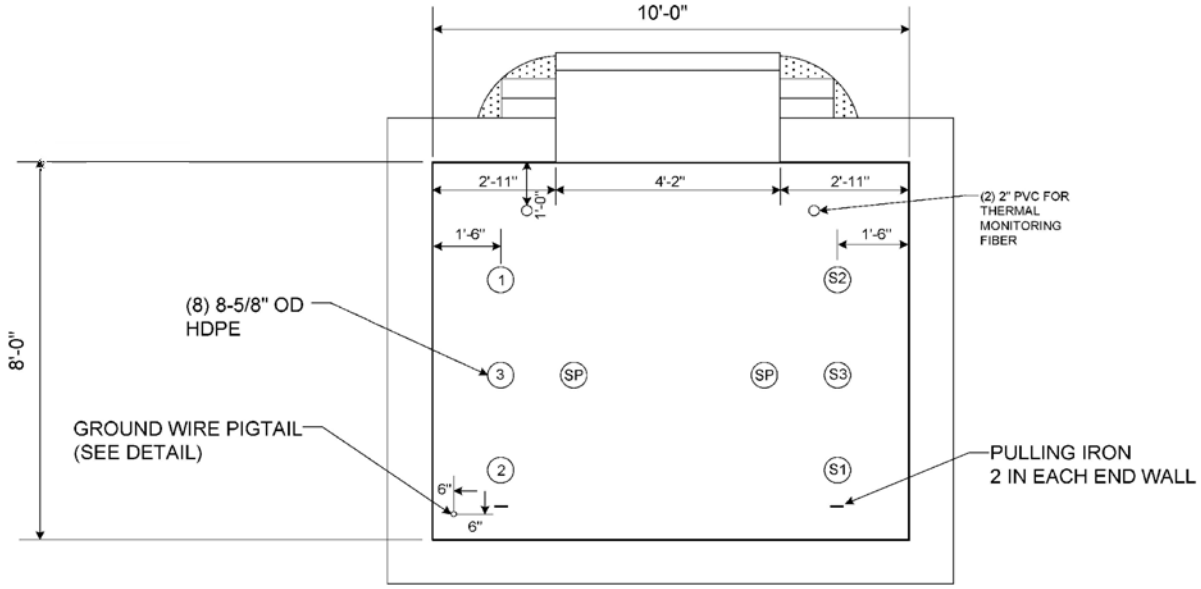

Figure 2
Section A-A
End View

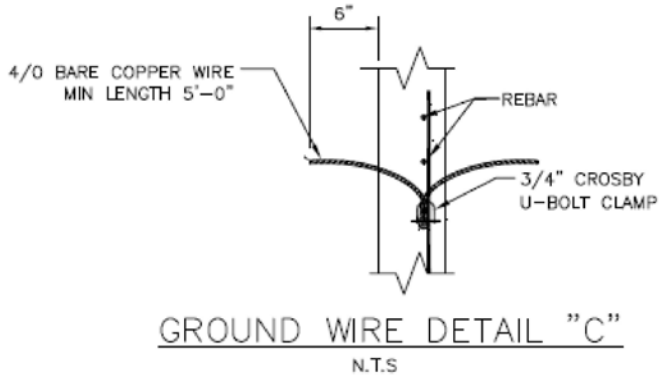

Figure 3
Detail "C"

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Not To Scale

Page 2 of 3

Source: Eversource

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Sudbury-Hudson Transmission Reliability Project

Figure 5-17: Splice Vault Cross Section

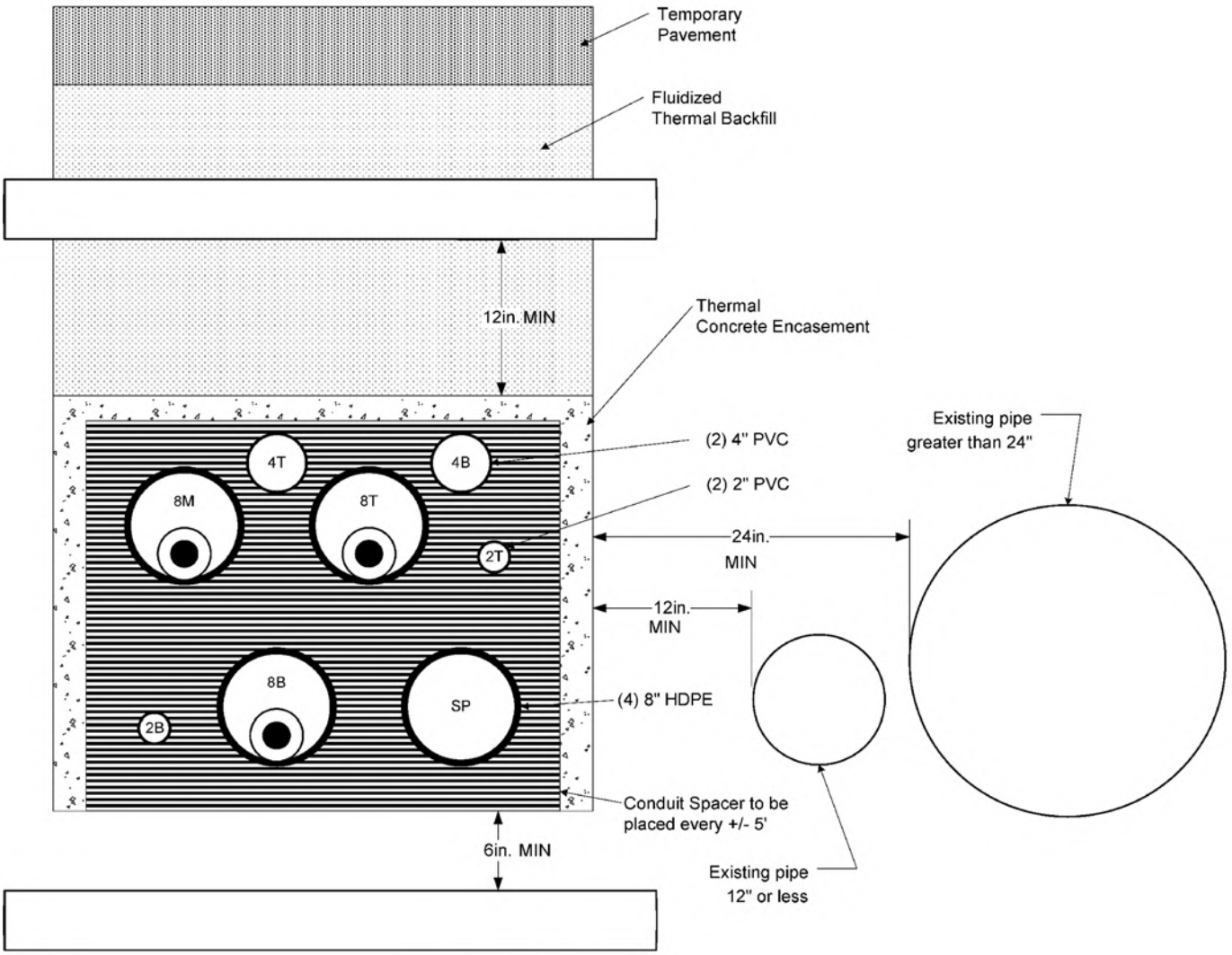

Figure 4
Single Line Installation
2 x 2 Trefoil Configuration
Minimum Clearance to Neighboring Utilities

Notes:

1. All pipe sizes are nominal
2. Minimum desired separation between outside of pipe surface and outside of foreign structures shall be as follows:

Structure	Minimum Separation
Concrete and Masonry	6"
Welded-Joint Gas and Water Pipes	12"
Communication, other Electric Supply Pipes and Bell-and-Spigot Joint Gas and Water Pipes	18"
Steam Lines	Alert Project Manager

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Not To Scale

Source: Eversource

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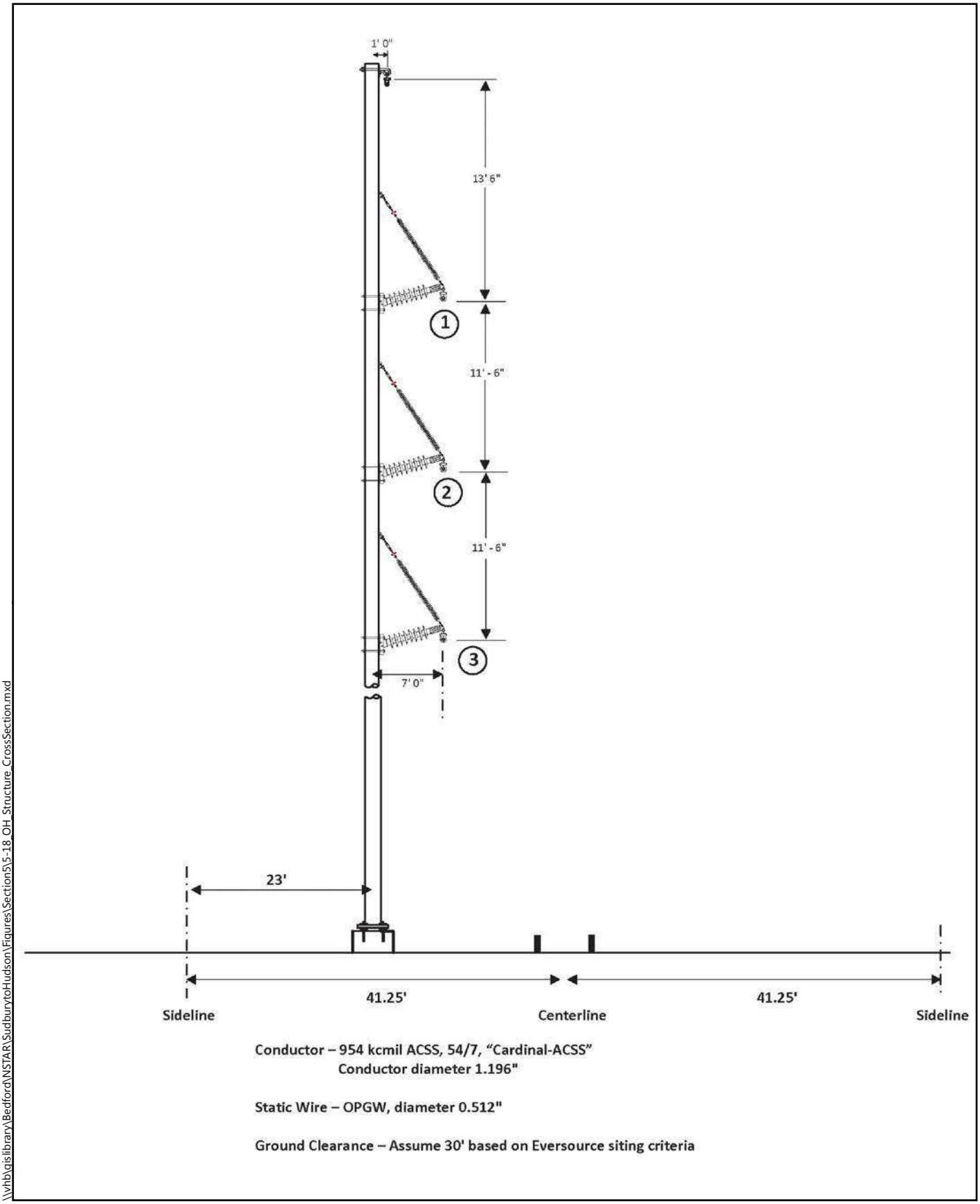
Sudbury-Hudson Transmission Reliability Project

Figure 5-17: Splice Vault Cross Section



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Not To Scale

Source: Eversource

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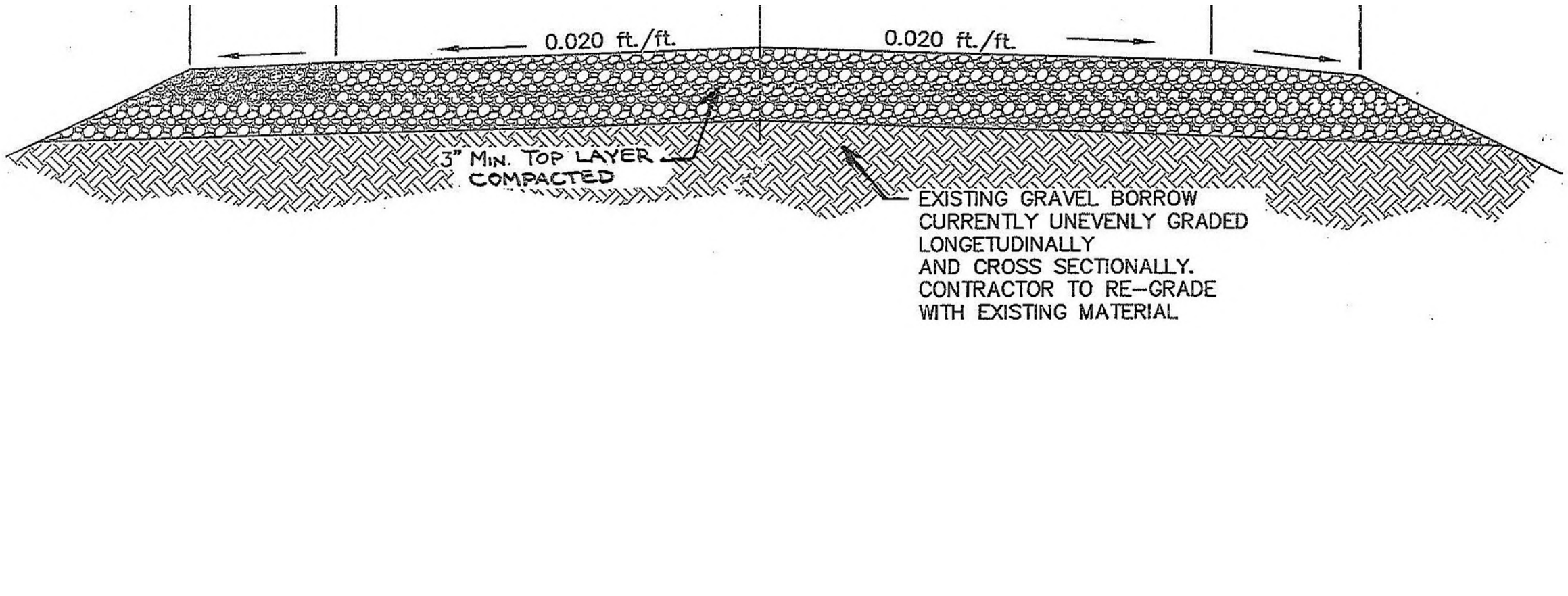
Sudbury-Hudson Transmission Reliability Project
Figure 5-18: Overhead Structure Cross Section

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-19_Access Road - Noticed Variation.mxd



Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-19: Access Road - Noticed Variation

Source:
Eversource

4/12/2017

vhb

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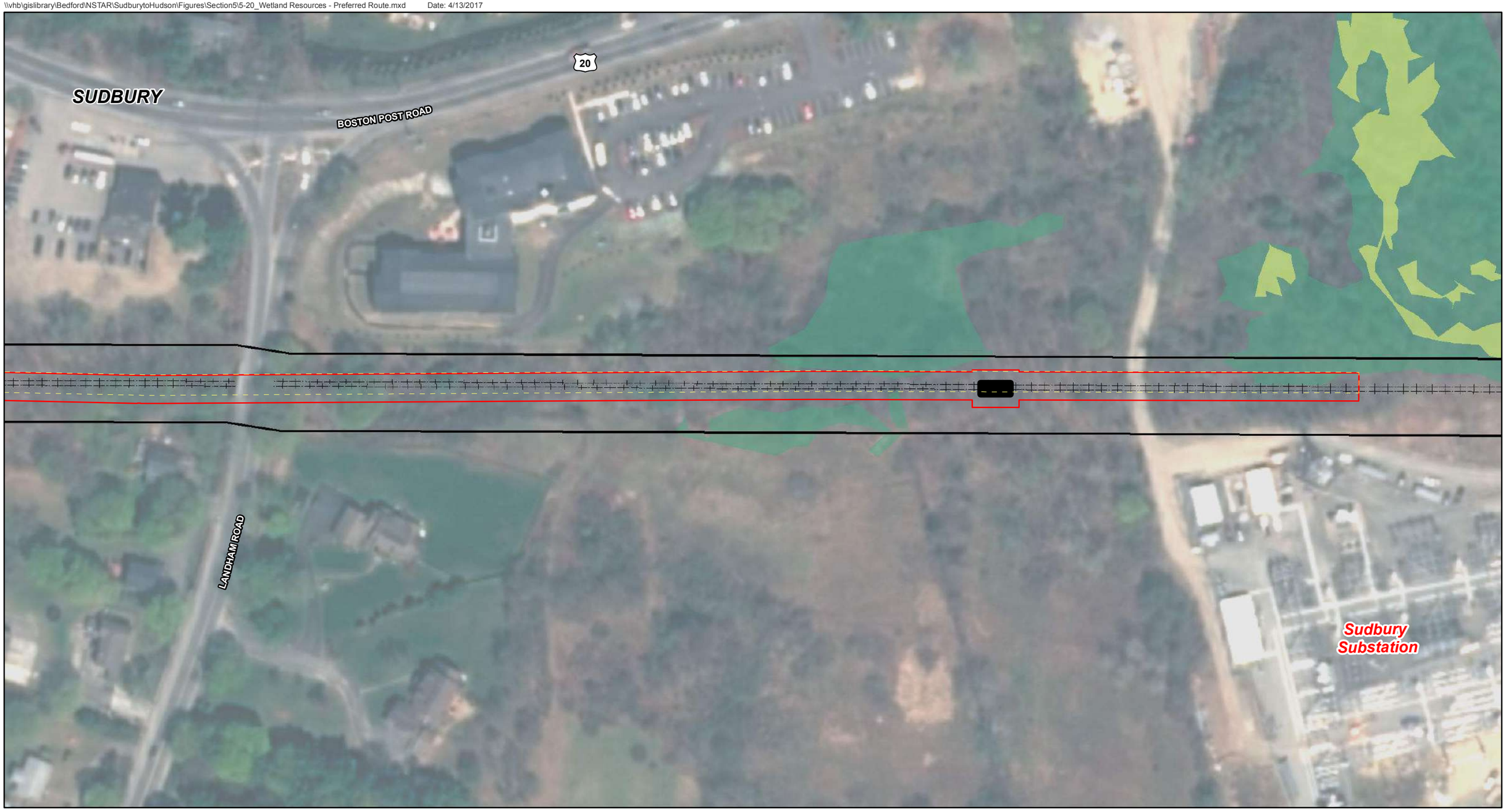

- MBTA ROW Boundary
- Tree Clearing
- Trench and Manhole System in Roadways
- 22-ft Construction Platform along MBTA ROW
- Splice Vault Locations
- BVW
- Field Identified Potential Vernal Pool
- Open Water
- Stream
- NHESP Certified Vernal Pool
- NHESP Potential Vernal Pool
- Bordering Land Subject to Flooding
- Existing Rails
- Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-20_Wetland Resources - Preferred Route.mxd Date: 4/13/2017

MBTA ROW Boundary
Tree Clearing
Trench and Manhole System in Roadways
22-ft Construction Platform along MBTA ROW
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
NHESP Certified Vernal Pool
NHESP Potential Vernal Pool
Bordering Land Subject to Flooding
Existing Rails
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

Sheet 2 of 31

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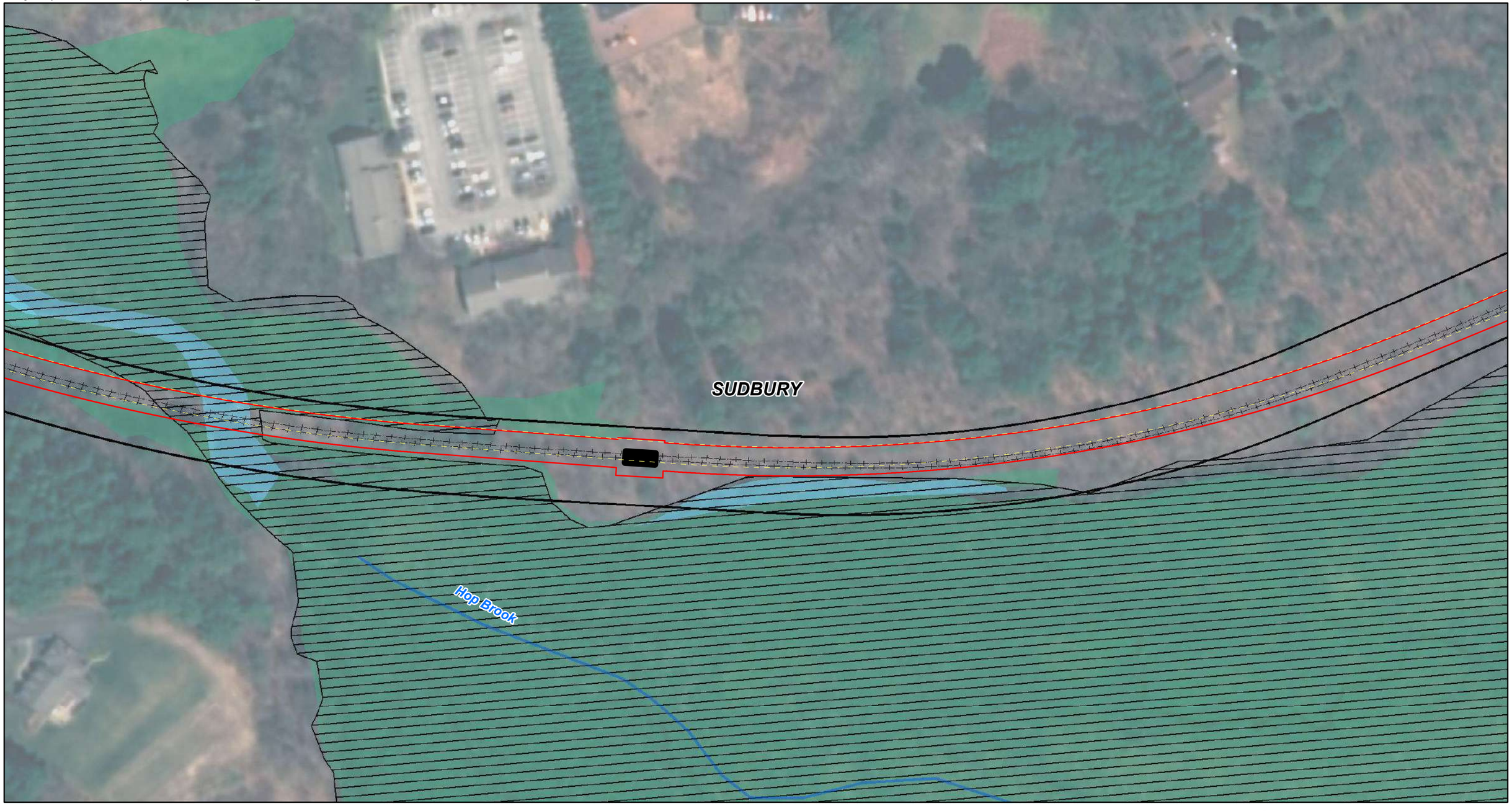

MBTA ROW Boundary
Tree Clearing
Trench and Manhole System in Roadways
22-ft Construction Platform along MBTA ROW
Splice Vault Locations

BVW
Field Identified Potential Vernal Pool
Open Water
Stream

NHESP Certified Vernal Pool
NHESP Potential Vernal Pool
Bordering Land Subject to Flooding
Existing Rails
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

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0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

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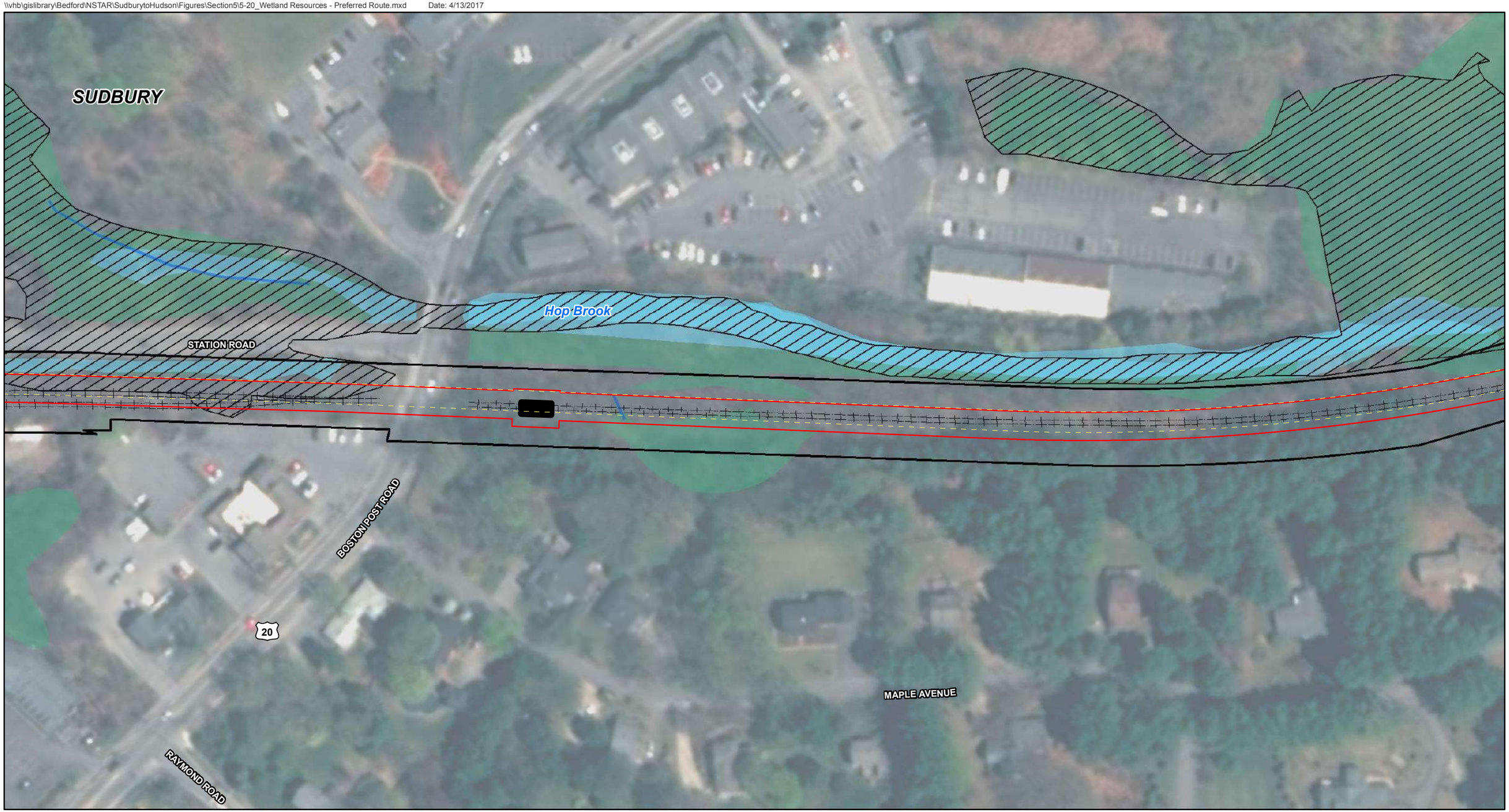

- MBTA ROW Boundary
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MassGIS, 2015
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4/13/2017

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0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

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MBTA ROW Boundary
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4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

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MBTA ROW Boundary
Tree Clearing
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4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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MBTA ROW Boundary
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4/13/2017

N

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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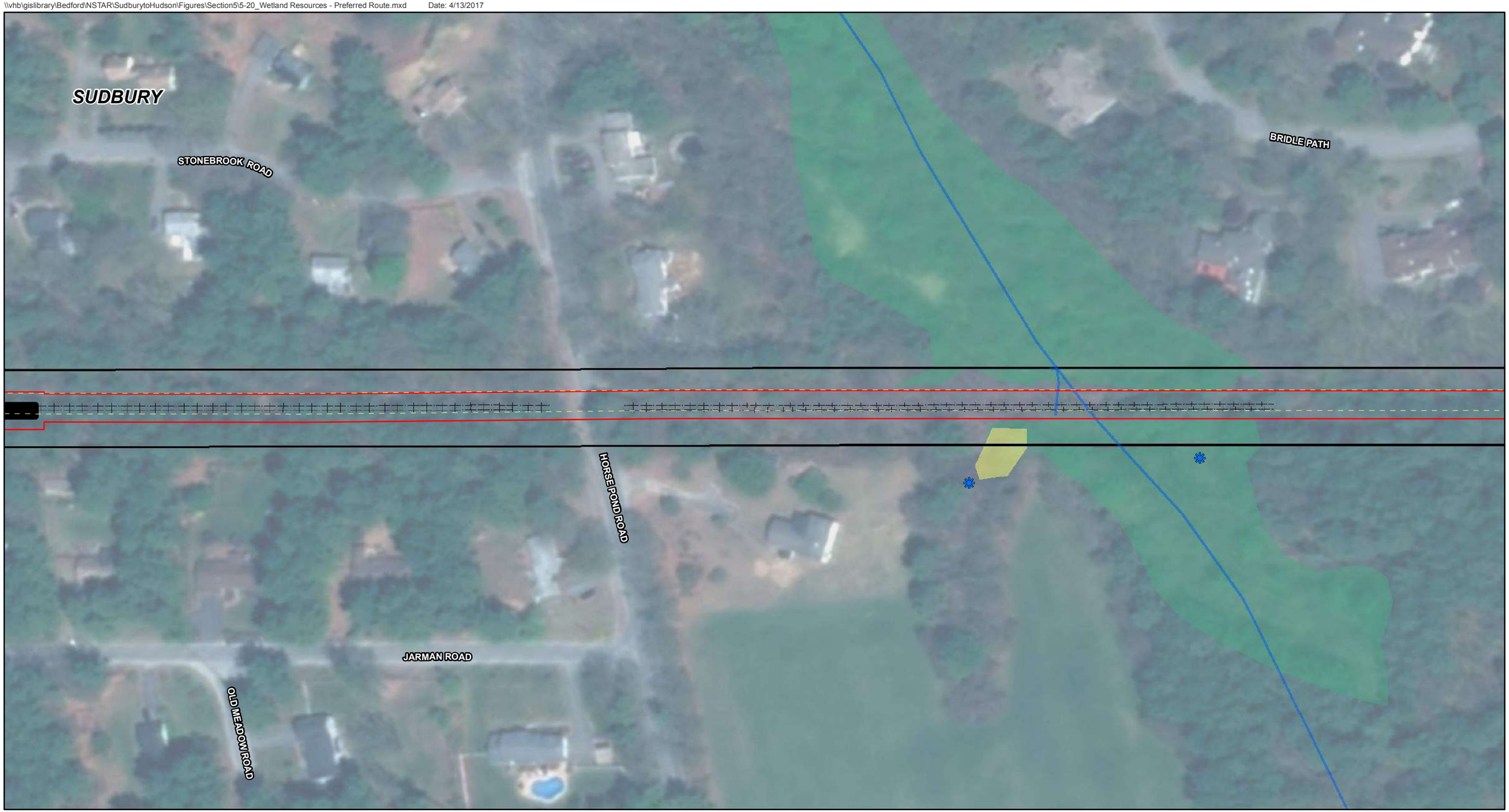

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4/13/2017

N

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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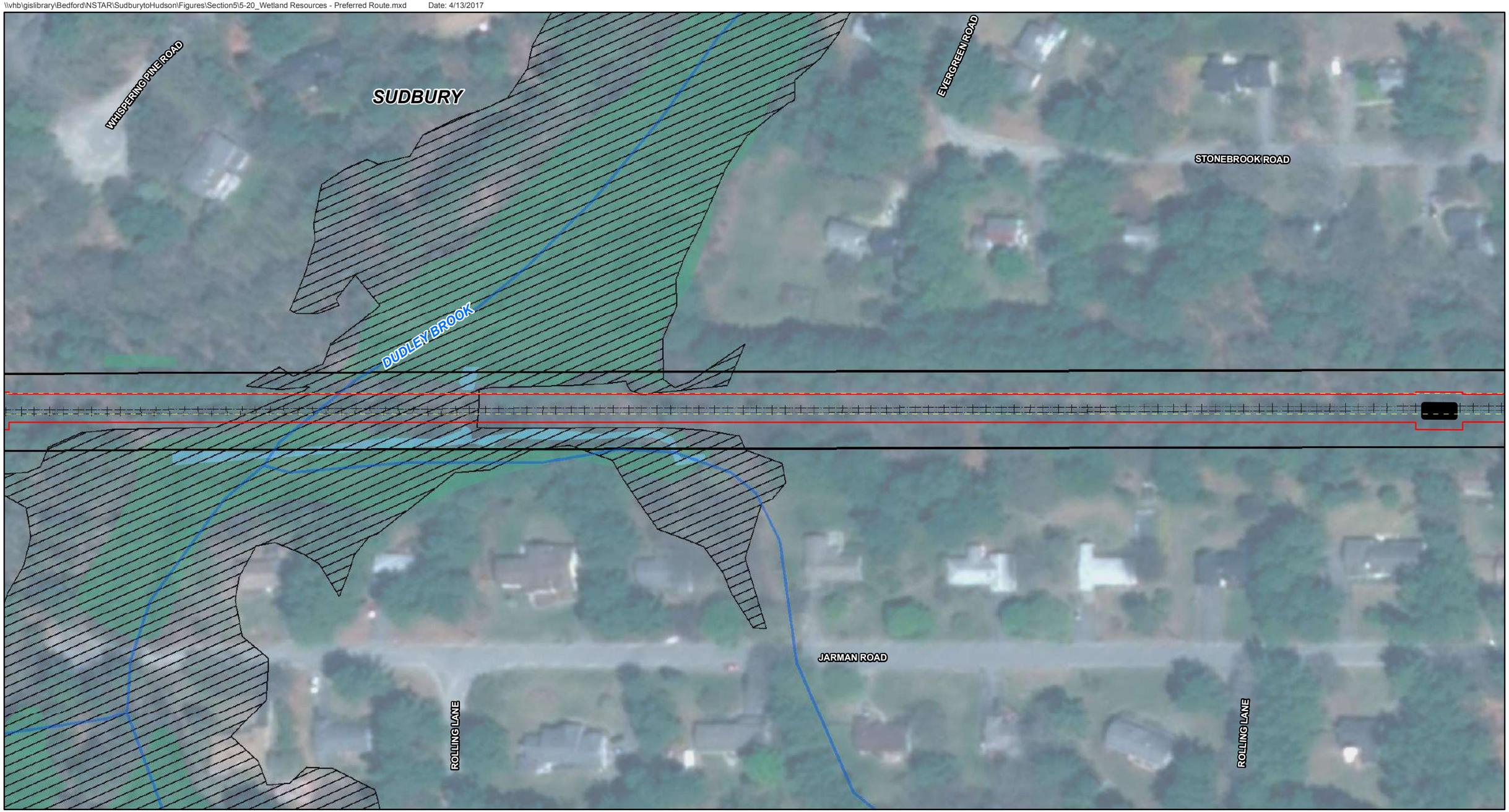

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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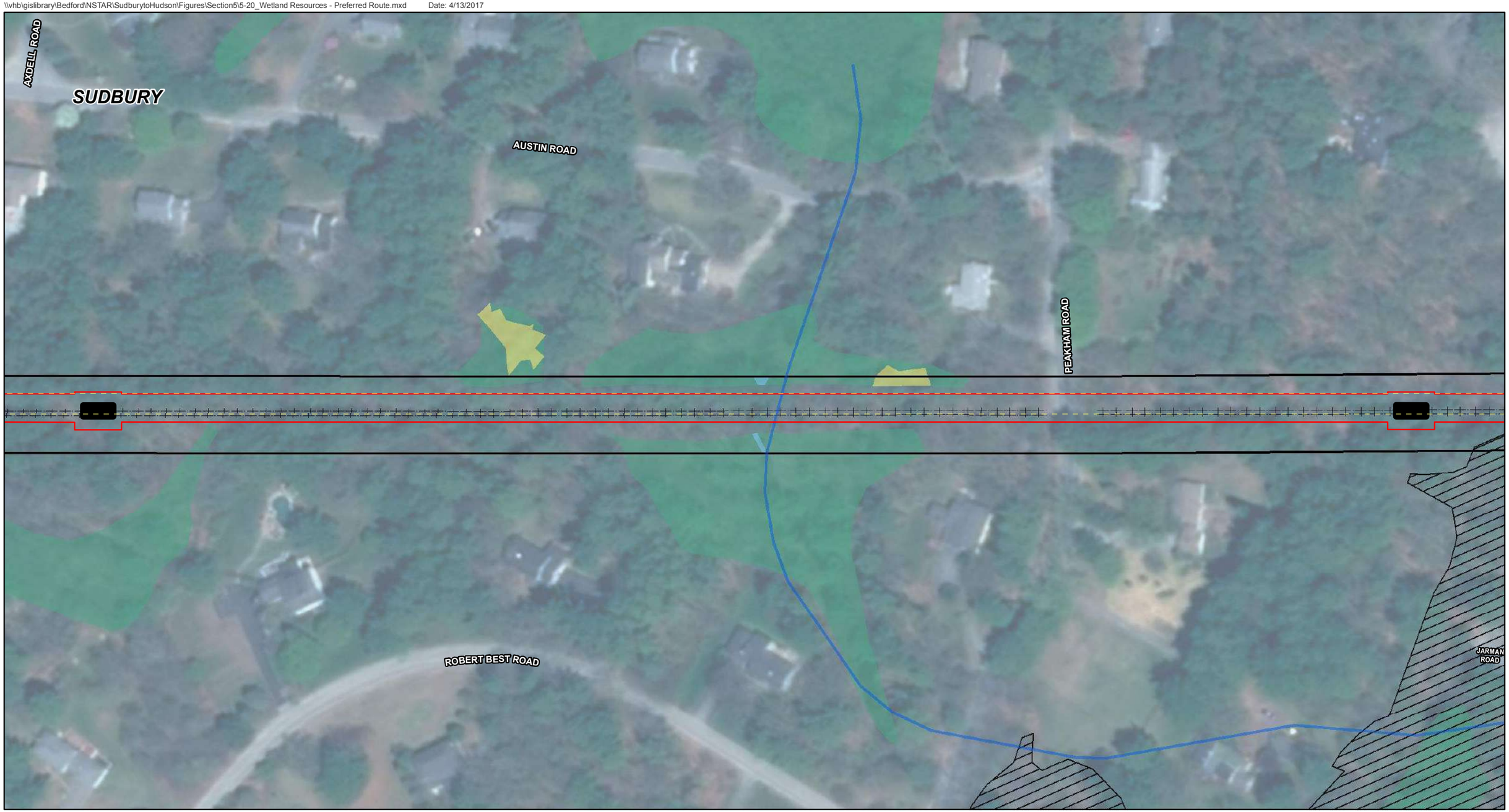

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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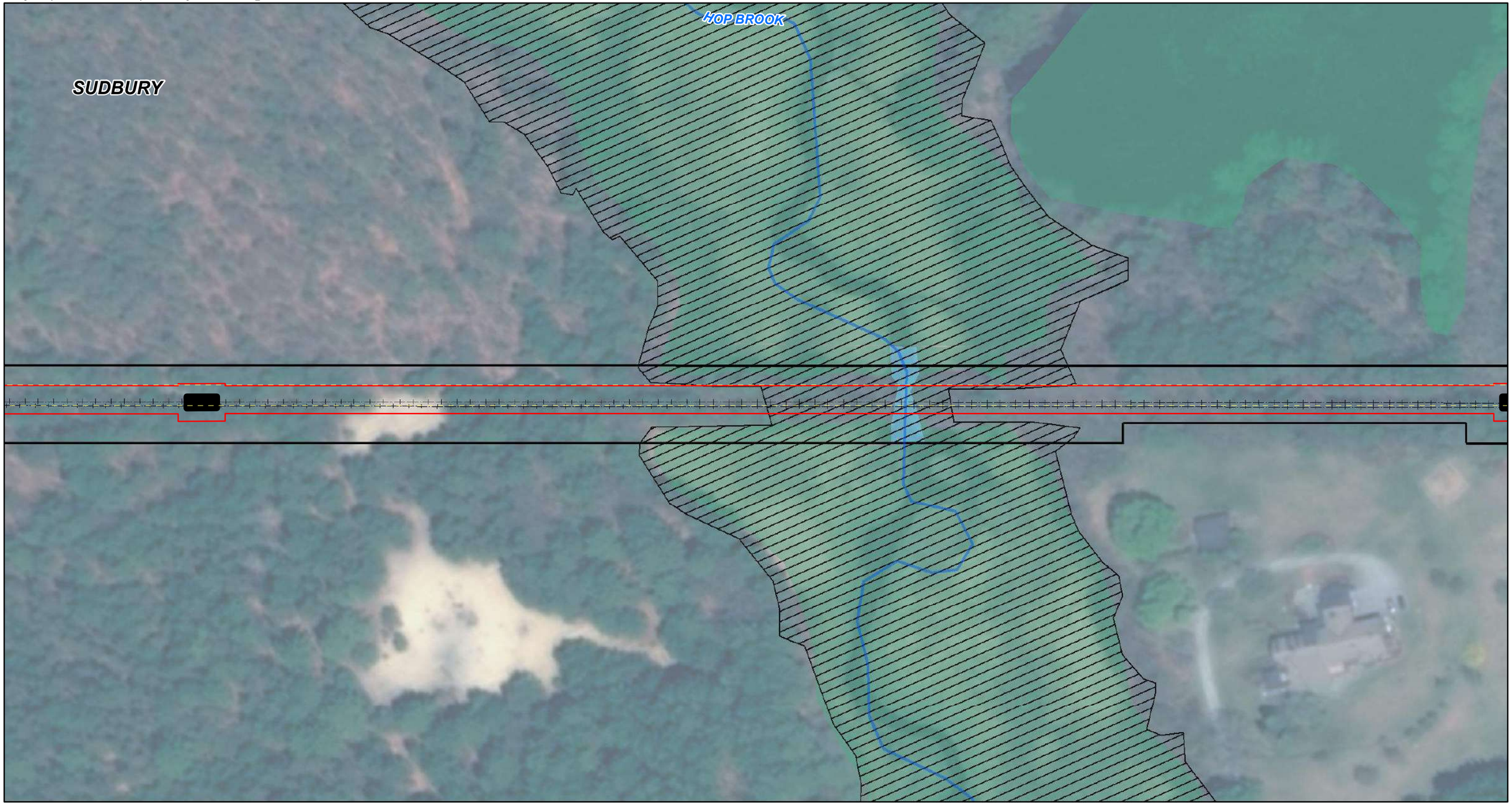

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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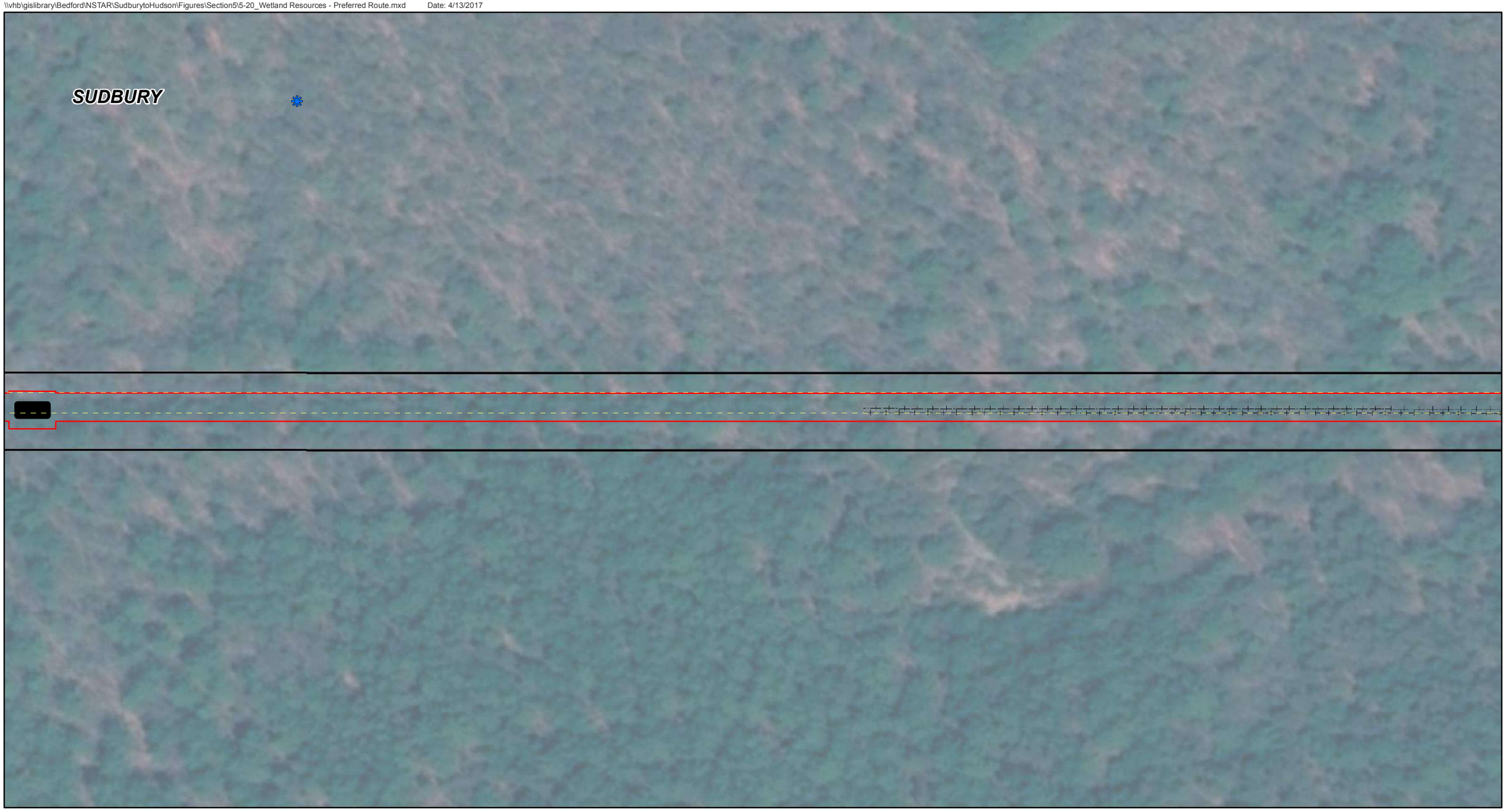

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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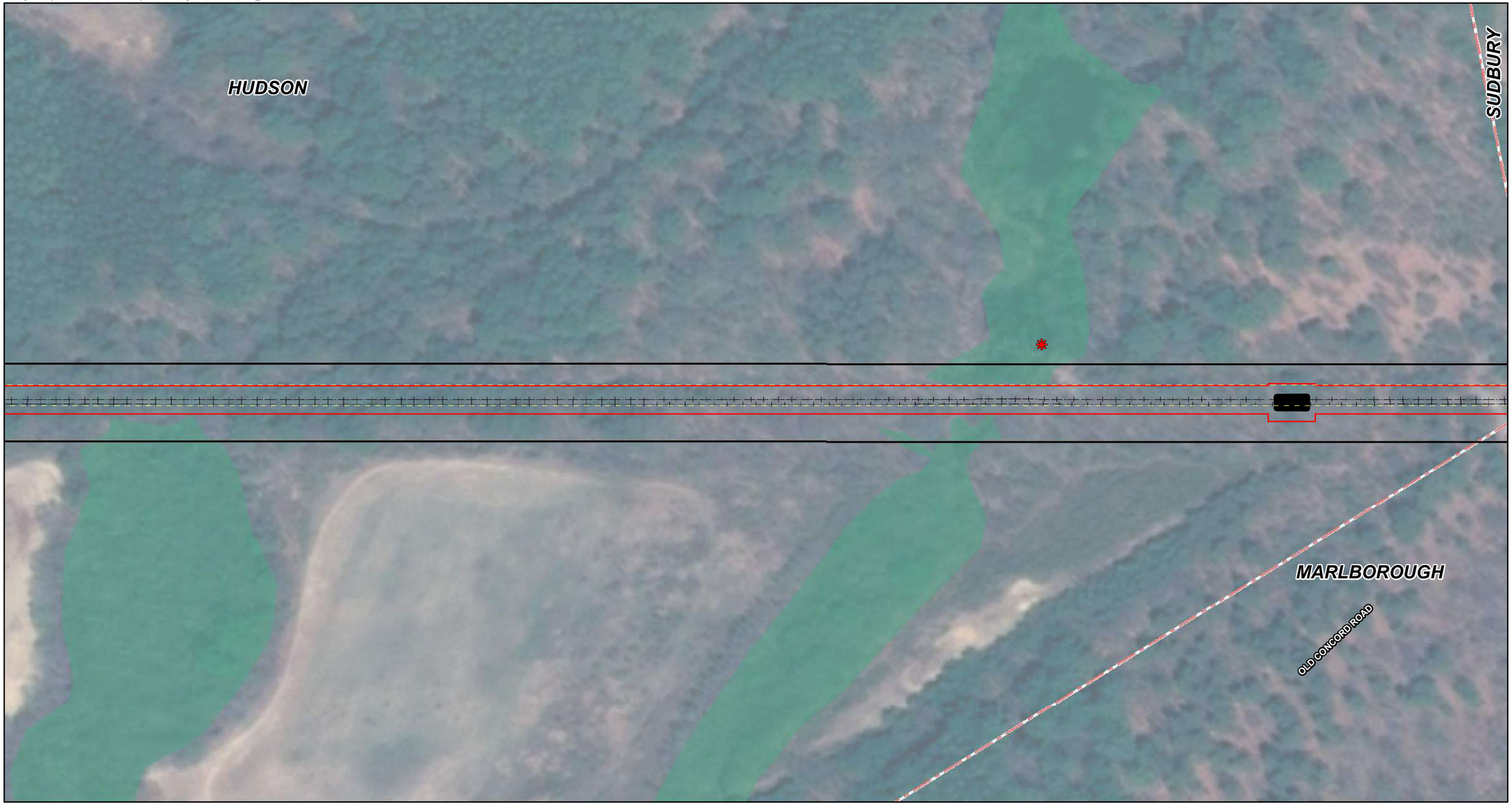

- MBTA ROW Boundary
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4/13/2017

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

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MBTA ROW Boundary
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N

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

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MBTA ROW Boundary
Tree Clearing
Trench and Manhole System in Roadways
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4/13/2017

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0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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- MBTA ROW Boundary
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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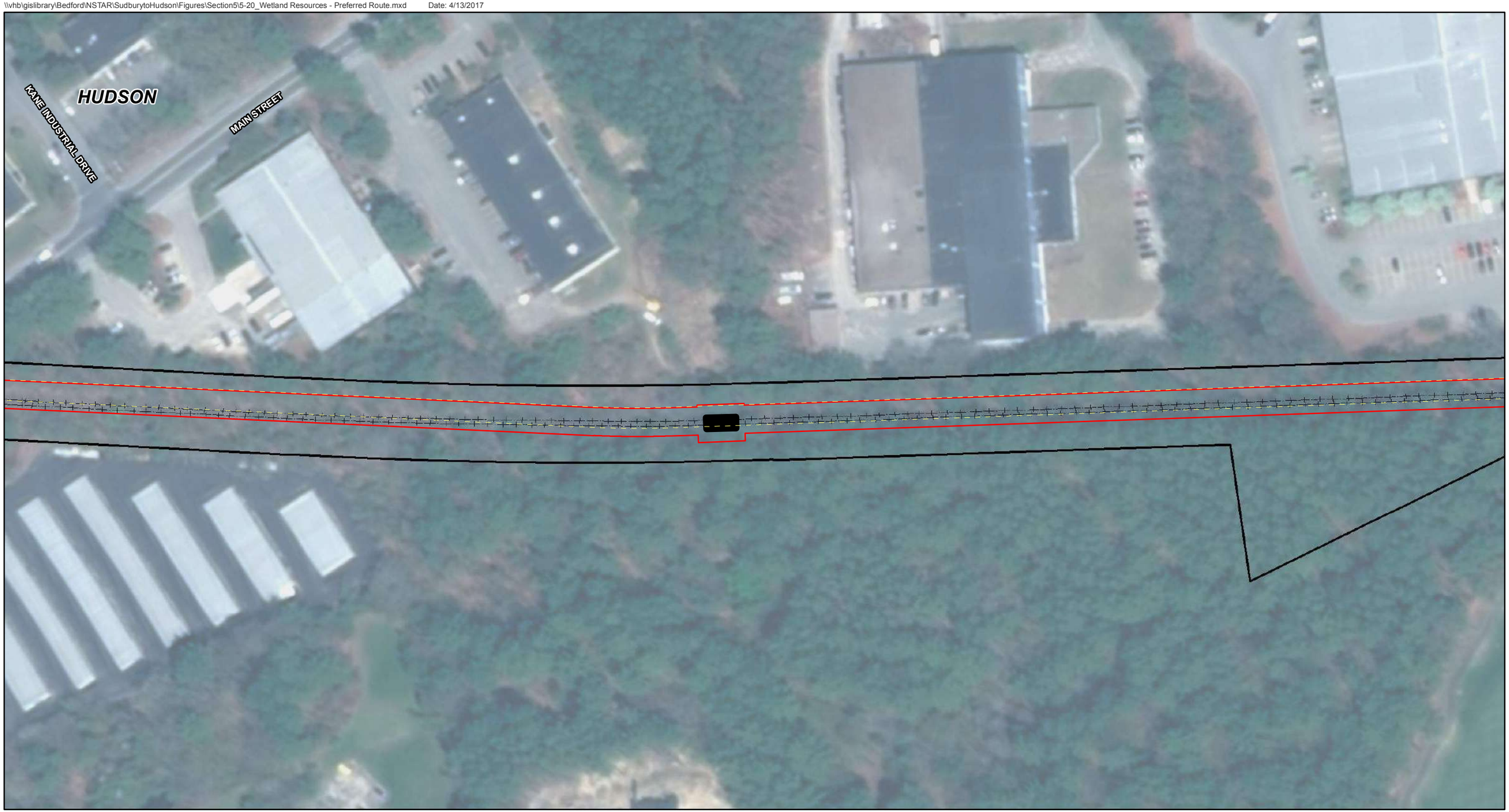

MBTA ROW Boundary
Tree Clearing
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Splice Vault Locations

BVW
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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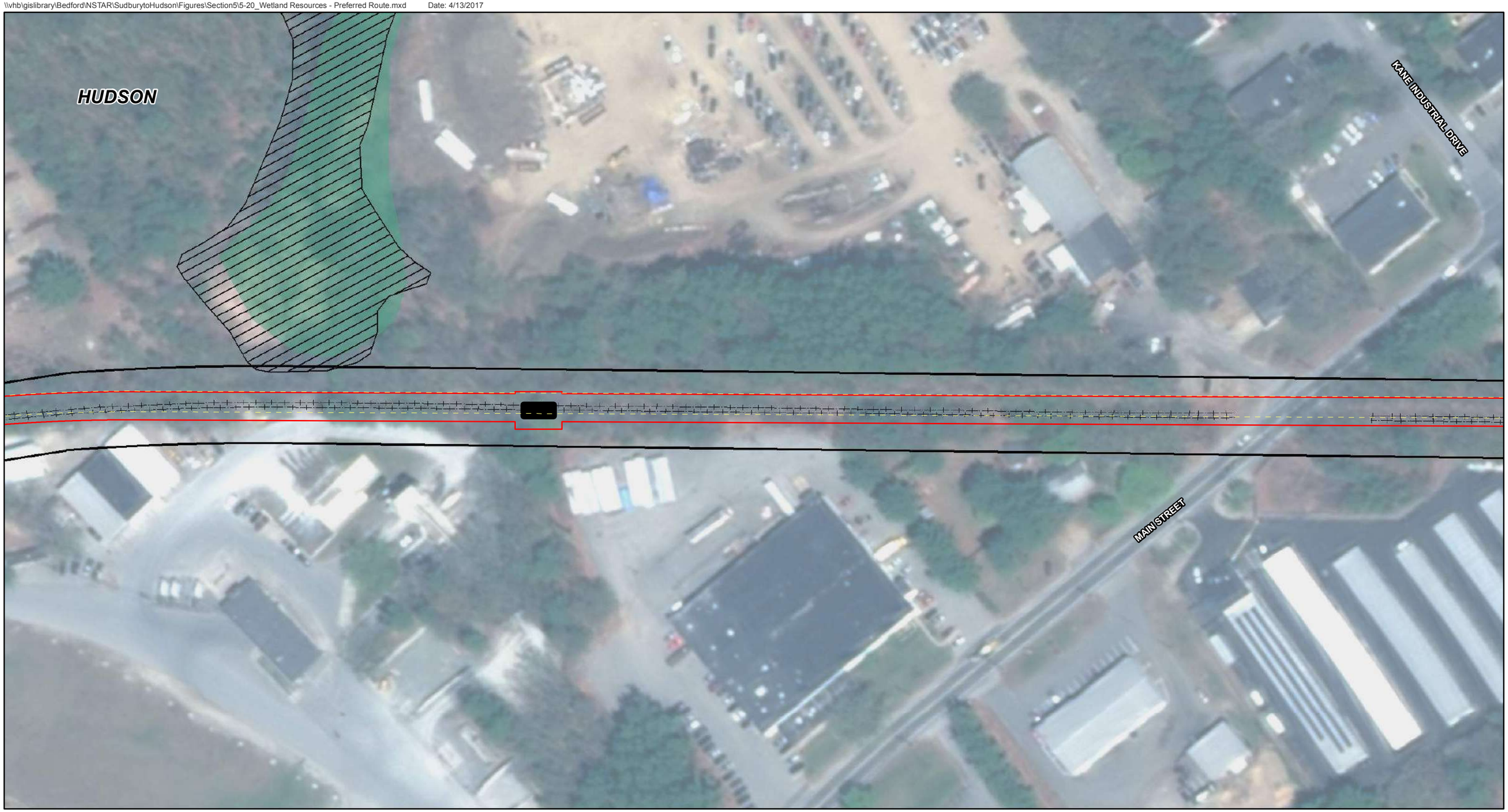

- MBTA ROW Boundary
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

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MBTA ROW Boundary
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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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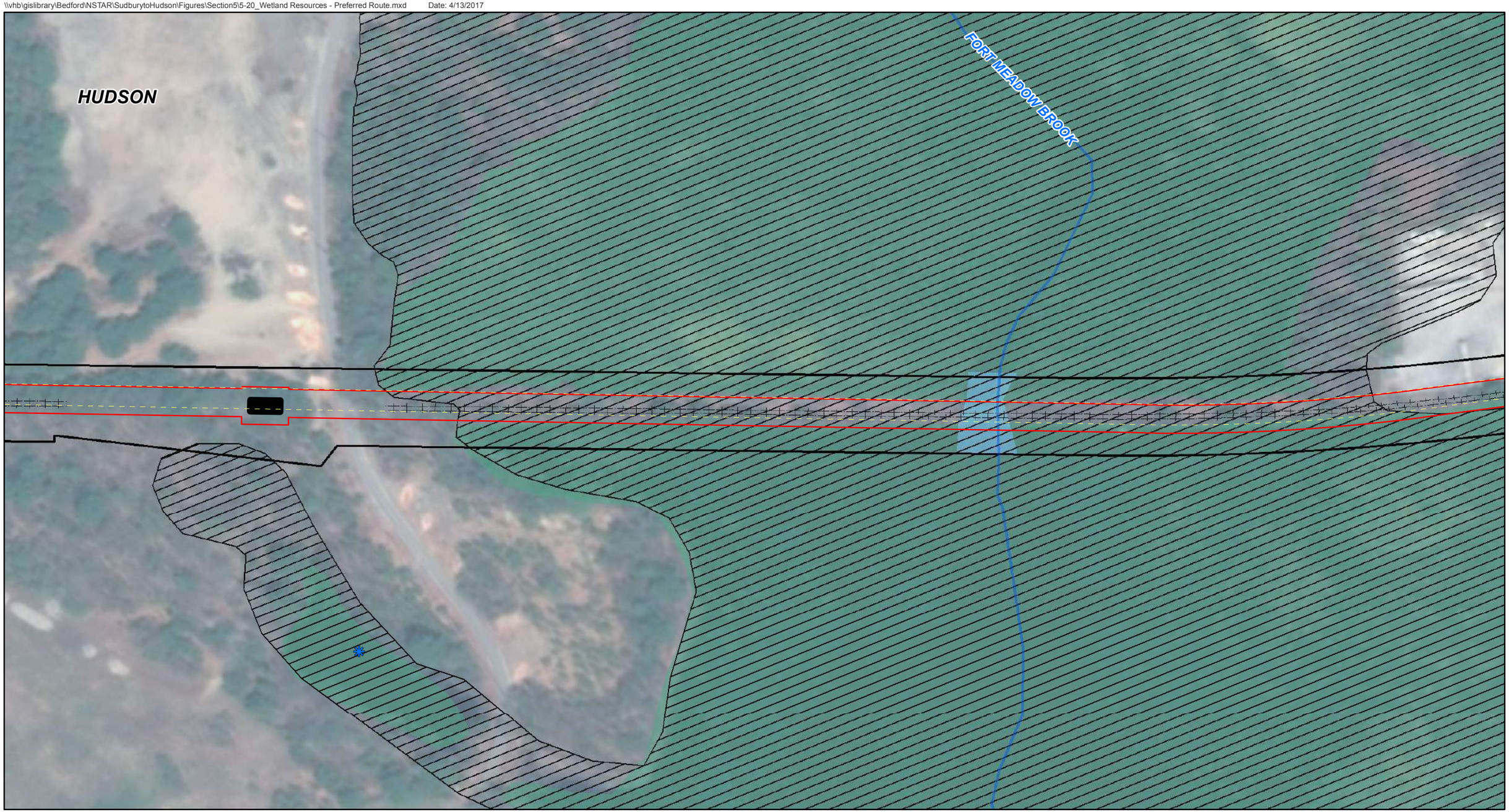

MBTA ROW Boundary
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4/13/2017

N

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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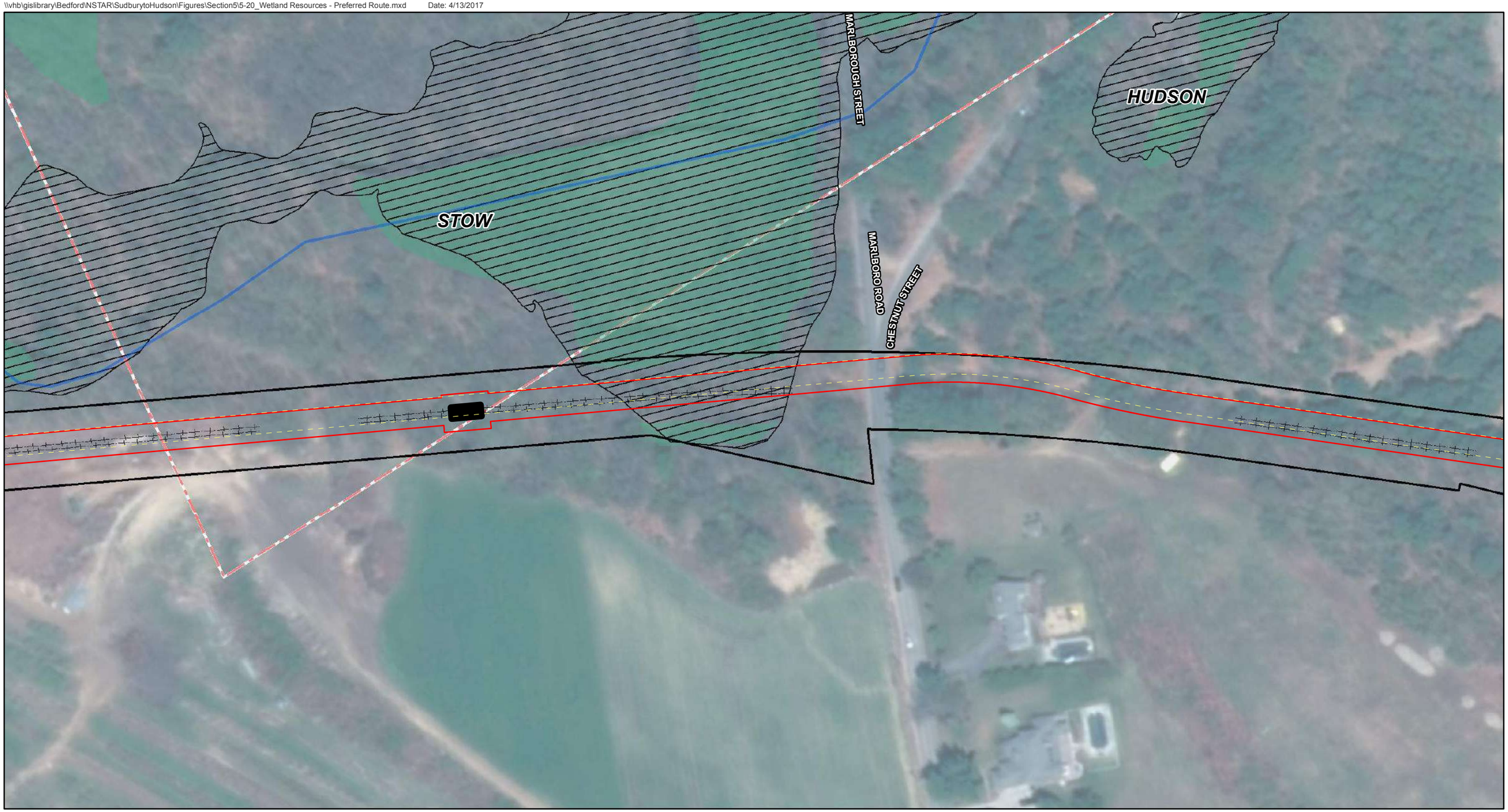

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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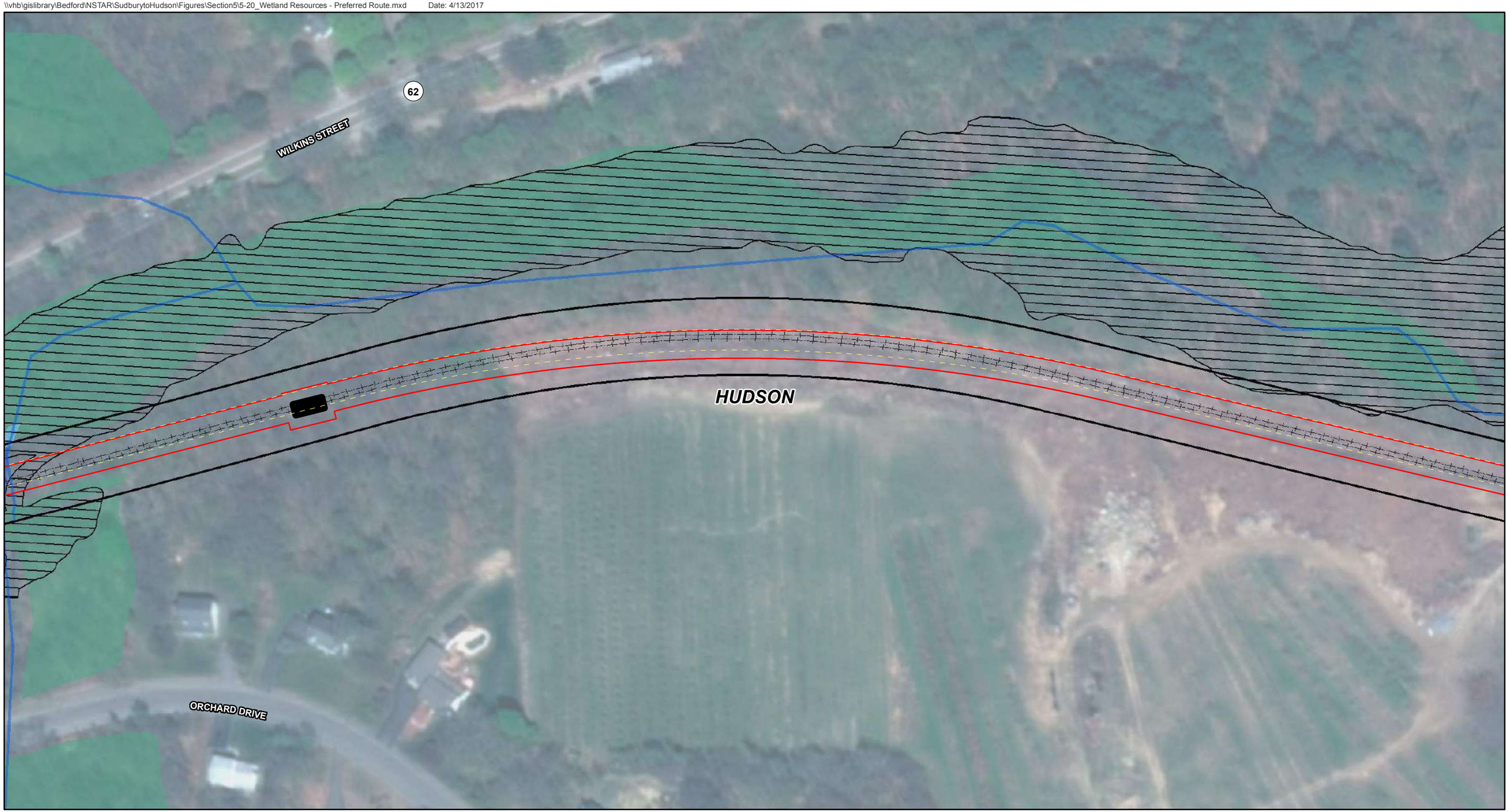

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EVERSOURCE ENERGY

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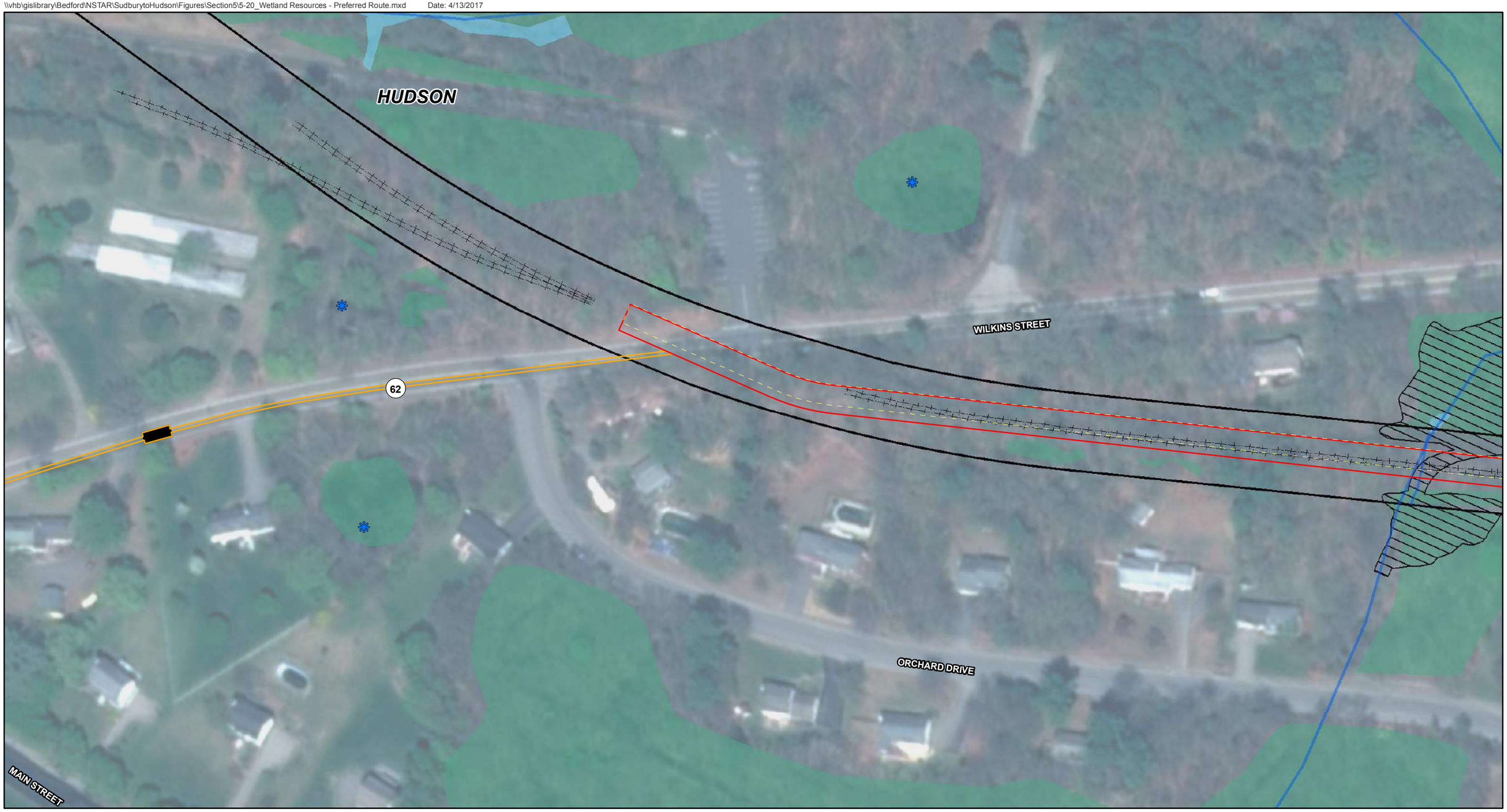

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Sudbury-Hudson Transmission Reliability Project

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

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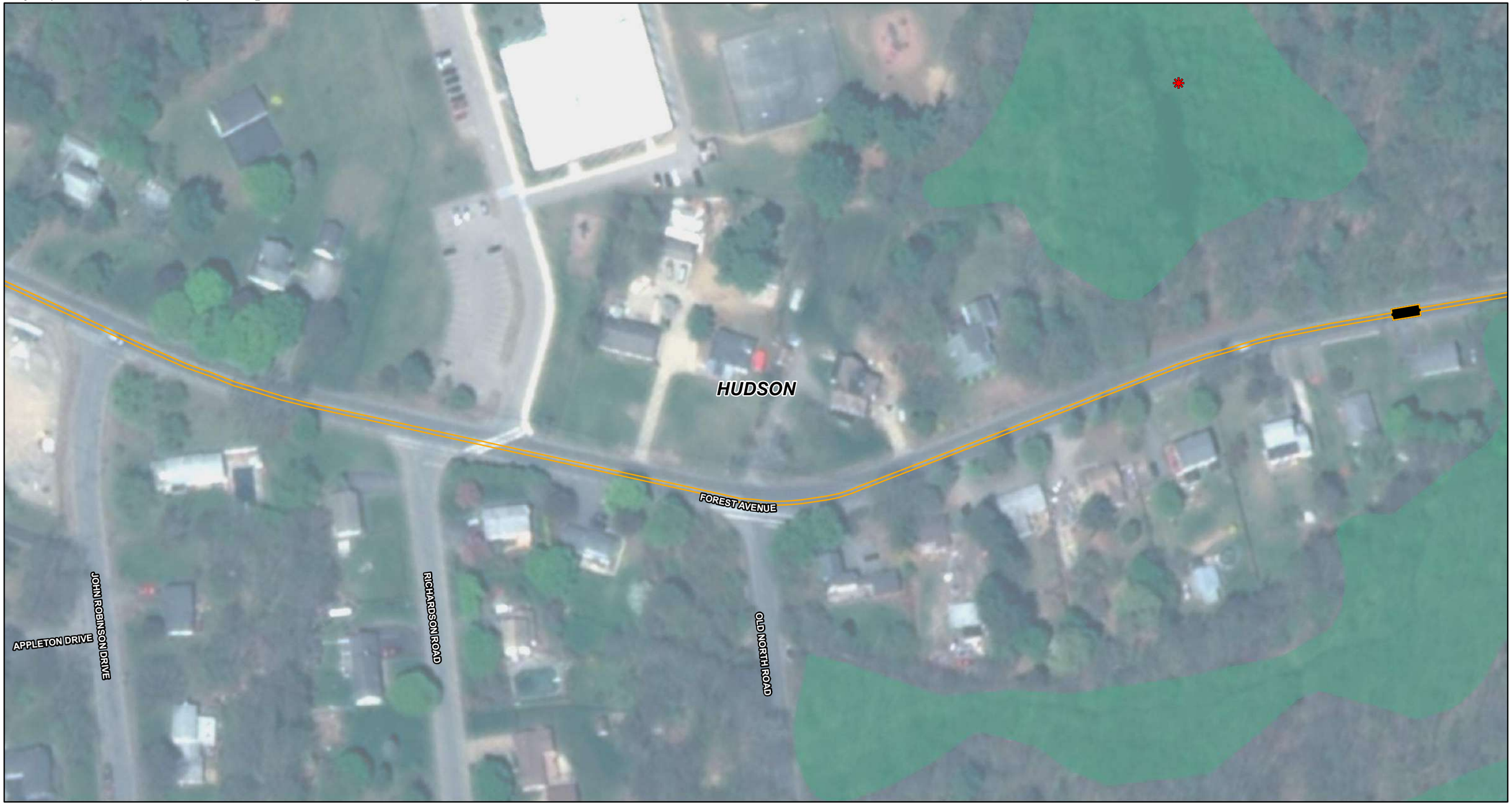

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EVERSOURCE ENERGY

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Figure 5-20: Wetland Resource Areas - Project

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MBTA ROW Boundary
Tree Clearing
Trench and Manhole System in Roadways
22-ft Construction Platform along MBTA ROW
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
NHESP Certified Vernal Pool
NHESP Potential Vernal Pool
Bordering Land Subject to Flooding
Existing Rails
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

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- MBTA ROW Boundary
- Tree Clearing
- Trench and Manhole System in Roadways
- 22-ft Construction Platform along MBTA ROW
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Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-20: Wetland Resource Areas - Project

vhb

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Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
Noticed Variation Structure Locations
Noticed Variation Transition Structure Locations
Access Road
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
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NHESP Potential Vernal Pool
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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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- Project and Noticed Variation (UG on Wilkins)
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Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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MassGIS, 2015
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4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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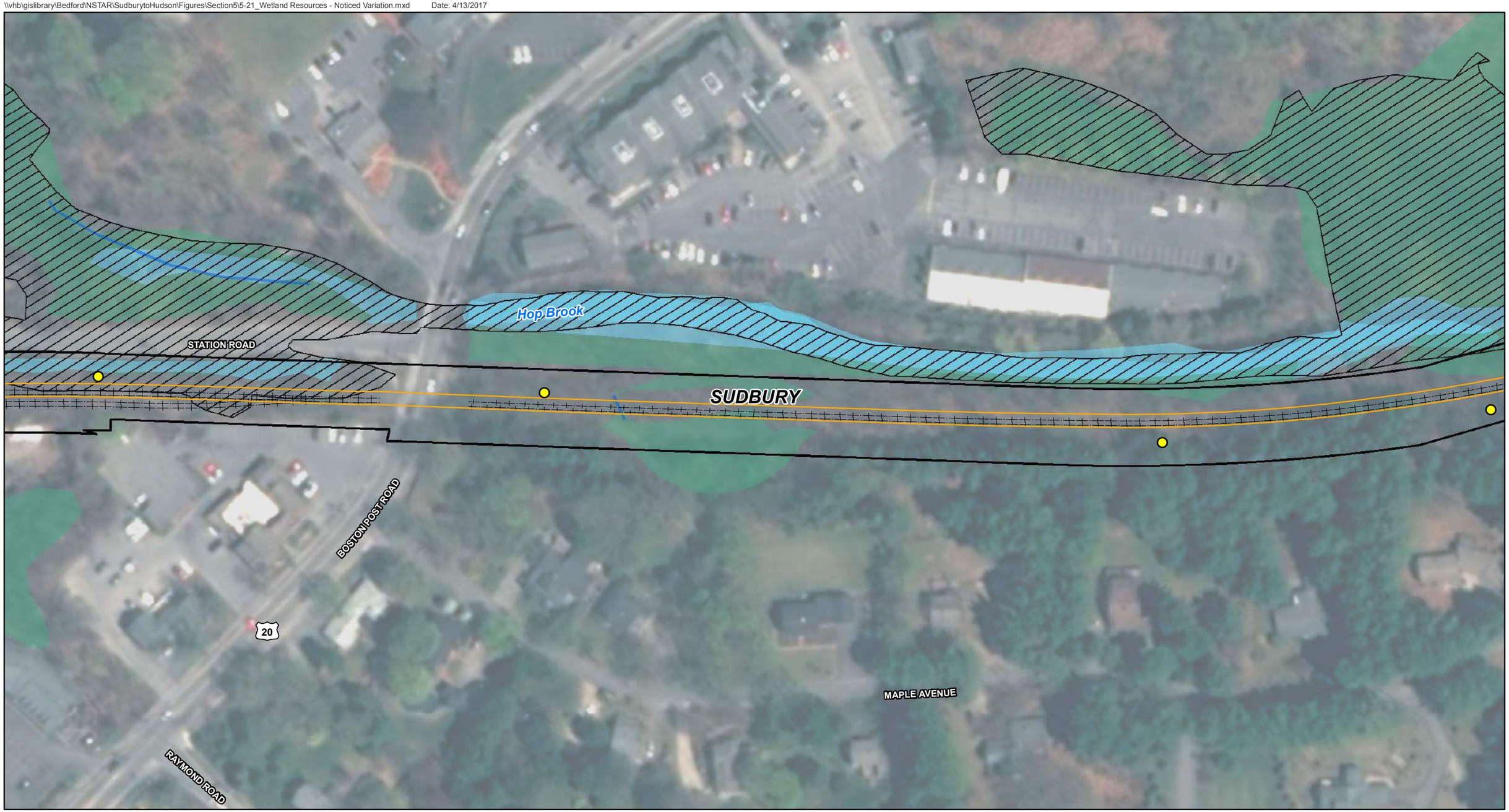

Project and Noticed Variation (UG on Wilkins)
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Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

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0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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Project and Noticed Variation (UG on Wilkins)
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OrthoImagery, VHB

4/13/2017

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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MassGIS, 2015
OrthoImagery, VHB

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

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Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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OrthoImagery, VHB

4/13/2017

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0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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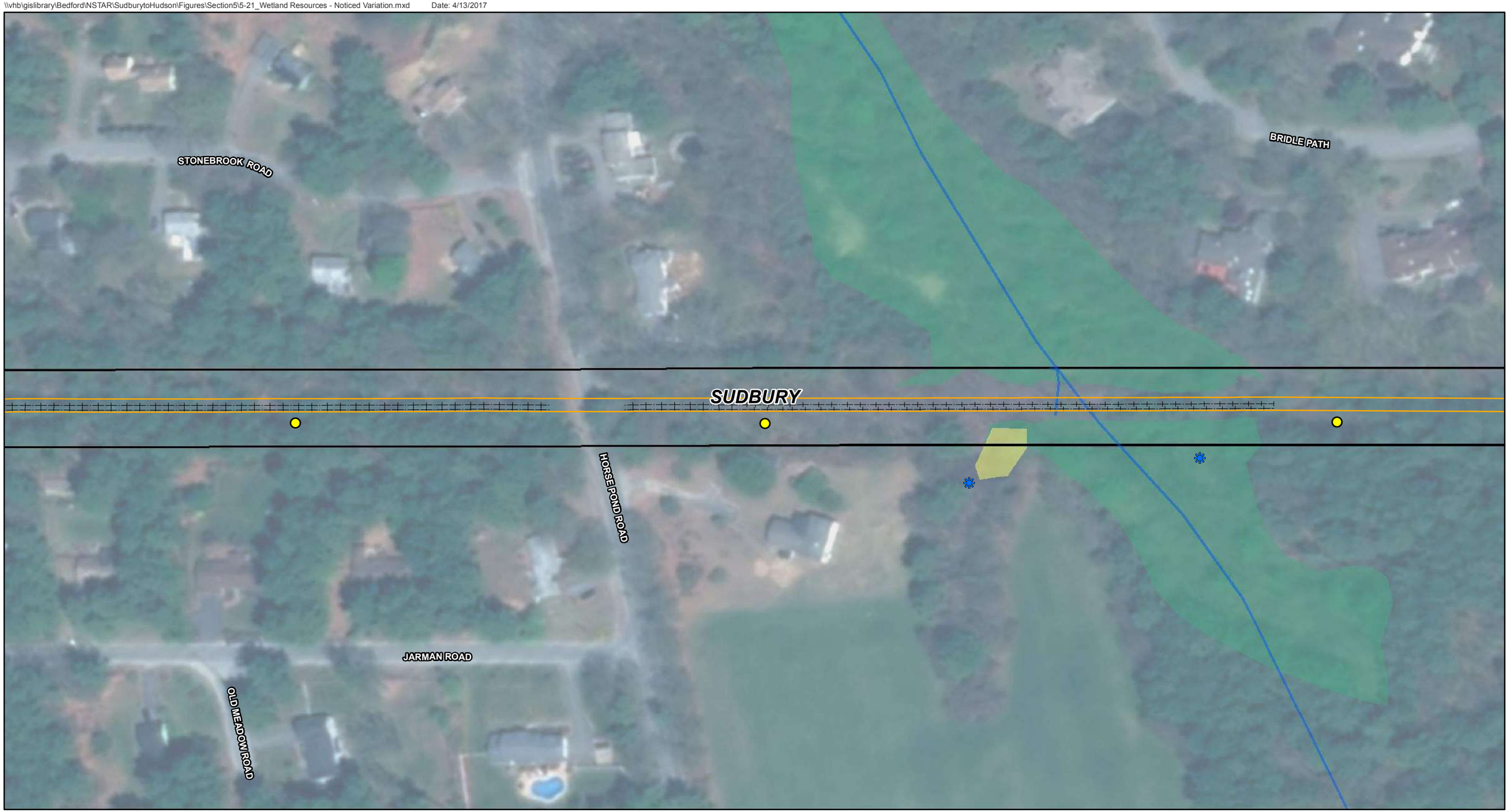

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MassGIS, 2015
OrthoImagery, VHB

4/13/2017

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0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

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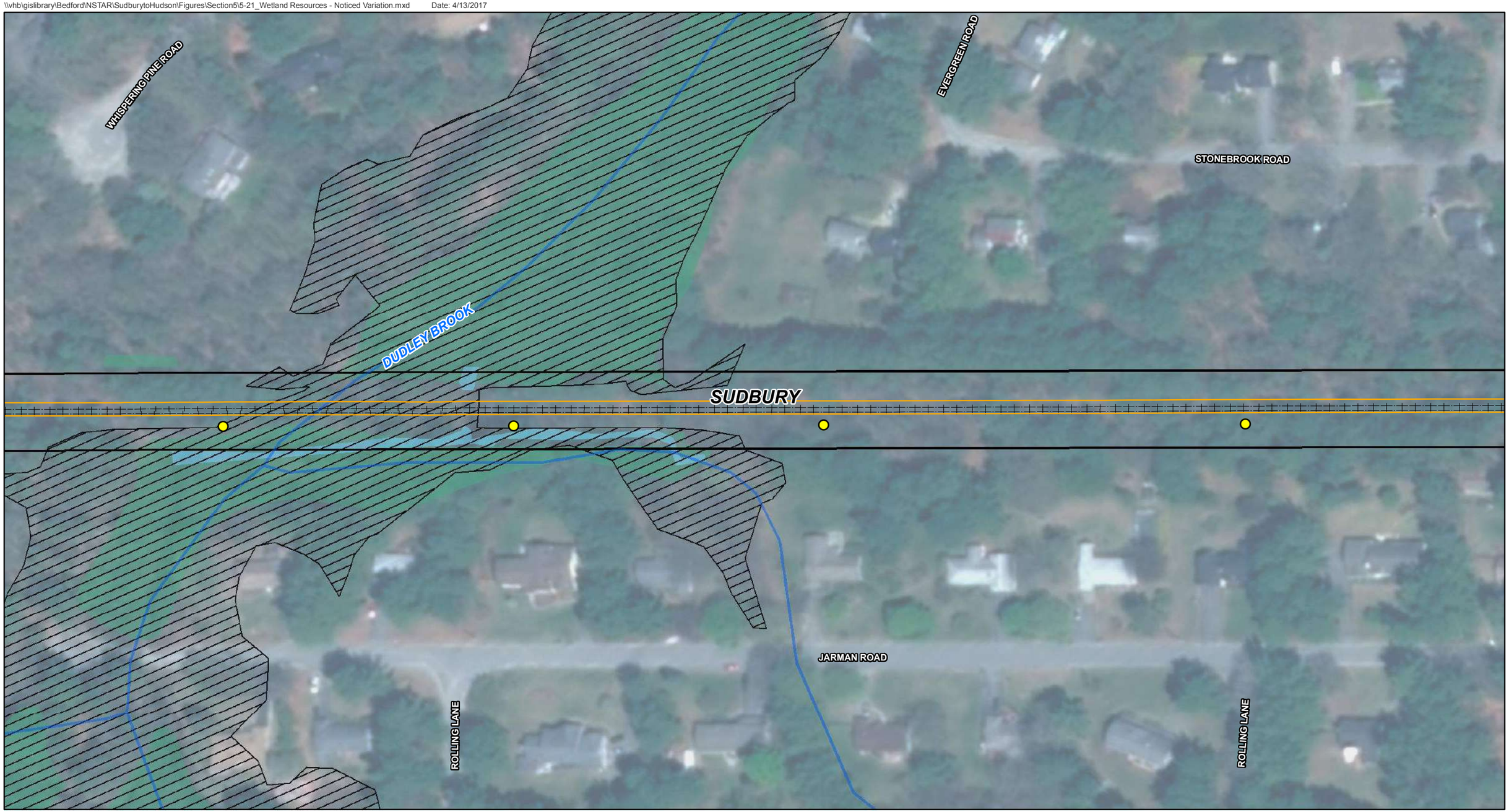

- Project and Noticed Variation (UG on Wilkins)
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OrthoImagery, VHB

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N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

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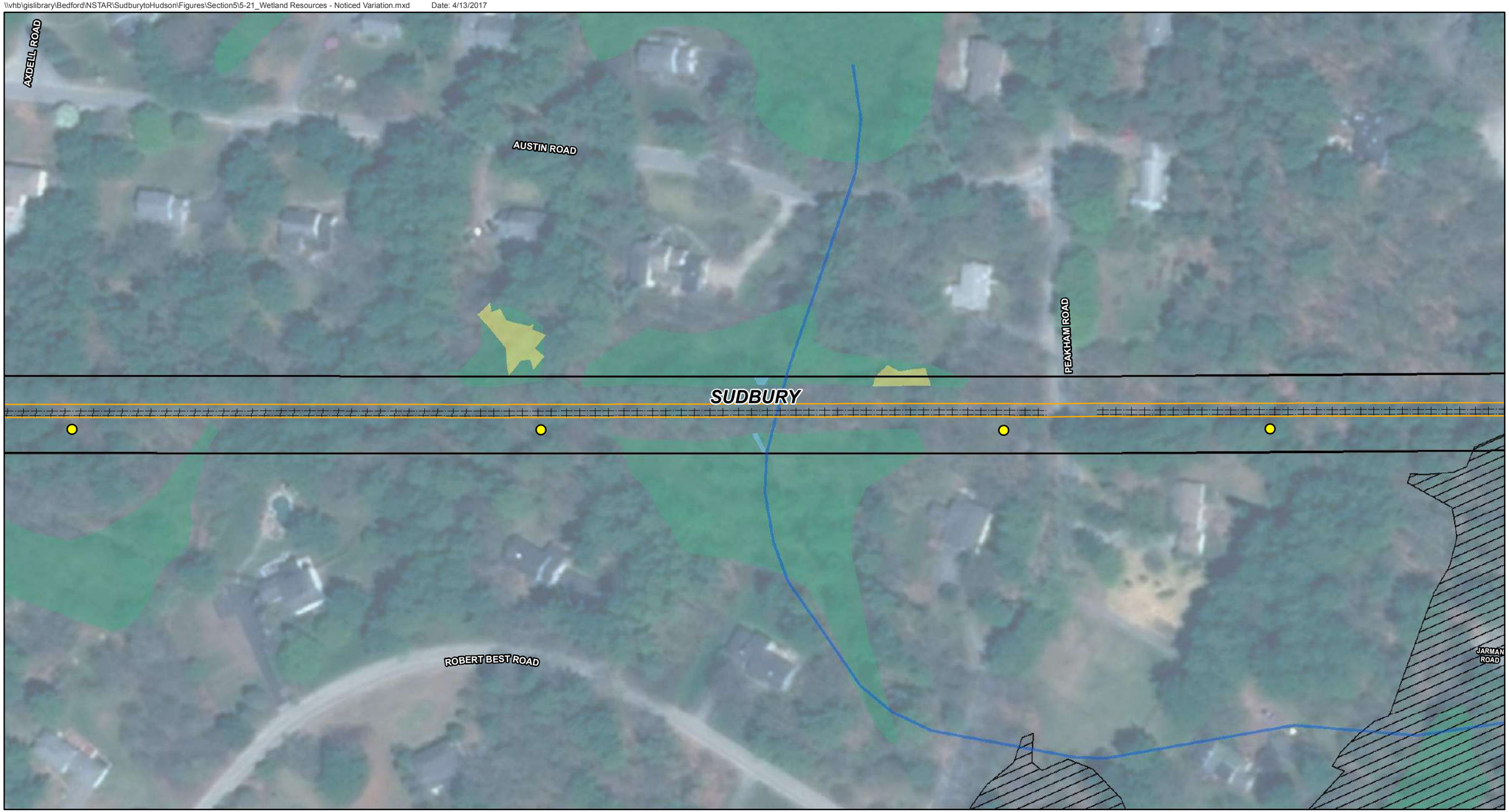

Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

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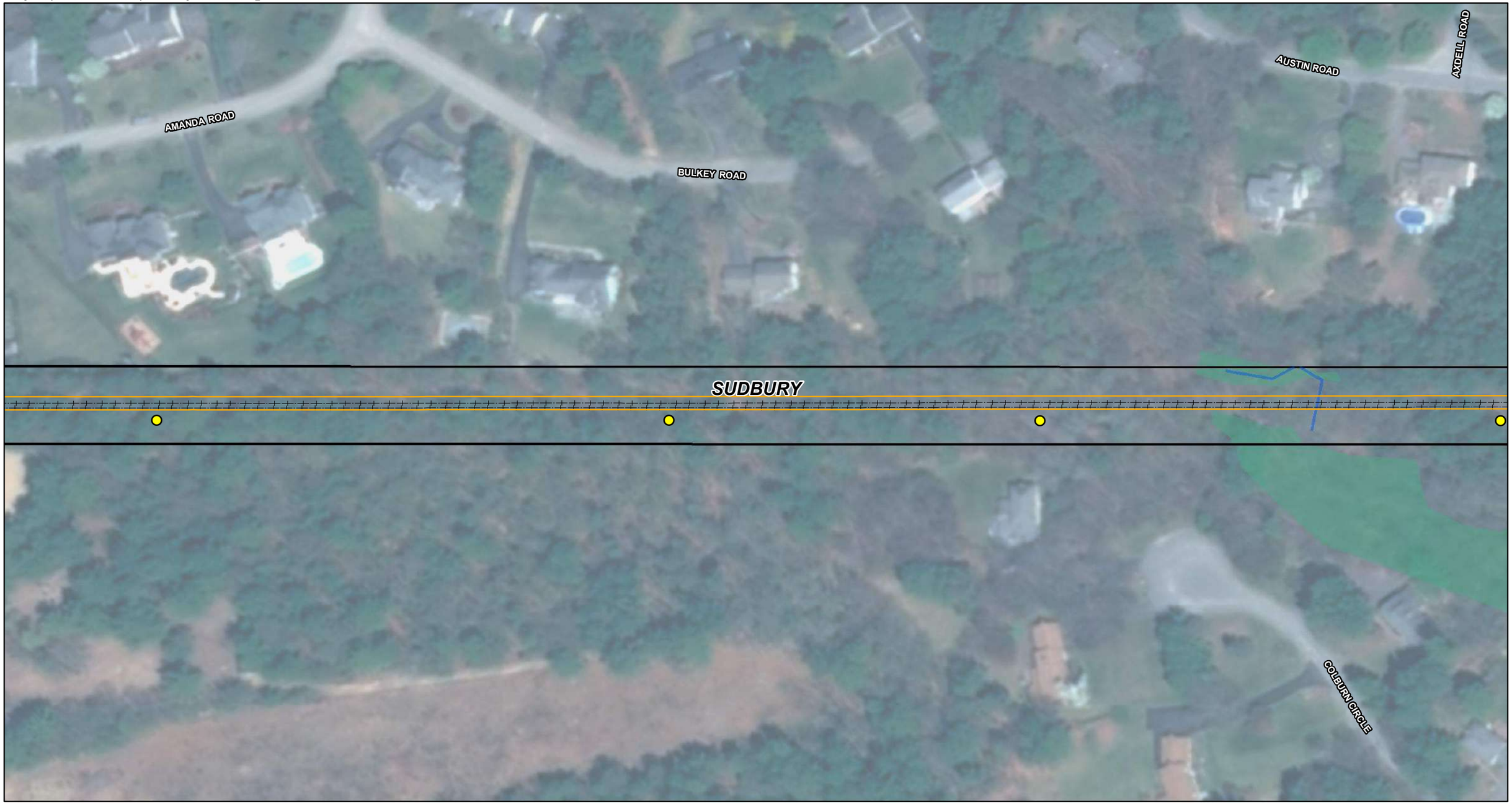

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Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

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Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

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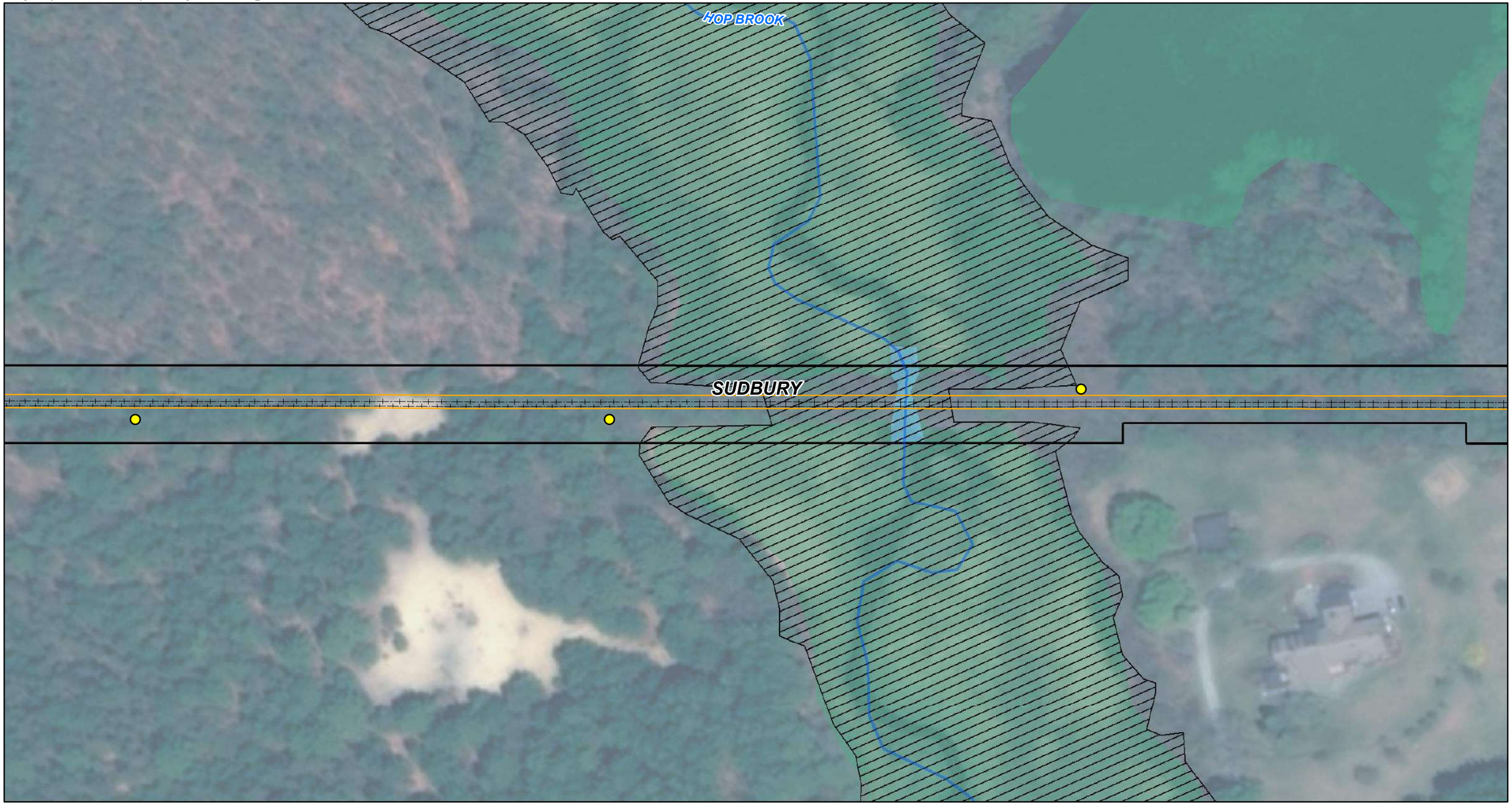

Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

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MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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MassGIS, 2015
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4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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Project and Noticed Variation (UG on Wilkins)
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MassGIS, 2015
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4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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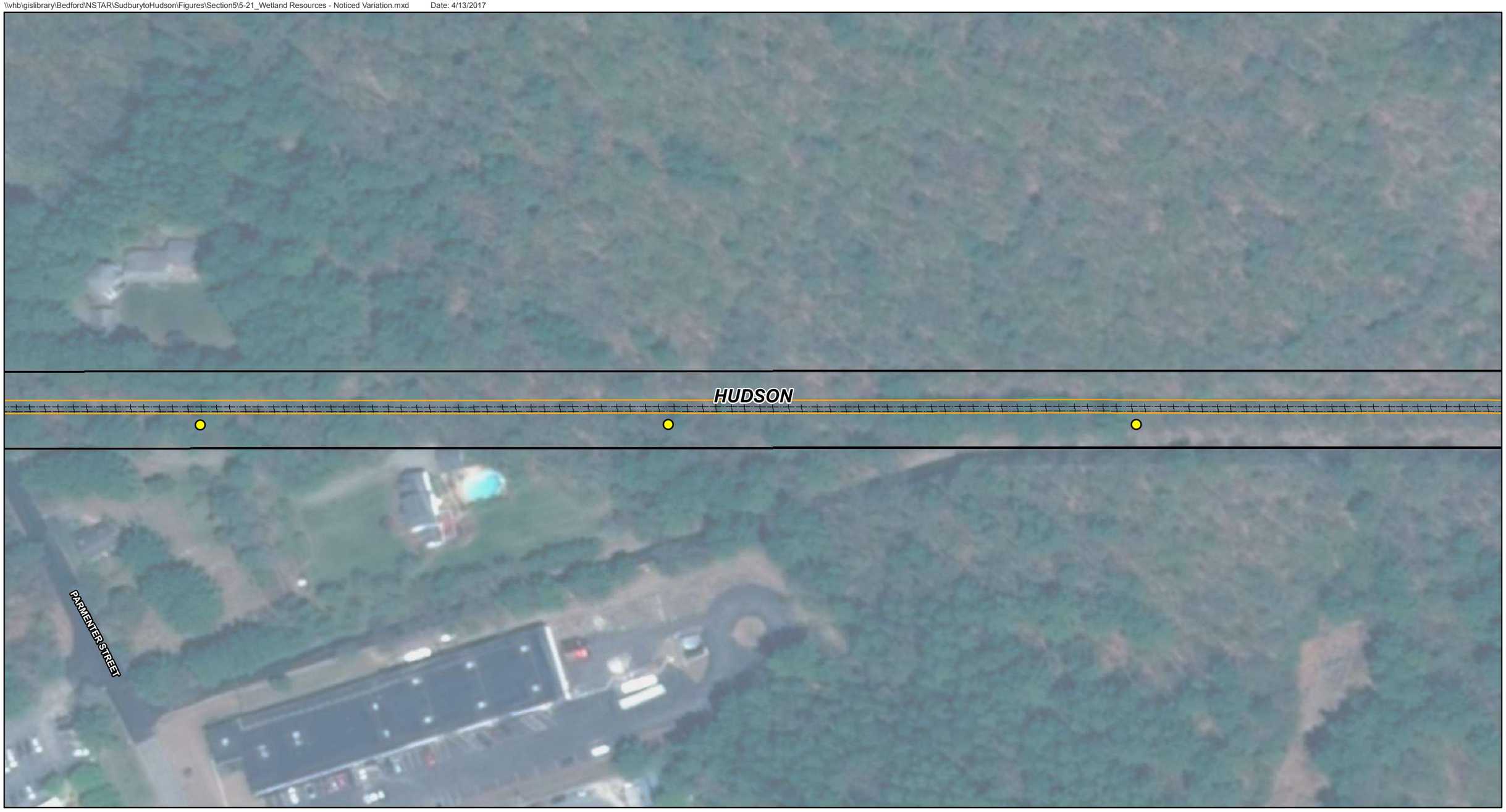

Project and Noticed Variation (UG on Wilkins)
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MassGIS, 2015
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4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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MassGIS, 2015
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4/13/2017

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0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

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4/13/2017

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0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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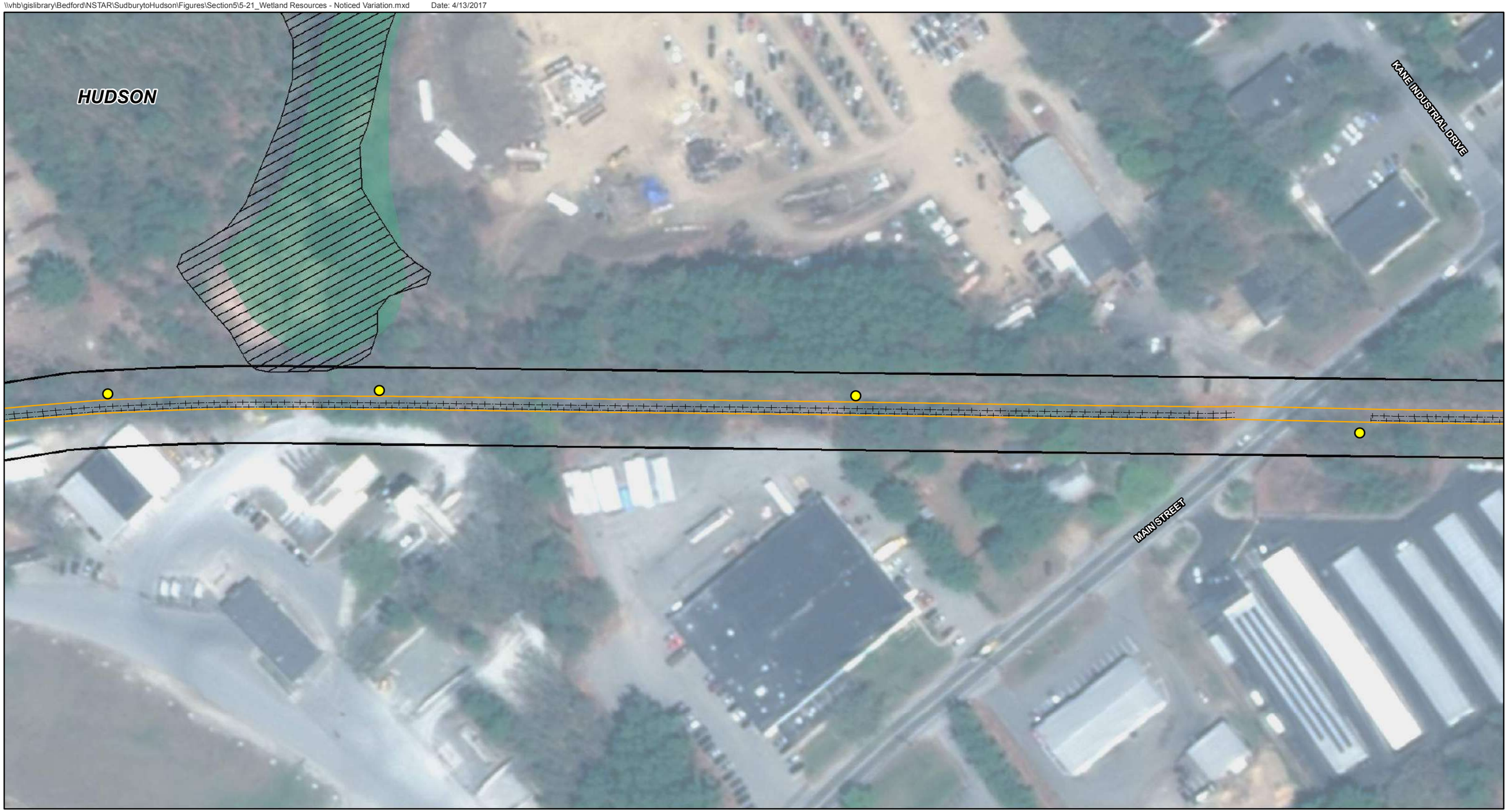

Project and Noticed Variation (UG on Wilkins)
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MassGIS, 2015
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4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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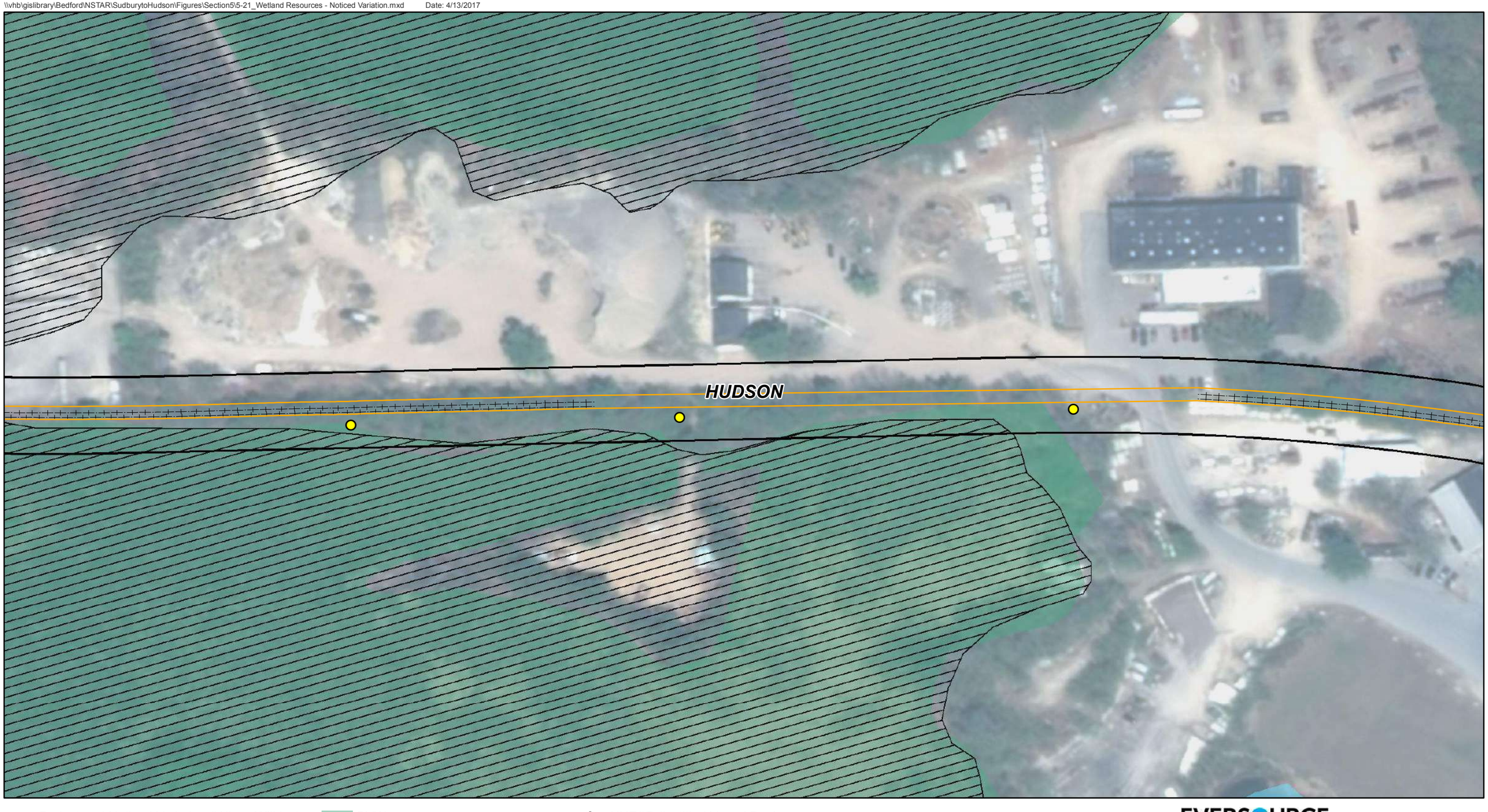

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MassGIS, 2015
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4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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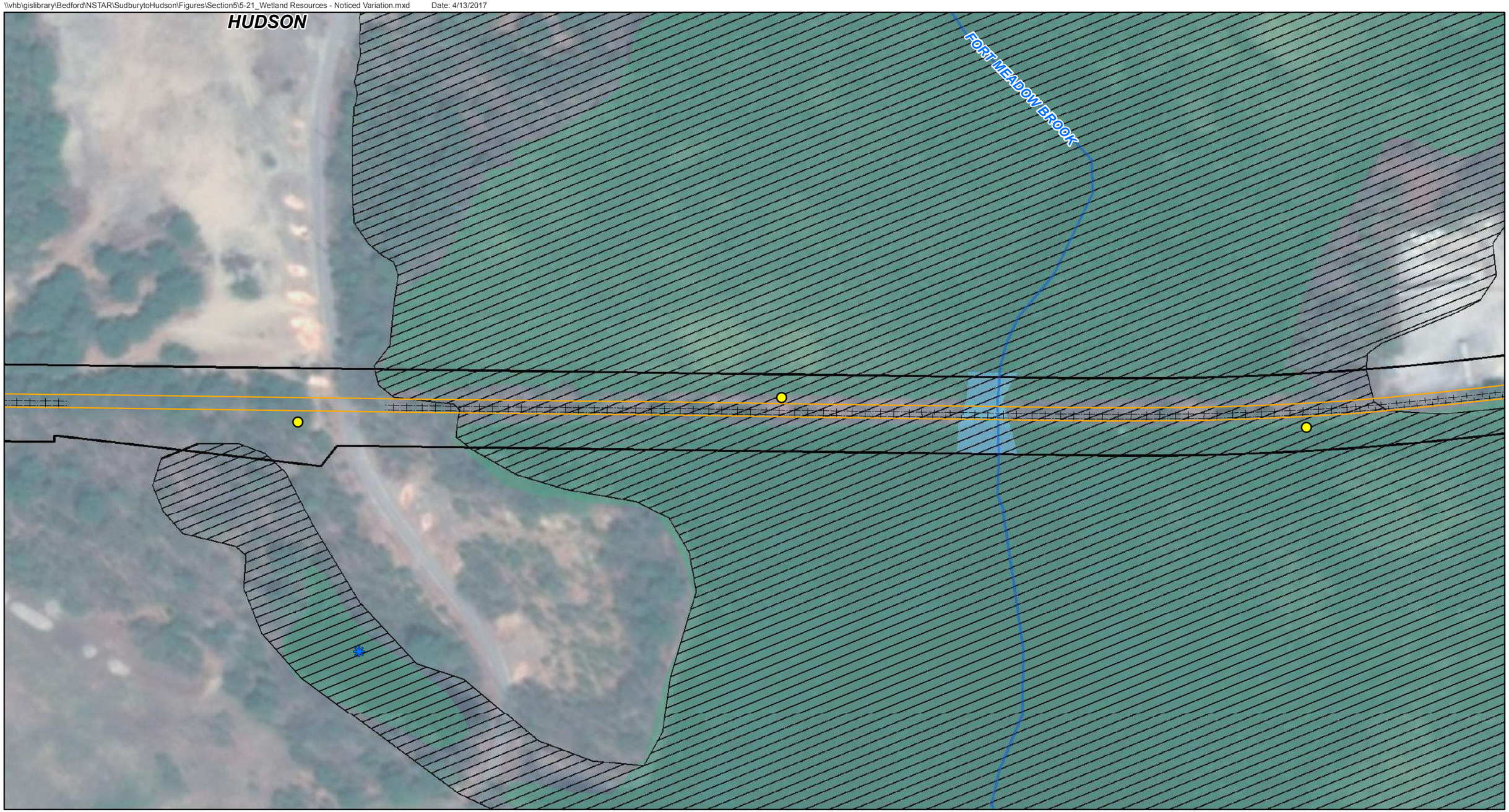

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MassGIS, 2015
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4/13/2017

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

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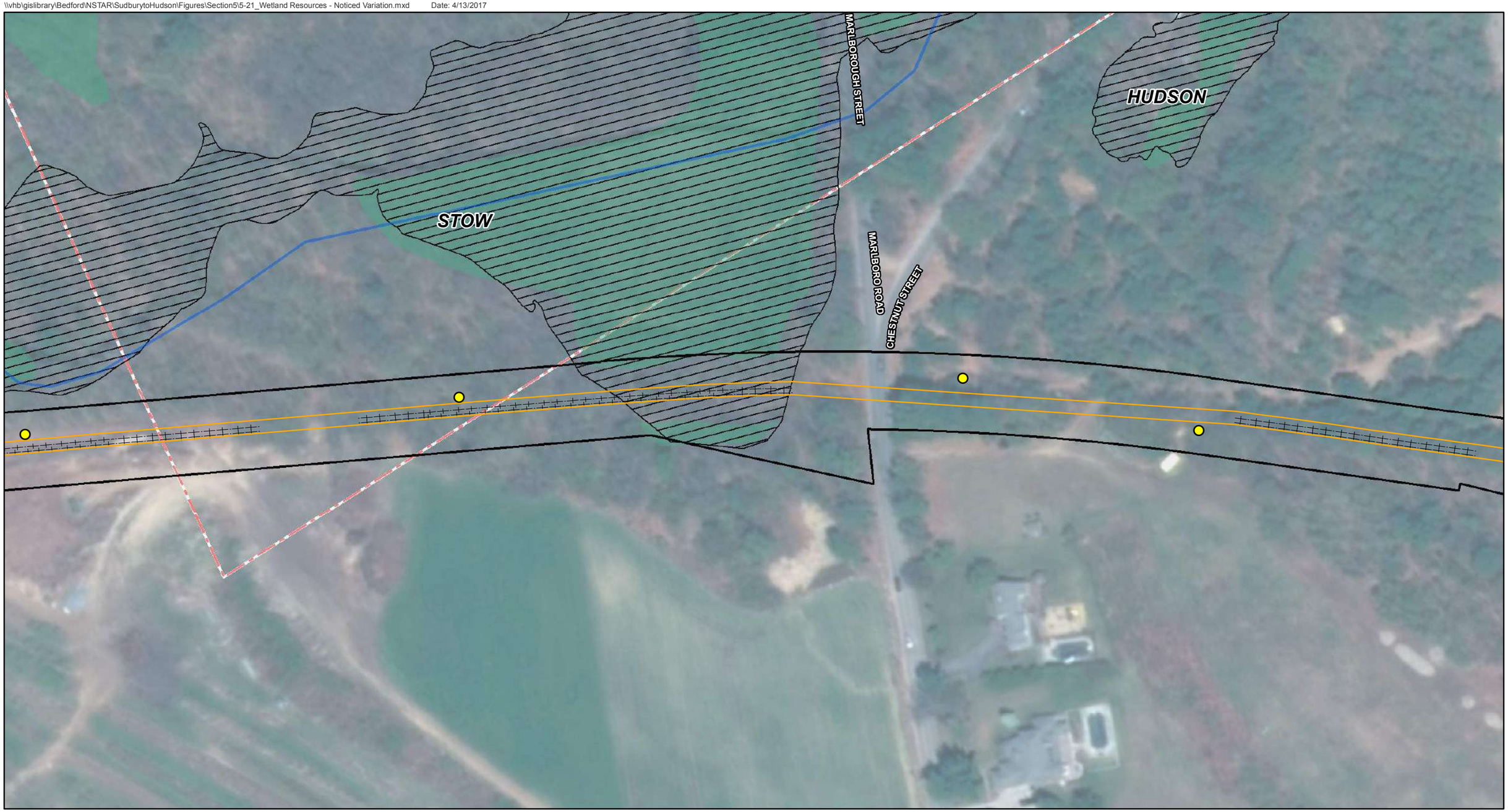

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EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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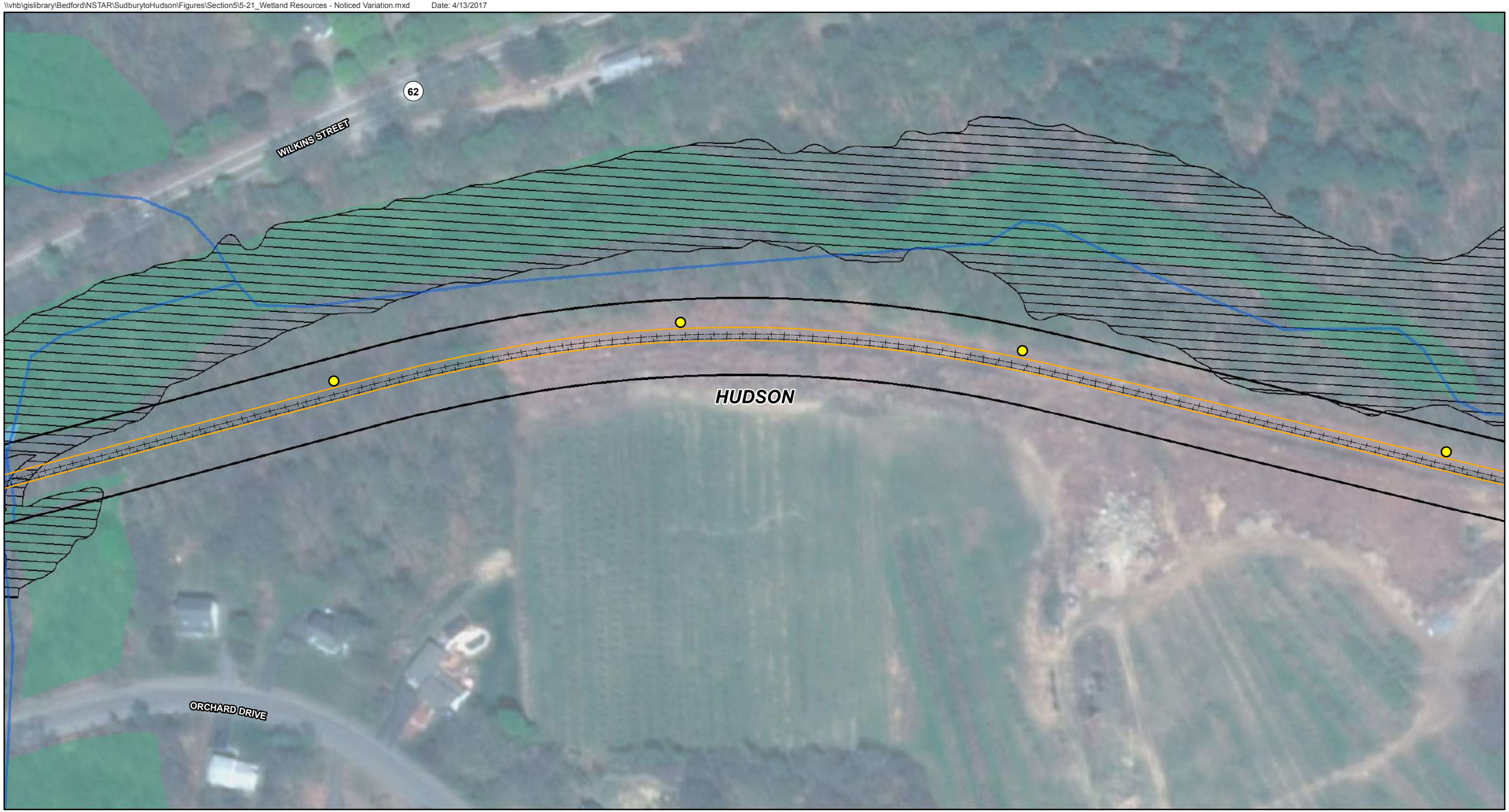
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-21_Wetland Resources - Noticed Variation.mxd Date: 4/13/2017



Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
Noticed Variation Structure Locations
Noticed Variation Transition Structure Locations
Access Road
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
NHESP Certified Vernal Pool
NHESP Potential Vernal Pool
Bordering Land Subject to Flooding
Existing Rail
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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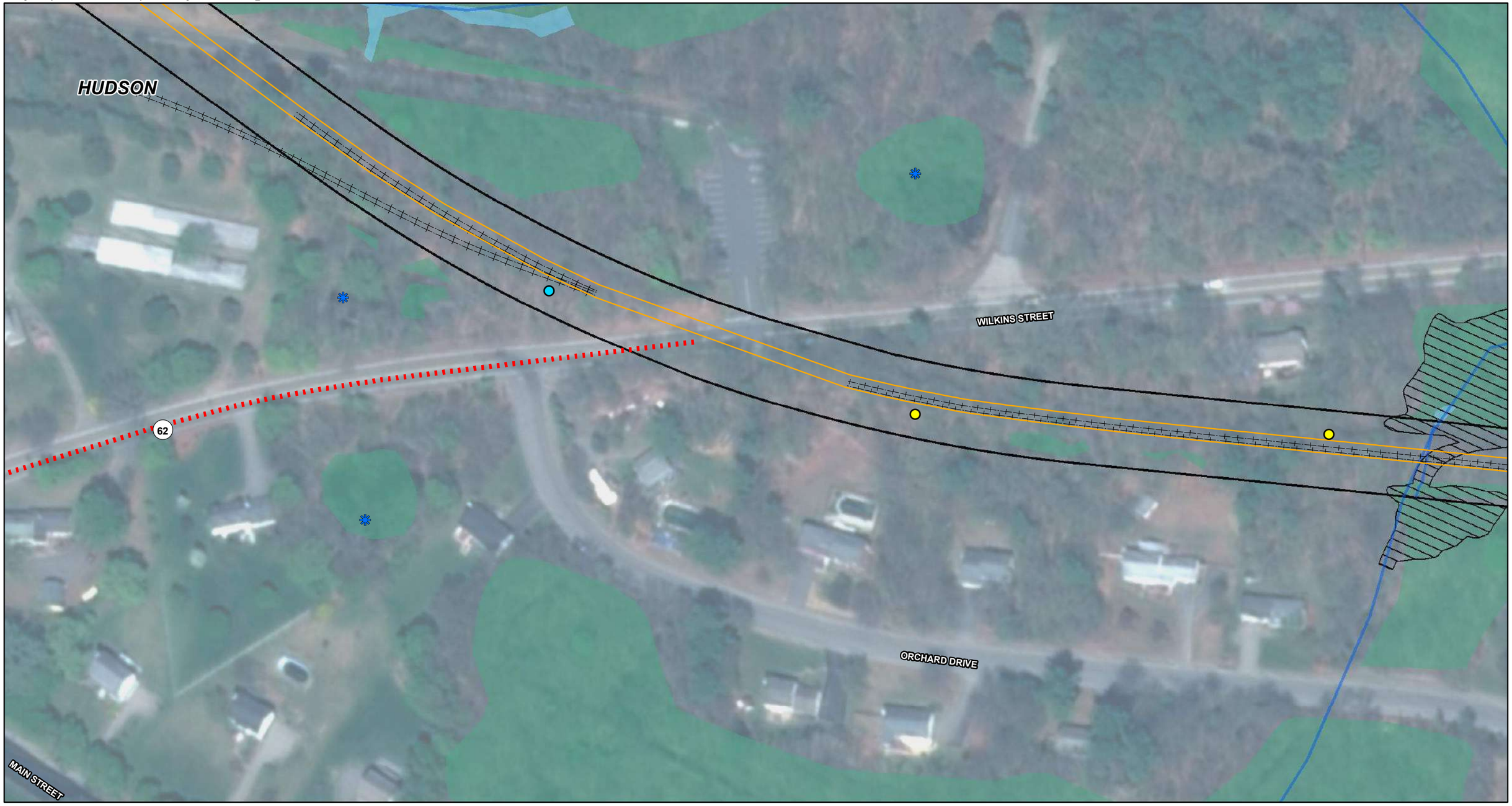

- Project and Noticed Variation (UG on Wilkins)
- MBTA ROW Boundary
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- Noticed Variation Transition Structure Locations
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- Field Identified Potential Vernal Pool
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- Existing Rail
- Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-21_Wetland Resources - Noticed Variation.mxd Date: 4/13/2017

Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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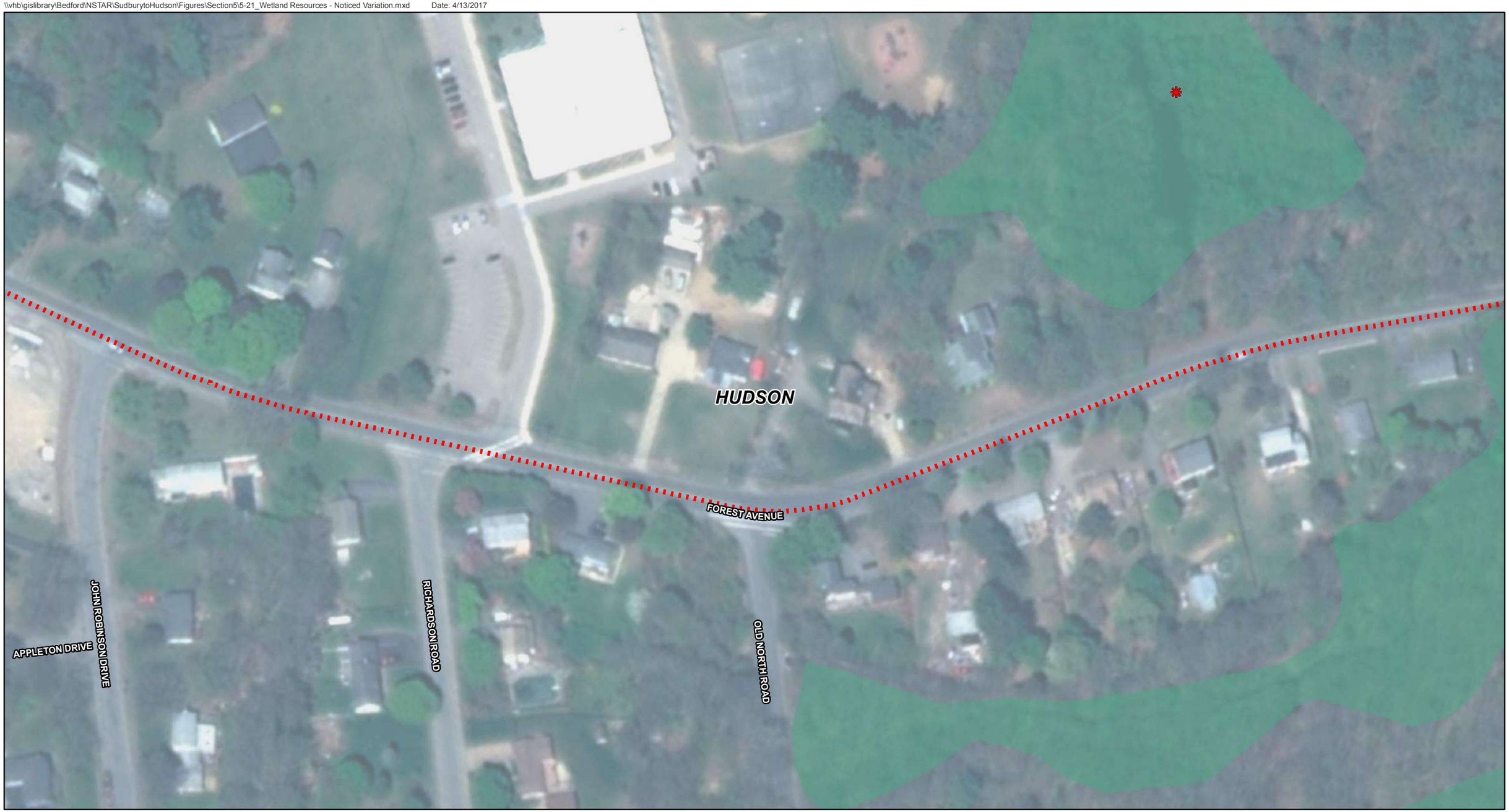
\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-21_Wetland Resources - Noticed Variation.mxd Date: 4/13/2017



Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
Noticed Variation Structure Locations
Noticed Variation Transition Structure Locations
Access Road
BVW
Field Identified Potential Vernal Pool
Open Water
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Existing Rail
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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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Project and Noticed Variation (UG on Wilkins)
MBTA ROW Boundary
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Open Water
Stream
NHESP Certified Vernal Pool
NHESP Potential Vernal Pool
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Existing Rail
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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- Project and Noticed Variation (UG on Wilkins)
- MBTA ROW Boundary
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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/13/2017

N

0 100 200 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-21: Wetland Resource Areas - Noticed Variation

vhb

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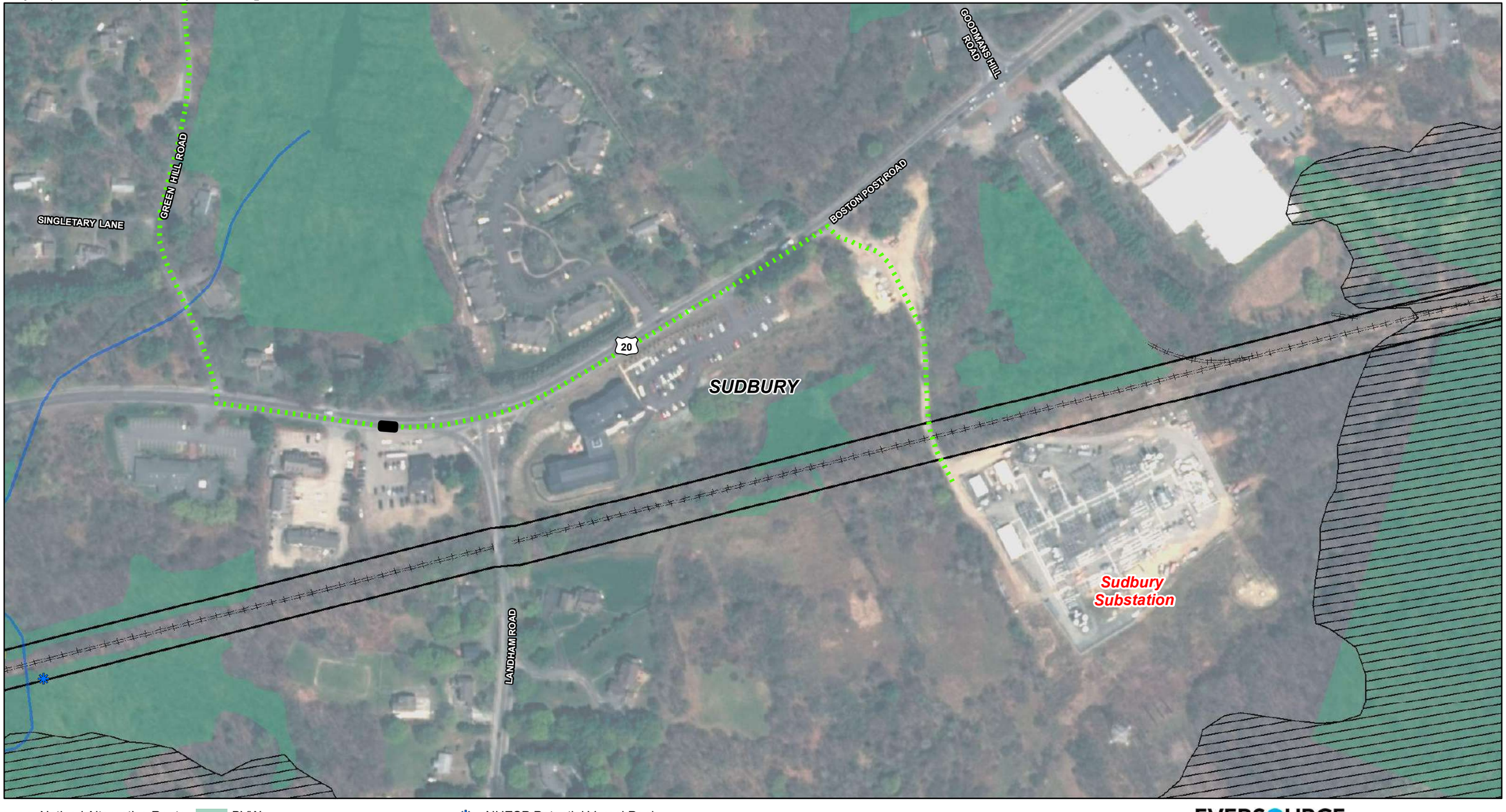

- Noticed Alternative Route
- MBTA ROW Boundary
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- Stream
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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

Sheet 1 of 17

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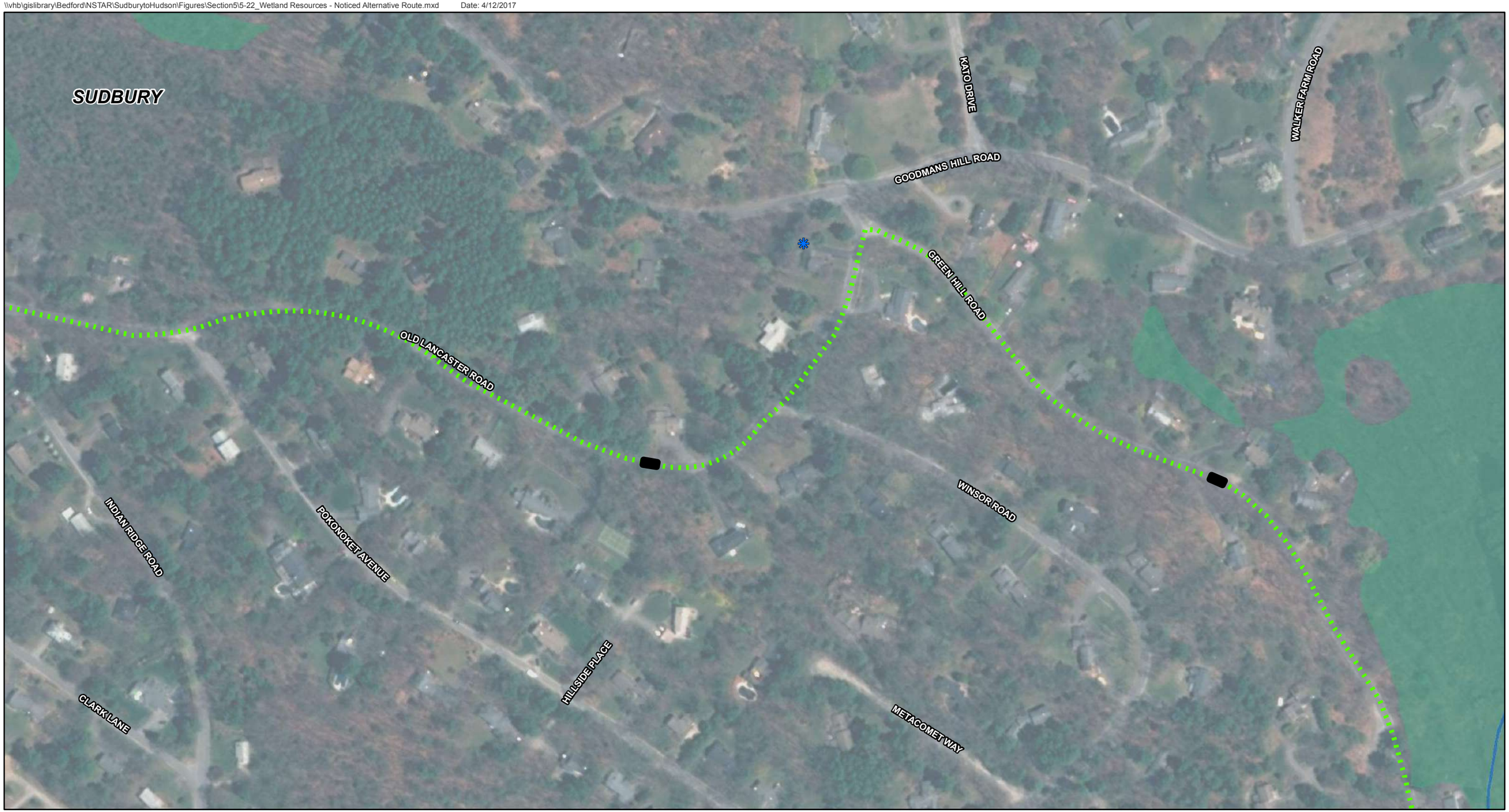

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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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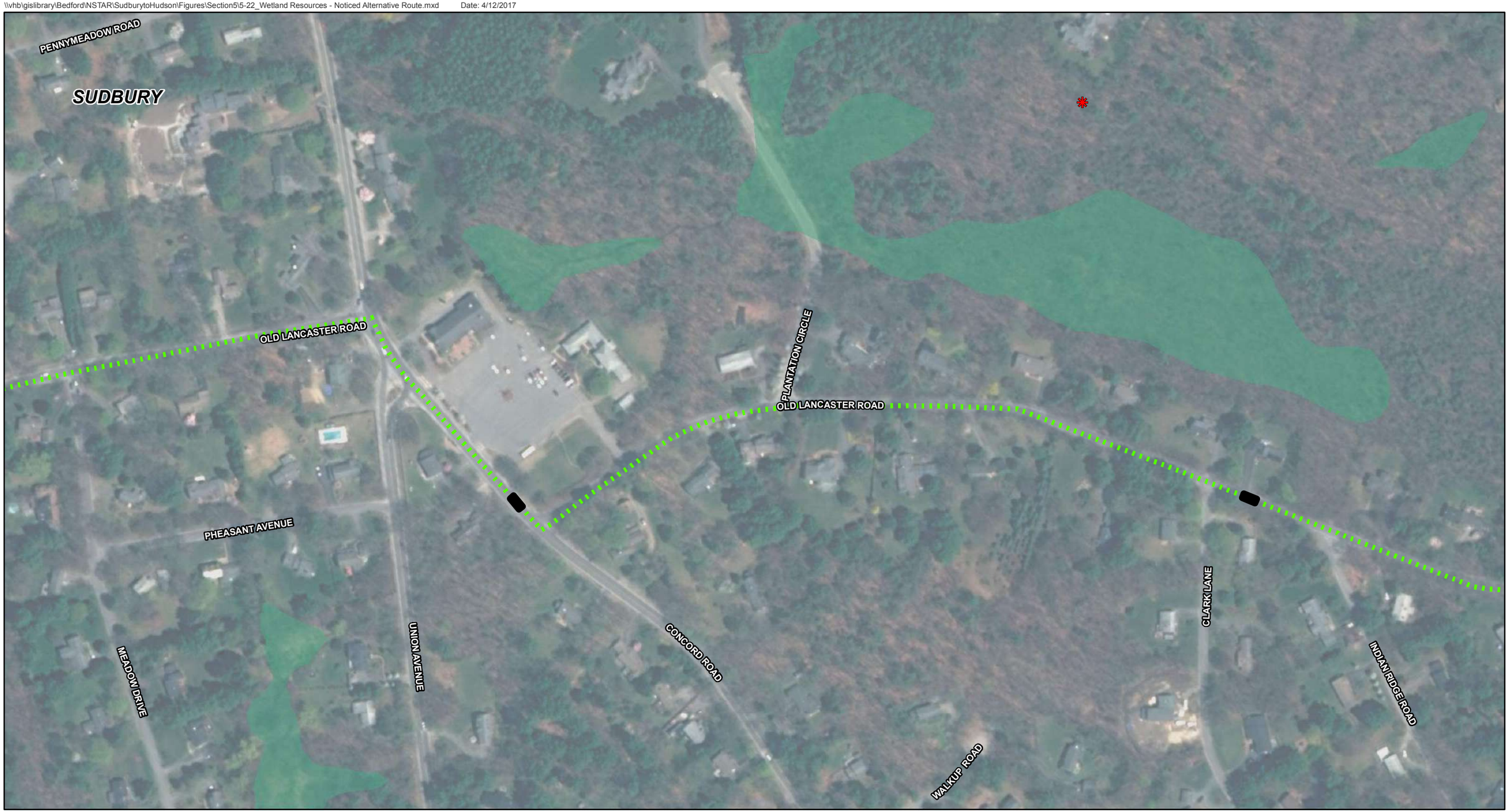

Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
NHESP Potential Vernal Pool
NHESP Certified Vernal Pool
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Existing Rails
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
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Open Water
Stream
NHESP Potential Vernal Pool
NHESP Certified Vernal Pool
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Existing Rails
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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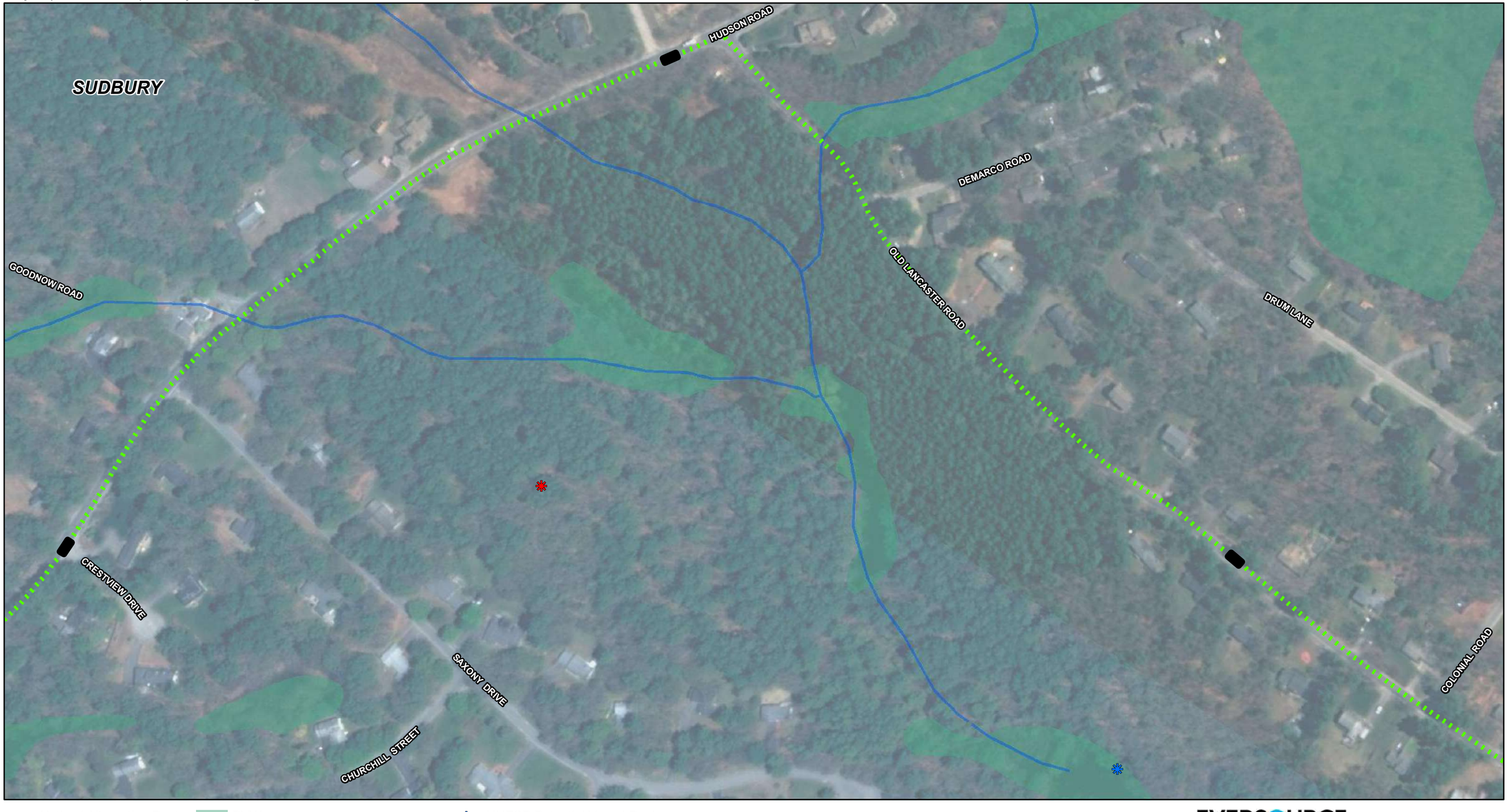

- Noticed Alternative Route
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Source:
MassGIS, 2015
OrthoImagery, VHB

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0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

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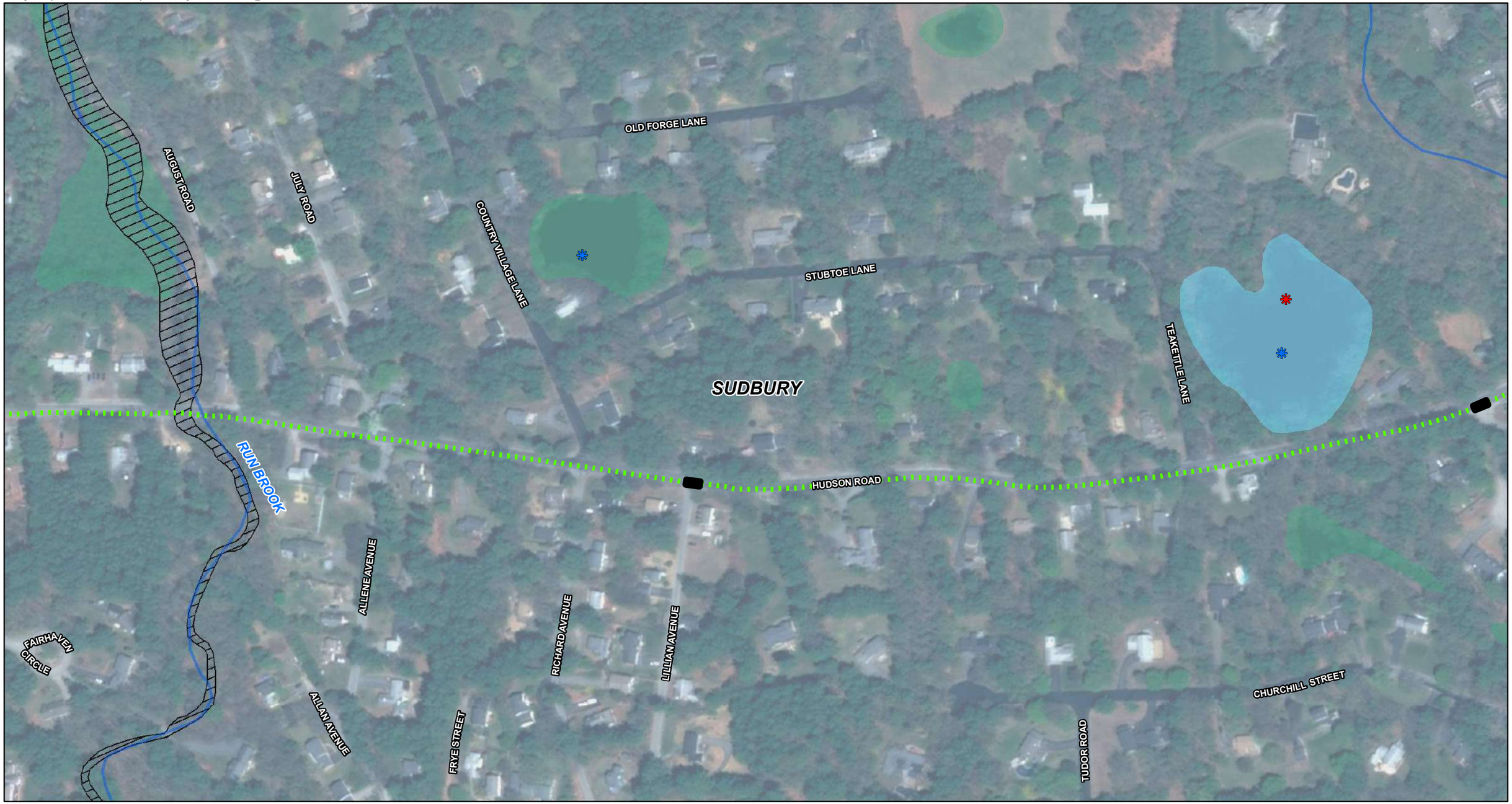

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Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

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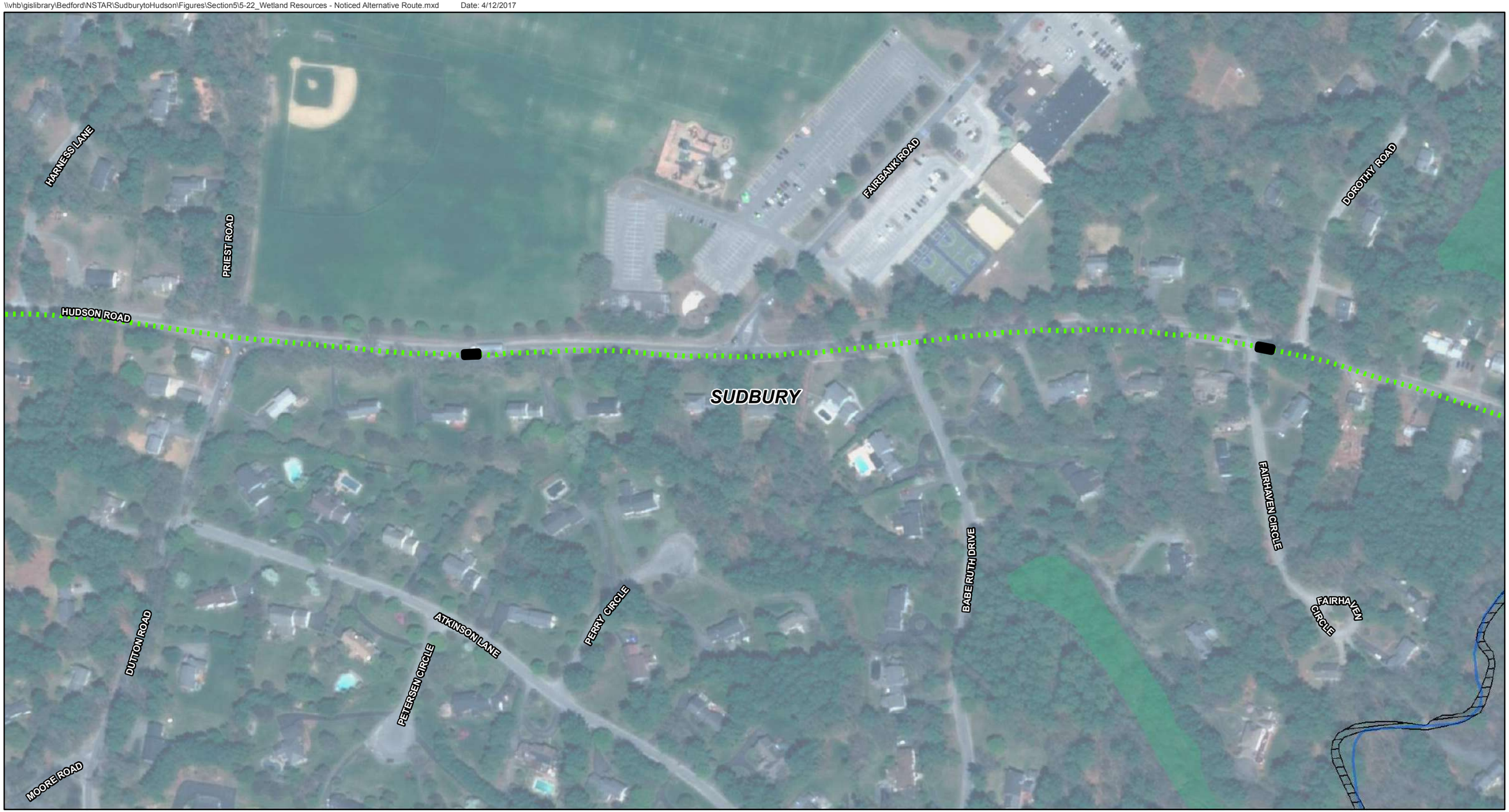

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- MBTA ROW Boundary
- Splice Vault Locations
- BVW
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- Stream
- NHESP Potential Vernal Pool
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Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

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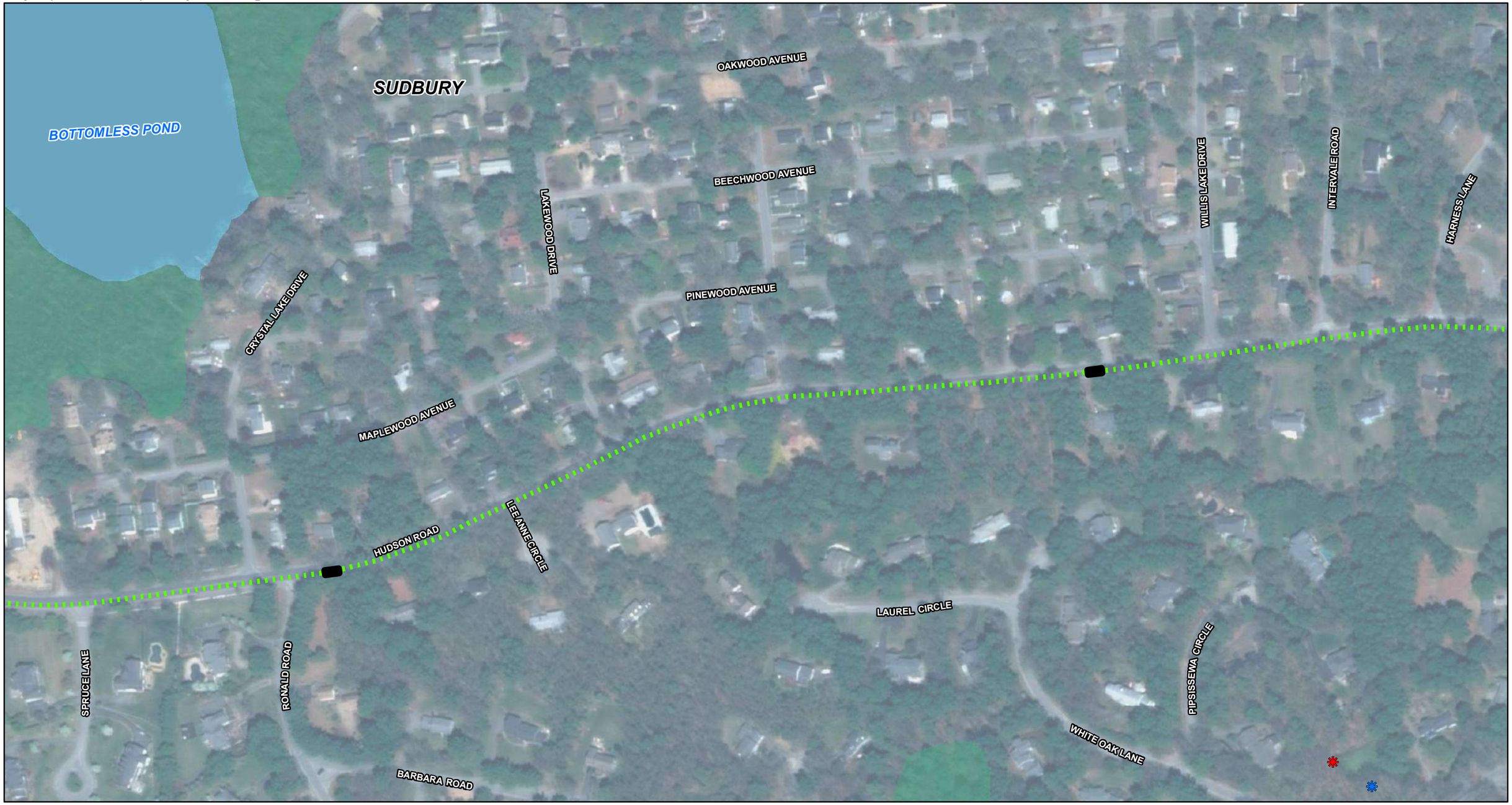

Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
NHESP Potential Vernal Pool
NHESP Certified Vernal Pool
Bordering Land Subject to Flooding
Existing Rails
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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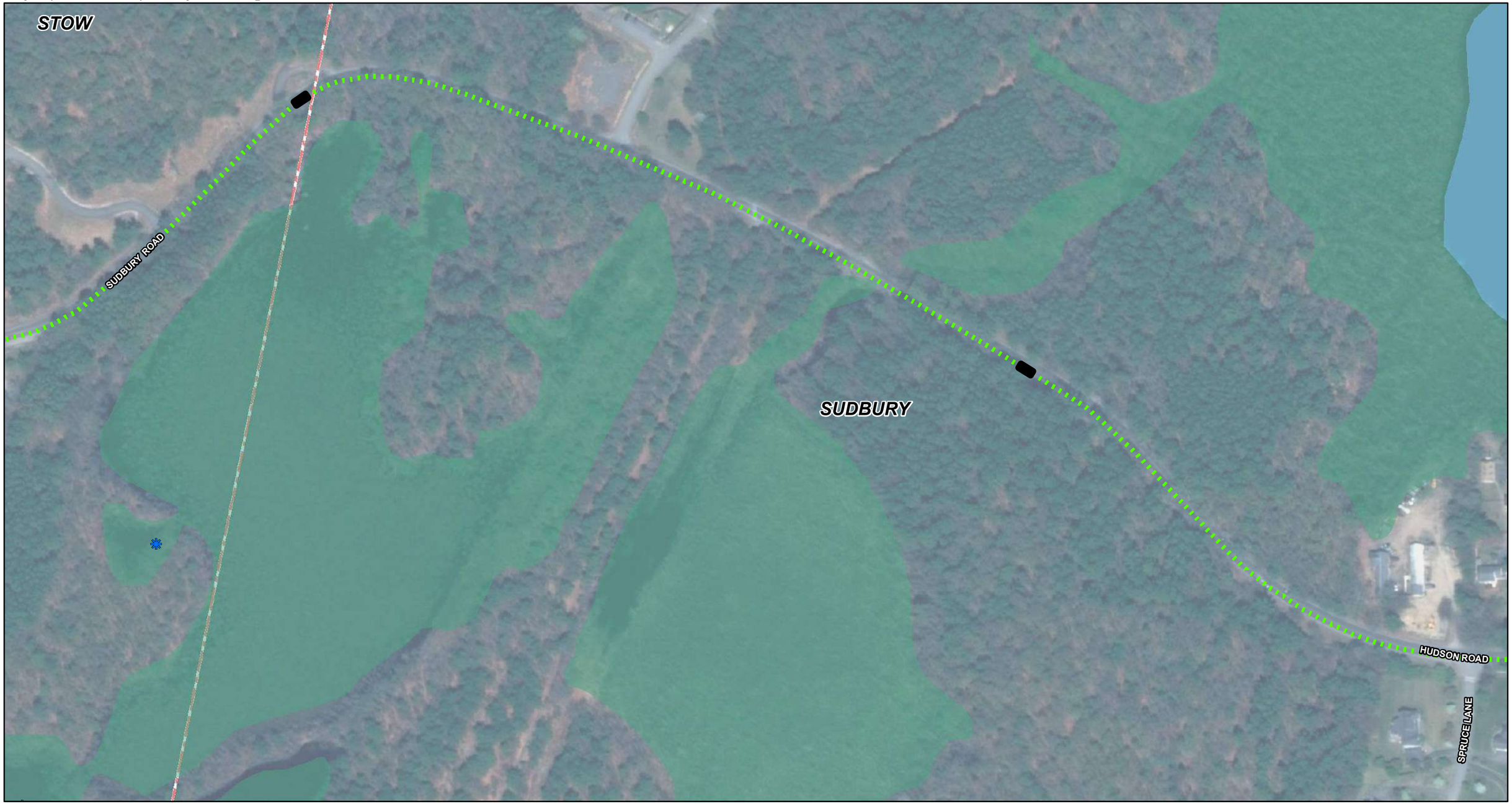

Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
NHESP Potential Vernal Pool
NHESP Certified Vernal Pool
Bordering Land Subject to Flooding
Existing Rails
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
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Existing Rails
Town Boundaries

NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
NHESP Potential Vernal Pool
NHESP Certified Vernal Pool
Bordering Land Subject to Flooding
Existing Rails
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MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
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Existing Rails
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Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
NHESP Potential Vernal Pool
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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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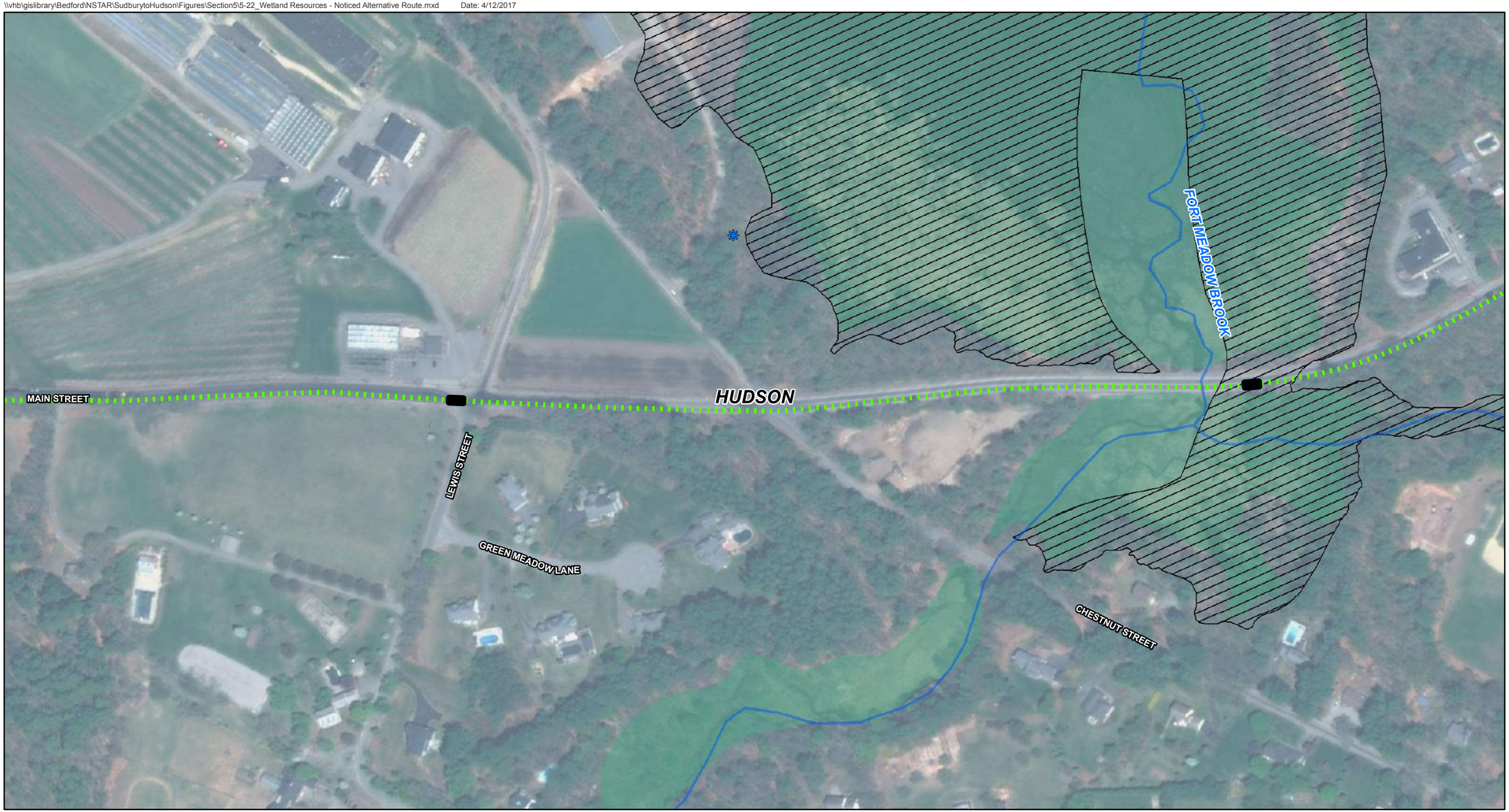

Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
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Field Identified Potential Vernal Pool
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Source:
MassGIS, 2015
OrthoImagery, VHB

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N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
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MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-22_Wetland Resources - Noticed Alternative Route.mxd Date: 4/12/2017

Noticed Alternative Route
MBTA ROW Boundary
Splice Vault Locations
BVW
Field Identified Potential Vernal Pool
Open Water
Stream
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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

vhb

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- Noticed Alternative Route
- MBTA ROW Boundary
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NOTE: Design is conceptual and subject to change

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 200 400 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-22: Wetland Resource Areas - Noticed Alternative Route

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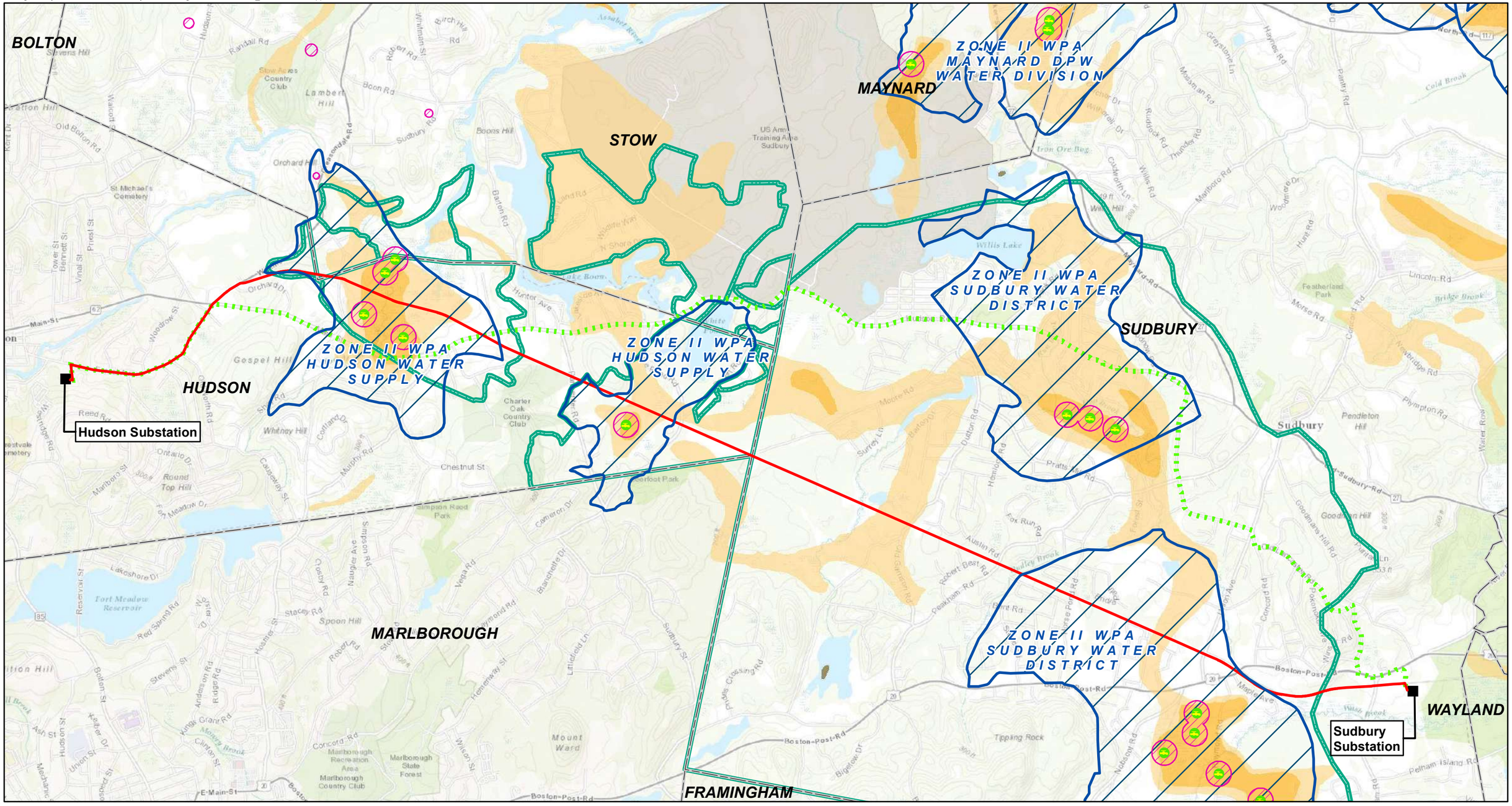
vhb

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-23_Public Water Supplies.mxd



Project and Noticed Variation
Noticed Alternative Route
Municipal Boundary

Community Groundwater Source
Zone I Wellhead Protection Area
Zone II Wellhead Protection Area
Local Water District

Aquifer
High yield (> 300 gallons per minute)
Medium yield (100-300 gpm)
Low yield (< 50 gpm)

N

0 3,000 6,000 Feet

Source:
MassGIS, VHB, Eversource

4/12/2017

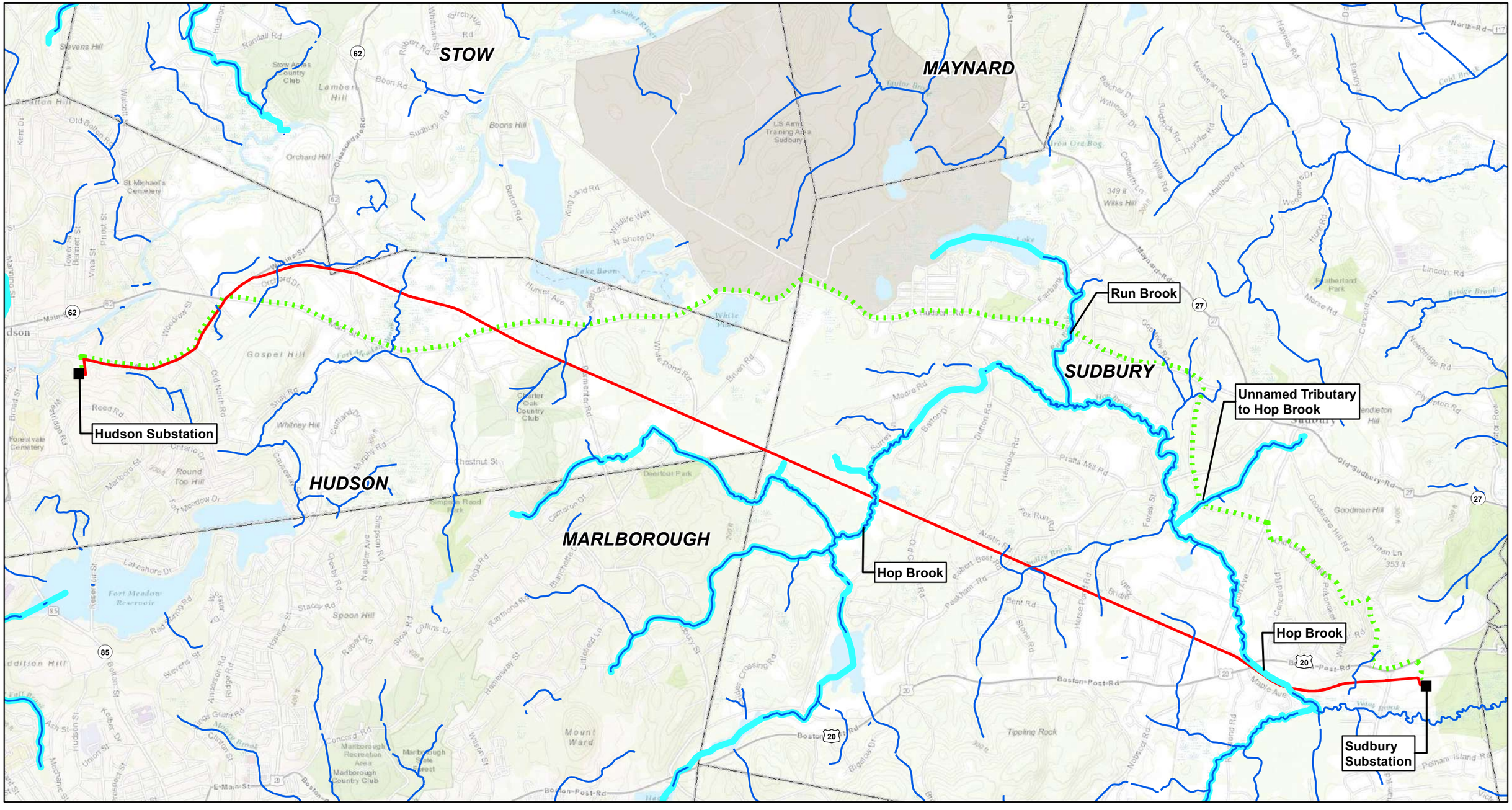
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-23: Public Water Supplies

vhb

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-24_Coldwater Fisheries.mxd



Source:
MassGIS, VHB

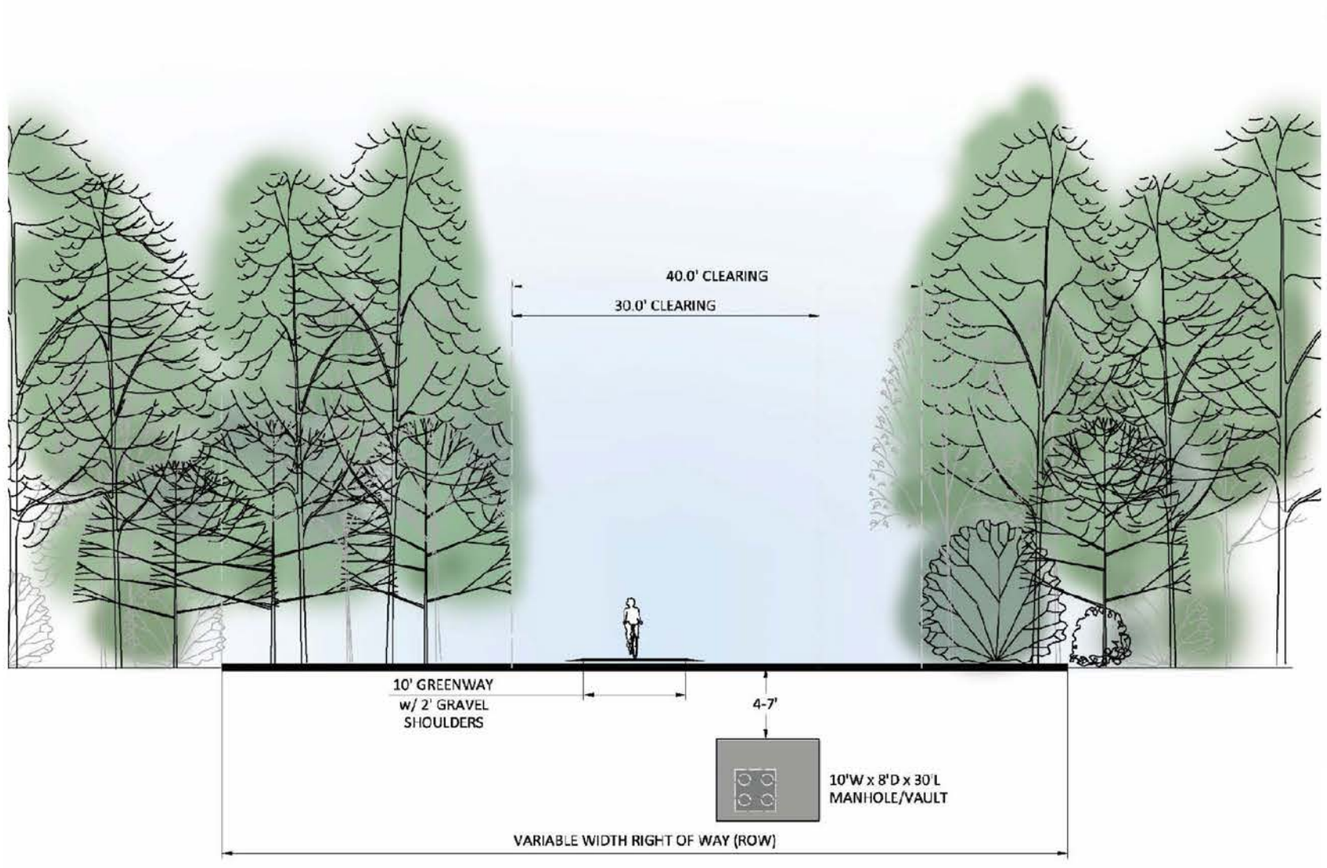
4/12/2017

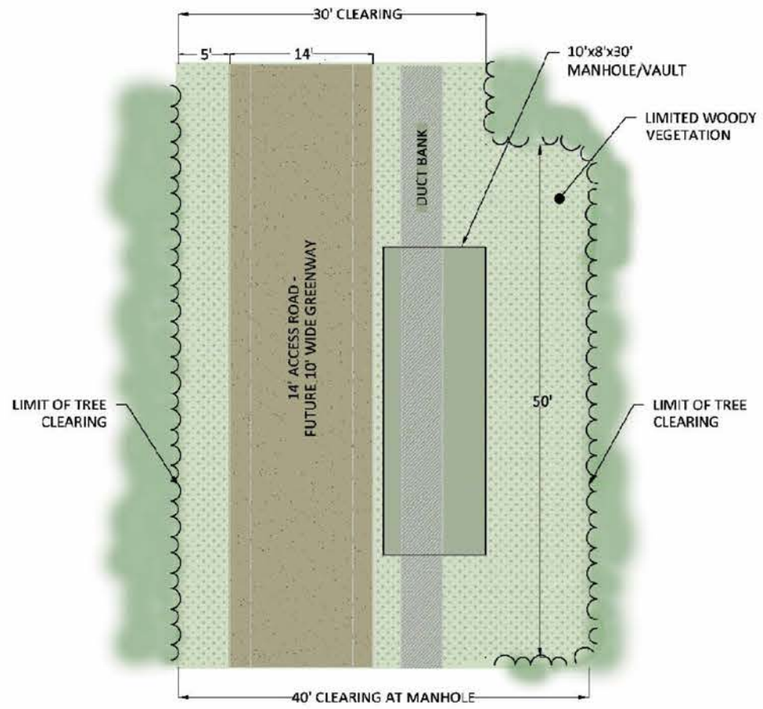
EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-24: Coldwater Fisheries

vhb





Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-25: Vegetation Cross Section - Project

Image Source:
Beals and Thomas

4/12/2017

vhb

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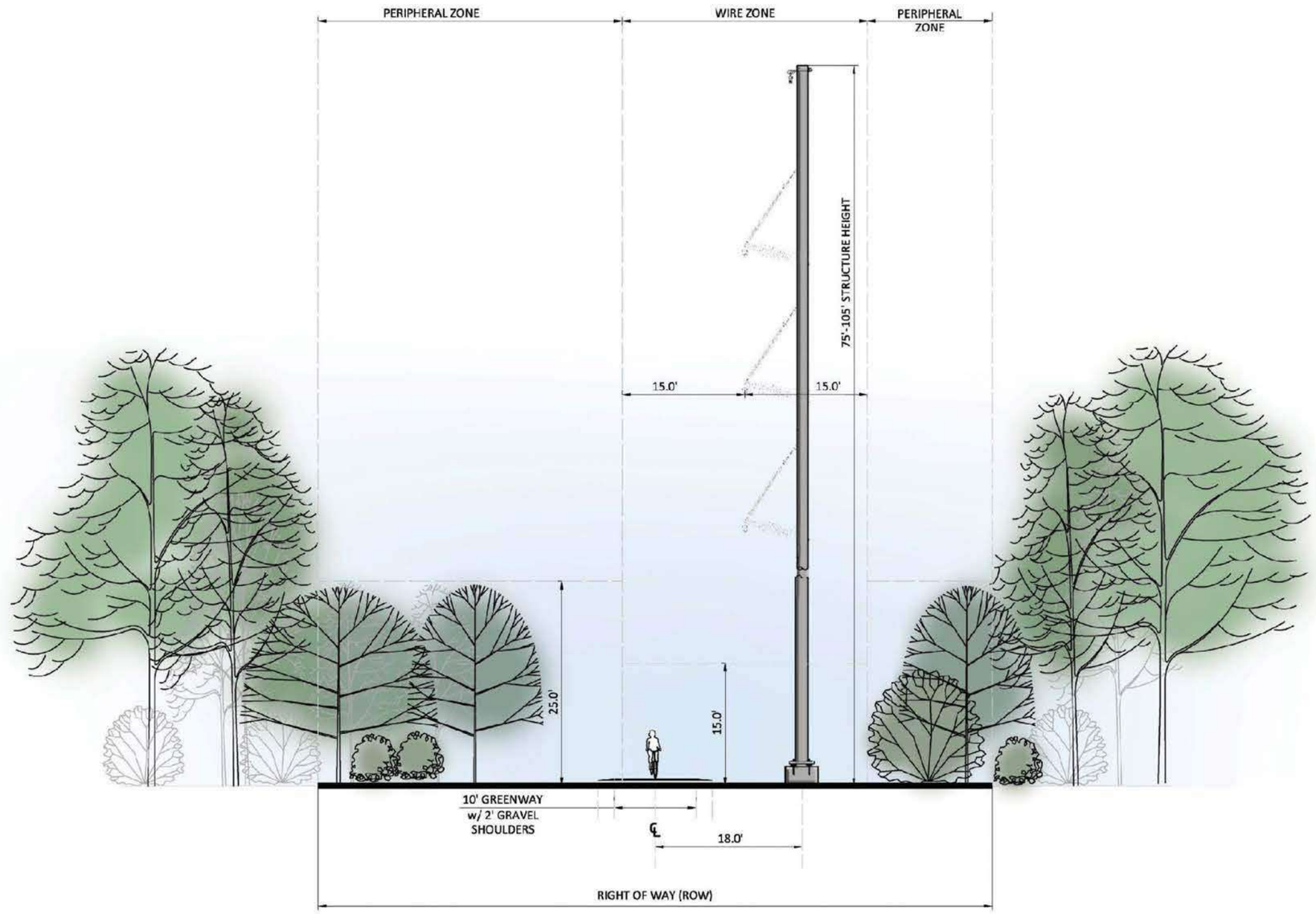

Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-26: Vegetation Cross Section - Noticed Variation

Image Source:
Beals and Thomas

4/12/2017

vhb

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-27_Land Cover2.mxd Date: 4/12/2017

CURTIS MIDDLE SCHOOL FIELDS
EMMONS CR
WOLBACH FARM
WOLBACH TRACT
PEAKHAM ROAD
FOREST STREET PARCEL
KATO PARCEL
STRAND PARCEL
BORDEN HILL CR
UNION AVENUE
NEELON GIFT
SUDBURY
20
Sudbury Substation
HORSE POND ROAD
Stone Agricultural Preservation Restriction
BOSTON POST ROAD
20
GREAT MEADOWS NWR
WAYLAND
WASH BROOK PARCEL
LANDHAM ROAD
MAPLE MEADOWS CR
20
SUDBURY WATER DISTRICT LAND
FRANK G FEELEY FIELD
LYONS CUTLER RESERVATION
RAYMOND RESERVATION
LANDHAM ROAD
Nobscot Scout Reservation CR
CUTLER FARM

Project and Noticed Variation
Noticed Alternative Route
Protected and Recreational Open Space

NOAA 2010 Land Cover

Cultivated Crops
Developed, Open Space
Forested Land
Wetland (Forested Scrub/Shrub, Emergent)
Developed Land
Pasture/Hay

N

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

0 1,000 2,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-27: Land Cover

vhb

Sheet 1 of 4

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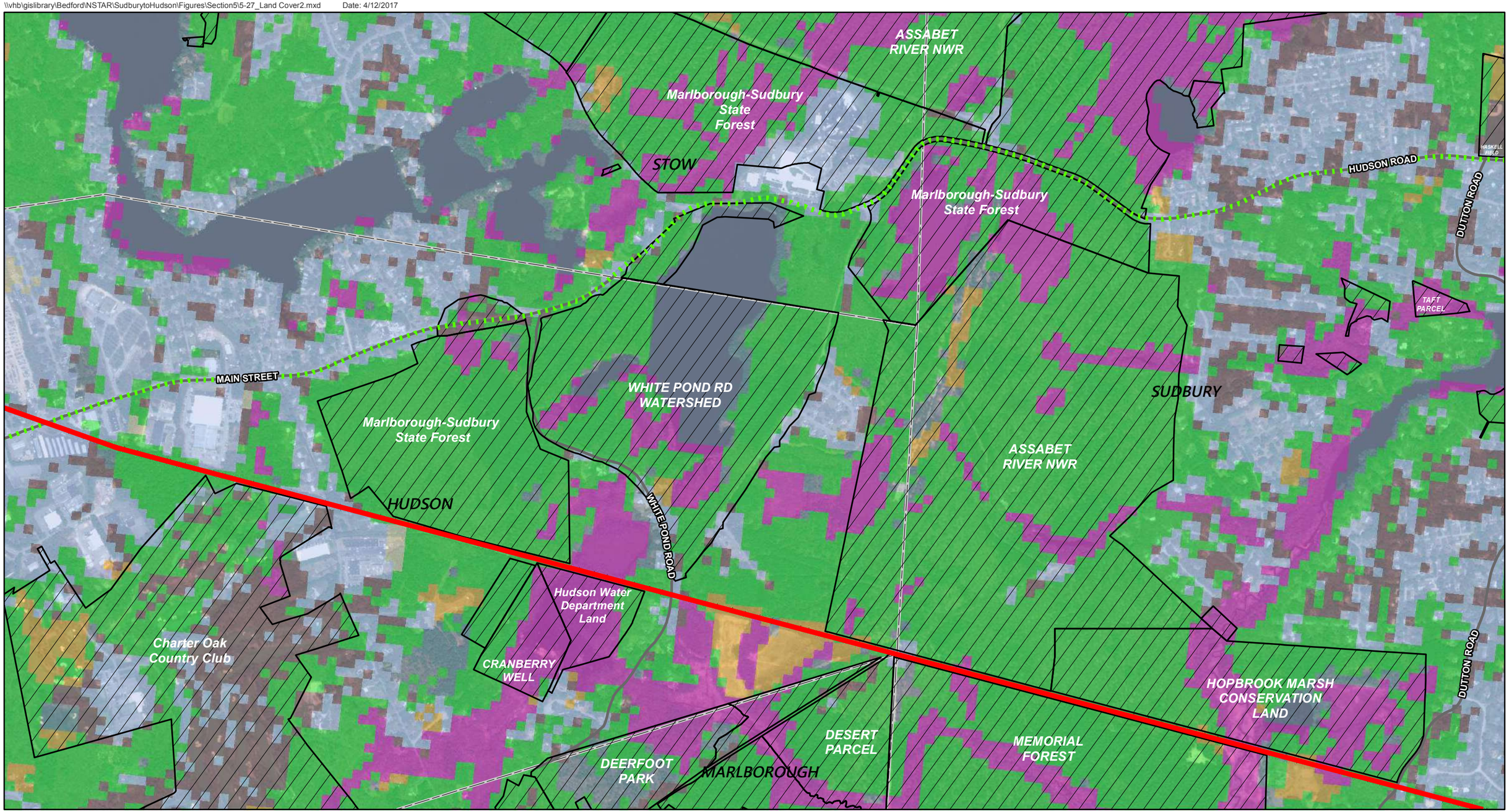


Project and Noticed Variation
Noticed Alternative Route
Protected and Recreational Open Space

NOAA 2010 Land Cover

- Cultivated Crops
- Forested Land
- Developed Land
- Developed, Open Space
- Wetland (Forested Scrub/Shrub, Emergent)
- Pasture/Hay

N

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

0 1,000 2,000 Feet

EVERSOURCE ENERGY

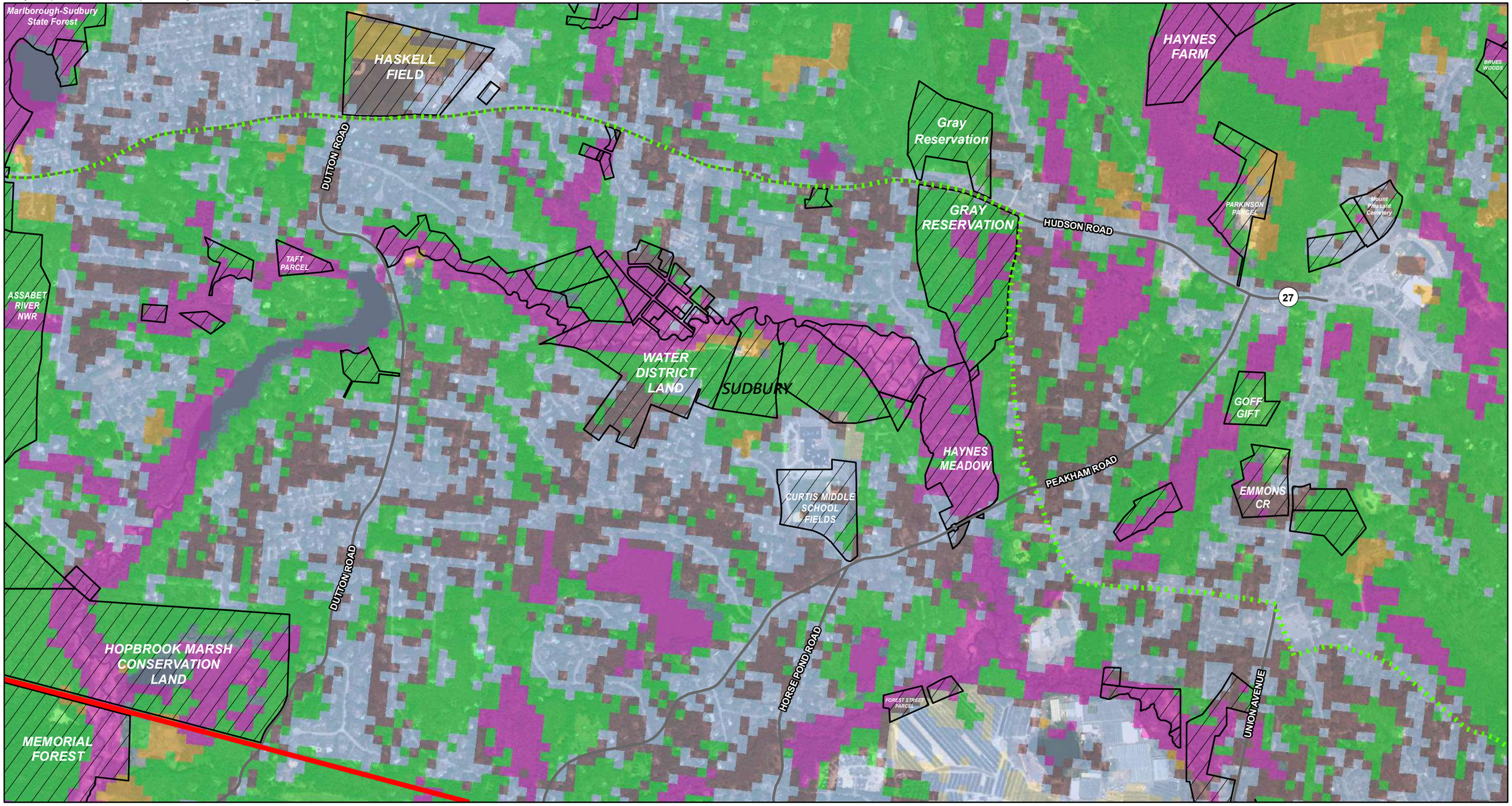
Sudbury-Hudson Transmission Reliability Project

Figure 5-27: Land Cover

Sheet 2 of 4

vhb

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-27_Land Cover2.mxd Date: 4/12/2017



Project and Noticed Variation
Noticed Alternative Route
Protected and Recreational Open Space

NOAA 2010 Land Cover

- Cultivated Crops
- Developed, Open Space
- Forested Land
- Wetland (Forested Scrub/Shrub, Emergent)
- Developed Land
- Pasture/Hay

Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 1,000 2,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-27: Land Cover

Sheet 3 of 4

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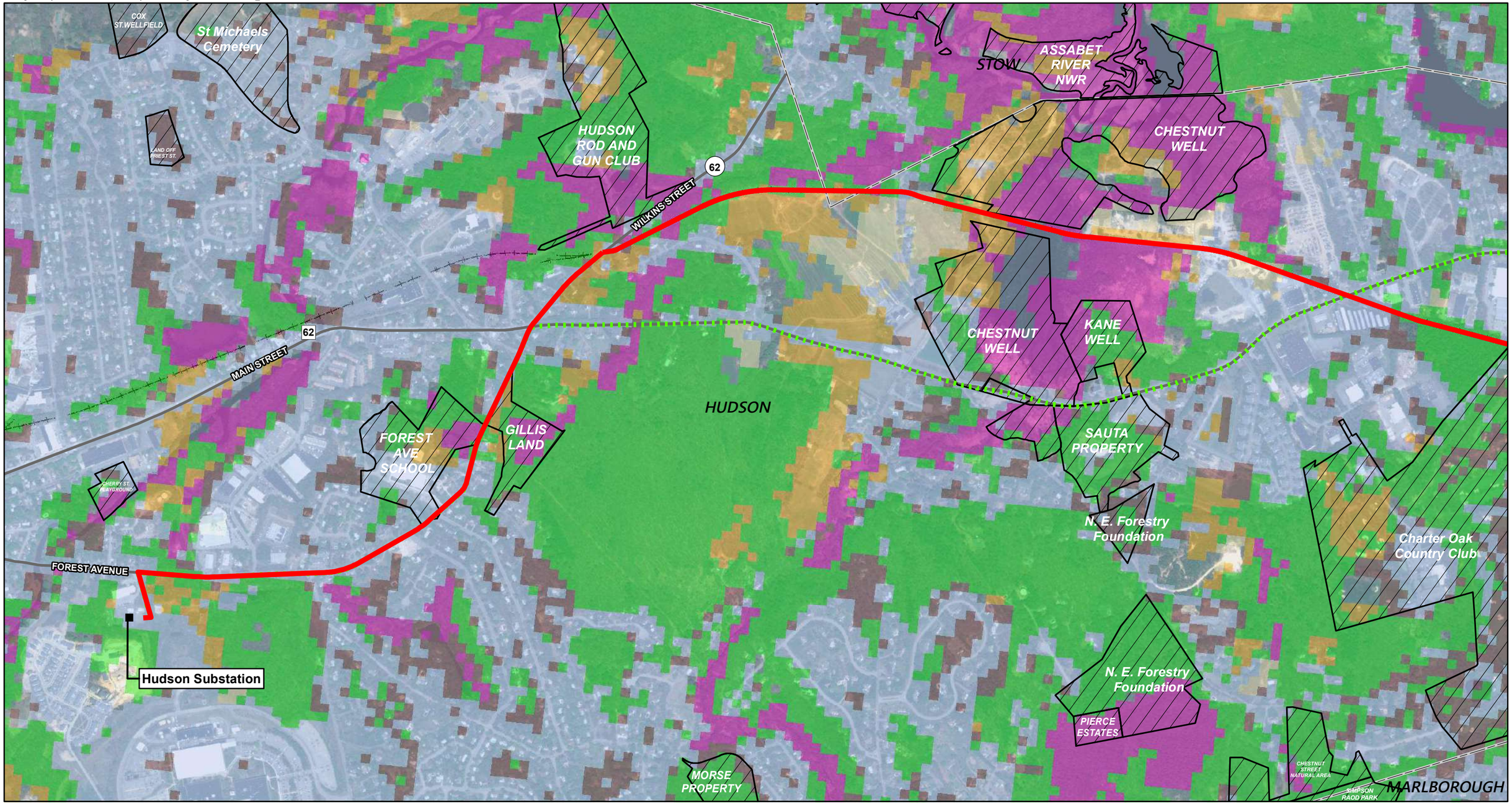

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Noticed Alternative Route
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Source:
MassGIS, 2015
OrthoImagery, VHB

4/12/2017

N

0 1,000 2,000 Feet

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-27: Land Cover

Sheet 4 of 4

vhb

Model Assumptions
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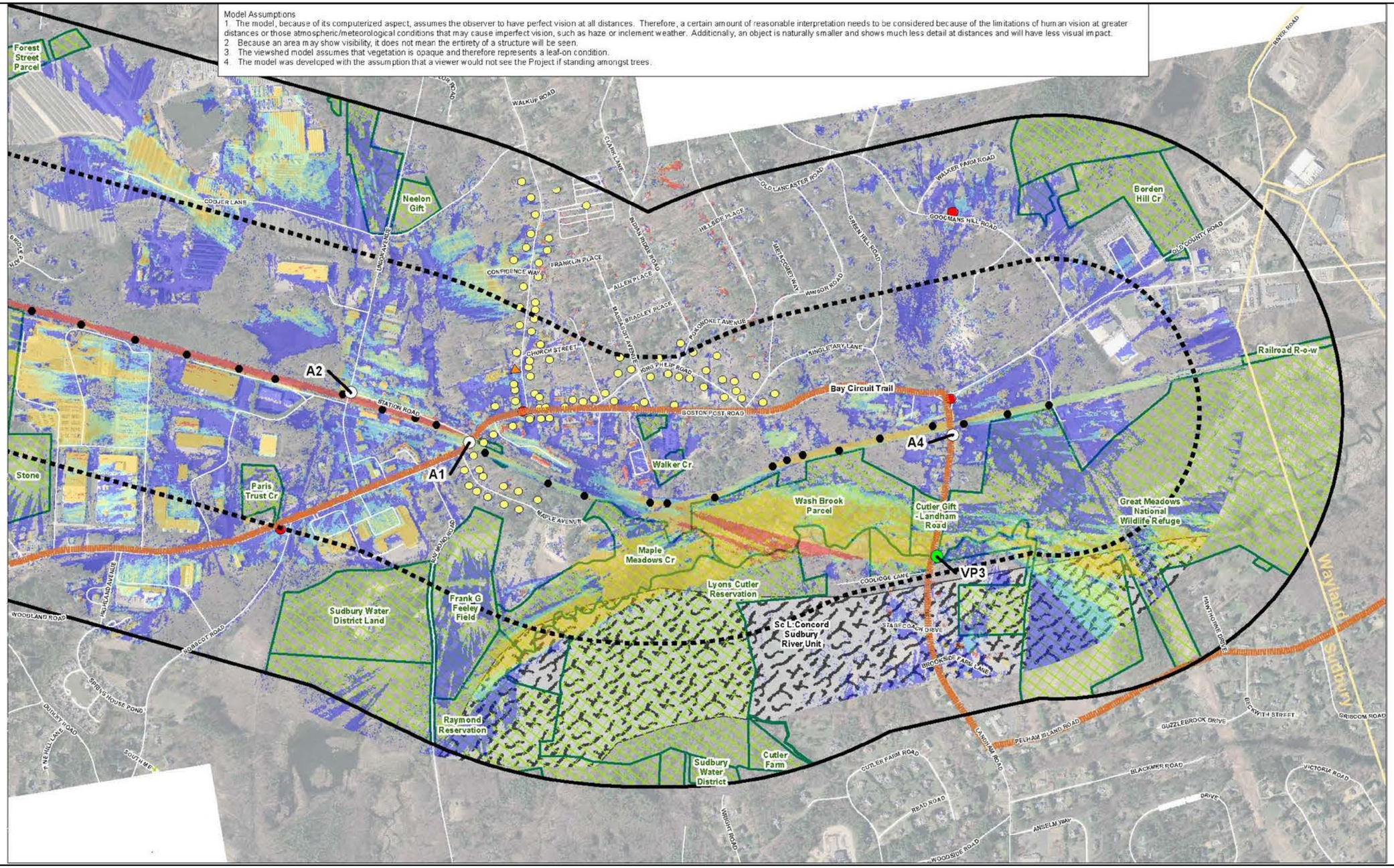
3. The viewshed model assumes that vegetation is opaque and therefore represents a leaf-on condition.
4. The model was developed with the assumption that a viewer would not see the Project if standing amongst trees.



0.25 Mile Radius
0.50 Mile Radius
Proposed Transmission Structure
Underground Segment

RENDERING LOCATIONS
Artist Render (A)
Photosimulation (VP)

Open Space
Canoe Access Points
Canoe Trips
DCR Roads and Trails

LONG DISTANCE TRAILS
Bay Circuit Trail

THE SCENIC LANDSCAPE INVENTORY
Noteworthy

MHC HISTORIC INVENTORY POINTS
Nat'l Register of Historic Places
Local Historic District
NRHP and LHD

BIKETRAILS
Underway (Assabet River Rail Trail)

VISIBILITY
Number of Visible Structures
1 - 3
4 - 5
6 - 8
9 - 15
16 - 89

Image Source:
TRC

4/12/2017

N

Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-28: Viewshed Inventory

Sheet 1 of 5

vhb

Model Assumptions
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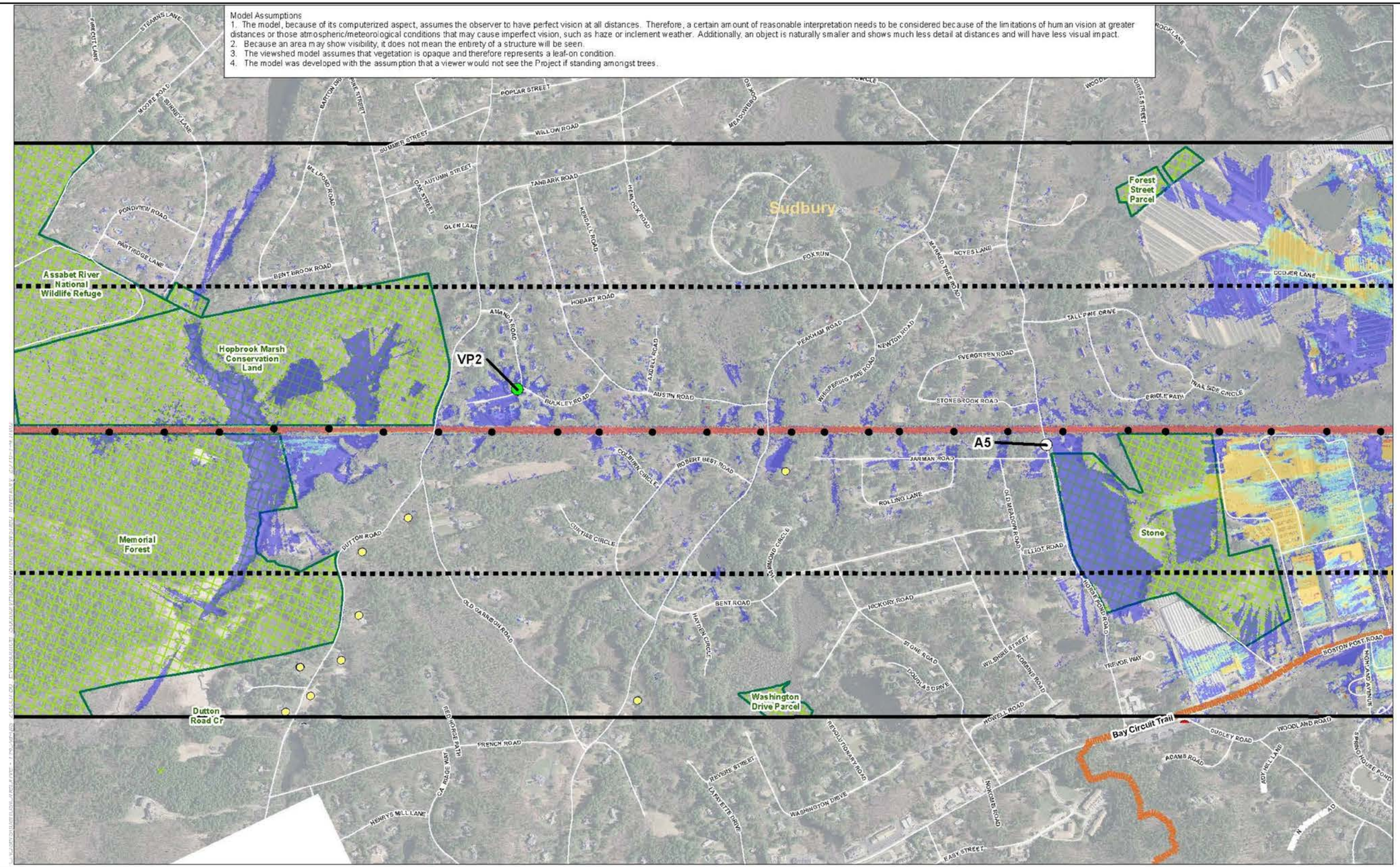

0.25 Mile Radius
0.50 Mile Radius
Proposed Transmission Structure
Underground Segment
RENDERING LOCATIONS
Artist Render (A)
Photosimulation (VP)

Open Space
Canoe Access Points
Canoe Trips
DCR Roads and Trails
LONG DISTANCE TRAILS
Bay Circuit Trail
THE SCENIC LANDSCAPE INVENTORY
Noteworthy

MHC HISTORIC INVENTORY POINTS
Nat'l Register of Historic Places
Local Historic District
NRHP and LHD
BIKETRAILS
Underway (Assabet River Rail Trail)

VISIBILITY
Number of Visible Structures
1 - 3
4 - 5
6 - 8
9 - 15
16 - 89

Image Source:
TRC

4/12/2017

N

Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-28: Viewshed Inventory

Sheet 2 of 5

vhb

Model Assumptions
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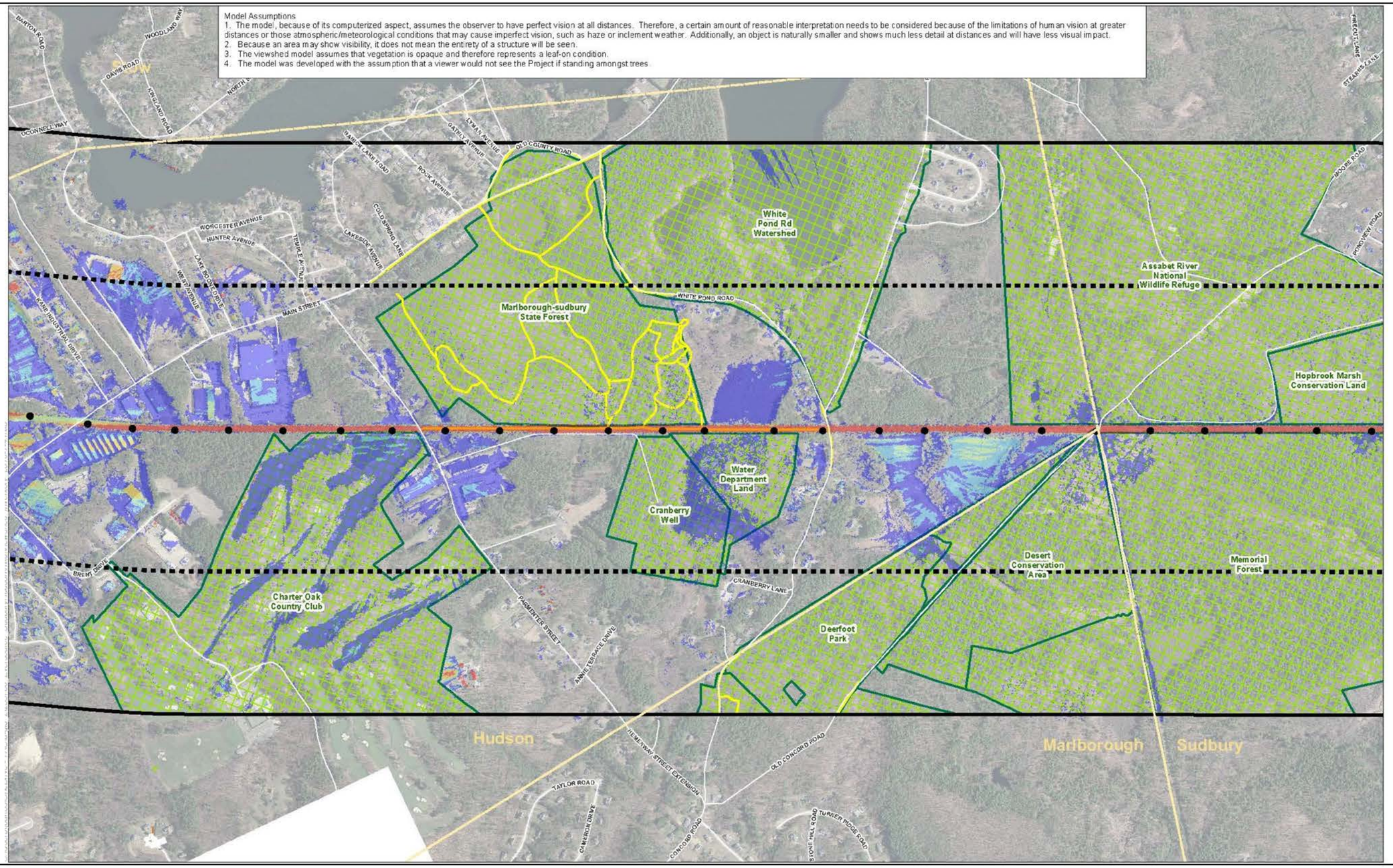

0.25 Mile Radius
0.50 Mile Radius
Proposed Transmission Structure
Underground Segment

RENDERING LOCATIONS
Artist Render (A)
Photosimulation (VP)

Open Space
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Canoe Trips
DCR Roads and Trails

LONG DISTANCE TRAILS
Bay Circuit Trail

THE SCENIC LANDSCAPE INVENTORY
Noteworthy

MHC HISTORIC INVENTORY POINTS
Nat'l Register of Historic Places
Local Historic District
NRHP and LHD

BIKETRAILS
Underway (Assabet River Rail Trail)

VISIBILITY
Number of Visible Structures
1 - 3
4 - 5
6 - 8
9 - 15
16 - 89

Image Source:
TRC

4/12/2017

N

Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-28: Viewshed Inventory

Sheet 3 of 5

vhb

Model Assumptions
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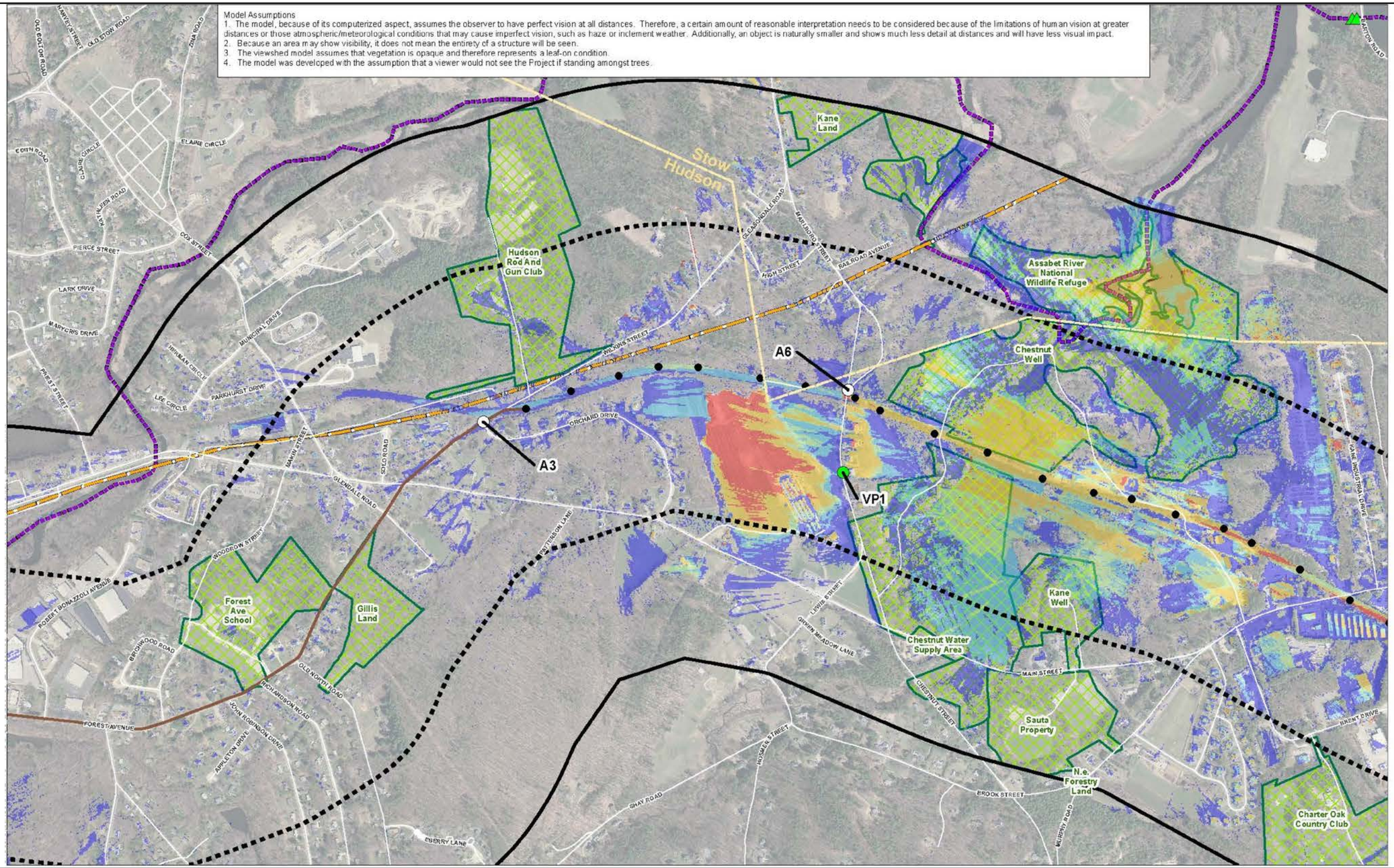

0.25 Mile Radius
0.50 Mile Radius
Proposed Transmission Structure
Underground Segment
RENDERING LOCATIONS
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BIKETRAILS
Underway (Assabet River Rail Trail)

VISIBILITY
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1 - 3
4 - 5
6 - 8
9 - 15
16 - 89

Image Source:
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4/12/2017

N

Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-28: Viewshed Inventory

vhb

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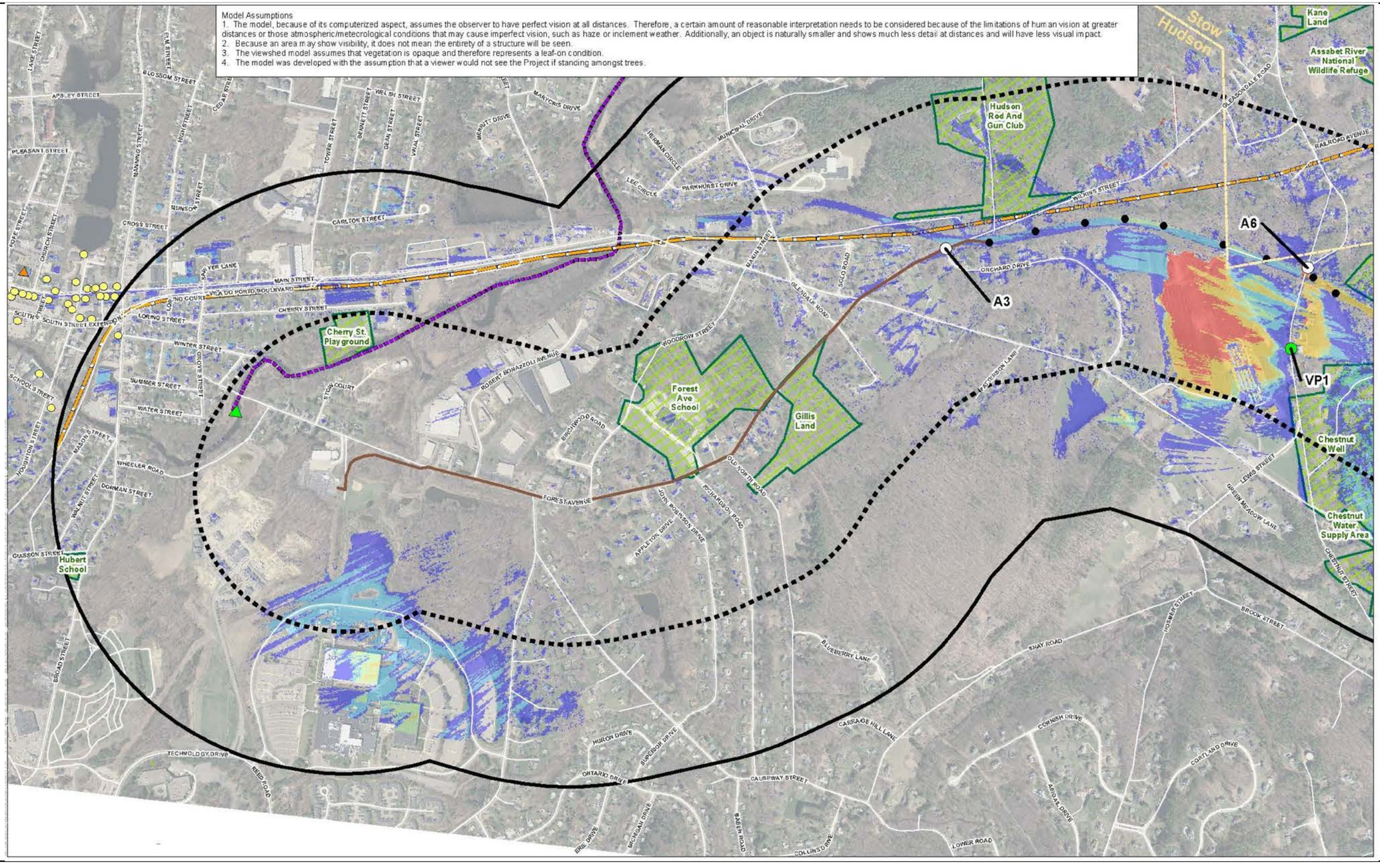

0.25 Mile Radius
0.50 Mile Radius
Proposed Transmission Structure
Underground Segment

RENDERING LOCATIONS
Artist Render (A)
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MHC HISTORIC INVENTORY POINTS
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NRHP and LHD

BIKETRAILS
Underway (Assabet River Rail Trail)

VISIBILITY
Number of Visible Structures
1 - 3
4 - 5
6 - 8
9 - 15
16 - 89

Image Source:
TRC

4/12/2017

N

Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-28: Viewshed Inventory

Sheet 5 of 5

vhb

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Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-29: Artist Rendering: Boston Post Road, Sudbury - Project

Image Source:
Beals and Thomas

4/12/2017

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Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-30: Artist Rendering: Boston Post Road, Sudbury - Noticed Variation

Image Source:
Beals and Thomas

4/12/2017

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Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-31: Photo Simulation: Landham Road, Sudbury - Noticed Variation

Image Source:
TRC

4/12/2017

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Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-31: Photo Simulation: Landham Road, Sudbury - Noticed Variation

Image Source:
TRC

4/12/2017

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Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-32: Photo Simulation:
Amanda Road, Sudbury - Noticed Variation

Image Source:
TRC

4/12/2017

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Not To Scale

Image Source:
TRC

4/12/2017

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-32: Photo Simulation:
Amanda Road, Sudbury - Noticed Variation

vhb

\\vhb\gislibrary\Bedford\NSTAR\SudburytoHudson\Figures\Section5\5-33_Photo Stimulation - Chestnut Street, Hudson - Noticed Variation - Existing Conditions.mxd

Not To Scale

Image Source:
TRC

4/12/2017

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-33: Photo Simulation:
Chestnut Street, Hudson - Noticed Variation

vhb

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Not To Scale

EVERSOURCE ENERGY

Sudbury-Hudson Transmission Reliability Project

Figure 5-33: Photo Simulation:
Chestnut Street, Hudson - Noticed Variation

Image Source:
TRC

4/12/2017

vhb

6.0 CONSISTENCY WITH THE CURRENT HEALTH, ENVIRONMENTAL PROTECTION, AND RESOURCE USE AND DEVELOPMENT POLICIES OF THE COMMONWEALTH

6.1 Introduction

G.L. c. 164, § 69J states, inter alia, that the Siting Board shall approve a petition to construct a facility if it determines that "plans for expansion and construction of the applicant's new facilities are consistent with current health, environmental protection, and resource use and development policies as adopted by the commonwealth." As discussed below and in more detail throughout the Analysis, the Project not only satisfies the requirements of this statute, but is also fully consistent with other important state energy policies as articulated in the Electric Utility Restructuring Act of 1997 ("Restructuring Act"), the Green Communities Act (c. 169 of the Acts of 2008), the Global Warming Solutions Act (c. 298 of the Acts of 2008) and the Energy Diversity Act (c. 188 of the Acts of 2016).

6.2 Health Policies

The Restructuring Act provides that reliable electric service is of "utmost importance to the safety, health and welfare of the Commonwealth's citizens and economy…" (see Restructuring Act, § 1(h)). The Legislature has expressly determined that an adequate and reliable supply of energy is critical to the state's citizens and economy. The Project will be fully consistent with this policy. The Project will enhance the reliability of the interconnected electric transmission system in the Marlborough Subarea of Subarea D, enabling the Company to continue to ensure the availability of sufficient and reliable electric service to the citizens and businesses of the Commonwealth and the region.

The Company will design, build, and maintain the facilities for the Project so that the health and safety of the public are protected. This will be accomplished through adherence to all federal, state, and local regulations, and industry standards and guidelines established for protection of the public. As discussed in Section 5, all design, construction, and operation activities will be in accordance with applicable governmental and industry standards such as the Massachusetts Code for the Installation and Maintenance of Electric Transmission Lines (220 C.M.R 125.00) as well as the National Electrical Safety Code and Occupational Safety and Health Administration regulations, and will have no adverse health effects. The facilities will be designed in accordance with sound engineering practices using established design codes and guides published by, among others, the Department, the Institute of Electrical and

Electronic Engineers, the American Society of Civil Engineers ("ASCE"), the American Concrete Institute, and the American National Standards Institute.

Practices that will be used to protect the public during construction will include, but not be limited to, establishing traffic control plans for construction traffic on municipal streets and state highways to maintain safe driving conditions; restricting public access to work areas; and using temporary guard structures at road and other utility crossings to prevent accidental contact with the conductor during installation. Following construction of the facilities, all transmission structures and substation facilities will be clearly marked with warning signs to alert the public to potential hazards.

In addition, because the Project will be consistent with, and promote, the Commonwealth's energy policies as outlined in the Restructuring Act, it will also be consistent with its health policies. The Restructuring Act provides that, "since reliable electric service is of the utmost importance to the safety, health and welfare of the Commonwealth's citizens and economy, electric industry restructuring should enhance the reliability of the interconnected regional transmission system…" (see Restructuring Act, § 1(h)).

6.3 Environmental Protection Policies

The Project is consistent with the Commonwealth's environmental protection policies as set forth in Chapter 164 of the General Laws and in other state and local environmental policies as described below.

6.3.1 The Restructuring Act

The Restructuring Act provides that the Company must demonstrate that the Project minimizes environmental impacts consistent with the minimization of costs associated with mitigation, control, and reduction of the environmental impacts of the Project. Accordingly, an assessment of all impacts of a proposed facility is necessary to determine whether an appropriate balance is achieved both among conflicting environmental concerns as well as among environmental impacts, cost, and reliability.

A facility that achieves the appropriate balance thereby meets the Chapter 164 requirement to minimize environmental impacts at the lowest possible cost. To determine if a petitioner has achieved the proper balance among environmental impacts, cost, and reliability, the Siting Board first determines if the petitioner has provided sufficient information regarding environmental impacts and potential mitigation measures in order to make such a

determination. The Siting Board then determines whether environmental impacts are minimized. Similarly, the Siting Board evaluates whether the petitioner has provided sufficient cost information in order to determine if the appropriate balance among environmental impacts, cost, and reliability has been achieved.

In Sections 3, 4, and 5 of this Analysis, the Company demonstrated that it compared a range of alternative projects and proposed specific plans to mitigate environmental impacts associated with the construction, operation, and maintenance of the proposed transmission line, consistent with cost minimization. As such, the Project is consistent with the environmental policies of the Commonwealth as set forth in Chapter 164 of the General Laws.

6.3.2 State and Local Environmental Policies

The Company will obtain all environmental approvals and permits required by federal, state, and local agencies and will construct and operate the Project to fully comply with Federal, state and municipal regulations and environmental policies. Thus, the Project will contribute to a reliable, low cost, diverse energy supply for the Commonwealth while avoiding, minimizing, and mitigating environmental impacts to the maximum extent practicable. The Federal permits and approvals that the Project will secure include a Section 404 Permit under the Federal Clean Water Act issued by the USACE; Obstruction Review (14 CFR Part 77) by the Federal Aviation Administration ("FAA"); and, a USEPA issued National Pollutant Discharge and Elimination System ("NPDES") General Permit for Storm Water Discharges from Construction Activities.

The state permits and approvals that the Company will secure include a 401 Water Quality Certificate from the MassDEP; Highway Access Permit and Land Lease Agreement from the MassDOT; MHC 106(c) review. The Company will also file an Environmental Notification Form pursuant to the MEPA) and will obtain a Certificate from the Secretary of Energy and Environmental Affairs ("EEA") affirming the Project's consistency with MEPA.

In addition, the Project will require and obtain local approvals from the Towns of Hudson, Stow and Sudbury, including road opening permits; grants of location; and, Orders of Condition under the Massachusetts Wetlands Protection Act and local wetland bylaws, as applicable.

Table 6-1 below identifies the anticipated permits, reviews, and approvals required for the Project (in addition to the Siting Board's review). By meeting the requirements for acquiring

each of these programs and permits, the Project will be in compliance with applicable state and local environmental policies.

In addition, the Project is consistent with the Commonwealth's Environmental Justice ("EJ") Policy. Environmental justice is the equal protection and meaningful involvement of all people and communities with respect to the development, implementation, and enforcement of energy, climate change, and environmental laws, regulations, and policies and the equitable distribution of energy and environmental benefits and burdens. The EJ Policy was initially promulgated in 2002 by the predecessor to the EEA; was in 2014 subsequently updated through Executive Order #552; and most recently, on January 31, 2017, was further updated by the Secretary of EEA. The current EJ Policy is imposed on state agencies under the Executive Office of Energy and Environmental Affairs, including the Siting Board and the Department, rather than on project applicants *per se*. In turn, project applicants must comply with relevant directives and requirements established by these state agencies. Thus, the provisions and requirements of the Commonwealth's EJ Policy are not directly applicable to the Project. Nevertheless, the Company's environmental analysis in this proceeding is designed to minimize the Project's impacts to *all* populations, including EJ populations. Further, regardless of any legal obligation and consistent with the Commonwealth's EJ Policy, the Company has undertaken, and will continue to undertake, an extensive community outreach effort in order to facilitate the meaningful opportunity to participate by all. As such, the Project is consistent with the Commonwealth's environmental policies.

6.3.3 The Green Communities Act

On July 2, 2008, then-Massachusetts Governor Patrick signed into law the Green Communities Act. The Green Communities Act is a comprehensive, multi-faceted energy reform bill that encourages energy and building efficiency, promotes renewable energy, creates green communities, implements elements of the Regional Greenhouse Gas Initiative, and provides market incentives and funding for various types of energy generation. The Green Communities Act (as amended and supplemented by St. 2012, c. 209, An Act Relative to Competitively Priced Electricity), can be expected to result in greater renewable supplies and substantial new conservation initiatives in future years. The improvements to the transmission system in the Marlborough Subarea of Subarea D will strengthen and improve the reliability of the regional transmission system. While the primary Project purpose is improved reliability consistent with ISO-NE requirements, the more robust system will enable a more efficient and flexible operation of the grid consistent with the Green Communities Act.

6.3.4 The Global Warming Solutions Act

On August 7, 2008, then-Massachusetts Governor Patrick signed into law the Global Warming Solutions Act ("GWSA"), which established aggressive greenhouse gas ("GHG") emissions reduction targets of 25% from 1990 levels by 2020 and 80% from 1990 levels by 2050. Pursuant to the GWSA, the Secretary of the EEA issued the Clean Energy & Climate Plan for 2020 in December of 2010. Among other provisions, the GWSA obligates administrative agencies such as the Siting Board, in considering and issuing permits, to consider reasonably foreseeable climate change impacts (e.g., additional GHG emissions) and related effects (e.g., sea level rise). The proposed improvements to the transmission system in the Marlborough Subarea of Subarea D will have no adverse climate change impacts or negative effects on sea levels. Consequently, the Project is consistent with the GWSA.

6.3.5 The Energy Diversity Act

On August 8, 2016, Governor Baker signed into law the "An Act to Promote Energy Diversity" ("Energy Diversity Act"). St. 2016, c. 188. The Energy Diversity Act is a multi-faceted energy bill that, among other things, facilitates the procurement and integration of renewable energy generation resources, including new offshore wind energy generation, firm service hydroelectric generation and new Class I RPS eligible resources. St. 2016, c. 188, § 12. The Project will improve the reliability of the regional transmission system and thereby create a more robust transmission system that is better able to accommodate various energy resources that may come online in the future as a result of the Energy Diversity Act. Accordingly, the Project is consistent with the Energy Diversity Act.

6.4 Resource Use and Development Policies

The Project, which will contribute to the long-term maintenance and reliability of the electric transmission system in the Marlborough Subarea of Subarea D and surrounding communities, will be constructed and operated in compliance with Massachusetts' policies regarding resource use and development. For example, in 2007, the EEA's Smart Growth/Smart Energy policy established the Commonwealth's Sustainable Development Principles, including: (1) supporting the revitalization of city centers and neighborhoods by promoting development that is compact, conserves land, protects historic resources and integrates uses; (2) encouraging remediation and reuse of existing sites, structures and infrastructure rather than new construction in undeveloped areas; and (3) protecting environmentally sensitive lands, natural resources, critical habitats, wetlands and water resources and cultural and historic landscapes.

As described more fully in Section 5, the Project will support these principles because, among other reasons, the Project will be located primarily within an MBTA ROW and existing streets and does not require the establishment of new rights-of-way; thus, no previously undisturbed property will be affected by the siting, construction or installation of the Project.

In addition, the MBTA ROW would incur similar impacts as a result of the construction and operation of the planned multi-use trail proposed by the DCR. The community will benefit from the Project by advancing the proposed Mass Central Rail Trail, saving Commonwealth funds to construct the multi-use trail and reducing the overall cumulative environmental impact.

The Project, therefore, is in compliance with, and furthers, the Commonwealth's policies regarding resource use and development.

Table 6-1: Environmental Permits for the Project

Regulatory Agency	Program/Permit	Jurisdictional Trigger
FEDERAL		
USACE	Section 404 Federal Clean Water Act – Pre-Construction Notification Form for permanent impacts >5,000 sf but less <1 acre	Discharge of dredged or fill material to Waters of the U.S. in the Commonwealth of Massachusetts
FAA	FAA Form 7460-1 for Obstruction Evaluation / Airport Airspace Analysis	Proximity to airport
USEPA	NPDES General Permit for Storm Water Discharges from Construction Activities	Land disturbance greater than one acre
STATE		
EFSB/DPU	G.L. c. 164, § 72, approval to construct; G.L. c. 40A, § 3, request for zoning exemptions	New transmission line with a design rating of more than 69 kV within a new transmission corridor; new transmission; grant of required zoning exemptions
EEA	MEPA Mandatory EIR Required 301 CMR 11.00	Alteration of one or more acres of bordering vegetated wetlands
MassDEP	401 Water Quality Certification, 314 CMR 9.00	Discharge of dredged or fill material to Waters of the US in the Commonwealth of Massachusetts
MassDOT	State Highway Access Permit(s), G.L. c. 81, § 21/G.L. c. 85, § 2	Construction within or over a state roadway
MHC	Determination of effect on historic and archaeological properties, G.L. c. 9, § 27C Project Notification Form ("PNF")	Historic and prehistoric cultural resources
LOCAL		
Conservation Commissions (Hudson, Stow, Sudbury)	Massachusetts Wetlands Protection Act (310 CMR 10.00) and municipal wetland non-zoning bylaw filings (Notice of Intent)	Alteration of jurisdictional wetland resource areas
Board of Selectmen (Hudson, Sudbury)	Grants of Location and Street Opening Permits	Construction over or within local streets