Appendix 1-1

Expanded Environmental Notification Form

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

SUBMITTED TO

The Executive Office of Energy and Environmental Affairs
MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

SUBMITTED BY

New England Power Company d/b/a/ National Grid
170 Data Drive
Waltham, MA 02451

PREPARED BY

vhb
260 Arsenal Place #2
Watertown, MA 02472-4026

AUGUST 15, 2024

August 15, 2024

Ref: 15773.00

Rebecca Tepper, Secretary
Executive Office of Energy and Environmental Affairs
Attn: Tori Kim, MEPA Director
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: Palmer to Ware Improvement Project
Expanded Environmental Notification Form

Dear Secretary Tepper:

On behalf of the New England Power Company (NEP) d/b/a National Grid (the "Proponent" or "NEP"), we are pleased to submit this enclosed Expanded Environmental Notification Form (EENF) for proposed upgrades to an existing 10.35-mile-long overhead transmission line (the "Project") that originates at Palmer Substation #503 located southeast of downtown Palmer, crosses Route 20 and the Massachusetts Turnpike, and continues northeast until it crosses Route 9 and Route 32, terminating at the Ware Substation #501 northeast of downtown Ware (the "Project Site").

The Project will rebuild the existing line to address widespread damage to the existing structures, improve telecommunications between the two substations, and improve reliability of the transmission line. The transmission line will be moved to the center of the existing right-of-way ("ROW"), completely replacing the existing structures, conductor, and shield wire. Work will include minor vegetation management, upgrading existing access, and creating new access as required to construct and maintain the rebuilt line. The line will be rebuilt with steel structures and will continue to be operated at 69 kilovolts ("kV") but designed to allow future operation at 115 kV to meet future requirements to support electrification within the Commonwealth, if needed.

This EENF is being submitted as the initial filing for review under MEPA. Pursuant to 301 CMR 11.06(8), the Proponent respectfully requests that that the Secretary of the Energy and Environmental Affairs ("EEA") consider granting a Single Environmental Impact Report ("SEIR").

Please publish notice of availability of the EENF for public review in the August 23, 2024, edition of *The Environmental Monitor*. We understand that public comments will be due by September 23, 2024, and a Certificate is anticipated to be issued on September 30, 2024. This filing has been distributed electronically and hard copies will be made available at the Young Men's Library Association in Ware, Palmer Public Library in Palmer, and Merriam-Gilbert Public Library in West Brookfield, as well as by request.

We look forward to your review of this Project. Please contact me at 617-607-6172 or ejohnson@vhb.com if you have any questions.

Sincerely,

Erika Johnson
Senior Environmental Planner

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Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs
Massachusetts Environmental Policy Act (MEPA) Office

Environmental Notification Form

For Office Use Only

EEA#: ____________________

MEPA Analyst: ______________

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: **Palmer to Ware Improvement Project**		
Street Address: **Palmer Substation, 45-99 Blanchard Street, Palmer; to Ware Substation, 48A Gilbertville Road, Ware; and existing overhead transmission right-of-way in Ware, West Brookfield, and Palmer, Massachusetts**		
Municipality: **Ware, West Brookfield, and Palmer**	Watershed: **Chicopee River**	
Universal Transverse Mercator Coordinates: Start: Easting 722908.67, Northing 4669442.56 End: Easting 729717.97, Northing 4684012.45	Start Latitude: **42.14540** Start Longitude: **-72.30239** End Latitude: **42.27450** End Longitude: **-72.21432**	
Estimated commencement date: **July 2027**	Estimated completion date: **Dec 2028**	
Project Type: **Overhead Transmission Line Refurbishment**	Status of project design: **50%** complete	
Proponent: **New England Power Company d/b/a/ National Grid**		
Street Address: **170 Data Drive**		
Municipality: **Waltham**	State: **MA**	Zip Code: **02451**
Name of Contact Person: **Rucha Ragalwar**		
Firm/Agency: **VHB**	Street Address: **260 Arsenal Place #2**	
Municipality: **Watertown**	State: **MA**	Zip Code: **02472**
Phone: **617.607.2713**	Fax:	E-mail:**rragalwar@vhb.com**

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☒Yes ☐No

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

a Single EIR? (see 301 CMR 11.06(8)) ☒**Yes** ☐No
a Rollover EIR? (see 301 CMR 11.06(13)) ☐Yes ☒No
a Special Review Procedure? (see 301CMR 11.09) ☐Yes ☒No
a Waiver of mandatory EIR? (see 301 CMR 11.11) ☐Yes ☒No
a Phase I Waiver? (see 301 CMR 11.11) ☐Yes ☒No
(Note: Greenhouse Gas Emissions analysis must be included in the Expanded ENF.)
Stationary and mobile source GHG emissions analyses are not required for this Project as they are not anticipated to exceed the 2,000 tons per year threshold.

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?

- **310 CMR 11.03(3)(a)1.a. alteration of one or more acres of bordering vegetated wetlands**
- **310 CMR 11.03(3)(b)1.d. alteration of 5,000 or more sf of bordering or isolated vegetated wetlands**
- **310 CMR 11.03(3)(b)1.f. alteration of ½ or more acres of any other wetlands**
- **[Potential] 301 CMR 11.03(2)(b)(2) – Taking of an endangered or threatened species or species of special concern, provided that the Project site is two or more acres and includes an area mapped as Priority Site of Rare Species Habitat and Exemplary Natural Communities– To be Determined based on ongoing consultation with NHESP.**

Which State Agency Permits will the project require?

- **State Highway Access Permit (MassDOT);**
- **Section 401 Water Quality Certificate (MassDEP); and**
- **Energy Facilities Siting Board/Department of Public Utilities approval under G.L. c. 164, §69J and §72**
- **[Potential] NHESP Conservation and Management Permit –To be Determined based on ongoing consultation with NHESP.**

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:

None

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Massachusetts Environmental Policy Act (MEPA) Office

Summary of Project Size & Environmental Impacts	Existing	Change	Total
LAND			
Total site acreage	**150 AC**		
New acres of land altered		**19 AC**	
Acres of impervious area	**0**	**0**	**0**
Square feet of new bordering vegetated wetlands alteration		**Temporary 199,967 SF** **Permanent 113 SF**	
Square feet of new other wetland alteration		**Total other Wetland Alteration:** 70,313 SF **Land Under Water:** Temporary - 4,811SF Permanent- 0 SF **Bank:** Temporary - 2,617 LF Permanent – 0 LF **Riverfront Area:** Temporary – 93,989 SF Permanent – 4,534 SF	
Acres of new non-water dependent use of tidelands or waterways		**-0-**	
STRUCTURES			
Gross square footage	**-0-**	**-0-**	**-0-**
Number of housing units	**-0-**	**-0-**	**-0-**
Maximum height (feet)	**Existing structure maximum height 90 ft**	**Proposed structure maximum height 125 ft**	**Maximum height difference 35 ft**
TRANSPORTATION			
Vehicle trips per day	N/A	N/A	N/A
Parking spaces	**-0-**	**-0-**	**-0-**
WASTEWATER			
Water Use (Gallons per day)	**-0-**	**-0-**	**-0-**

Water withdrawal (GPD)	**-0-**	**-0-**	**-0-**
Wastewater generation/treatment (GPD)	**-0-**	**-0-**	**-0-**
Length of water mains (miles)	**-0-**	**-0-**	**-0-**
Length of sewer mains (miles)	**-0-**	**-0-**	**-0-**
Has this project been filed with MEPA before? ☐ Yes (EEA #___________) ☒No			
Has any project on this site been filed with MEPA before? ☐ Yes (EEA #___________) ☒No			

GENERAL PROJECT INFORMATION – all proponents must fill out this section

PROJECT DESCRIPTION:

NOTE: The project description should summarize both the project's direct and indirect impacts (including construction period impacts) in terms of their magnitude, geographic extent, duration and frequency, and reversibility, as applicable. It should also discuss the infrastructure requirements of the project and the capacity of the municipal and/or regional infrastructure to sustain these requirements into the future.

Describe the existing conditions and land uses on the project site:

New England Power Company ("NEP", or "the Proponent") proposes to replace the O15N Line ("Existing Line") with a Rebuilt Line within its existing right-of-way ("ROW") in Palmer, West Brookfield, and Ware, Massachusetts ("the Palmer to Ware Improvement Project", or "the Project"). The Existing Line is situated entirely within the existing ROW comprised of NEP easements or land owned in fee ("the Project Site"). The existing, maintained O15N ROW encompasses approximately 10.35 miles and varies between 100 and 200 feet wide, with heavy vegetation and tall trees on both sides of the circuit outside of the ROW for its entire length. The total Project area within the ROW is approximately 150 acres.

The Existing Line is surrounded primarily in forested and rural land. The existing ROW consists mostly of scrub-shrub and meadow habitat maintained by the Proponent through periodic vegetation mowing, cutting, and removal of hazard trees. Further details on the existing conditions within the Project ROW and surrounding land uses are described in Section 1.2 of Chapter 1, _Project Description_.

Describe the proposed project and its programmatic and physical elements:

The proposed Project includes rebuilding the entire O15N Line. The Rebuilt Line will generally be constructed on light-duty steel single-pole braced-post structures at suspension locations ranging in height from approximately 80 feet to 125 feet above ground. The existing steel shield wire will be replaced with optical ground wire (OPGW) and will include 15 OPGW splice boxes. The Project will remove 147 structures and install 112 structures, including:

- **88 light-duty steel braced-post structures;**
- **Structure 1 as an engineered steel pole vertical dead-end structure;**
- **Structures 87 and 88 as engineered steel H-Frame dead-end structures; and**
- **21 engineered steel single-pole davit arm dead-end structures.**

Please refer to Section 1.3 of Chapter 1, _Project Description_, for more details on the proposed Project and its programmatic and physical elements.

Describe the on-site project alternatives (and alternative off-site locations, if applicable), considered by the proponent, including at least one feasible alternative that is allowed under current zoning, and the reasons(s) that they were not selected as the preferred alternative:

NOTE: *The purpose of the alternatives analysis is to consider what effect changing the parameters and/or siting of a project, or components thereof, will have on the environment, keeping in mind that the objective of the MEPA review process is to avoid or minimize damage to the environment to the greatest extent feasible. Examples of alternative projects include alternative site locations, alternative site uses, and alternative site configurations.*

In addition to the No-Build scenario, the Proponent identified and evaluated four types of build/no-build alternatives and two transmission structure design options, listed below. These are described in greater detail in Chapter 2, Alternatives Analysis.

Build Alternatives:
- **Non-Wires Alternative;**
- **Partial Rebuild Alternative**
- **New Build/New Route Alternative**
- **Complete Rebuild (Preferred) Alternative**

Design Alternatives:
- **Rebuild with Spacer Cable**
- **69 kV and 115 kV Designs**

Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:

The Project will avoid, minimize or mitigate damage to the environment to the maximum extent practicable. To offset the impacts of the preferred alternative, the Proponent is committed to restoring and revegetating areas temporarily disturbed by construction. The Project will employ Best Management Practices (BMP's) to avoid and minimize erosion. For unavoidable permanent wetland impacts, the Proponent will provide 1:1 wetland replication as required by regulations. For protection of rare species, the Proponent will continue to refine the design to avoid these species where possible, and work with NHESP to identify any additional protection measures or mitigation that may be required. The Proponent will develop a Transportation Management Plan (TMP) to minimize construction-related traffic impacts and take measures to control air quality and noise during construction. The Proponent commits to, and is responsible for, these mitigation measures and others as outlined in Table 7-1 of Chapter 7, *Mitigation and Draft Section 61 Findings*. The Project provides several benefits as summarized in Chapter 1, *Project Description*.

If the project is proposed to be constructed in phases, please describe each phase:

The Project will not be constructed in phases.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN:
Is the project within or adjacent to an Area of Critical Environmental Concern?
☐Yes (Specify_________________________________)
☒No
if yes, does the ACEC have an approved Resource Management Plan? ___ Yes ___ No;
If yes, describe how the project complies with this plan. ____________________________________

Will there be stormwater runoff or discharge to the designated ACEC? ___ Yes ___ No;
If yes, describe and assess the potential impacts of such stormwater runoff/discharge to the designated ACEC.

RARE SPECIES:
Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species? (see http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/priority_habitat_home.htm)
☒Yes (Specify: **PH 1106 / EH 800**) ☐No

HISTORICAL /ARCHAEOLOGICAL RESOURCES:
Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?
☐Yes (Specify:) ☒No

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources? ☐Yes (Specify:) ☒No

WATER RESOURCES:
Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site?
_X_ Yes ___No;

if yes, identify the ORW and its location. **The Lower Graves Brook ORW is approximately 0.5 miles from the edge of the existing ROW. In addition, there are 16 Certified Vernal Pools within 0.5 miles of the existing ROW. None of these are within the ROW.**

(NOTE: Outstanding Resource Waters include Class A public water supplies, their tributaries, and bordering wetlands; active and inactive reservoirs approved by MassDEP; certain waters within Areas of Critical Environmental Concern, and certified vernal pools. Outstanding resource waters are listed in the Surface Water Quality Standards, 314 CMR 4.00.)

Are there any impaired water bodies on or within a half-mile radius of the project site?
_**X**__Yes ___No; if yes,
identify the water body and pollutant(s) causing the impairment:

Quabog River: bacteria and other microbes: *E. coli*, fecal coliform
Kings Brook River: temperature: dam/impoundment
Ware River:
- **bacteria and other microbes: *E. coli***
- **nuisance plants or animals (foreign): non-native aquatic plants**

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? ___Yes **_X_No**

STORMWATER MANAGEMENT:

Generally describe the project's stormwater impacts and measures that the project will take to comply with the standards found in MassDEP's Stormwater Management Regulations:

No new impervious areas will be created as part of this Project and the Project has been designed to meet all applicable Massachusetts Stormwater Standards as required per the Massachusetts Wetlands Regulations at 310 CMR 10.05 (6)(k) through (q). The majority of the stormwater management standards are not applicable to the proposed work. The primary applicable standard is Standard #8: Construction Period Pollution Prevention and Erosion and Sedimentation Controls. Erosion and sediment control measures will be installed to manage stormwater during construction in accordance with National Grid's BMPs and approved plans and permit requirements. More detail can be found in section 3.3 of the attached narrative.

MASSACHUSETTS CONTINGENCY PLAN:
Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? Yes ___ **No _X__** ; if yes, please describe the current status of the site (including Release Tracking Number (RTN), cleanup phase, and Response Action Outcome classification):__________________

Is there an Activity and Use Limitation (AUL) on any portion of the project site? Yes ___ **No _X__**;
if yes, describe which portion of the site and how the project will be consistent with the AUL:
_____________________.

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN?
Yes ___ **No _X__** ; if yes, please describe:____________________________________

SOLID AND HAZARDOUS WASTE:

If the project will generate solid waste during demolition or construction, describe alternatives considered for re-use, recycling, and disposal of, e.g., asphalt, brick, concrete, gypsum, metal, wood:

Solid waste generated from the Project will consist primarily of the old structures being removed. The Project may also generate minor amounts of construction debris such as wood pallets and wooden spools. The Project's construction manager will implement a waste management plan to divert Project-related construction waste material from landfills through recycling and salvaging where practicable. See Section 6.2.8 of Chapter 6, *Construction Period Impacts*, for more details.

(NOTE: Asphalt pavement, brick, concrete and metal are banned from disposal at Massachusetts landfills and waste combustion facilities and wood is banned from disposal at Massachusetts landfills. See 310 CMR 19.017 for the complete list of banned materials.)

Will your project disturb asbestos containing materials? Yes ___ **No _X__** ;
if yes, please consult state asbestos requirements at http://mass.gov/MassDEP/air/asbhom01.htm

Describe anti-idling and other measures to limit emissions from construction equipment:

The Commonwealth of Massachusetts anti-idling law will be enforced during the construction phase of the Project with the installation of on-site anti-idling signage and procedures described in Section 6.2.4 of Chapter 6, *Construction Period Impacts*. Construction contractors will be required to adhere to all applicable regulations regarding control of construction vehicle emissions. Construction specifications will require that all diesel construction equipment used on site would be fitted with after-engine emissions controls, and contractors will be required to utilize ultra-low sulfur diesel fuel and minimize idling time.

DESIGNATED WILD AND SCENIC RIVER:

Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? Yes ___ **No _X_** ;
if yes, specify name of river and designation:

If yes, does the project have the potential to impact any of the "outstandingly remarkable" resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River?
Yes ___ No ___ ; if yes, specify name of river and designation: _____________;
if yes, will the project will result in any impacts to any of the designated "outstandingly remarkable" resources of the Wild and Scenic River or the stated purposes of a Scenic River.
Yes ___ No ___ ;
if yes, describe the potential impacts to one or more of the "outstandingly remarkable" resources or stated purposes and mitigation measures proposed.

ATTACHMENTS:

1. List of all attachments to this document.

- **Cover Letter**
- **Project Narrative and Figures (Chapters 1 through 7)**
- **Appendices -**
  Appendix A – MEPA Distribution List (includes EJ CBO List)
  Appendix B – Natural Resources and Stormwater Management Documentation
  Appendix C – Climate Change Supporting Documentation
  Appendix D – Environmental Justice Screening Form
  Appendix E – Historic Resources Supporting Documentation

2. U.S.G.S. map (good quality color copy, 8-½ x 11 inches or larger, at a scale of 1:24,000) indicating the project location and boundaries.

Refer to Figure 1.1 for Site Locus Map.

3. Plan, at an appropriate scale, of existing conditions on the project site and its immediate environs, showing all known structures, roadways and parking lots, railroad rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.

Refer to Figures 1.2 and 1.3 for Existing Site Conditions.

4. Plan, at an appropriate scale, depicting environmental constraints on or adjacent to the project site such as Priority and/or Estimated Habitat of state-listed rare species, Areas of Critical Environmental Concern, Chapter 91 jurisdictional areas, Article 97 lands, wetland resource area delineations, water supply protection areas, and historic resources and/or districts.

Refer to Figure 3.4 for Environmental Constraints.

5. Plan, at an appropriate scale, of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).

Refer to Figure 1.4 for the Proposed Site Plan.

6. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).

Refer to Appendix A – MEPA Distribution List.

7. List of municipal and federal permits and reviews required by the project, as applicable.

Refer to Table 1-2 of Chapter 1, *Project Description*, for a list of anticipated permitting approvals.

8. Printout of output report from RMAT Climate Resilience Design Standards Tool, available here.

Refer to Appendix C for an output report from the RMAT Tool.

9. Printout from the EEA EJ Maps Viewer showing the project location relative to Environmental Justice (EJ) Populations located in whole or in part within a 1-mile and 5-mile radius of the project site.

Refer to Figure 5.1 for the Environmental Justice Populations Map.

<u>LAND SECTION</u> – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1) ___ Yes _X__ No; if yes, specify each threshold:

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	N/A	N/A	N/A
Internal roadways*	N/A	N/A	N/A
Parking and other paved areas	N/A	N/A	N/A
Other altered areas**	**8**	**19**	**27**
Undeveloped areas	**142**	**-19**	**123**
Total: Project Site Acreage	**150**	**N/A**	**150**

** There are existing and proposed unpaved access roads within the right-of-way.*
***Includes existing gravel and dirt roads and existing graveled work pads*

B. Has any part of the project site been in active agricultural use in the last five years? ___ Yes _**X**_ No; if yes, how many acres of land in agricultural use (with prime state or locally important agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use? ___ Yes _**X**_ No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a forest management plan approved by the Department of Conservation and Recreation:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ___ Yes _**X**_ No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction? ___ Yes___ No _**X**_; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes __**X**_ No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No _**X**__; if yes, describe:

III. Consistency

A. Identify the current municipal comprehensive land use plan

Title:_Palmer Master Plan	**Date: August 2021**
Title:_A Window to Ware's Future	**Date: September 21, 2016**
Title:_West Brookfield Master Plan	**Date: January 8, 2018**

B. Describe the project's consistency with that plan with regard to:

1) economic development: **The Project will support and provide reliable energy for future economic development in the area, which is a general goal for all three municipalities.**

2) adequacy of infrastructure: **The Project is intended to provide a continued reliable source of electricity to Massachusetts Electric customers in Ware, Hardwick,**

Palmer, Monson, and Brimfield. The Project will support Palmer's desired growth and goals of increasing use of renewable energy and electric vehicle charging stations.

3) open space impacts: **The Project will be built within an existing transmission line ROW and will not have any impacts to open space. Within areas classified as protected lands or open space and recreation, Project construction is contained within an existing NEP ROW and along historically utilized access routes. As such, there are no anticipated permanent changes to the function of the existing open space and recreational land uses along the Project Route, and no impact to any open space goals for any of these municipalities.**

4) compatibility with adjacent land uses: **The Project will be built within an existing transmission line ROW and will not result in any change in compatibility with adjacent land uses or any land use goals for each of these municipalities.**

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)

RPA: **Central Massachusetts Regional Planning Commission**
Title:__________________________ Date___________________

CMRPC is currently in the process of developing *Imagine 2050: A Vision for Central Massachusetts.* The descriptions below are based on preliminary information available for this plan, as well as *Bridge to Resiliency: The 2023 Central Massachusetts Infrastructure Plan*.

D. Describe the project's consistency with that plan with regard to:

1) economic development: **The Project will provide a more reliable energy supply and support current and future economic development in the area by addressing the region's current lack of capacity for development as identified in *Bridge to Resiliency*.**

2) adequacy of infrastructure: **The Project will also address several other concerns identified in *Bridge to Resiliency*, including a rapid transition to electrification of heating and transportation, aiming to be net zero by 2050, prevalence of fallen trees on exposed wires, and pole replacements**.

3) open space impacts: **The Project will be located within an existing electric transmission line ROW and will not result in any open space impacts.**

RARE SPECIES SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? ___ Yes **___ No**; if yes, specify, in quantitative terms:

(NOTE: If you are uncertain, it is recommended that you consult with the Natural Heritage and Endangered Species Program (NHESP) prior to submitting the ENF.)

To be determined. NEP will continue to work with NHESP to avoid a prohibited take for state-listed species.

B. Does the project require any state permits related to **rare species or habitat**?
_ _ Yes ___ No
To be determined. NEP will continue to work with NHESP to avoid a prohibited take for state-listed species.

C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)?
__X_ Yes ___ No.

The Project falls within Priority Habitat (PH) 1106 and Estimated Habitat (EH) 800, both located within Palmer near the Ware municipal border, as shown in Figure 3.4.

D. If you answered "No" to all questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? **_X__ Yes** ___ No. If yes,

1. Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? **_X__Yes** ___No; if yes, have you received a determination as to whether the project will result in the "take" of a rare species? ___ Yes **_X__ No**; if yes, attach the letter of determination to this submission.

2. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate rare species impacts.

   To be determined. NEP will continue to work with NHESP to avoid and minimize impacts to habitat for the listed species to the extent possible.

3. Which rare species are known to occur within the Priority or Estimated Habitat?

   There is one species of moth, three plants, and one amphibian known to occur in these areas.

4. Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? **_X__** Yes ___ No

5. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes **__X_** No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:

To be determined. NEP will continue to work with NHESP to avoid and minimize impacts to habitat for the listed species to the extent possible.

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? _X_ Yes ___ No; if yes, specify, in quantitative terms:

301 CMR 11.03(3)(a)1.a. alteration of one or more acres of bordering vegetated wetlands
301 CMR 11.03(3)(b)1.d. alteration of 5,000 or more sf of bordering or isolated vegetated wetlands
301 CMR 11.03(3)(b)1.f. alteration of ½ or more acres of any other wetlands

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? _**X**__ Yes ___ No; if yes, specify which permit:

401 Water Quality Certification and Orders of Conditions under the Wetlands Protection Act will be required.

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? _**X**__ Yes ___ No; if yes, has a Notice of Intent been filed? ___ Yes _**X**_ No; if yes, list the date and MassDEP file number: ______; if yes, has a local Order of Conditions been issued? ___ Yes ___ No; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes _**X**_ **No**.

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site:

Rebuilding the line in the center of the existing ROW will result in mostly temporary construction impacts to wetland resource areas in Palmer, Ware, and West Brookfield. Five of the 112 structures will directly impact wetland resource areas resulting in 113 SF of permanent impact to BVW. Temporary access roads ,workpads, and pull pads will be constructed in BVW and at stream crossings using construction mats resulting in 199,967 square feet of temporary impact to BVW, 4,811 square feet of temporary impact to Land Under Water, and 2,617 linear feet of temporary impact to Bank. Access roads constructed in Riverfront Areas will be permanent and will result in 4.534 square feet of permanent impact; however, workpads and pull pads in these areas will be temporary and will be restored after construction of the Rebuilt Lines is complete. This temporary work in Riverfront Area will result in 93,989 square feet of impact. Temporary construction mats will be used where construction in wetlands is unavoidable; mats will be removed upon completion of construction. Further detail is provided in Section C below.

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

The Project will not result in temporary or permanent impacts to coastal wetlands.

Coastal Wetlands	Area (square feet) or Length (linear feet)	Temporary or Permanent Impact?
Land Under the Ocean	________________	__________________

Designated Port Areas	___	___
Coastal Beaches	___	___
Coastal Dunes	___	___
Barrier Beaches	___	___
Coastal Banks	___	___
Rocky Intertidal Shores	___	___
Salt Marshes	___	___
Land Under Salt Ponds	___	___
Land Containing Shellfish	___	___
Fish Runs	___	___
Land Subject to Coastal Storm Flowage	___	___
<u>Inland Wetlands</u>		
Bank (lf)	**2,617**	**Temporary**
Bordering Vegetated Wetlands	**113 / 199,967**	**Permanent / Temporary**
Isolated Vegetated Wetlands	**0**	
Land under Water	**4,811**	**Temporary**
Isolated Land Subject to Flooding	**0**	
Bordering Land Subject to Flooding	**0**	
Riverfront Area	**4,534 / 93,989**	**Permanent / Temporary**

D. Is any part of the project:

1. proposed as a **limited project**?
   __**X**_ **Yes** __ No; if yes, what is the area (in sf)?_approximately 6,534,000 SF__

   See Section II.C. The entire Project is proposed as a Limited Project pursuant to 310 CMR 10.53(3)(d) –construction of electric transmission lines

2. the construction or alteration of a **dam**? ___ Yes _**X**_ **No**; if yes, describe:
3. fill or structure in a **velocity zone** or **regulatory floodway**? ___ Yes _**X**_ **No**
4. dredging or disposal of dredged material?
   ___ Yes _**X**_ **No**; if yes, describe the volume of dredged material and the proposed disposal site:
5. a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical Environmental Concern (ACEC)**? ___ Yes _**X**_ **No**
6. subject to a wetlands restriction order? ___ Yes _**X**_ **No**; if yes, identify the area (in sf):
7. located in buffer zones? _**X**_**Yes** ___No; if yes, how much (in sf) **<u>345,531 sf</u>**

E. Will the project:

1. be subject to a local wetlands ordinance or bylaw? _**X**__ **Yes** ___ No
2. alter any federally-protected wetlands not regulated under state law?
   ___ Yes _**X**__ No; if yes, what is the area (sf)?

III. Waterways and Tidelands Impacts and Permits

A. Does the project site contain waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? ___ Yes __**X No**; if yes, is there a current Chapter 91 License or Permit affecting the project site? ___ Yes ___ No; if yes, list the date and license or permit number and provide a copy of the historic map used to determine extent of filled tidelands:

B. Does the project require a new or modified license or permit under M.G.L.c.91?
___ Yes _**X**__ **No**; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent use? Current ___ Change ___ Total ___

If yes, how many square feet of solid fill or pile-supported structures (in sf)?

C. For non-water-dependent use projects, indicate the following:
Area of filled tidelands on the site:__________0___________
Area of filled tidelands covered by buildings:___0_________
For portions of site on filled tidelands, list ground floor uses and area of each use:
______0________
Does the project include new non-water-dependent uses located over flowed tidelands?
Yes ___ No _X__
Height of building on filled tidelands________________

Also show the following on a site plan: Mean High Water, Mean Low Water, Water-dependent Use Zone, location of uses within buildings on tidelands, and interior and exterior areas and facilities dedicated for public use, and historic high and historic low water marks.

D. Is the project located on landlocked tidelands? ___ Yes **_X__ No**; if yes, describe the project's impact on the public's right to access, use and enjoy jurisdictional tidelands and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

E. Is the project located in an area where low groundwater levels have been identified by a municipality or by a state or federal agency as a threat to building foundations?
___Yes **_X__ No**; if yes, describe the project's impact on groundwater levels and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

F. Is the project non-water-dependent **and** located on landlocked tidelands **or** waterways or tidelands subject to the Waterways Act **and** subject to a mandatory EIR?
___ Yes **_X__ No**;
(NOTE: If yes, then the project will be subject to Public Benefit Review and Determination.)

G. Does the project include dredging? ___ Yes **_X_ No**; if yes, answer the following questions:
What type of dredging? Improvement ___ Maintenance ___ Both ____
What is the proposed dredge volume, in cubic yards (cys) _________
What is the proposed dredge footprint ____length (ft) ___width (ft)____depth (ft);
Will dredging impact the following resource areas?
Intertidal Yes__ No__; if yes, ___ sq ft
Outstanding Resource Waters Yes__ No__; if yes, ___ sq ft
Other resource area (i.e. shellfish beds, eel grass beds) Yes__ No__;
if yes __ sq ft
If yes to any of the above, have you evaluated appropriate and practicable steps to: 1) avoidance; 2) if avoidance is not possible, minimization; 3) if either avoidance or minimize is not possible, mitigation?
If no to any of the above, what information or documentation was used to support this determination?
Provide a comprehensive analysis of practicable alternatives for improvement dredging in accordance with 314 CMR 9.07(1)(b). Physical and chemical data of the sediment shall be included in the comprehensive analysis.
Sediment Characterization
Existing gradation analysis results? __Yes ___No: if yes, provide results.
Existing chemical results for parameters listed in 314 CMR 9.07(2)(b)6?
___Yes ____No; if yes, provide results.
Do you have sufficient information to evaluate feasibility of the following management options for dredged sediment? If yes, check the appropriate option.

Beach Nourishment ___
Unconfined Ocean Disposal ___

Confined Disposal:

Confined Aquatic Disposal (CAD) ___

Confined Disposal Facility (CDF) ___

Landfill Reuse in accordance with COMM-97-001 ___

Shoreline Placement ___

Upland Material Reuse____

In-State landfill disposal____

Out-of-state landfill disposal ____

(NOTE: This information is required for a 401 Water Quality Certification.)

IV. Consistency:

A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone? ___ Yes **_X_ No**; if yes, describe these effects and the projects consistency with the policies of the Office of Coastal Zone Management:

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes **_X_ No**; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

WATER SUPPLY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ___ Yes **_X__ No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **water supply**? ___ Yes **__X_ No**; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits

A. Describe, in gallons per day (gpd), the volume and source of water use for existing and proposed activities at the project site:

	Existing	Change	Total
Municipal or regional water supply	________	________	________
Withdrawal from groundwater	________	________	________
Withdrawal from surface water	________	________	________
Interbasin transfer	________	________	________

(NOTE: Interbasin Transfer approval will be required if the basin and community where the proposed water supply source is located is different from the basin and community where the wastewater from the source will be discharged.)

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source, has a pumping test been conducted? ___ Yes ___ No; if yes, attach a map of the drilling sites and a summary of the alternatives considered and the results. ______________

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons per day)? ______Will the project require an increase in that withdrawal? ___Yes ___No; if yes, then how much of an increase (gpd)? ____________________

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___No. If yes, describe existing and proposed water supply facilities at the project site:

	Permitted Flow	Existing Avg Daily Flow	Project Flow	Total
Capacity of water supply well(s) (gpd)	_______	________	________	____
Capacity of water treatment plant (gpd)	_______	________	________	____

F. If the project involves a new interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve:

1. new water service by the Massachusetts Water Resources Authority or other agency of the Commonwealth to a municipality or water district? ___ Yes ___ No
2. a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?

3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes ___ No

III. Consistency

Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ___ Yes **_X__ No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes **__X_ No**; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe the volume (in gallons per day) and type of disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00 for septic systems or 314 CMR 7.00 for sewer systems):

	Existing	Change	Total
Discharge of sanitary wastewater	________	________	________
Discharge of industrial wastewater	________	________	________
TOTAL	________	________	________

	Existing	Change	Total
Discharge to groundwater	________	________	________
Discharge to outstanding resource water	________	________	________
Discharge to surface water	________	________	________
Discharge to municipal or regional wastewater facility	________	________	________
TOTAL	________	________	________

B. Is the existing collection system at or near its capacity? ___ Yes ___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

C. Is the existing wastewater disposal facility at or near its permitted capacity? ___ Yes___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No; if yes, describe as follows:

	Permitted	Existing Avg Daily Flow	Project Flow	Total
Wastewater treatment plant capacity (in gallons per day)	_______	________	________	____

E. If the project requires an interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or new?

(NOTE: Interbasin Transfer approval may be needed if the basin and community where wastewater will be discharged is different from the basin and community where the source of water supply is located.)

F. Does the project involve new sewer service by the Massachusetts Water Resources Authority (MWRA) or other Agency of the Commonwealth to a municipality or sewer district? ___ Yes ___ No

G. Is there an existing facility, or is a new facility proposed at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, wastewater reuse (gray water) or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (tons per day):

	Existing	Change	Total
Storage	________	________	________
Treatment	________	________	________
Processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

H. Describe the water conservation measures to be undertaken by the project, and other wastewater mitigation, such as infiltration and inflow removal.

III. Consistency

A. Describe measures that the proponent will take to comply with applicable state, regional, and local plans and policies related to wastewater management:

B. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EEA number for the plan and whether the project site is within a sewer service area recommended or approved in that plan:

TRANSPORTATION SECTION (TRAFFIC GENERATION)

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? ___ Yes **_X__ No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **state-controlled roadways**? ___ Yes **_X__ No**; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

	Existing	Change	Total
Number of parking spaces	_______	_______	________
Number of vehicle trips per day	_______	_______	________
ITE Land Use Code(s):	_______	_______	________

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1. ____________________	________	________	________
2. ____________________	________	________	________
3. ____________________	________	________	________

C. If applicable, describe proposed mitigation measures on state-controlled roadways that the project proponent will implement:

D. How will the project implement and/or promote the use of transit, pedestrian and bicycle facilities and services to provide access to and from the project site?

E. Is there a Transportation Management Association (TMA) that provides transportation demand management (TDM) services in the area of the project site? ____ Yes ____ No; if yes, describe if and how will the project will participate in the TMA:

F. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation facilities? ____ Yes ____ No; if yes, generally describe:

G. If the project will penetrate approach airspace of a nearby airport, has the proponent filed a Massachusetts Aeronautics Commission Airspace Review Form (780 CMR 111.7) and a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) (CFR Title 14 Part 77.13, forms 7460-1 and 7460-2)?

III. Consistency

Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

TRANSPORTATION SECTION (ROADWAYS AND OTHER TRANSPORTATION FACILITIES)

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? ___ Yes **_X__ No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **roadways or other transportation facilities**? **_X_ Yes** ___ No; if yes, specify which permit:

- MassDOT State Highway Access Permit

C. If you answered "No" to both questions A and B, proceed to the **Energy Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities in the immediate vicinity of the project site:

Due to construction within or over a state roadway (Interstate 90/the Massachusetts Turnpike), a State Highway Access Permit (G.L. c. 81 § 21/G.L. c. 85 § 2) must be obtained. The overhead transmission line crosses over Route 20, Interstate 90, and Route 9. The Project is proposed to be constructed within the existing ROW and will not result in any changes to transportation infrastructure or facilities outside the ROW.

Limited temporary construction-related traffic impacts are anticipated over the construction period which will be mitigated by developing construction Traffic Management Plans (TMPs) in close coordination with MassDOT and local municipalities. Section 6.2.9 of Chapter 6, Construction Period Impacts, provides further details regarding anticipated construction impacts on traffic and transportation and related proposed mitigation measures.

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? __No*__________
2. Cutting of living public shade trees (number)? __No________
3. Elimination of stone wall (in linear feet)? __No________

**** The Project will have no permanent impacts to bank. In areas where temporary access roads or work pads need to be constructed over the Bank, wetland timber mats will be utilized to span the stream to ensure that the stability of the Bank and its capacity to carry water is not impacted. If there is any disturbance to the bank from this work, these areas will be restored.***

III. Consistency -- Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

Proposed construction traffic will be temporary in nature, occurring along different sections of NEP's Project ROW during the various stages of construction. Traffic will be limited to construction-related vehicles accessing the utility ROW using existing routes off state highways (See Figure 6.2 for construction truck routes). Traffic volume during construction or maintenance of the utility line will not significantly

affect existing volumes or adversely impact the ability of existing traffic to safely navigate the roadway.

Prior to beginning construction, the Proponent will work closely with the municipalities and MassDOT to develop construction Traffic Management Plans ("TMPs"), which include construction-phase traffic controls, and to minimize the impacts of construction on the traveling public. Implementation of a well-designed TMP will reduce the potential for traffic disruptions and inconvenience to drivers. The TMP may include closures to travel lanes and/or roadway shoulders in order to set up the work zone. All TMP work will conform to the Manual of Uniform Traffic Control Devices and MassDOT standards. Along local roadways, the Proponent will coordinate with the municipalities on requirements for work hours, signage, and police details.

ENERGY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))? ___ Yes **_X_ No**; if yes, specify, in quantitative terms:

C. Does the project require any state permits related to **energy**? **_X_ Yes** __ No; if yes, specify which permit:

- **EFSB/DPU approval to construct, G.L. c. 164, § 69J and 72**

C. If you answered "No" to <u>both</u> questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

	Existing	Change	Total
Capacity of electric generating facility (megawatts)	__N/A__	__N/A__	__N/A__
Length of fuel line (in miles)	__N/A__	__N/A__	__N/A__
Length of transmission lines (in miles)	_10.35__	__N/A__	_10.35__
Capacity of transmission lines (in kilovolts)	_69 kV__	__46kV_	_115kV_

B. If the project involves construction or expansion of an electric generating facility, what are:

1. the facility's current and proposed fuel source(s)? N/A
2. the facility's current and proposed cooling source(s)? N/A

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___Yes __X_No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

The Project proposes complete replacement of the 10.35-mile O15N Line. The O15N Line is an integral part of NEP's transmission system and connects NEP's Ware Substation and Palmer Substation, serving customers in Ware, Hardwick, Palmer, Monson, and Brimfield. Replacing the Existing Line will maintain and improve the reliability of the transmission system and service to these areas. There are no taps or other substations on the line, so there are no impacts on any other energy facilities or services.

III. Consistency

Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

The Project is consistent with the following federal, state and local plans:

- **The federal Energy Policy Act encourages modernization of the energy grid, improved reliability, and enhanced capacity for renewable energy sources. The Rebuilt Line meets these objectives.**
- **While the primary Project purpose is to address the poor asset condition of the exsiting line, mitigate potential risks of electrical failure, and to provide long-term reliable delivery of electrical service, the more robust system will also enable the future integration of additional clean energy generated by renewables suppliers, expansion of electrification projects in the area, and will support increased usage of electric vehicles and the associated installation of electric charging**

stations, consistent with the Green Communities Act. The Project will meet the identified need in a reliable, cost-effective, and environmentally benign manner and therefore, is consistent with the Green Communities Act.

- **Consistent with the Global Warming Solutions Act and the Roadmap Act, NEP has taken steps to promote climate change adaptation and resiliency in the design of the Project and continues to consider climate change and long-term infrastructure resiliency as an important goal in its long-term infrastructure planning. The Project will result in a more climate-ready and resilient transmission system that can withstand more extreme weather events; address existing system capacity shortages and increased demand; and support future interconnections from renewable energy projects. In addition, the Project uses an existing ROW, thereby minimizing alteration of new land resources to construct the Project.**
- **The Project will not only improve the reliability of the transmission system, but the Rebuilt Line will also be able to accommodate future increased injections of renewable and other clean energy resources, such as new energy storage units, solar and wind. Accordingly, the Project is consistent with the Energy Diversity Act as amended by the Clean Energy Act.**

AIR QUALITY SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes **_X__ No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ___ Yes **_X__ No**; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)? ___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

	Existing	Change	Total
Particulate matter	________	________	________
Carbon monoxide	________	________	________
Sulfur dioxide	________	________	________
Volatile organic compounds	________	________	________
Oxides of nitrogen	________	________	________
Lead	________	________	________
Any hazardous air pollutant	________	________	________
Carbon dioxide	________	________	________

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes **_X_ No**; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? ___ Yes **_X_ No**; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Treatment, processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Recycling	________	________	________
Treatment	________	________	________
Disposal	________	________	________

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos?
___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. Consistency

Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts

A. Have you consulted with the Massachusetts Historical Commission? **_X__ Yes** ___ No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ____Yes _X__ No; if yes, attach correspondence

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes **_X__ No**; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes ___ No; if yes, please describe:

C. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes **_X__ No**; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe:

D. If you answered "No" to <u>all parts of both</u> questions A, B and C, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to <u>any part of either</u> question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts

Describe and assess the project's impacts, direct and indirect, on listed or inventoried historical and archaeological resources:

III. Consistency

Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:

CLIMATE CHANGE ADAPTATION AND RESILIENCY SECTION

This section of the Environmental Notification Form (ENF) solicits information and disclosures related to climate change adaptation and resiliency, in accordance with the MEPA Interim Protocol on Climate Change Adaptation and Resiliency (the "MEPA Interim Protocol"), effective October 1, 2021. The Interim Protocol builds on the analysis and recommendations of the 2018 Massachusetts Integrated State Hazard Mitigation and Climate Adaptation Plan (SHMCAP), and incorporates the efforts of the Resilient Massachusetts Action Team (RMAT), the inter-agency steering committee responsible for implementation, monitoring, and maintenance of the SHMCAP, including the "Climate Resilience Design Standards and Guidelines" project. The RMAT team recently released the RMAT Climate Resilience Design Standards Tool, which is available here.

The MEPA Interim Protocol is intended to gather project-level data in a standardized manner that will both inform the MEPA review process and assist the RMAT team in evaluating the accuracy and effectiveness of the RMAT Climate Resilience Design Standards Tool. Once this testing process is completed, the MEPA Office anticipates developing a formal Climate Change Adaptation and Resiliency Policy through a public stakeholder process. Questions about the RMAT Climate Resilience Design Standards Tool can be directed to rmat@mass.gov.

All Proponents must complete the following section, referencing as appropriate the results of the output report generated by the RMAT Climate Resilience Design Standards Tool and attached to the ENF. In completing this section, Proponents are encouraged, but not required at this time, to utilize the recommended design standards and associated Tier 1/2/3 methodologies outlined in the RMAT Climate Resilience Design Standards Tool to analyze the project design. However, Proponents are requested to respond to a respond to a user feedback survey on the RMAT website or to provide feedback to rmat@mass.gov, which will be used by the RMAT team to further refine the tool. Proponents are also encouraged to consult general guidance and best practices as described in the RMAT Climate Resilience Design Guidelines.

Climate Change Adaptation and Resiliency Strategies

I. Has the project taken measures to adapt to climate change for all of the climate parameters analyzed in the RMAT Climate Resilience Design Standards Tool (sea level rise/storm surge, extreme precipitation (urban or riverine flooding), extreme heat)? **_X__Yes** __ No

Note: Climate adaptation and resiliency strategies include actions that seek to reduce vulnerability to anticipated climate risks and improve resiliency for future climate conditions. Examples of climate adaptation and resiliency strategies include flood barriers, increased stormwater infiltration, living shorelines, elevated infrastructure, increased tree canopy, etc. Projects should address any planning priorities identified by the affected municipality through the Municipal Vulnerability Preparedness (MVP) program or other planning efforts, and should consider a flexible adaptive pathways approach, an adaptation best practice that encourages design strategies that adapt over time to respond to changing climate conditions. General guidance and best practices for designing for climate risk are described in the RMAT Climate Resilience Design Guidelines.

A. If no, explain why.

B. If yes, describe the measures the project will take, including identifying the planning horizon and climate data used in designing project components. If applicable, specify the return period and design storm used (e.g., 100-year, 24-hour storm).

The Proponent incorporated resiliency measures into site and structure design considerations. The transmission line wire will be elevated high enough to prevent encountering potential flood water and new structures will be located outside of any regulatory floodways. The Project will be made more resilient through installation of

concrete caisson foundations, steel structures, and state of the art conductors that respond well to corrosion and operate at higher maximum operating temperatures. The Project is designed to adapt to extreme heat events and extreme precipitation, as described in more detail in Section 4.3 of Chapter 4, *Climate Change Preparedness and Resiliency*.

C. Is the project contributing to regional adaptation strategies? __ Yes _**X**_ No; If yes, describe.

II. Has the Proponent considered alternative locations for the project in light of climate change risks? __ Yes **_X_ No**

A. If no, explain why.
The climate risks associated with this Project are minimal and do not require relocation due to climate risks. Since the Project is being constructed within its existing ROW, the Project also will not lead to any additional or new climate change risks.

B. If yes, describe alternatives considered.

III. Is the project located in Land Subject to Coastal Storm Flowage (LSCSF) or Bordering Land Subject to Flooding (BLSF) as defined in the Wetlands Protection Act? **__X__Yes** __X__No

There is 100-year floodplain (BLSF) that crosses the ROW associated with Kings Brook in Palmer; however, there is no work proposed in this location.

If yes, describe how/whether proposed changes to the site's topography (including the addition of fill) will result in changes to floodwater flow paths and/or velocities that could impact adjacent properties or the functioning of the floodplain. General guidance on providing this analysis can be found in the CZM/MassDEP Coastal Wetlands Manual, available here.

The Project will have no impacts to BLSF. The Rebuilt Line will cross above the 100-year floodplain but no work is proposed within the BLSF. The Project will not result in changes to the 100-year floodplain that crosses the Project ROW in Palmer.

ENVIRONMENTAL JUSTICE SECTION

I. Identifying Characteristics of EJ Populations

A. If an Environmental Justice (EJ) population has been identified as located in whole or in part within 5 miles of the project site, describe the characteristics of each EJ populations as identified in the EJ Maps Viewer (i.e., the census block group identification number and EJ characteristics of “Minority,” “Minority and Income,” etc.). Provide a breakdown of those EJ populations within 1 mile of the project site, and those within 5 miles of the site.

The Project Site is not located within an EJ population census tract. There are three EJ communities located within a 1-mile radius of the Project Site, which meet the EJ criteria based on Income. There are ten EJ communities located within a 5-miles radius of the Project Site, which meet the EJ criteria based on Minority and Income, and Income. The characteristics and breakdown of EJ Populations within 1 and 5 miles of the Project Site are described in Section 5.1.1 of Chapter 5, *Environmental Justice and Public Health*.

B. Identify all languages identified in the “Languages Spoken in Massachusetts” tab of the EJ Maps Viewer as spoken by 5 percent or more of the EJ population who also identify as not speaking English “very well.” The languages should be identified for each census tract located in whole or in part within 1 mile and 5 miles of the project site, regardless of whether such census tract contains any designated EJ populations.

According to the “Languages Spoken in Massachusetts” tab of MEPA’s EJ Maps Viewer, there are no census tracts within the DGA (1-mile radius) or within 5 miles radius of the Project Site wherein 5 percent or more of the population report that they do not speak English “very well.”

C. If the list of languages identified under Section I.B. has been modified with approval of the EEA EJ Director, provide a list of approved languages that the project will use to provide public involvement opportunities during the course of MEPA review. If the list has been expanded by the Proponent (without input from the EEA EJ Director), provide a list of the additional languages that will be used to provide public involvement opportunities during the course of MEPA review as required by Part II of the MEPA Public Involvement Protocol for Environmental Justice Populations (“MEPA EJ Public Involvement Protocol”). If the project is exempt from Part II of the protocol, please specify.

The list of languages has not been modified. Consultations with municipal officials in the project area identified Spanish as another language that is spoken by some residents, If requested, the Proponent can provide Spanish-language oral interpretation at the MEPA Site Consultation public meeting and any subsequent public/community meetings held during the MEPA review process to ensure meaningful community engagement.

II. Potential Effects on EJ Populations

A. If an EJ population has been identified using the EJ Maps Viewer within 1 mile of the project site, describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

There are three EJ communities within 1 mile of the Project site, designated based on Income. The Project does not pass through any EJ populations. No effects on the identified EJ populations are anticipated from the Project. Short term impacts related to construction are anticipated; however, through best management practices there are no anticipated disproportionate or adverse effects on identified EJ Populations.

Since Project impacts on EJ populations are not anticipated, the Project will not materially exacerbate any existing unfair or inequitable environmental or public health burden impacting the EJ population. Overall, the Project will improve transmission system infrastructure, support electrification goals, and comply with comprehensive regional plans for maintaining electric transmission reliability in New England, for EJ and non-EJ Populations alike.

B. If an EJ population has been identified using the EJ Maps Viewer within 5 miles of the project site, will the project: (i) meet or exceed MEPA review thresholds under 301 CMR 11.03(8)(a)-(b) __ Yes **_X_ No**; or (ii) generate150 or more new average daily trips (adt) of diesel vehicle traffic, excluding public transit trips, over a duration of 1 year or more. ___ Yes **_X_ No**

C. If you answered “Yes” to either question in Section II.B., describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

Not Applicable

III. Public Involvement Activities

A. Provide a description of activities conducted prior to filing to promote public involvement by EJ populations, in accordance with Part II of the MEPA EJ Public Involvement Protocol. In particular:

1. If advance notification was provided under Part II.A., attach a copy of the Environmental Justice Screening Form and provide list of CBOs/tribes contacted (with dates). Copies of email correspondence can be attached in lieu of a separate list.

2. State how CBOs and tribes were informed of ways to request a community meeting, and if any meeting was requested. If public meetings were held, describe any issues of concern that were raised at such meetings, and any steps taken (including modifications to the project design) to address such concerns.

3. If the project is exempt from Part II of the protocol, please specify.

A copy of the Environmental Justice Screening Form is included in Appendix D and the list of CBOs/tribes contacted is included in the MEPA Distribution List attached as Appendix A. Contact information was provided in the EJ Screening Form to allow interested parties to request a meeting regarding this Project. The Proponent has not received any requests until date. As per the requirements stated under Section II of the Public Involvement Protocol, “Measures to Enhance Public Involvement Prior to Filing ENF”, the Proponent has made a meaningful effort to engage with the community prior to this EENF filing. The Proponent has taken the following enhanced public outreach measures:

- **Two open houses were held in Ware (May 22, 2024) and Palmer (May 28, 2024) to which invitations were sent to the CBOs and tribal organizations in addition to all**

abutters within 300 feet of the Project route in Ware, Palmer, and West Brookfield. The Proponent also presented the Project in-person to the Ware Board of Selectmen on April 16, 2024, and Palmer Town Council on May 13, 2024; and provided a copy of the presentationvia email to the West Brookfield Board of Selectmen on March 27, 2024 (the Board declined an offer for an in-person presentation). These meetings are described in further detail in Section 1.6 of Chapter 1, *Project Description*.

- **A Project website was launched to publicly broadcast project information and provide another location to access public filings (https://palmertowareimprovementproject.com).**
- **The Proponent completed the 45-day advanced notification of the Project by circulating the MEPA EJ Screening Form (refer to Appendix D) to the MEPA-determined EJ CBO list on April 16, 2024, and again on July 16, 2024, and provided contact information therein for interested parties to request an in-person/virtual meeting regarding the Project.**
- **The Proponent published the EENF public notice in the *Worcester Telegram* newspaper concurrent with the filing of this EENF.**
- **A hard copy of the ENF filing has been provided at local library locations within approximately 1 mile of the Project Site, including the Young Men's Library Association in Ware, Palmer Public Library in Palmer, and Merriam-Gilbert Public Library in West Brookfield.**

The Proponent also held a pre-filing meeting with the MEPA Office on May 23, 2024. During this meeting, the Proponent and MEPA staff discussed the need for Environmental Justice Protocol compliance as the Project Site is located within one mile of an EJ population, and the Proponent provided an overview of the pre-filing public outreach held to date.

The requested list of CBOs/tribes is included in the MEPA Distribution List included as Appendix A and the EJ Screening Form is included in Appendix D.

B. Provide below (or attach) a distribution list (if different from the list in Section III.A. above) of CBOs and tribes, or other individuals or entities the Proponent intends to maintain for the notice of the MEPA Site Visit and circulation of other materials and notices during the course of MEPA review.

The Proponent will use the same distribution list as the one in Section III.A.

C. Describe (or submit as a separate document) the Proponent's plan to maintain the same level of community engagement throughout the MEPA review process, as conducted prior to filing.

Following the filing of this EENF, the Proponent will hold a public site consultation to present the Project to the MEPA office, state agencies, and the public. This presentation will also provide the attendees with the opportunity to ask questions about the Project. This will provide the public direct access to the Proponent and project team, allowing them to inquire about Project specifics and better understand how impacts will be mitigated. Even though there are no Census Tracts within one mile of the Project Site in which there are "Languages other than English spoken by 5% or more of the population who do not speak English very well," the Proponent will offer Spanish-language translation services on an as-requested basis based on consultation with local officials. The Proponent will also invite state, tribal, and local community groups to the virtual site consultation.

The Proponent will also continue to communicate with local officials and the public through quarterly update meetings, the Energy Facilities Siting Board process, and via the Project website.

Please refer to Table 5-3 of Chapter 5, *Environmental Justice and Public Health,* for a summary of the proposed outreach plan that will be implemented during the MEPA review process. This plan was developed through guidance provided in MEPA's Public Involvement Protocol for Environmental Justice Populations.

CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

   (Name) **Worcester Telegram** (Date) **August 23, 2024**

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

8/14/24 Rucha Ragalwar

Date	Signature of Responsible Officer or Proponent	Date	Signature of person preparing ENF (if different from above)

Kevin O'Brion	Rucha Ragalwar
Name (print or type)	Name (print or type)
New England Power Company d/b/a National Grid	VHB
Firm/Agency	Firm/Agency
170 Data Drive	260 Arsenal Place #2
Street	Street
Waltham	Watertown
Municipality/State/Zip	Municipality/State/Zip
(781) 663-3137	617.607.2713
Phone	Phone

1 Project Description

New England Power Company d/b/a National Grid (the "Proponent" or "NEP") is submitting this Expanded Environmental Notification Form ("EENF") in accordance with the Massachusetts Environmental Policy Act ("MEPA"), Massachusetts General Law ("G.L.") Chapter 30, Section 61-62I and the regulations promulgated thereunder set forth at 301 CMR 11.00, for proposed upgrades to an existing 10.35-mile-long overhead electrical transmission line (the "Project") that originates at Palmer Substation #503 located southeast of downtown Palmer, crosses Route 20 and the Massachusetts Turnpike, and continues northeast until it crosses Route 9 and Route 32, terminating at the Ware Substation #501 northeast of downtown Ware (the "Project Site"). Refer to Figure 1.1 for the site location map.

The Project will rebuild the existing line to address widespread damage to the existing structures, improve telecommunications between the two substations, and improve reliability of the transmission line ("Rebuilt Line"). The transmission line will be moved to the center of the existing right-of-way ("ROW"), completely replacing the existing structures, conductor, and shield wire. The Rebuilt Line will contain fewer structures, removing the existing 147 structures and installing 112 new steel structures. Work will include minor vegetation management, upgrading existing access, and creating new access as required to construct and maintain the rebuilt line. The line will be rebuilt with steel structures and will be operated at 69 kilovolts ("kV") but designed to allow future operation at 115 kV to support long term electric load growth.

This EENF is being submitted as the initial filing for review under MEPA. Pursuant to 301 CMR 11.06(8), the Proponent respectfully requests that that the Secretary of Energy and Environmental Affairs ("EEA") consider granting a Single Environmental Impact Report ("SEIR").

1.1 Project Overview

The NEP transmission system is an integral part of the regional power system, transmitting electricity to support regional electricity markets and delivering electricity to customers throughout New England. The need for the Project stems from the Proponent's fundamental obligation as an electric company to provide safe and reliable transmission service to residential, commercial, and industrial customers throughout its service territory. In addition, maintaining system reliability is critical to support recent local, state, and federal climate change and electrification policies that are aimed at addressing the adverse effects of climate change and eliminating reliance on fossil fuels by increasing the use of electric vehicles and electric heating applications.

To maintain the integrity of this system, the Proponent must ensure that adequate and reliable transmission capacity is available to meet existing and projected load requirements and that a secure and reliable telecommunications network is in place to strengthen the security and resilience of critical infrastructure. The grid is designed to meet reliability standards and criteria developed by North American Electric Reliability Commission ("NERC"), which sets the minimum standards for electric power transmission for all North America, the Northeast Power Coordinating Council, Inc. ("NPCC") and the Independent System Operator – New England ("ISO-NE").

Accordingly, to ensure that its transmission assets are and will remain in condition to meet these objectives, the Proponent evaluates the reliability and condition of its assets to determine whether they should be replaced before their performance negatively impacts the provision of safe and reliable service. The need for the Project is consistent with the Proponent's proactive approach to ensure continued reliability of its transmission system.

A review of the 69 kV O15N transmission line's (the "Existing Line") recent operating history, design, and physical condition demonstrates that it should be rebuilt to ensure reliable service. The Existing Line has inherent design characteristics that compromise the Proponent's ability to provide reliable service, including the Line's off-center location within the existing ROW resulting in increased outage risk due to fallen trees, poor access for maintenance and outage restoration, and widespread woodpecker damage and structure deterioration. In addition, the Project is needed to provide increased shielding to protect the line from lightning and fiber optic capability to improve telecommunications.

In light of these concerns, the Proponent proposes to replace the Existing Line with a rebuilt line within the existing ROW (the "Rebuilt Line"). The Project also includes installation of a new optical ground wire ("OPGW"), which will provide improved communications in the area by enabling connection to the fiber already on the W175 Line at Palmer Substation and the planned fiber at Ware Substation. The Rebuilt Line will be designed with additional capacity to meet existing load requirements with additional capacity to carry increasing transfers of power over time to support electrification within the Commonwealth. The Rebuilt Lines and Taps will initially be operated at 69 kV but will be designed to allow for operation at 115 kV if it becomes necessary in the future.

1.2 Site Context and Existing Conditions

The Project Site is the existing O15N electric transmission line ROW in Palmer, West Brookfield, and Ware. The Existing Line is situated entirely within existing ROWs comprised of NEP easements or land owned in fee (the "Project Site"). The existing, maintained O15N ROW encompasses approximately 10.35 miles of the Project Route and varies between 100 and 200 feet wide, with heavy vegetation and tall trees on both sides of the circuit outside of the ROW for its entire length. The ROW encompasses approximately 150 acres.

The Existing Line is located primarily in forested and rural land. The existing ROW consists mostly of scrub-shrub and meadow habitat maintained by the Proponent through periodic vegetation mowing, cutting, and removal of hazard trees. Vegetation management is necessary to control tree growth in and along the ROW so that it does not interfere with the lines and structures, and to allow access for maintenance and response actions to emergencies.

Land use outside of the maintained part of the ROW is predominantly woodland, but also includes residential, agricultural, and light industrial uses. Existing access roads traverse parts of the ROW; however, much of the ROW is extremely hilly and rocky, and access is limited. The sloping terrain of the ROW, the fact that few roads intersect the ROW, and the poor condition of existing access roads makes it difficult for machinery to reach the ROW, which increases restoration time during outages. Traversing from south to north, the ROW crosses Park Street, Flynt Street, Thompson Street, Interstate Route 90 (the "Massachusetts Turnpike"), Peterson Road, Smith Street, Old Warren Road, and West Ware Road in Palmer; Prendiville Road and Gilbertville Road in Ware; and West Main Street in West Brookfield.

Wetlands and water bodies under federal jurisdiction (U.S. Environmental Protection Agency and U.S. Army Corps of Engineers), state jurisdiction, (Massachusetts Department of Environmental Protection), and local jurisdiction (Conservation Commissions of Palmer, Ware, and West Brookfield) intersect the ROW. The following resource areas have been identified in the ROW based on publicly available data and field delineation, respectively: land subject to flooding; and vegetated wetlands and intermittent and perennial streams. The Massachusetts Wetlands Protection Act also protects a 100-foot Buffer Zone ('BZ") from wetlands and waterways, and a 200-foot Riverfront Area ("RFA") from perennial streams. The wetlands and water bodies are further described in Chapter 3, *Natural Resources and Stormwater Management*.

The Project Site also includes land designated as Priority and Estimated Habitat by the Massachusetts Division of Fisheries and Wildlife's Natural Heritage and Endangered Species Program ("NHESP") for certain state-listed protected species. Field surveys have been completed to identify plant locations for avoidance during project design and construction. Protected species are described in Section 3.2 of Chapter 3, *Natural Resources and Stormwater Management,* and Priority and Estimated Habitat areas are identified in Figure 3.3.

1.2.1 Existing Line

The O15N Line is approximately 10.35 miles in length and connects NEP's Ware #501 Substation and Palmer #503 Substation. The Ware Substation serves Massachusetts Electric customers in Ware and Hardwick. The Palmer Substation serves Massachusetts Electric customers in Palmer, Monson and Brimfield.

The Existing Line traverses the Massachusetts towns of Ware, West Brookfield, and Palmer. There are no taps or other substations on the Existing Line. From Ware Substation south for approximately eight miles to Structure 118, the O15N Line is the only circuit in the ROW. For the remaining approximately two miles to the Palmer Substation, the Existing Line shares the ROW with the Proponent's 115 kV X-176 Line.

The eight-mile stretch of the ROW from the Ware Substation to Structure 118 is approximately 100 feet wide and is generally cleared to the edge of the Project Site's easement rights. In the remaining two miles to the Palmer Substation, the ROW is approximately 200 feet wide and similarly cleared to the edge of its easement rights. Heavy vegetation and tall trees are located on either side of the circuit outside of the ROW. For its entire length, the Existing Line is off-center, with the outermost conductor only approximately 30 feet away from the edge of the ROW.

The Existing Line consists of a total of 147 structures, including 125 wood suspension structures, 14 wood dead-end structures, six steel H-frame steel suspension structures, and two steel H-frame dead-end structures. The structures range in height from approximately 50 to 90 feet above ground. The majority of the structures are in a pole arm configuration with a chair frame design with horizontal framing. There is one shield wire at the top location on the poles.

The Existing Line was constructed and put into operation in 1955. The majority of the wood poles were replaced in the 1990s and the existing shield wire was installed in 1993. In 2009, one structure was replaced, which was in poor condition. In 2021, the Proponent replaced six wood polearm structures with light duty steel structures due to woodpecker issues.

Refer to Appendix B for the detailed plan set that shows the location of the Existing Line and Figure 1.3 for a representative cross-section of the Existing Line.

Recent analyses and studies demonstrate that the Existing Line is in poor condition and needs to be rebuilt. Specifically:

- The Existing Line has a history of poor performance; in the past 25 years, the Existing Line experienced 32 outages due to lightning, heavy thunderstorms, and fallen trees.
- A physical review of the condition of the Existing Line found widespread damage to the line's wooden structures caused by woodpecker activity, which poses a threat to the reliability of the transmission system.
- Broader physical issues related to the off-center location of the transmission line in the ROW and the physical geometry of the existing shield wires, which do not adequately protect the conductors from lightning strikes due to shielding angles less than 30 degrees, likely contribute to the poor performance of the Existing Line.
- Increased fiber optic capability is needed to serve protection and telecommunications needs. The existing circuit does not contain any fiber or communication technology.

1.2.2 Surrounding Land Uses

Parcel data from MassGIS was used to identify land uses along the route, based on parcel designation. As listed in Table 1-1, land uses along the Project Route are predominantly Exempt Properties and residential areas, interspersed with vacant and industrial uses. Land use types along the Project Route are also shown in Figure 1.2.

Table 1-1: Land Uses Within the Project ROW and 300-foot Buffer to ROW

Land Use Type	Project Route (Acres)	
	Within Existing ROW	300-foot Buffer to Existing ROW
Agricultural/Horticultural	7	25
Commercial	4	20
Exempt Property	53	288
Forest Land	10	41
Industrial	16	45
Residential	38	171
Vacant	21	108
Right-of-Way	5	25
Total	**155**	**723**

As shown in Table 1-1, the primary land use on the Project ROW and within 300 feet consists of approximately 341 acres of Exempt Property. Exempt Property associated with the Project includes land owned primarily by municipalities and the Massachusetts Department of Fish and Game ("DFG"). Municipal properties include the Midura Family Conservation Area and the King's Brook Conservation Area in Palmer. The DFG properties include the Cory Hill Wildlife Management Area and the Palmer Wildlife Management Area.

Secondarily, approximately 38 acres and 171 acres of land on Project ROW and within 300 feet are classified as residential land use, respectively. Adjacent to the Project Route, residential development occurs primarily at existing roadway crossings or roads running parallel to the right of way, such as Gilbertsville Road in Ware and West Ware Road, Saint John Street, Thompson Street, and Old Farm Road in Palmer. There are no residences within the ROW. The closest residence is located 18 feet from the Project ROW.

Table 1-2: Residences Adjacent to the Project Route

Project Component	Residences within 50-ft of ROW	Residences within 100 ft of ROW	Residences within 200 ft of ROW	Residences within 300 ft of ROW
O15N ROW	2	5	9	21

Source: MassGIS; VHB

Industrial development is minimal along and within the Project ROW. Palmer Paving Corporation has a production facility along Blanchard Street. Other significant industrial areas are all operated by NEP. The primary commercial area near the ROW is the Palmer Motorsports Track. Thirty acres of ROW land use includes transportation corridors such as Interstate 90, CSX railroad line, and MassDOT roads.

Sensitive receptor land uses are defined as public facilities including hospitals, elder care facilities and nursing homes, public and private schools, cemeteries, licensed daycares, district courts, police stations, fire stations, and places of worship. No sensitive receptors are located within 300 feet of the Project ROW.

NEP has evaluated potential impacts within the Project ROWs, as well as adjacent lands within 300 feet, and did not identify any potential impacts to abutting stakeholders during construction.

1.3 Project Description

The proposed Project includes rebuilding the entire O15N Line. The Rebuilt Line will generally be constructed on light-duty steel single-pole braced-post structures at suspension locations ranging in height from approximately 75 feet to 110 feet above ground. All structures will be replaced with steel structures. The majority of structures on the Rebuilt Line will be directly embedded. Dead-end structures will be engineered steel single-pole davit arm structures, with the exception of the portion of the line that goes under the existing 345 kV 301 Line north of Smith Street in Palmer, which will use engineered steel H-frame dead-ends. Tangent structures will be replaced with Light Duty (LD) steel braced suspension structures. The steel single-pole davit-arm dead-end structures along the Rebuilt Line and the steel H-Frame dead-ends will be supported by concrete caisson foundations. The proposed caisson foundations are larger than the existing footprint of existing wood pole structures. The 21 caisson foundations will range in size from 6 feet to 8 feet in diameter, as compared to the existing wood poles, which are approximately 14-inches wide. Alternative foundation types such as helical piles, steel vibratory caisson foundations or micro pile foundations may be utilized if warranted by site conditions or other factors. The existing steel shield wire will be replaced with OPGW and include 15 OPGW splice boxes.

The Project will remove 147 structures and install 112 structures including:

- 88 light-duty steel braced-post structures;
- Structure 1 as an engineered steel pole vertical dead-end structure;
- Structures 87 and 88 as engineered steel H-Frame dead-end structures; and
- 21 engineered steel single-pole davit arm dead-end structures

Project construction will be contained within the existing O15N ROW. Additional access roads will be constructed within the ROW and improvements will be made to existing access. New road construction will consist of grading and laying gravel. Additionally, work pads will be constructed for structure removal and new pole installations. Work pads constructed in wetlands will consist of temporary construction mats. Work pads constructed in upland areas that are part of RFA, , or Priority/Estimated habitat will be graded and restored after construction of the Rebuilt Line is completed. Work pads in the remaining upland areas will be constructed through grading and installation of gravel.

Refer to Appendix B for the detailed plan set that shows the Proposed Project Layout.

1.3.1 Overhead Transmission Line Construction Sequence

Conventional overhead electric transmission line construction techniques will be used to construct the Rebuilt Line. The work will be completed in a progression of activities that will generally proceed as follows:

- Removal of vegetation and ROW mowing in advance of construction;

- Installation of soil erosion and sediment controls;
- Construction of access routes and access route improvements;
- Construction of work pads and staging areas;
- Installation of foundations and structures;
- Installation of conductor, OPGW, and shield wire;
- Removal and disposal of existing transmission line components; and
- Restoration and stabilization of the ROW.

1.4 Summary of Public Benefits

The main benefits associated with the Project are summarized below:

- The Project will address the need for improved reliability and telecommunications as the Proponent is invested in improving the electrical infrastructure through upgrades of the existing O15N Line;
- The Project will improve transmission system infrastructure and comply with comprehensive regional plans for maintaining electric transmission reliability in New England, for EJ and non-EJ Populations alike;
- Replacing the existing shield wire with OPGW will provide improved communications in the area by enabling connection to the fiber already on the W175 Line at Palmer Substation and the planned fiber at Ware Substation;
- Installation of OPGW will improve the Proponent’s ability to quickly repair damage to the line when it does occur;
- The Project will enable future load growth in the area and increased transfers of power over time to support electrification within the Commonwealth since the Rebuilt Line will be designed with additional capacity;
- Replacing the existing conductor with ACSS conductor will provide additional thermal capacity and voltage support if needed to support future electric load and, to interconnect future distributed energy resources;
- Moving to a single-pole configuration in the center of the corridor will minimize exposure to danger trees by narrowing the footprint and maximizing the distance between wires and trees; and
- Taller structures will also reduce opportunities for trees striking the line and will correct the poor shielding angle and avoid many of the outages caused by lightning.

1.5 Project Schedule and Cost

The Project is scheduled to begin access road improvements and light duty steel pole installation in July 2027. Installation of engineered steel poles is anticipated to begin in June of 2028. All work is anticipated to be completed by November 2028.

The estimated cost for the Project is approximately $65.62 million.

1.6 Summary of Agency and Community Outreach

As required by the MEPA Public Involvement Protocol for Environmental Justice Populations, NEP provided a copy of the EJ Screening Form to the Community-Based Organizations ("CBOs") and tribal organizations identified in Appendix A on April 15 and July 16, 2024.

NEP communicated with the West Brookfield Board of Selectmen on March 27, 2024. The Board declined an in-person meeting and indicated that sending the presentation via email would suffice. NEP presented the Project to the Ware Board of Selectmen on April 16, 2024, and Palmer Town Council on May 13, 2024.

In addition, NEP held two in-person open houses in Ware (May 22, 2024) and Palmer (May 28, 2024). Invitations to these Open Houses were sent to the CBOs and tribal organizations, designated in the Project's Environmental Justice Reference List (see Appendix A), in addition to all 300-foot abutters along the route in Ware, Palmer, and West Brookfield. The Open House invitations were posted in print publications during the weeks of May 13th and May 20th, specifically within *The Journal Register*, *Ware River News*, and *Quaboag Current*.

A Project website, hotline and email address have been created:

- https://www.palmertowareimprovementproject.com/index.htm
- (800) 674-9510
- info@O15Nproject.com

As the Project design and permitting progress, NEP will provide quarterly updates to interested parties, and translation services can be provided upon request.

Once permitting is complete and NEP is preparing for construction, pre-construction notifications will be provided to abutters and other interested parties, and regular project updates will be provided during construction. Periodic updates will also be available on the project website. When construction is complete, NEP will send a Project closeout notification.

1.7 Regulatory Compliance

This section identifies the anticipated permits and approvals, as well as Project compliance with applicable regulations.

1.7.1 Anticipated Permits & Approvals

Table 1-2 lists the anticipated permits and approvals which are presently expected to be required for the Project. It is possible that not all of these permits or actions will be required, or that additional permits may be needed as design is finalized.

Table 1-3 Anticipated Permits and Approvals

Agency	Review/Permit/Approval	Status
Federal		
U.S. Army Corps of Engineers ("USACE")	Section 404 Pre-Construction Notification (PCN) Section 106 Consultations	Projected filing Q2 2025
U.S. Fish and Wildlife Service ("USFWS")	Section 7 Consultation for Threatened and Endangered Species	Included in Section 404 process
Environmental Protection Agency ("USEPA")	National Pollutant Discharge Elimination System General Permit ("NPDES") Construction General Permit ("CGP")	Projected filing June 2027
Commonwealth of Massachusetts		
Energy Facilities Siting Board ("EFSB") / Department of Public Utilities ("DPU")	Approval to construct, G.L. c. 164, § 69J and 72	Projected filing July 2024
Executive Office of Energy and Environmental Affairs ("EEA")	MEPA Environmental Notification Form/Environmental Impact Report	This filing
Massachusetts Department of Environmental Protection ("MassDEP")	Section 401 Water Quality Certificate (Joint Filing with Section 404)	Projected filing Q2 2025
Massachusetts Department of Transportation ("MassDOT")	State Highway Access Permit	Projected filing Q1 2026
Massachusetts Division of Fisheries and Wildlife ("DFW") Natural Heritage and Endangered Species Program ("NHESP")	Massachusetts Endangered Species Act ("MESA") Project Review Checklist MESA Conservation and Management Permit	Projected filing Q3 2024 Potential - To be Determined based on ongoing consultation with NHESP
Massachusetts Historical Commission ("MHC")	Review of Historic Properties G.L. c. 9, §§ 26-27C	Included in this filing
Local		
Conservation Commissions (Palmer, Ware, West Brookfield)	Massachusetts Wetlands Protection Act and Palmer and Ware Wetland Bylaw Notices of Intent ("NOI")	Projected filing Q1 2026
West Brookfield Stormwater Authority	Town of West Brookfield Stormwater Bylaw	Projected filing Q1 2026

Note: This list is subject to change based upon the evolution of the Project's design.

1.7.2 Description of Regulatory Approvals

1.7.2.1 U.S. Army Corps of Engineers ("USACE")

It is anticipated that the Project will qualify for coverage under the Massachusetts Programmatic General Permit as a Pre-Construction Notification ("PCN") filing to the USACE. The Programmatic

General Permit contains a list of General Conditions that must be adhered to. Further details are described in Section 3.1.1.1 of Chapter 3, *Natural Resources and Stormwater Management*.

Compliance with Section 106 of the National Historic Preservation Act will be addressed as part of the Section 404 filing with USACE. No impacts to cultural resources are anticipated; see Section 6.2.7 for information regarding the historic and archaeological resources in the vicinity of the Project.

1.7.2.2 U.S. Fish and Wildlife Service ("USFWS")

Under the federal Endangered Species Act, Section 7, consultation is a key regulatory requirement set forth by the USFWS for any project potentially impacting federally threatened and endangered species. This process evaluates the potential for a proposed federal action to adversely affect any threatened or endangered species or critical habitat in the project area. Compliance with Section 7 of the ESA will be addressed as part of both the Section 404 filing with the USACE as well as the NPDES CGP filing with the USEPA. Further details are described in Section 3.2 of Chapter 3, *Natural Resources and Stormwater Management*.

1.7.2.3 U.S. Environmental Protection Agency ("USEPA")

The Project will require coverage under the NPDES 2022 CGP due to the anticipated disturbance of over an acre of land from proposed construction activities. The NPDES permit program, created in 1972 by the Clean Water Act ("CWA"), helps address water pollution by regulating point sources that discharge pollutants to waters of the United States. Further details are described in Section 3.1.1.2 of Chapter 3, *Natural Resources and Stormwater Management*.

1.7.2.4 Energy Facilities Siting Board/Department of Public Utilities ("EFSB/DPU")

The Project will require approvals from the EFSB and DPU. The Proponent will submit a petition to the EFSB application pursuant to G.L. c. 164, § 69J ("Section 69J Petition") for approval to rebuild the Existing Line at a higher voltage. Contemporaneous with the filing of the Section 69J Petition, the Proponent will file a petition with the DPU under G.L. c. 164, § 72 ("Section 72 Petition") requesting authority to continue to use, with altered construction, the Existing Line, and a determination that the Project is necessary and will serve the public convenience and be consistent with the public interest. The Proponent anticipates that these filings will be consolidated into a joint review process.

1.7.2.5 Massachusetts Environmental Policy Act ("MEPA")

MEPA and the regulations promulgated thereunder set forth impact reporting requirements for projects undertaken by agencies, departments, boards, commissions or authorities of the Commonwealth; projects seeking financial assistance from or the issuance of a permit by an agency of the Commonwealth; and projects otherwise subject to the reporting requirements of MEPA. The Project is subject to MEPA review because it requires one or more permits from state agencies and because it exceeds review thresholds pursuant to:

- 301 CMR 11.03(3)(a)1.a – Temporary alteration of one or more acres of Bordering Vegetated Wetlands (BVW);
- 301 CMR 11.03(3)(b)(1.d) – Temporary alteration of greater than 5,000 SF of BVW or Isolated Vegetated Wetlands (IVW); and

- 310 CMR 11.03(3)(b)1.f. Temporary alteration of ½ or more acres of any other wetlands.
- [Potential] 301 CMR 11.03(2)(b)(2) – Taking of an endangered or threatened species or species of special concern, provided that the Project site is two or more acres and includes an area mapped as Priority Site of Rare Species Habitat and Exemplary Natural Communities – To be Determined based on ongoing consultation with the Natural Heritage & Endangered Species Program (NHESP).

The Project location is also within one mile of an Environmental Justice population, necessitating an EIR.

1.7.2.6 Massachusetts Department of Environmental Protection ("MassDEP")

The Project will include 113 square feet of permanent dredge or fill material and 204,778 square feet of temporary dredged or fill material (including construction mats) in waters of the United States within the Commonwealth, which is subject to state water quality certification under 33 U.S.C. 1251. As currently proposed the Project will include113 square feet of permanent impacts and 199,967 square feet of temporary impacts to BVW, with 4,811 square feet of temporary impacts to land under water. NEP will provide a 1:1 replacement for permanently impacted BVW to comply with 310 CMR 10.55(4)(b). The Project will not result in any activity that would require conformance with the Massachusetts Stream Crossing Standards. Lastly, the Project is not anticipated to result in any impact to a Certified or Vernal Pool and does not propose fill within an Outstanding Resource Water, nor is it subject to any other categories identified at 314 CMR 9.04. Further details are described in Sections 3.1.1.2 of Chapter 3, *Natural Resources and Stormwater Management*.

1.7.2.7 Massachusetts Department of Transportation ("MassDOT")

Due to construction within or over a state roadway (Interstate 90/the Massachusetts Turnpike), a State Highway Access Permit (G.L. c. 81 § 21/G.L. c. 85 § 2) must be obtained. The Proponent will work with MassDOT to develop a construction Traffic Management Plan ("TMP"). 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;

- 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.

NEP will coordinate with local municipalities to review the TMP prior to the start of 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."

1.7.2.8 Natural Heritage & Endangered Species Program ("NHESP")

NHESP released the 15th Edition of the Natural Heritage Atlas on August 1, 2021. The Proponent submitted a formal Information Request to NHESP to identify rare species located in the Priority/Estimated Habitat that occurs within the O15N ROW. Based on the response from NHESP provided on August 3, 2022, a copy of which is provided in Appendix C, the Project is located in Priority/Estimated Habitat area (PH 1106 / EH 800). The species listed in these habitats are protected under MESA (G.L. c. 131A) and its implementing regulations (321 CMR 10.00). State-listed wildlife species are also protected under the state's Wetlands Protection Act (WPA) (G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Further details are described in Section 3.2.1 of Chapter 3, *Natural Resources and Stormwater Management*.

1.7.2.9 Massachusetts Historical Commission ("MHC")

The Project is located near known historic and archaeological cultural resources and may be subject to review by MHC for potential adverse effects to listed properties. A copy of this Expanded ENF will be provided to MHC to initiate their review.

1.7.2.10 Local Conservation Commissions

Based on the most current design, the Project will involve work within the following wetland resource areas subject to protection under the Massachusetts Wetlands Protection Act ("MWPA"): BVW, Bank, Land Under Water Bodies and Waterways ("LUWW"), and RFA. In addition, the Project will include activities within the 100-foot BZ, an area subject to regulation under the MWPA. As discussed in Chapter 2, *Alternatives Analysis*, the Proponent has evaluated reasonable alternatives. As the project design develops, NEP will continue to minimize impacts, and where impacts are unavoidable, appropriate mitigation will be provided. NEP will design the Project to meet all applicable MWPA performance standards. Further details are described in Section 3.1.1.3 of Chapter 3, *Natural Resources and Stormwater Management*.

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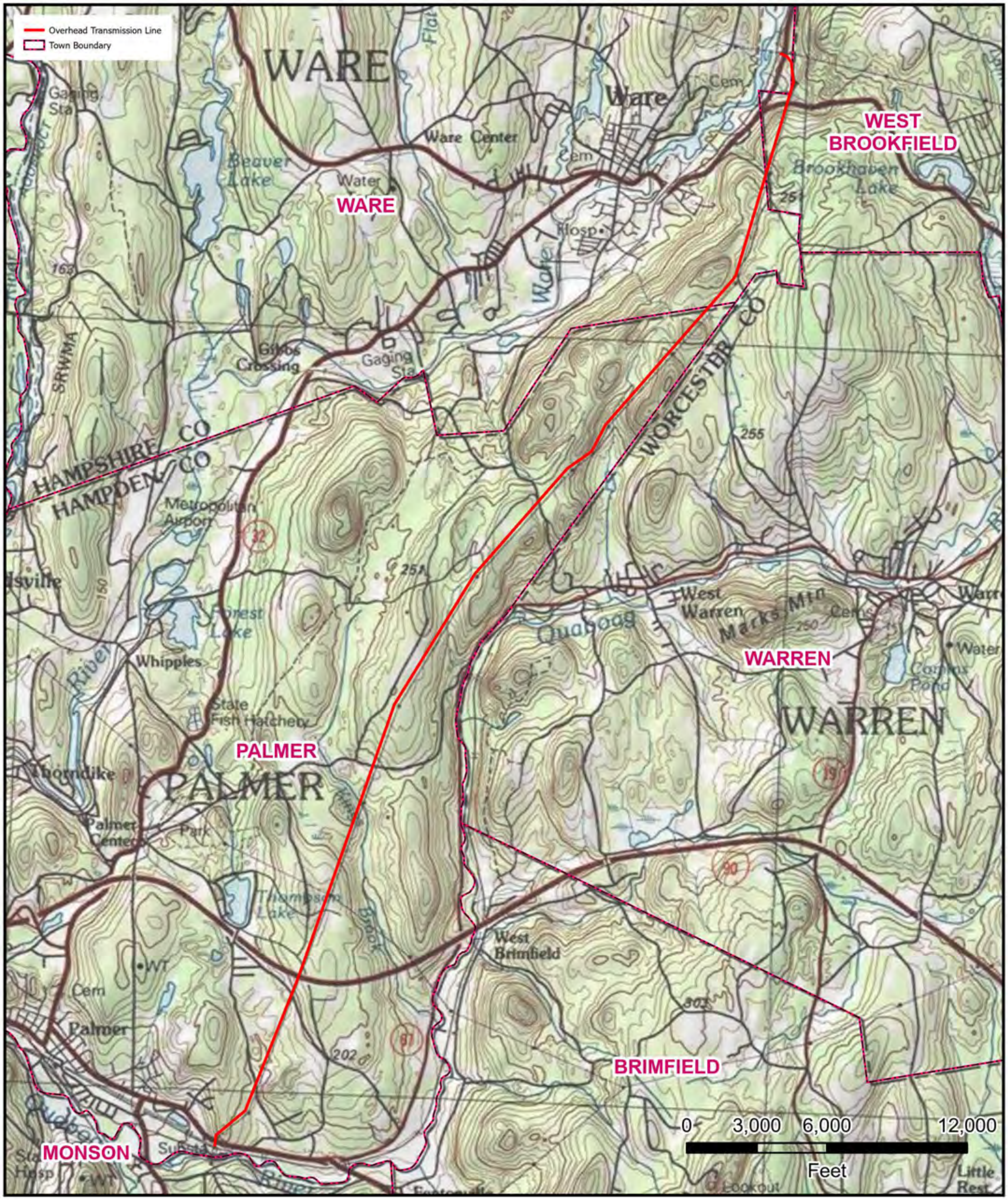

Scale

1:72,000

PALMER TO WARE IMPROVEMENT PROJECT

Figure 1.1: USGS Map
Ware, West Brookfield, and Palmer, Massachusetts
June 2024

nationalgrid

vhb

THIS DOCUMENT IS INTENDED FOR GENERAL PLANNING & INFORMATION PURPOSES ONLY. ALL MEASUREMENTS & LOCATIONS ARE APPROXIMATE

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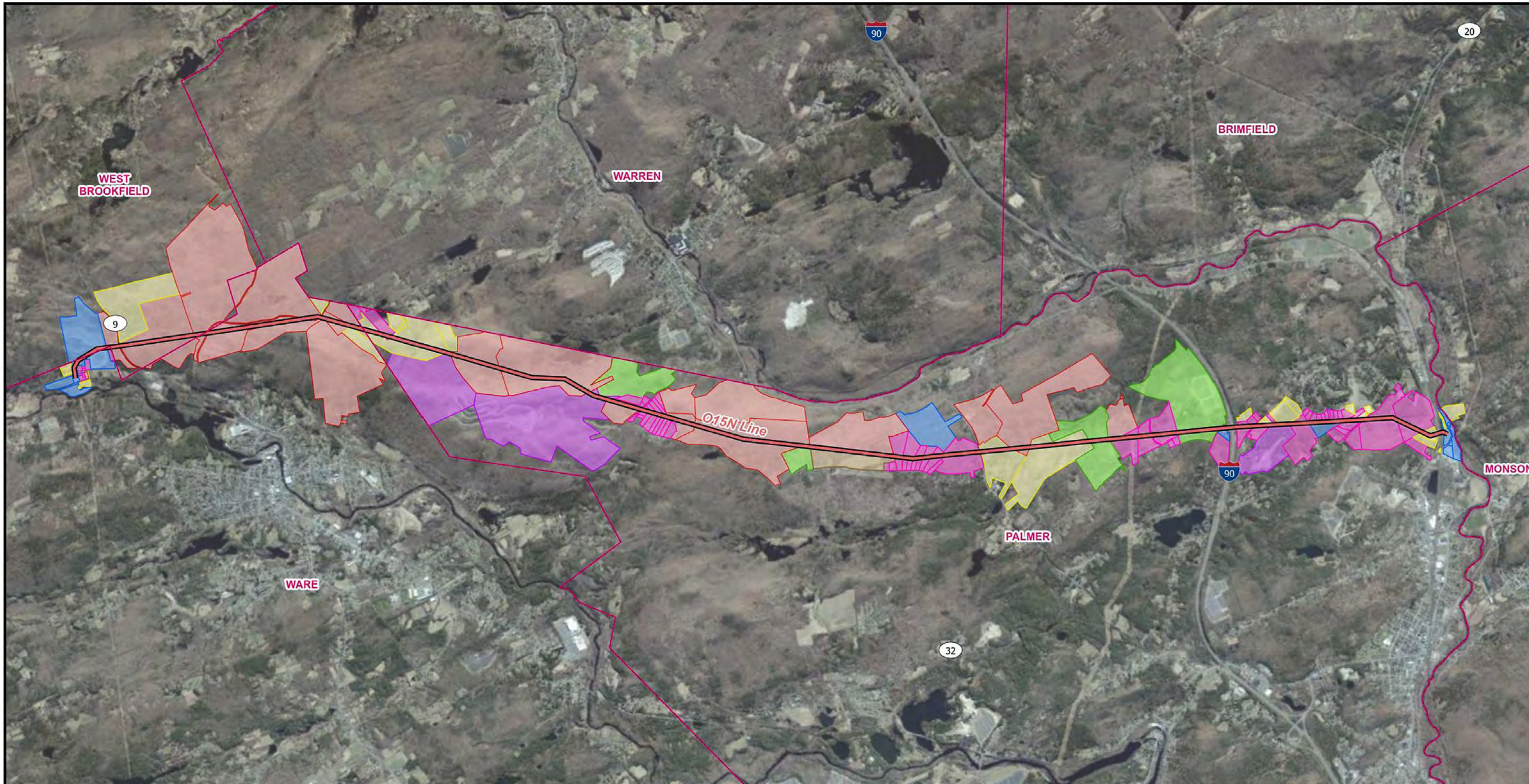
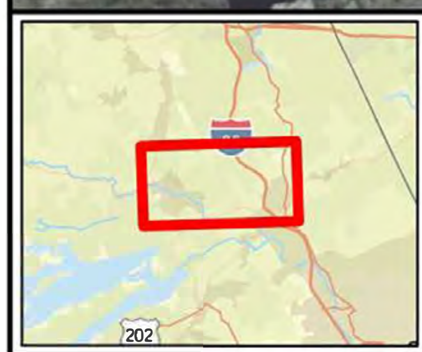




Existing O15N Transmission Line
Town Boundary

Agricultural/Horticultural
Commercial
Exempt
Forest Land
Industrial
Residential
Vacant

1:60,000
0 2,500 5,000 10,000
Feet

Palmer to Ware Improvement Project

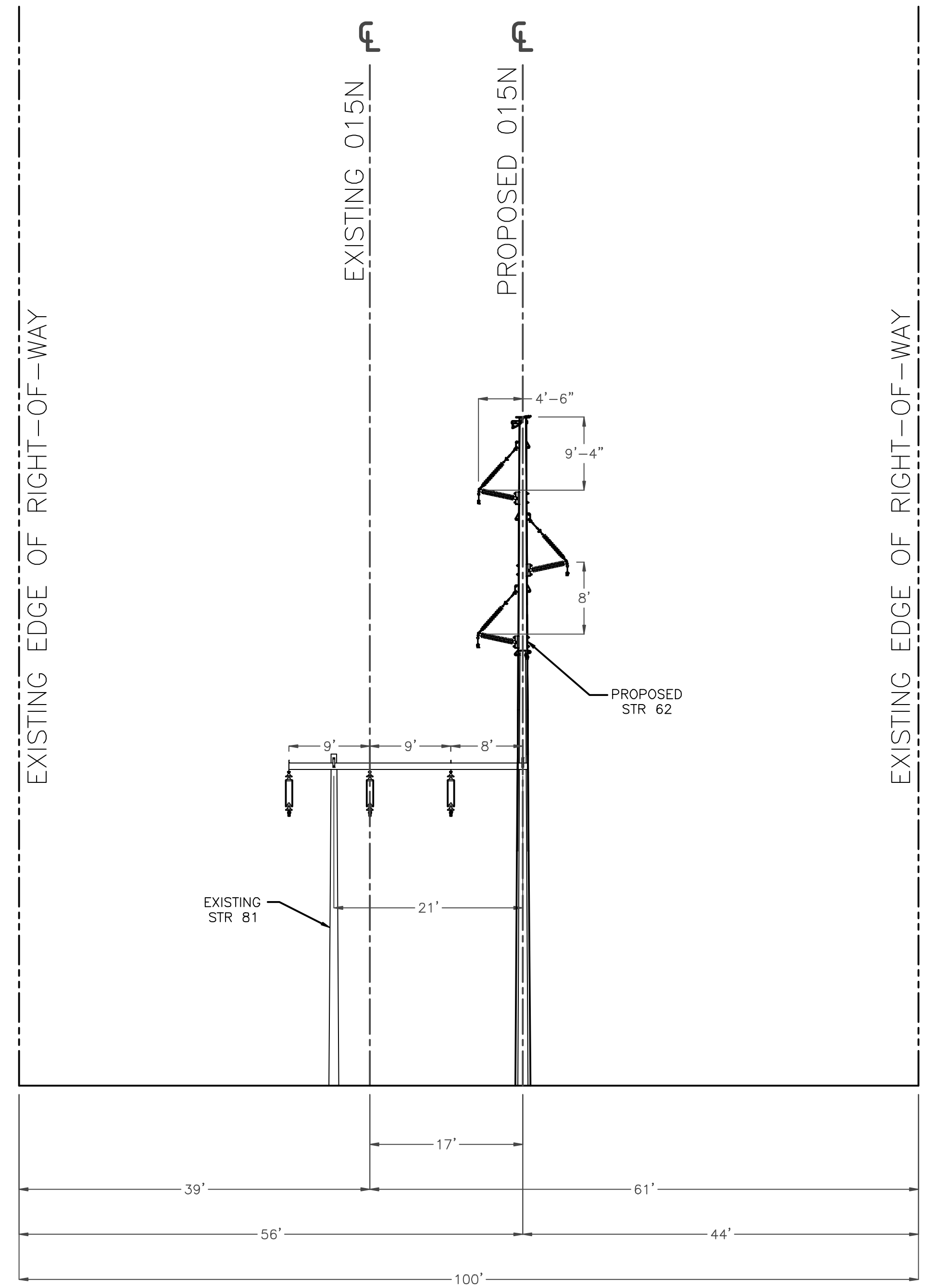
Ware, West Brookfield, and Palmer, MA
Figure 1.2: Surrounding Land Use
Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 7/24/2024

nationalgrid

vhb



OVERLAID CROSS SECTION
LOOKING TOWARDS PALMER SUBSTATION
WARE - PALMER ROW
EXISTING 100' WIDE CORRIDOR
WARE, MA
HAMPSHIRE COUNTY
MILE 0 TO MILE 8

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 1.3: Representative Cross-Section
Page 1 of 2

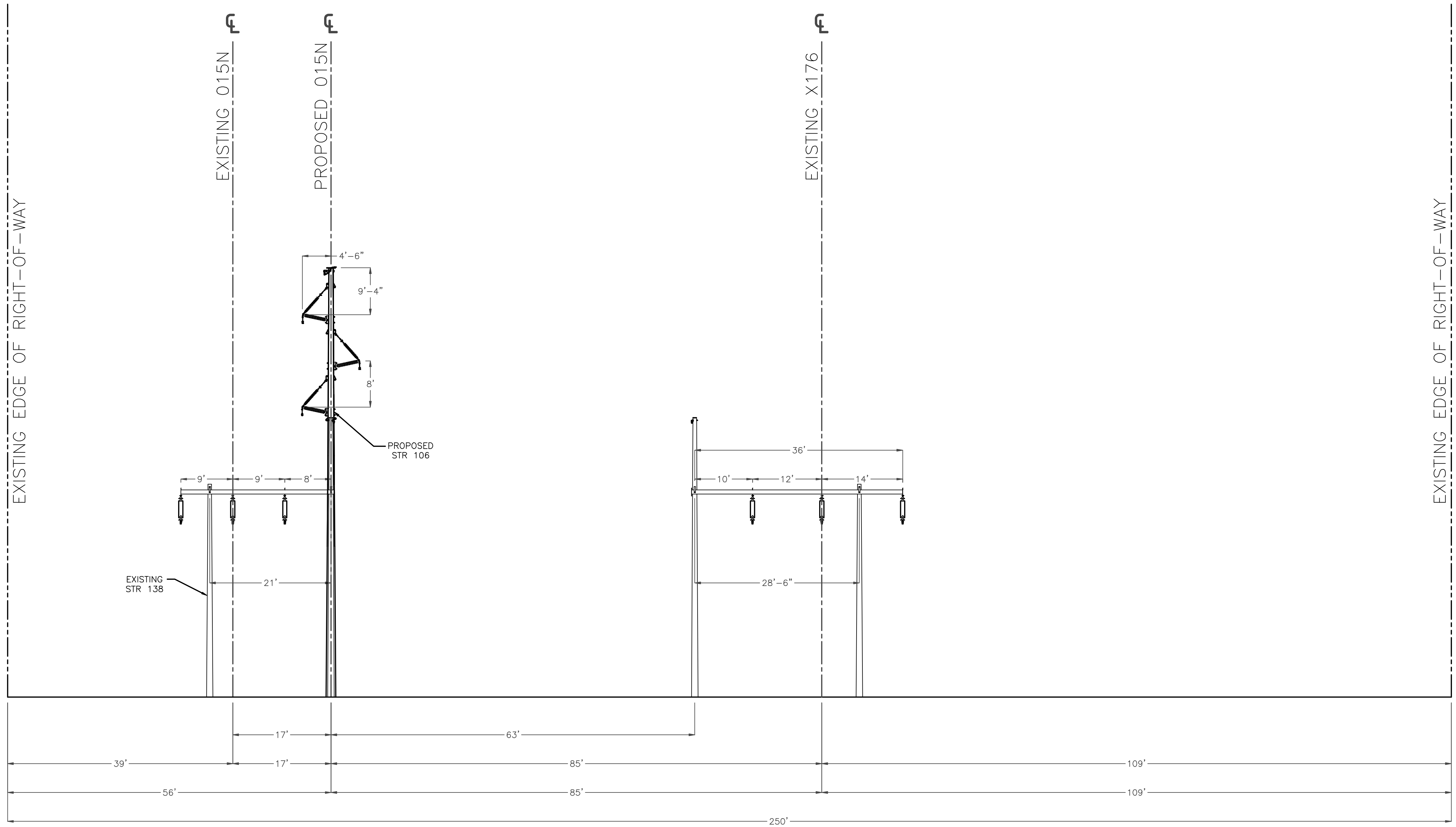
015N LINE WARE TO PALMER SUB
015N 69KV TRANSMISSION LINE
CROSS SECTION OVERLAY
MILE 0 TO MILE 8

PREPARED BY GEB 02/19/24
REVIEWED BY MCR 02/19/24
APPROVED BY JEB 02/19/24
SCALE NTS
SHEET 1 OF 2

VER 0 DATE 02/19/24 INITIAL RELEASE GEB MCR JEB

INCHES ON ORIGINAL

PROPOSED X-SECTION OVERLAY



OVERLAID CROSS SECTION
LOOKING TOWARDS PALMER SUBSTATION
WARE - PALMER ROW
EXISTING 250' WIDE CORRIDOR
WARE, MA
HAMPSHIRE COUNTY
MILE 8 TO MILE 10

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 1.3: Representative Cross-Section
Page 2 of 2

015N LINE WARE TO PALMER SUB
015N 69KV TRANSMISSION LINE
CROSS SECTION OVERLAY
MILE 8 TO MILE 10

nationalgrid

VER	DATE	VERSION DESCRIPTION	PREPARED	REVIEWED	APPROVED
0	02/19/24	INITIAL RELEASE	GEB	MCR	JEB

PREPARED BY	GEB	02/19/24
REVIEWED BY	MCR	02/19/24
APPROVED BY	JEB	02/19/24
SCALE	NTS	
SHEET	2 OF 2	
INDEX		

VERSION 0

PROPOSED X-SECTION OVERLAY

INCHES ON ORIGINAL

2

Alternatives Analysis

This chapter discusses the Project alternatives that the Proponent identified and evaluated for their potential to address the needs identified in Chapter 1, *Project Description*. As described in Chapter 1, recent analyses and studies demonstrate that the Existing Line is in poor condition and needs to be rebuilt due to widespread damage, poor shielding angles, and a history of outages from lighting, thunderstorms, and fallen trees.

As a result, the Proponent developed the following Project goals to guide the Project alternatives and routing alternatives evaluation:

- Maintain system function;
- Increase reliability;
- Increase the fiber optic capability;
- Minimize impacts to the natural and social environments; and
- Minimize construction and operation costs.

A suite of alternatives was considered to address the transmission repair needs determined by the Proponent. The sections below describe the Project Alternatives considered, including a No-Build Alternative (Section 2.1.1); Non-Wires Alternative (Section 2.1.2); Partial Rebuild Alternative (Section 2.1.3); Rebuild with Spacer Cable Alternative (Section 2.1.4); New Build/New Route Alternative (Section 2.1.5); and Complete Rebuild Alternative (the Project or "Preferred Alternative") (Section 2.1.6). Of these, only the Complete Rebuild Alternative addresses the full range of Project needs identified in Section 1.1 of Chapter 1, *Project Description*, while also limiting the environmental impact and cost.

In addition, the Proponent considered two transmission structure designs for the Rebuilt Line: one that complies with 115 kV design standards, and a second that complies with 69 kV design standards. NEP also considered a design option involving installation of spacer cables. Section 2.2.2 compares these two structure designs with respect to transmission system reliability, environmental impacts, and project cost. This comparison also considers the ability of the two designs to support long-term electric load growth driven by regional commitments to address climate change through electrification and a deeper integration of renewable resources. These analyses demonstrate that the replacement of the Existing Line with an overhead line built in the center of the existing ROW to 115 kV specifications is the superior approach in terms of its ability to meet the identified need at the lowest reasonable cost, with the fewest environmental impacts, and with a high degree of reliability.

2.1 Project Alternatives

2.1.1 No-Build

Under the No-Build Alternative, the Existing Line would remain in place, and no improvements would be made to the existing electric supply system serving NEP customers. The structures on the Existing Line are primarily wood and woodpecker damage is widespread. If the Proponent did not partially or fully rebuild the Existing Line, it would nevertheless need to repair and replace structures on an as-needed basis to address deterioration. However, replacing woodpecker-damaged wooden structures with steel structures typically results in woodpeckers moving to a nearby wooden structure. While repairing and replacing structures on an ad-hoc basis would address physical issues on individual structures, replacement structures would need to be in line with the existing structures and of a similar configuration, and therefore would not address the poor shielding angles on the Existing Line, nor reduce the potential for outages due to fallen trees. Furthermore, while this alternative would avoid environmental impacts associated with construction of the Rebuilt Line, it would result in repeated temporary environmental impacts for access and to stage equipment to repair or replace structures on an as-needed basis. Since the No-Build Alternative would not address the above issues nor avoid environmental impacts, it was eliminated from further consideration.

2.1.2 Non-Wires Alternative

Non-wire alternatives ("NWAs") use a combination of energy efficiency and demand response programs, new distributed generation, and new energy storage facilities as alternative means of deferring or addressing the underlying need for a transmission or distribution project. NWAs generally are appropriate when the underlying need for a Project is driven by increasing load levels, so that the load reductions provided by the NWA allow an increasing number of electric customers to be served with the existing transmission and distribution infrastructure.

Potential environmental impacts of NWAs vary depending on the size and location of a given solution. While the Project will provide additional, reliable capacity to support anticipated future loads, in this case, the Project is primarily driven by the need to remedy the deteriorating condition and design of the Existing Line, as well as the need for increased fiber optic capability. The implementation of an NWA would not address the deteriorating condition of the structures, the inherent structure constraints that predispose the Existing Line to outages from lightning strikes, or the proximity of tall, dense vegetation outside of the Project Site's control that exposes the line to tree falls and dropped limbs, nor would it enable the Project Site to enhance its protection and telecommunication abilities. For these reasons, NWAs would not meet the identified resource need and the Company eliminated them from further consideration.

2.1.3 Partial Rebuild Alternative

The Proponent considered but rejected a partial rebuild alternative from further consideration for the same reasons discussed regarding a no build alternative. This alternative would be a targeted structure repair program that would address only the structures in the worst condition. Partially rebuilding the Existing Line would not address the inherent design issues, and would not completely avoid environmental impacts as repeated temporary impacts would still be incurred to obtain access to and safely stage equipment around the existing structures. Replacing individual structures in a piecemeal fashion would require keeping the Existing Line in its current configuration in the existing off-center alignment on the ROW. The replacement structures could not be rebuilt in the center of the ROW, in a narrower one-pole configuration with OPGW at the top with an improved shielding angle, as proposed with the Project. Therefore, a partial rebuild would not improve either reliability or communication capability, nor would it avoid environmental impacts.

2.1.4 New Build/New Route Alternative

When considering the New Build/New Route Alternative, the Proponent conducted a route evaluation as part of the siting process to identify technically feasible route alternatives, within a defined Study Area located in proximity to the existing route and substations, that would maintain system function, maximize the use of existing linear corridors, minimize impacts to the natural and social environments, and minimize construction and operation costs. The Proponent identified a wide variety of potential overhead routes using the most recent available mapping, databases, and aerial photography, focusing on identifying existing linear corridors located within or adjacent to the O15N transmission corridor. These potential route options included existing electric transmission, railroad, pipeline, and highway and roadway corridors. The Proponent then screened these linear corridors against the above-noted route selection criteria to assess whether any would be a potentially superior route to the existing O15N ROW. Many configurations were deemed not superior given that they were more circuitous and did not share the general northeast to southwest orientation of the existing ROW. As shown in Figure 2.1, although five route options ranging from approximately 13 miles to 16 miles long, which share a similar orientation, could be delineated using existing road and railroad corridors within the Study Area, installation of a new overhead line along railroads and roadways would require obtaining new rights and encroaching upon open space and residential properties in some locations. Working within these corridors would require access restrictions, workspace constraints, traffic disruptions, restrictive work hours, and potential safety concerns during both initial construction and long-term maintenance and operations activities. In addition, transportation agencies often require that there is on feasible alternative to collocating with their facilities, which is not the case here. Their longer length compared to the proposed Project would likely also result in increased construction duration and cost. As a result of this iterative evaluation process, the Proponent rejected the New Build/New Route Alternative after determining that no candidate routes were equal or superior to the Project Route, which maintains the Existing Line in its existing ROW.

2.1.5 Complete Rebuild Alternative (Preferred)

Under the Complete Rebuild Alternative, which is the proposed Project, the Proponent will rebuild the Existing Line centered on the existing ROW, completely replacing the existing structures, conductor, and shield wire in the center of the ROW. All steel pole suspension structures will have direct-buried foundations and all dead-end or angle structures will be supported by caisson foundations. Key components of this alternative include:

- Replacing all tangent structures on the Existing Line with direct-embedded steel and replacing all dead-end structures with engineered steel on concrete foundations;
- Reconductoring 10.35 miles of existing conductor with new aluminum conductor steel supported ("ACSS") conductor;
- Replacing 10.35 miles of existing steel shield wire with one OPGW; and
- Vegetation management, upgrading existing access, and creating new access as required to construct and maintain the Rebuilt Line.

Rebuilding the Existing Line on new steel structures in the center of the ROW would address all the needs identified in Section 1.1 of Chapter 1, *Project Description*. Moving the configuration into the center of the corridor will maximize the distance between wires and trees, while changing to a single pole structure from the wider H-Frame configuration will minimize the overall exposure to hazard trees by narrowing the footprint, or width of the line configuration, exposed to falling trees. Taller structures will also reduce opportunities for trees striking the line. In addition, the taller replacement structures will correct the poor shielding angle and avoid many of the outages caused by lightning. Taken together, these design changes will reduce the frequency of outages on the Existing Line and increase its reliability. In addition, the OPGW will improve the Project's ability to quickly repair damage to the line when it does occur.

Replacing the existing conductor with ACSS conductor will provide additional thermal capacity and voltage support needed both to support projected electric load and growth and, if needed, to interconnect future Distributed Energy Resources ("DER"). Replacing the existing shield wire with OPGW will improve fault protection and communications in the area by enabling the Project Site to connect the fiber already on the W175 Line at Palmer Substation and the planned fiber at Ware Substation.

The Complete Rebuild Alternative is the only alternative that will improve performance of the Existing Line by addressing all the needs and provide additional thermal capacity and voltage support required to support future load growth. Accordingly, the Proponent selected it and dismissed other alternatives from further consideration.

2.2 Comparison of Project Alternatives Impacts

As discussed above, a suite of alternatives was considered to address the needs determined by the Proponent. This section compares the Project alternatives impacts, in relation to land alteration, wetland resource area impacts, and stormwater impacts. Table 2-2 below provides a summary of comparison of impacts associated with the Project alternatives.

2.2.1 Land Alteration

The Project is located along an existing transmission line ROW, which consists of maintained scrub-shrub vegetation, is free of trees, and does not contain any impervious surface other than existing public roadway crossings. The Project would largely result in temporary land alteration from construction period disturbance, which would be restored back to existing conditions after Project completion. Some permanent in-ROW land alteration would occur from the installation of new structures and the installation of gravel access roads and stone work pads, which are discussed in further detail in Section 6.2.1 of Chapter 6, *Construction Period Impacts*. The Project will not result in an increase of impervious surfaces or the removal of any trees. No off-ROW impacts are anticipated, as there will be no expansion of offsite access roads or need for tree removal. Some mowing or sideline trimming may be required if access is located along the edge of the ROW.

As summarized in Table 2-2, the No Build alternative and Partial Rebuild alternatives would result in less land alteration than the preferred option. For the Non-Wires alternative, land alteration for new energy generation and/or new energy storage facilities are unknown and could potentially be less or more depending on the size and number of projects proposed. Any potential alternative facilities would require siting, development and construction of the facility as well as potential substation development and construction, which would result in an unknown amount of land alteration and could result in tree removal or an increase in impervious surfaces depending on the exact footprint and location of the proposed solution. The New Build/New Route alternative consists of five potential routes ranging from 13 to 16 miles long along existing road or railroad corridors. While the exact land alterations would vary depending on the actual design, it is possible that there would be less land alteration than the Project along roadways, as the roadway serves as an existing access road. There would still be new land alteration for structure installation along any road or railroad.

2.2.2 Wetland Resource Areas

The Project is expected to have temporary and permanent impacts to waters of the U.S. and state-jurisdictional wetlands. Anticipated temporary and permanent impacts from the proposed design are discussed in detail in Chapter 3, *Natural Resources and Stormwater Management*. Permanent impacts to BVW will occur from the installation of the proposed steel structures. Temporary impacts will occur from the installation of construction matting for access roads, work pads, and pull pads. There are no anticipated permanent impacts to Bank or LUWW. Temporary impacts are anticipated to RFA and BZ from the construction of temporary work pads in upland areas and wetland matting laid for the construction of access roads and work pads in wetland resource areas. Permanent impacts are expected to occur to RFA and BZ from the construction of upland access roads.

As summarized in Table 2-2, the No-Build alternative and Partial Rebuild alternatives could result in less permanent and temporary impacts to waters of the U.S. and state-jurisdictional wetlands. As noted above, for the Non-Wires alternative, wetland impacts for any new energy generation and/or new energy storage facilities are unknown and would vary depending on the size and location of proposed projects. Similarly, the exact impacts to waters of the U.S. and state-jurisdictional wetlands along each of the New Build/New Route alternatives is unknown; along roadways there would likely be less impact than the proposed Project as no additional access roads would need to be built, but there could still be some new permanent and temporary impacts along a given road or railroad for installation of new structures.

2.2.3 Stormwater Management

The Project has been designed to meet all current applicable Massachusetts Stormwater Standards as required per the Massachusetts Wetlands Regulations at 310 CMR 10.05(6)(k) through (q). The majority of the stormwater management standards are not applicable to the proposed work. The primary applicable standard is Standard #8: Construction Period Pollution Prevention and Erosion and Sedimentation Controls. Due to the location of the preferred alternative along an existing transmission line ROW, the Complete Rebuild preferred alternative would not result in any stormwater impacts nor would the No Build, Partial Build, or New Build/New Route alternatives. The Non-Wires alternative has the potential to have greater stormwater impacts than the preferred alternative depending on impervious structures that may be needed to house these alternatives.

2.2.4 Comparison of Project Alternatives against Goals

Under the No-Build Alternative, impacts to the natural and social environments would be the lowest of all alternatives, however, the systems functions and reliability would not be maintained due to the deteriorating conditions of the structures. Additionally, while there would be an initial savings in construction costs, future replacement of deteriorating structures would be inevitable and operation costs due to unreliable service would increase. Also, this alternative would not provide an increase in fiber optic capability or provide expanded capability for the future.

Under the Non-Wires Alternatives, the implementation of an NWA alone would not increase the reliability by reducing outages from lightning strikes or tree falls and dropped limbs. Additionally, this alternative would not maintain system function by addressing the deteriorating condition of the structures nor would it enable the Company to enhance its protection and telecommunication abilities. Impacts to natural and social environments under the Non-Wires Alternative would vary depending on the location and size of proposed projects; however, land alteration would certainly occur for development of these facilities and the could result in tree removal and/or an increase in impervious surfaces to house these facilities.

Under the Partial Rebuild Alternative, initially the system function would be maintained by targeting only the most deteriorated structures and impacts to the natural and social environment and construction costs would all be lower than the preferred alternative; however, over time the cost to maintain a further deteriorating system from continued woodpecker damage and the resulting impacts and costs would increase. Cumulative environmental impacts would also be greater as repeated visits to the ROW would be necessary to repair or replace the structures as needed, and eventually access roads would need to be built to access hard-to-reach structures. Lastly, this alternative would not increase the reliability of the system by addressing inherent design issues to reduce outages from lightning strikes or tree falls and dropped limbs, nor would this alternative provide an increase in fiber optic capability or provide expanded capability in the future.

Under the New Build/New Route Alternative, the development of a new route and infrastructure would meet the goals of maintaining system function, increasing reliability, and increasing the fiber optic capability. There may also be fewer impacts along roadway corridors as there would be no need to construct an access road; however, there would likely still be some new permanent and temporary impacts along these roads or railroads for installation of new structures. In addition, installation of a new overhead line along these corridors would require new rights and encroachment upon open space and residential properties in some locations, and construction of these longer routes would result in more construction noise and traffic, greater visual impacts, to the communities, and greater construction duration and cost.

As summarized in Table 2-1 below, while each alternative does achieve at least one of the Project goals, only the Complete Rebuild preferred alternative is able to meet all the Project goals.

Table 2-1 Comparison of Alternatives Against the Project Goals

Alternative	Do the Alternatives Meet the Project Goals? (Y/N)				
	Maintain System Function	Increase Reliability	Increase Fiber Optic Capability	Minimize Impacts to the Natural and Social Environments	Minimize Construction and Operational Costs
1. No Build	N	N	N	**Y**	N
2. Non-Wires	N	N	N	unknown	N
3. Partial Rebuild	Y	N	N	**Y**	**Y**
4. New Build/New Route	**Y**	**Y**	**Y**	Y	N
5. Complete Rebuild (preferred)	**Y**	**Y**	**Y**	**Y**	**Y**

2.2.5 Project Alternatives Conclusion

The Proponent determined that the needs identified in Section 1.1 of Chapter 1, *Project Description*, could only be met by replacing both the existing structures and the existing conductor, as well as adding OPGW to the entirety of the Existing Line. The Proponent's analysis of the alternatives shows that the no-build, non-wires, and partial rebuild alternatives would neither address the asset condition and design issues of the Existing Line, nor enable it to add OPGW, while the new build/new route alternative would be more circuitous, more costly, and would result in greater impacts to human and natural environments.

In summary, the proposed Project is the preferred solution based on the fulfillment of the Project needs and will enable the Proponent to serve future load growth, if needed.

Table 2-2 Overall Comparison of Program Alternatives

Alternative	Addresses all Project needs	Project length (mi)	Land Alteration relative to preferred option	Cost relative to preferred option	New property easements required	Environmental impacts relative to preferred option	Constructability
1. No Build	No, does not address any of the stated project needs.	N/A	Less in the short term at any given time, until it becomes necessary to access hard-to-reach structures	Short term: Less at any given time Long term: Likely more as the line will continue to deteriorate and require repairs, and eventually road work will be needed to access all structures.	No	Incremental but repeated short-term impacts as NEP repairs or replaces individual structures in danger of imminent failure, and eventually all structures will need to be replaced and road work will become necessary to access all structures.	N/A
2. Non-Wires	No, addresses reliability only and does not address the issues of structural damage, shielding angles, increased fiber optic capability, or tree hazards.	N/A	Unknown; dependent on footprint, location, scale and number of proposed projects. Potential increase in impervious surfaces for structures to house these facilities.	Unknown; dependent on footprint, location, scale and number of proposed projects.	Unknown	› Potentially less impacts depending on footprint, location, scale, and number of projects proposed › Potentially more tree clearing, as the proposed project has none › Potential for permanent wetland fill › Likely less temporary matting in wetlands/waterways › Potentially less access road work › Likely greater visual impacts due to construction of new facilities › Potentially greater construction times depending on the type and number of projects proposed	No line outages needed during construction
3. Partial Rebuild	No, addresses structural damage for the worst structures only and does not address shielding angles, increased fiber optic capability, tree hazards, or reliability.	Up to 10.35	Less – a partial rebuild would be smaller in scope than the proposed Project.	Short term: Less Long term: Likely more as remaining structures will continue to deteriorate and require repairs.	No	› No new permanent impacts to BVW, Bank, LUWW or BLSF › Less temporary impacts to wetlands, waterways, RFA, and Buffer Zone in the short term › Potentially less access road work, at least in the short term (eventually the harder-to-reach structures will still need to be replaced) › Cumulatively more impacts over time due to repeated ROW access for repairing/replacing structures as needed	Planned outages
4. New Build/New Route	Yes, addresses all the stated Project needs.	Various routes ranging from 13 to 16	Potentially less due to reduction in access road work	More – due to establishment of new easements and a longer Project route.	Yes	› Potentially less wetland impact along roadway alternatives due to lack of access road work › Some land alteration and potential temporary and permanent wetland impacts for installation of new structures › Encroachment on open space and residential properties › Longer construction times › Greater noise, traffic, and visual impacts to the community	No line outages needed during construction
5. Complete Rebuild (preferred)	Yes, addresses all the stated Project needs.	10.35	› No increase in impervious surfaces › Temporary and permanent land impacts	N/A	No	› Some permanent impacts to BVW › No permanent impacts to Bank, LUWW or BLSF › Some temporary matting in wetlands and waterways › Some temporary and permanent impacts to RFA and 100-foot Buffer Zone › Some vegetation management › Some access road work	Planned outages

lf = linear feet; sf = square feet; mi = mile; BWV = Bordering Vegetated Wetland; LUWW = Land Under Waterbodies and Waterways; BLSF = Bordering Land Subject to Flooding; RFA = Riverfront Area

2.3 Design Alternatives

Having determined that a complete replacement of the Existing Line is necessary, the Proponent then evaluated three designs to determine which would best meet the identified need while minimizing cost and environmental impacts and providing for the long-term reliability of the electric transmission system. The Proponent analyzed rebuilding the Existing Line using spacer cable, as well as two transmission structure design alternatives: one that complies with 115 kV design standards ("115 kV Design"), and a second that complies with 69 kV design standards ("69 kV Design").

2.3.1 Rebuild With Spacer Cable

Spacer cable is a pre-engineered electrical system designed for high reliability and improved ROW flexibility, which would be able to support the new conductor and OPGW and would involve the structures being rebuilt in the center of the ROW. The system consists of heavily covered non-shielded phase conductors held together and supported by a high-strength messenger cable and connected to diamond-shaped spacers within the span. It is a completely covered system and, accordingly, requires less foliage removal and reduces the risk of temporary faults due to tree contact and incidental bird and animal contact. However, additional structures at reduced spacing compared to existing conditions would be required to support the greatly increased weight and wind load of the covered spacer cable conductors. Along the full approximately 10.35-mile length of the Existing Line, the use of spacer cable would more than triple the amount of structures needed and result in increased cost. The additional structures would increase the environmental impact of the Project, as the additional structures would result in increased permanent impacts from the installation of additional foundations and increased temporary impacts from associated work pads For these reasons, the spacer cable alternative was eliminated from further consideration.

2.3.2 69 kV and 115 kV Designs

Both the 69 kV and 115 kV designs would be able to support the new conductor and OPGW, and in both cases, the Project would be rebuilt in the center of the ROW. The 115 kV Design would require a slightly higher structure height than required for the 69 kV Design because the higher design voltage requires a greater distance between two energized conductors and between energized conductors and the ground or nearby objects. However, the slight increase in structure height is offset by the fact that 33 fewer structures would be required for the 115 kV Design than the 69 kV Design (114 structures for the 115 kV Design, including two current structures that are not being replaced; versus 197 structures for the 69 kV Design) because the taller structures for the 115 kV Design allow for greater span lengths. The 115 kV and 69 kV designs would both use monopole structures, but for the 69 kV design, the structures would be rebuilt with davit arms in a delta configuration, while for the 115 kV design the structures would be rebuilt with braced posts in a delta configuration. The use of braced poles allows for a narrow configuration, reducing the potential for tree contact.

As discussed below, the Company evaluated reliability, environmental and cost considerations of constructing the Rebuilt Line to 115 kV Design standards. The Company notes that the Existing Line is operating at 69 kV. There are no reliability needs observable now that would necessitate the operation of the Rebuilt Line at 115 kV within the 10-year planning horizon. If future planning studies find that increased DER penetration and/or increased load growth require the operation of the line at 115 kV, NEP will advance any remaining upgrades required for such operation.

2.3.2.1 Reliability Comparison

The 69 kV and 115 kV Designs both address the design issues associated with the deteriorating condition and poor performance record of the Existing Line by replacing the wooden structures with steel which will eliminate damage from woodpecker infestations. In addition, the replacement structures under either design will have a shielding angle, of 30 degrees or less, consistent with the current industry practice. Similarly, the higher elevation of the conductors on the Rebuilt Line, as well as its position in the center of the ROW, will reduce the probability of faults resulting from off-ROW vegetation striking the energized line. In addition, the change in structure configuration from pole arm structures to narrower delta monopole structures will reduce the potential for tree-related outages by increasing the horizontal distance to off-ROW vegetation. Overall, either design will result in significant improvements in line performance.

The use of the 115 kV design standard, however, will provide both near-term and longer-term transmission system reliability benefits that the 69 kV design would not. In the short term, the increased insulation and phase spacing associated with the 115 kV design will further improve lightning performance, and the additional structure height, while limited, will provide additional vertical clearance that may further reduce the probability of off-ROW vegetation striking the energized conductor. In addition, the lowest conductor, which is the most likely to be struck by vegetation, will be elevated higher with the 115 kV design than with the 69 kV design, thus improving reliability for the 115 kV design option.

In the longer term, the 115 kV design will allow the Rebuilt Line to be operated at 115 kV in the future without further costly transmission line upgrades. Operation at 115 kV will provide several advantages over 69 kV operation. First, it will provide 66% more capacity on the line. As a result, rebuilding with the 115 kV design will support future load growth and enable the interconnection of DER. Additionally, 115 kV operation provides superior voltage regulation due to the lower impedance of 115 kV on a per Mega Volt-Amp ("MVA") basis. In practice, this helps avoid the need for additional transmission switching stations, capacitor banks, reactors, or dynamic voltage control devices to support new load.

2.3.2.2 Environmental Comparison

Chapter 3, *Natural Resources and Stormwater Management and Chapter 6, Construction Period Impacts,* provides a detailed analysis of the environmental impacts of the Project using the 115 kV design. Briefly, those impacts include temporary and permanent impacts to wetlands and water resources, impacts associated with vegetation management and removal, access improvements, and construction noise and traffic impacts. Chapter 7, *Mitigation and Draft Section 61 Findings,* also summarizes the mitigation measures that the Proponent has taken during Project design and engineering to reduce and mitigate these impacts.

Use of the 69 kV Design would not significantly reduce any of these impacts. The minor reduction in structure height for the 69 kV Design would be unlikely to change either the number of structures installed or their locations. The same construction techniques would be used and, as a result, construction-related impacts, including vegetation management, access improvements, wetlands and water resource impacts, and construction noise and traffic, would be similar or identical. Visual impacts would be marginally reduced based on a maximum 10-foot difference in structure height. Magnetic fields at any given load level would marginally increase for the same reason.

Finally, the use of the 115 kV design for the Project obviates the possible need for a future project within the ROW to upgrade the line to 115 kV at a later date. A future upgrade to 115 kV from 69 kV-designed structures would require that all structures be replaced, as the structures would not have the appropriate phase-to-phase separation to allow for insulation or operation at 115 kV. This would require a re-mobilization and significant redundant construction efforts, which would place a repeat burden on the abutters along this ROW, as well as create an approximate doubling of environmental impacts. On balance, the Proponent considers the 115 kV design to be preferable to the 69 kV design from the perspective of environmental impacts.

2.3.3 Design Alternatives Conclusion

NEP proposes to construct the Rebuilt Line with the 115 kV Design because the conductor spacing and increased insulation provide significant reliability benefits even when operated at 69 kV. Moreover, building to the 115 kV Design now provides the ability to operate the line at 115 kV in the future without further upgrades when such need arises. If the Proponent fails to take advantage of the opportunity to rebuild to 115 kV standards now, the Proponent will need to either rebuild the O15N Line to the 115 kV Design standard at that time or construct a second transmission line in the same area, both of which would result in a duplication of costs and impacts. As discussed above, the environmental impacts of the Project would be similar regardless of the structure design at 69 kV or 115 kV, with the marginally increased visibility of the 115 kV structures offset by a marginal decrease in magnetic field levels. The increased cost of the 115 kV design is low relative to the overall cost of the Project. This additional cost ensures the ability to maximize the utilization of the line by enabling future operation at 115 kV.

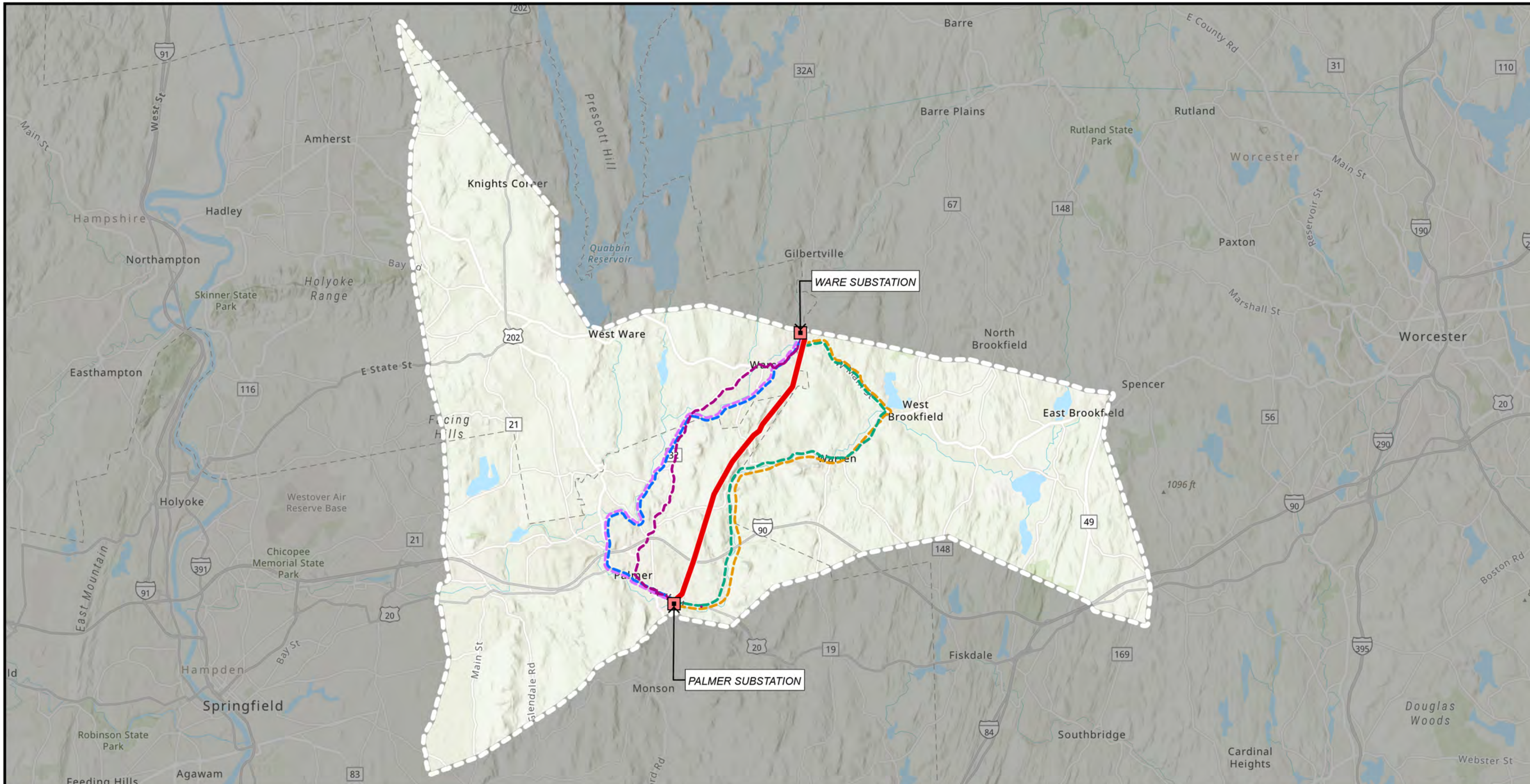
In short, constructing the Project to 115 kV design standards will not significantly increase the estimated cost of the Project, will provide reliability benefits even when operated at 69 kV, and will allow the Proponent to adapt its transmission network to future demands without undertaking costly upgrades that result in further impacts at a later date. The Proponent believes this is a prudent decision, particularly given the initial findings of ISO-NE's ongoing 2050 Transmission Study. The *2050 Transmission Study* highlights the need for additional transmission capacity across New England to accommodate the electrification of heating and transportation systems and the large-scale integration of on-shore and off-shore wind, solar, and storage resources. The 115 kV design provides the Proponent with the flexibility to convert the Rebuilt Line's circuits to 115 kV in the future if needed to support large-scale electrification and interconnection of renewable energy sources throughout the Commonwealth. It also provides the Proponent with the ability, when needed, to provide 115 kV service to its customers in the future, without a costly upgrade project. For these reasons, the Proponent selected the 115 kV design for its new monopole transmission structures.

2.4 Conclusion

As described in Sections 2.1.1 through 2.1.3, above, the Proponent initially considered various alternatives to meet the identified resource need. The no-build, non-wires, and partial rebuild alternatives were rejected because they would neither address the asset condition and design issues of the Existing Line, nor enable it to add OPGW. The new build/new route alternative was rejected as it would be more circuitous, more costly, and would result in greater impacts to human and natural environments.

The Proponent therefore determined that the Project goals could only be met by replacing both the existing structures and the existing conductor, as well as adding OPGW to the entirety of the Existing Line. After dismissing the use of spacer cable to rebuild the Existing Line due to its cost and environmental impacts, the Proponent compared the cost, environmental impact, and reliability benefits associated with the use of a 69 kV design and a 115 kV design and concluded that the additional capacity and flexibility provided by the 115 kV design outweighed the additional costs and visual impacts. Consequently, the Proponent concluded that the replacement of the Existing Line in the existing ROW, using a 115 kV design, would best address the identified needs at a low cost while minimizing environmental impact.

Path: \\vhb.com\gis\proj\Wat-EV\15773.00 NGrid O15N ACR\Project\Siting Figures.aprx



- Substation
- Existing O-15N Transmission Line
- Study Area
- Central Mass Rail Line and Ware River Branch
- State Route 32 and State Route 20
- State Route 9 and State Route 19/67
- State Route 9, State Route 19/67, and CSX Boston Subdivision
- Ware River Branch

1:204,000

0 8,500 17,000 34,000 Feet

O-15N MEPA ENF

Figure 2-1: Potential Linear Corridors for the New Build/New Route Alternative

Source: MassGIS,National Grid,VHB

Date: 5/13/2024

nationalgrid

vhb

3

Natural Resources and Stormwater Management

This chapter summarizes the potential impacts to federal and state-jurisdictional wetland resource areas and rare species based on the Project's current design. Additionally, compliance with Massachusetts Stormwater Regulations is also summarized.

3.1 Wetlands

3.1.1 Regulatory Context

As described in Chapter 1, *Project Description*, the Project will require the following federal, state, and local wetlands-related permits and approvals:

› **Federal:**
  - Clean Water Act Section 404
  - Clean Water Act Section 402 (NPDES)

› **State:** Clean Water Act Section 401

› **Local:**
  - MWPA
  - Palmer Wetland Ordinance
  - Ware Wetlands Protection Bylaw

The sections below describe the Project's compliance with these regulations, including the Massachusetts Stormwater Standards included in the regulations for Section 401 and the MWPA.

3.1.1.1 Federal Clean Water Act - Section 404

It is anticipated that the Project will qualify for coverage under the Massachusetts General Permit ("MA GP") as a Pre-Construction Notification to the USACE. The MA GP contains a list of General Conditions that must be adhered to.

The following paragraphs present an overview of these conditions and an explanation of how the Project will comply with them.

Historic Properties (Section 106 Review)

No undertaking shall cause effects on properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unknown historic properties within the permit area, unless the Corps or another Federal action agency has satisfied the consultation requirements of Section 106 of the National Historic Preservation Act ("NHPA").

As outlined in detail in Section 6.2.7 of Chapter 6, *Construction Period Impacts,* the Proponent has hired a cultural resource consultant to assess historic and archaeological features in the Project's permit area and will coordinate with the MHC, local historic commissions, and Tribal Historic Preservation Officer(s) as necessary during the USACE permit process, with the USACE serving as the consulting agency.

Federally Threatened and Endangered Species (Section 7 Consultation)

No activity is authorized which: a) is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act ("ESA"), or which will directly or indirectly destroy or adversely modify the critical habitat of such species; b) "may affect" a listed species or critical habitat, unless Section 7 consultation has been completed.

The Proponent has initiated consultation with the USFWS related to federally listed species along the Project and concluded that the Project is within an area mapped by the USFWS as potential northern long-eared bat ("NLEB") habitat. According to the latest NHESP mapping, provided as Figure 3.3, there are no known NLEB maternity roost trees or hibernacula within 0.25 miles of the Project. An Information for Planning and Consultation (IPaC) analysis was conducted using the USFWS online tool on February 23, 2024. A determination of "No Effect" on the Northern Long-Eared Bat was reached for the project. Based upon this information the Proponent does not anticipate any impacts to NLEB populations for the Project.

Soil Erosion, Sediment and Turbidity Controls

Appropriate soil erosion, sediment and turbidity controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills must be permanently stabilized at the earliest practicable date. Erosion, sediment and turbidity controls shall be capable of preventing erosion, of collecting sediment, suspended and floating materials, and of filtering fine sediment.

The Proponent requires its contractors to provide an adequate soil erosion, sediment and turbidity control plan to prevent the migration of soil and sediment from disturbed areas to adjacent wetlands and waterbodies. See Sections 3.1.1.2 and 3.1.4 below and Chapter 6 for more details.

Floodplains and Floodways

Appropriate measures must be taken to minimize flooding to the maximum extent practicable and activities within 100-Year Floodplains must comply with applicable Federal Emergency Management Agency ("FEMA")-approved State and/or local floodplain management permitting requirements.

The Project has been designed so that no work will occur within the 100-year floodplain (BLSF) as shown in Figure 3.1.

Vernal Pools

Direct, secondary and cumulative adverse effects to all vernal pools ("VPs"), including their envelopes and critical terrestrial habitats, shall be avoided and minimized to the maximum extent practicable.

The Project has been designed to avoid all direct impacts to vernal pools and to minimize activity within their envelopes and critical terrestrial habitats.

Mitigation

Activities must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the U.S. to the maximum extent practicable at the project site (i.e., on site). Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) is required to the extent necessary to ensure that the adverse effects to the aquatic environment are no more than minimal. Compensatory mitigation for effects to waters of the U.S., including direct, secondary and temporal will generally be required for permanent impacts that exceed the Self Verification ("SV") eligible area limits, and may be required for temporary impacts that exceed the SV area limits, to offset unavoidable impacts which remain after all appropriate and practicable avoidance and minimization has been achieved and to ensure that the adverse effects to the aquatic environment are no more than minimal.

The Project has been designed to avoid and minimize temporary and permanent adverse effects to waters of the U.S. The Project is not anticipated to result in permanent impacts that exceed the SV-eligible area limits; therefore, no mitigation for impacts to federal resource areas subject to jurisdiction under Section 404 of the CWA is proposed. However, the Project will require 1:1 replication for wetland impacts subject to jurisdiction under the state Section 401 Water Quality Certification regulations and the MWPA. This mitigation will be developed in compliance with the requirements of those regulations.

Invasive Species

General Permit Condition #25 in the MA GP identifies that the introduction or spread of invasive or other unacceptable plant or animal species on the project site caused by site work shall be avoided to the maximum extent practicable. The introduction or spread of invasive plant or animal species on the project site caused by the site work shall be controlled.

The Proponent will use best management practices during construction of the Project to minimize the spread of invasive species. Seed-free erosion controls, such as straw bales, wattles and mulch will be utilized. Soil stabilization and restoration will be done with weed-free seed mix. In addition, vehicles and equipment used for construction will be cleaned each day prior to entering the work site to reduce the transport of off-site seed. These and other best management practices are presented in more detail in National Grid's Environmental Guidance document for ROW Access, Maintenance and Construction Best Management Practices for New England (known as EG-303NE), dated August 2020 (included in Appendix C).

3.1.1.2 Federal USEPA National Pollutant Discharge Elimination System

The Project will require coverage under the NPDES 2022 Construction General Permit ("CGP") due to more than an acre of anticipated land disturbance. Key actions required under the CGP include the following:

- Develop a Storm Water Pollution Prevention Plan ("SWPPP") that details how stormwater discharges will be controlled;
- Complete and submit a Notice of Intent ("NOI") to the USEPA;
- Install and maintain erosion and sediment controls throughout the entire construction project so they operate effectively to control stormwater discharges;
- Implement pollution prevention practices to minimize the discharge of pollutants from stormwater and spilled or leaked materials;
- Conduct required inspections by a qualified person to verify compliance with the permit on-site, once every 7 calendar days, or once every 14 calendar days and within 24 hours of a 0.25-inch storm event or snowmelt from a 3.25-inch storm event;
- Conduct routine maintenance and take corrective actions to address any issues with stormwater controls or discharges;
- Keep the SWPPP up to date to reflect current conditions on the project site and complete documentation of all site inspections, dewatering inspections, and corrective actions; and
- Comply with any applicable state, Tribal, or territory-specific requirements in Part 9 of the permit.

The Proponent will develop a detailed SWPPP for the Project that will include an adequate soil erosion, sediment, and turbidity control plan to prevent the migration of soil and sediment from disturbed areas to adjacent wetlands and waterbodies. NEP and its contractor will designate qualified monitors to conduct regular inspections to identify maintenance or corrective actions needed and confirm compliance with permit requirements.

3.1.1.3 State 401 Water Quality Certification (314 CMR 9.00)

Based on the most current design, the Project will include 113 square feet of permanent and 204,778 temporary discharge of dredged or fill material in waters of the United States within the Commonwealth, which is subject to state water quality certification under 33 U.S.C. 1251 and 314 CMR 9.00.

As currently proposed the Project will include 113 square feet of permanent fill and 199,967 square feet of temporary fill in BVW, and 4,811 square feet of temporary fill in land under water. The Project will include 1:1 replacement for permanent fill in BVW in compliance with 310 CMR 9.06(2)(a). The

Project will not result in any activity that would require conformance with the Massachusetts Stream Crossing Standards. The Project will not result in any proposed impact to a certified or field identified vernal pool and does not propose fill within an Outstanding Resource Water, nor is it subject to any other categories identified at 314 CMR 9.04.

3.1.1.4 Massachusetts Wetlands Protection Act (MWPA) and Regulations (G.L. Chapter 131, Section 40 and 310 CMR 10.00)

Based on the most current design, the Project will involve work within the following wetland resource areas subject to protection under the MWPA: BVW, Bank, LUWW, and RFA. In addition, the Project will include activities within the 100-foot BZ, an area subject to regulation under the MWPA. BZ does not have performance standards associated with it in the MWPA.

As discussed in Chapter 2, *Alternatives Analysis*, the Proponent has evaluated reasonable alternatives. As the design develops, NEP will continue to minimize impacts, and where impacts are unavoidable, appropriate mitigation will be provided. The Project qualifies as a limited project; regardless, the Proponent has designed the Project to meet all applicable MWPA performance standards. The following paragraphs present an overview of applicable performance standards.

Bordering Vegetated Wetlands (BVW)

As per 310 CMR 10.55(4) the following performance standards apply to work in BVW.

- Any proposed work in a BVW shall not destroy or otherwise impair any portion of said area;
- Work which results in the loss of up to 5000 square feet of BVW may occur if area is replaced in accordance with the listed general conditions;
- No project may be permitted which will have an adverse effect on specified habitats for rare vertebrate or invertebrate species; and
- No proposed work shall destroy or otherwise impair any portion of BVW within an Area of Environmental Concern.

The Project will result in approximately 113 square feet of permanent impact to BVW. This area is less than 5000 square feet and appropriate mitigation will be designed to replace the impacted area in compliance with 310 CMR 10.55(4)(b). Areas of temporary BVW impact will be restored. The Project has been designed to avoid adverse effects for rare vertebrate and invertebrate species, and the Project is not located within an Area of Environmental Concern.

Riverfront Area (RFA)

As per 310 CMR 10.58(4) a project should meet the following performance standards for work within RFA.

- Meet performance standards of other resource areas within RFA;
- No impact to rare species or vernal pool habitat;
- No practicable and substantially equivalent economic alternative to the proposed project with less adverse effect on the interests in the MWPA;
- Maintain a 100-foot undisturbed area of vegetation or preserve existing vegetative cover to the maximum extent practicable; and

- Manage stormwater in accordance with the standards established by MassDEP in the most current Stormwater Policy.

The Project will be designed to meet all performance standards of other resource areas within the RFA as described in this section. The Project will be designed to avoid vernal pool habitat and the Proponent will coordinate with NHESP to avoid impacts to rare species within the ROW, and a MESA Checklist will be submitted to NHESP for their review once the Project design is advanced further. Stormwater will be managed in accordance with the current Stormwater Management Standards. NEP maintains the vegetation in the ROW as a low-growing herbaceous and shrub community to provide required safe clearance to the conductors. The Project will preserve this existing vegetative cover to the maximum extent practicable. There are two locations where there will be permanent vegetation removal within the inner 100-foot RFA of streams that cross the ROW due to installation of new access roads. This area will be limited to the 16-foot width of the access road and is unavoidable due to the linear nature of the ROW. All other disturbance areas within RFA will be revegetated upon completion of construction.

Bank

As per 310 CMR 10.54(4), work on a bank shall not impair the following:

- The physical stability of the Bank;
- The water carrying capacity of the existing channel within the Bank;
- Ground water and surface water quality;
- The capacity of the Bank to provide breeding habitat, escape cover and food for fisheries; and
- The capacity of the Bank to provide important wildlife habitat functions.

The Project will have no permanent impacts to bank. In areas where temporary access roads or work pads need to be constructed over the Bank, wetland timber mats will be utilized to span the stream to ensure that the stability of the Bank and its capacity to carry water is not impacted. If there is any disturbance to the bank from this work, these areas will be restored. There will be no impact to the capacity of the Bank to provide important wildlife habitat functions.

Land Under Water Bodies and Waterways (LUWW)

As per 310 CMR 10.57(4) a project should meet the following performance standards for work within LUWW:

- The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;
- Ground and surface water quality;
- The capacity of said land to provide breeding habitat, escape cover and food for fisheries; and
- The capacity of said land to provide important wildlife habitat functions.

The Project will have no permanent impacts to LUWW. As discussed above, in areas where temporary access roads or work pads need to be constructed over LUWW, timber mats will be utilized to span the stream to ensure that the carrying capacity of the defined channel is not impaired. Stormwater and erosion control measures will be installed during construction to ensure there are not impacts to water quality. Any impacts from the temporary timber mats will be restored to protect the ability of the land to provide habitat and escape cover and food for fisheries, and to fully maintain the ability of the land to provide wildlife habitat functions.

3.1.1.5 Local Wetland Bylaws

The Town of Palmer has established wetlands regulations based on the 2013 Palmer Wetland Ordinance. The Palmer Wetlands Regulations establish jurisdiction over wetland resources areas similar to those outlined in the WPA. Additionally, the regulations establish vernal pools and isolated wetlands and ponds greater than 5000 square feet as resource areas. A 100-foot BZ is established around vernal pools and no activities within the vernal pool or BZ may impact the capacity for the vernal pool to provide wildlife habitation. Furthermore, the regulations establish the 100-foot BZ to wetland resources, including floodplain, as a regulated area and imposes a 50-foot no disturbance strip from the edge of said wetland resources.

The Town of Ware has a Wetlands Protection Bylaw that establishes jurisdiction over wetland resource areas similar to those outlined in the WPA. Additionally, the regulations establish isolated wetlands as resource areas and establish jurisdiction over the 100-foot BZ. No regulations have been promulgated for the Bylaw.

The Town of West Brookfield does not have a wetlands bylaw or town-specific wetlands regulations. The sections below describe the Project’s compliance with the Palmer and Ware bylaws.

Palmer Wetland Ordinance

Within Palmer, the Project will have permanent and temporary impacts to BVW, Bank, LUWW, 100-foot BZ to Bank and BVW, and RFA. There will be temporary impacts within 100 feet of Certified Vernal Pools. The Palmer Wetlands Regulations incorporate the MWPA regulations for Bank, freshwater wetlands, BVW, and LUWW. As described above, the Project will comply with all applicable performance standards in the MWPA regulations.

In Vernal Pools, the Palmer Wetlands Regulations require that work will not result in any impairment of the capacity of the Vernal Pool nor the capacity of the area within 100 feet of the Vernal Pool to provide wildlife habitat. There are three Certified Vernal Pools within 100 feet of the proposed work in Palmer: two located off-ROW near proposed structures 53 and 89, and one located within the ROW near proposed structure 89. In all of these locations, the Project will involve installation of temporary construction mats within 100 feet of the vernal pools. There will be no permanent impacts and no impairment of the capacity of the Vernal Pools, nor the area within 100 feet of the Vernal Pools, to provide wildlife habitat.

The performance standards for 100-foot BZ in the Palmer Wetlands Regulations require that work does not alter any resource area, or if it does, that the alteration will comply with the applicable performance standards for the resource area. The regulations also require that a 50-foot No Disturbance Buffer be maintained between proposed work and the resource area, and that any drainage outlet in the BZ must be non-erosive and result in no significant change in off-site runoff. In Palmer, the Project will result in permanent impacts to BZ from new structures and from grading and installation of gravel for access roads and work pads where a permanent safe working surface must be constructed. Temporary impacts within BZ will include minor grading to provide a smooth work surface for temporary work pads and pull pads, structures to be removed or replaced, and upland construction matting. The Project will comply with all applicable performance standards for resource areas, and there are no new impervious surfaces proposed that would result in erosion or a significant change in off-site runoff.

The Project will require work within the 50-foot No Disturbance Buffer, and a variance from the Palmer Wetlands Regulations will be requested. Due to the linear nature of the transmission line corridor and existing topography, some permanent installation of access roads and work pads within the 50-foot No Disturbance Buffer is unavoidable. This work will not result in material detriment to the values protected by the Ordinance, which include the protection of public and private water supply, protection of groundwater and groundwater quality, protection of surface water and surface water quality, flood control, storm damage prevention, prevention of pollution, protection of fisheries, protection of wildlife habitat, erosion and sedimentation control, and protection of agricultural values. The areas of permanent impact within the 50-foot No Disturbance Buffer will be minimized to the maximum extent possible, and all temporary impacts will be restored to protect these values. The Project will not substantially derogate from the intent or purpose of the Ordinance, which is to protect the wetlands, related water resources, and adjoining land areas within Palmer by controlling activities deemed likely to have a significant or cumulative effect on the resource area values described above. In designing the Rebuilt Line to 115 kV standards, the Project minimizes the cumulative impacts within the ROW by avoiding repeated impacts that would occur when selectively replacing structures as needed or when simply replacing in kind and then having to rebuild the entire line for future load.

Ware Wetlands Protection Bylaw

Within Ware, the Project will have temporary impacts to BVW and LUWW, and permanent and temporary impacts to 100-ft BZ. There will be temporary impacts within 100 feet of a Certified Vernal Pool.

While there are no regulations or performance standards for the Ware Wetlands Protection Bylaw, the Bylaw itself provides guidance to the Conservation Commission in its review of proposed activities.

For proposed activities within the BZ, the Bylaw notes that adverse impacts may include erosion, siltation, loss of groundwater recharge, poor water quality, and loss of wildlife habitat. The Project will avoid and minimize permanent impacts to wildlife habitat to the maximum extent practicable, and will implement Best Management Practices during construction to protect against erosion and siltation and protect water quality. There are no impervious surfaces proposed and there will be no loss of groundwater recharge.

For activities within RFA, the Bylaw requires that there be no practicable alternative to the proposed project with less adverse effects, and that the activity will not have significant adverse impact on the areas or values protected by the Bylaw. As described in Chapter 2, *Alternatives Analysis*, the Proponent has evaluated alternatives that may be reasonably available and capable of being done after taking into consideration the proposed use, overall project purpose, logistics, existing technology, and costs. The proposed work meets the Project purpose and need while minimizing cumulative impacts to the resource areas within the ROW.

To prevent resource area loss, The Bylaw directs the Commission to require applicants to avoid and minimize alteration, and where alteration is unavoidable, to provide full mitigation. This is consistent with the requirements of federal and state regulations, and the Proponent will continue to refine the

Project to avoid and minimize impacts where feasible. Where impacts are unavoidable, 1:1 mitigation will be provided as required under the Section 401 regulations and the MWPA.

3.1.1.6 MassDEP Stormwater Standards

The Project has been designed to comply with the 10 stormwater standards outlined in Massachusetts Wetlands Regulations at 310 CMR 10.05(6)(k) through (q), as outlined in Section 3.4 below.

3.1.2 Existing Wetland Resource Areas

Wetland resource areas were delineated along the O15N ROW in August and September 2022 according to the methods identified in the Regional Supplement to the USACE's *Wetland Delineation Manual: Northcentral and Northeast Region, Version 2.0* (January 2012) and MassDEP's wetland delineation guidance document titled *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act* (March 1995). Wetland resource boundaries demarcated in the field in 2022 were located via GPS devices capable of sub-meter accuracy. The plan set included in Appendix B provides the wetland line as delineated by the wetland scientists in 2022.

3.1.3 Impacts to Wetlands Resource Areas

The Project is expected to have temporary and permanent impacts to waters of the U.S. and state-jurisdictional wetlands (see Figure 3.2). Anticipated temporary and permanent impacts from the proposed design are summarized in Table 3-1. Permanent impacts to BVW will occur as a result of the installation of some of the proposed steel structures. Temporary impacts will occur from the installation of construction matting for access roads and work pads and pull pads. There are no anticipated permanent impacts to Bank or LUWW. Temporary impacts are anticipated to RFA and BZ from the construction of temporary work pads in upland areas and wetland matting laid for the construction of access roads and work pads in wetland resource areas. Permanent impacts are expected to occur in RFA and BZ from the installation of structures and workpads and the construction of upland access roads.

Table 3-1 Potential Impacts to Wetland Resource Areas[1]

Resource Area	Permanent Impacts	Temporary Impacts	Total
BVW (sf)	113	199,967	200,080
Bank (lf)	0	2,617	2,617
LUWW (sf)	0	4,811	4,811
RFA (sf)	4,534	93,989	98,523

sf = square feet; lf = linear feet

1. Note that these resource areas overlap and cannot be added together to arrive at a total amount of impact.

3.1.4 Mitigation Measures

The Project has been designed to avoid and minimize temporary and permanent adverse effects to Waters of the U.S. and resource areas jurisdictional under the MWPA and local bylaws. The

Proponent will provide 1:1 replication for wetland impacts subject to jurisdiction under the state Section 401 Water Quality Certification regulations and the MWPA. This mitigation will be developed in compliance with the requirements of those regulations. Please see Section 6 for discussion of construction-phase avoidance and minimization measures.

3.2 Rare Species

3.2.1 Regulatory Context

The Massachusetts Endangered Species Act (MESA: G.L. c. 131A) and its implementing regulations (321 CMR 10.00) provide protections for Endangered, Threatened and Special Concern species. Projects within mapped Priority Habitat or Estimated Habitat of Rare Species must be reviewed under MESA. The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife (the Division) is the MESA regulatory authority.

3.2.2 Priority/Estimated Habitat

Based on the 15th Edition of the Natural Heritage Atlas (August 2021), portions of the project occur within mapped Priority Habitat or Estimated Habitat of Rare Species. State-listed species associated with these mapped habitat areas include one vertebrate animal, one invertebrate animal, and three vascular plants. NEP submitted a formal information request to NHESP to identify rare species located in the Priority/Estimated Habitat that occurs within the O15N ROW. Based on the response from NHESP provided on August 03, 2022, the Project is located in Priority/Estimated Habitat area (PH 1106 / EH 800).

Refer to Figure 3.3 for a map of protected species habitat within and adjacent to the Project Site.

3.2.3 Survey and Habitat Assessment

Botanical surveys of the Project area were completed to map the extents of state-listed plants and host plant species for the state-listed invertebrate.

VHB conducted surveys and habitat evaluations for state-listed species throughout the mapped habitat areas. The Project ROW contains actual habitat for state-listed animals and was found to support two state-listed vascular plants.

3.2.4 Potential Impacts

Table 3-2 provides a summary of potential impacts to Priority and Estimated Habitat. Permanent impacts will occur from structure installation and the construction of access roads, while temporary impacts will result from grading and construction matting for work pads, pull pads, and access. These temporary disturbance areas will be restored upon completion of construction.

Although there will be 2.3 acres of permanent road construction and structure installation within Priority Habitat, across the 3.96 miles of Priority Habitat within the ROW there are only six locations that may result in direct impacts to known listed plant or host plant locations based on the field surveys conducted. Similarly, although there will be 0.06 acres of permanent impact within Estimated

Habitat, due to the maintained nature of ROW vegetation, no impacts are anticipated to the state-listed vertebrate animal. The Proponent will continue to refine design to avoid and minimize impacts to listed species to the greatest extent possible.

Table 3-2 Summary of Potential Impacts to Rare Species Habitat (PH 1106/EH 800)

Impact Type	Estimated Habitat	Priority Habitat
Permanent impacts from access road construction and structure installation	2,467 square feet (0.06 acres)	99,012 square feet (2.3 acres)
Temporary impacts to habitat from construction matting for work pads, pull pads, and access	35,909 square feet (0.8 acres)	772,029 square feet (17.7) acres

3.2.5 Mitigation Measures

The Proponent will work with NHESP staff through the MESA review process to determine appropriate Protection Plans for each state-listed rare species. Measures included within the state-listed species Protection Plans could include time-of-year restrictions, pre-construction surveys, and/or use of temporary avoidance fencing during construction. Final protection measures will be developed through coordination with the Division.

If NHESP staff determines that construction along the O15N line would result in a "take," then the Proponent will file for and meet the performance standards for the issuance of a Conservation Management Permit ("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.

3.3 Protected Open Space

3.3.1 Regulatory Context

Article 97 is a critical component of environmental protection policy in Massachusetts, reinforcing the state's commitment to preserving natural resources and ensuring that any changes to the use of protected lands are thoroughly vetted and justified. Article 97 of the Massachusetts Constitution mandates the protection of public natural resources, including open spaces. Any proposed changes involving Article 97 lands often necessitate review and approval by relevant state agencies, such as the EEA. MEPA requires that state agencies consider the environmental impacts of their actions, including projects that impact open spaces.

The Urban Parks and Recreation Recovery Act program focuses on revitalizing and maintaining urban parks, protecting open spaces within urban environments, and ensuring that they continue to serve public recreational needs. Local conservation commissions play a pivotal role in regulating and protecting open spaces. They enforce the state's Wetlands Protection Act at the local level, manage conservation lands, and often implement additional local regulations designed to protect natural resources.

3.3.2 Protected Lands, Open Space and Recreation

Within areas classified as protected lands or open space and recreation, Project construction is contained within an existing NEP ROW and along historically utilized access routes. As such, there are no anticipated permanent changes to open space and recreational land uses associated with construction of the Project along the Project Route, and no additional easements or property acquisitions are necessary. However, NEP has evaluated protected lands and properties used for open space and recreation within the Project ROW, as well as adjacent lands within 300 feet, to identify potential impacts to abutting stakeholders during construction.

Protected open space and recreational land uses were identified using the MassGIS Protected and Recreational Open Space data layer and are depicted in Figure 3.4. Table 3-3 shows a summary of all open spaces and recreation resources identified for the Project. A portion of all of these resources are within the ROW; other than King's Brook, all of these resources are also composed of additional parcels that are within 300 feet of the ROW. As part of this analysis, NEP also reviewed Areas of Critical Environmental Concern ("ACECs").[1] No ACECs are located within 300 feet of the ROW.

Table 3-3 Open Space and Recreation Resources[2]

	Open Space and Recreation Resources			
Municipality	**Site Name**	**Agency**	**Owner**	**Primary Purpose**
PALMER	Palmer WMA	State	MA Department of Fish and Game	Conservation
	Midura Family Conservation Area	Local	Town of Palmer	Conservation and Recreation
	King's Brook Conservation Area	Local	Town of Palmer	Conservation
WARE	Coy Hill WMA	State	MA Department of Fish and Game	Conservation
WEST BROOKFIELD	Coy Hill WMA	State	MA Department of Fish and Game	Conservation

NEP identified four state- and municipal -owned open space lands located within or adjacent to the Project ROW, consisting of a total of approximately 42 acres of open space within the Project ROW and 247 acres within 300 feet of the Project ROW. The primary purpose of these protected lands is conservation. Many of these areas provide year-round recreational opportunities such as hiking and

[1] ACECs are identified as environmentally significant places in Massachusetts that receive special recognition because of the quality, uniqueness, and significance of their natural and cultural resources.

[2] This list contains G.L. c. 59 §2A - Land which is not otherwise classified, and which is not taxable under the provisions of Chapter 61, 61A or 61B, or taxable under a permanent conservation restriction, and which land is not held for the production of income but is maintained in an open or natural condition and which contributes significantly to the benefit and enjoyment of the public. Chapter 61, 61A, 61B Property Being Classified as Open Space Source might overlap with Exempt Property above. Source - Bureau of Local Assessment. (2019, April). Property Type Classification Codes - Massachusetts. PROPERTY TYPE CLASSIFICATION CODES. Retrieved April 4, 2023, from https://www.mass.gov/doc/property-type-classification-codes-non-arms-length-codes-and-sales-report-spreadsheet/download

nature study, and seasonal activities such as fishing. The majority of the open space areas located adjacent to the Project ROW provide scenic views and are often associated with rivers, reservoirs, wetlands, streams, and state forests.

In addition to the two Massachusetts Department of Fish and Game ("DFG") properties, there are two town-owned conservation properties, the Midura Family Conservation Area and the King's Brook Conservation Area, both of which are owned by the town of Palmer. The Midura Family Conservation Area offers recreational opportunities including hunting, fishing, and hiking. There is a network of hiking trails on the property.

3.3.2.1 State-Owned Properties

Palmer and Coy Hill WMAs

DFG owns and manages two state Wildlife Management Areas ("WMAs") in this area. These properties account for 40 acres of land within the Project ROW, and approximately 238 acres within 300 feet of the ROW. The Palmer WMA consists of 1,260 acres split across three main parcels located in Palmer and Warren. The primary habitat types are upland hardwood forests mixed with white pine and hemlock. There are also numerous beaver wetlands. The Coy Hill WMA is approximately 866 acres located in Ware and West Brookfield. It consists of mature hardwood forests and white pine stands. These DFG properties offer opportunities for hunting and wildlife viewing.

3.3.2.1 Town-Owned Properties

Midura Family and Kings Brook Conservation Areas

There are two town-owned conservation properties within and near the ROW: the Midura Family Conservation Area and the King's Brook Conservation Area, both of which are owned by the town of Palmer. The Midura Family Conservation Area offers recreational opportunities including hunting, fishing, and hiking. There is a network of hiking trails on the property.

3.3.3 Potential Impacts

The majority of Project construction activities will take place within the existing ROW; there will be no impacts to adjacent open space parcels. NEP's easements for the Existing Line predate the establishment of the open space properties in these areas. NEP holds easements that grant rights for the construction and maintenance of towers, poles, wires, and other structures for the transmission of electric power in these locations. The Project has been designed to utilize existing access or develop new access within NEP's existing easements.

3.3.4 Mitigation Measures

The Project Route is located within an existing ROW held in fee or easement by NEP. Rebuilding the Existing Line along the Project Route is consistent with the existing use of the ROW. Since the Project will continue to support utility infrastructure, it is not anticipated to interfere with any long-term existing or future land uses. In addition, the Project has been designed to utilize existing access rights.

NEP will provide notification of the intended construction plan and schedule to any affected abutters to minimize the effect of any temporary disruptions. To mitigate temporary construction-phase disturbances to public open spaces and existing trail systems, NEP will coordinate with the affected stakeholders and will develop an outreach plan to include safety signage and temporary detours around active construction zones. Normal operation at all facilities will otherwise continue and existing land uses will be allowed to continue following construction.

With the implementation of these measures, the anticipated impacts of the Project on protected, open space, and recreational lands will be minimized.

3.4 Stormwater Management

The Project has been designed to meet all applicable Massachusetts Stormwater Standards as required per the Massachusetts Wetlands Regulations at 310 CMR 10.05 (6)(k) through (q). No new impervious areas will be created as part of this Project. The majority of the stormwater management standards are not applicable to the proposed work. The primary applicable standard is Standard #8: Construction Period Pollution Prevention and Erosion and Sedimentation Controls. Erosion and sediment control devices such as straw bales, straw wattles, siltation fencing, compost socks, and/or chip bales will be installed in accordance with NEP's BMPs and approved plans and permit requirements. The installation of these erosion and sediment control devices will be supervised by the Project's construction contractors and reviewed by the Proponent's construction supervisors and designated environmental monitors. Erosion and sediment controls will be installed between the work site and environmentally sensitive areas such as wetlands, streams, drainage courses, roads, and adjacent properties when work activities will disturb soil and result in the potential for soil erosion and sedimentation. Erosion and sediment control devices will function to mitigate construction-related soil erosion and sedimentation and will also serve as a physical boundary to delineate resource areas and to contain construction activities within approved areas. The Project contractors, supervisors, and environmental monitors will regularly monitor installed controls.

In addition to those locations described above, erosion and sediment control devices will be installed along the perimeter of identified wetland resource areas prior to the onset of soil disturbance activities to ensure that stockpiles and other disturbed soil areas are confined and do not result in downslope sedimentation of wetland resources. Where structures requiring concrete foundations are located near wetlands, sedimentation controls will be installed to prevent transport of materials to these downgradient resource areas.

3.4.1 Compliance with MassDEP Stormwater Standards

The following paragraphs provide an overview of the MassDEP Stormwater Standards with an explanation of how the Project will comply.

Standard 1: *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

No new stormwater conveyances are proposed. The majority of the ROW is vegetated and stormwater will infiltrate on-site. Stormwater would generally be shed off any new gravel access roads (country drainage) directly into vegetated areas.

Standard 2: *Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.*

No new impervious area is proposed. As noted above, the ROW is vegetated and stormwater from access roads will generally shed off directly into vegetated areas.

Standard 3: *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance.*

No new impervious surfaces are proposed, and there will be no loss of annual recharge to groundwater.

Standard 4: *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS).*

The Project will not result in an increase to impervious surfaces and no stormwater management systems are proposed.

Standard 5: *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.*

The Project does not qualify as a land use with higher potential pollutant loads and this standard does not apply.

Standard 6: *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.*

Critical Areas include Outstanding Resource Waters and Special Resource Waters as designated in 314 CMR 4.00; Zone I, Zone II, and Interim Wellhead Protection Areas for ground water sources; Zone As for surface water sources; bathing beaches as defined in 105 CMR 445.000; cold-water fisheries; and shellfish growing areas. There is one Zone II wellhead protection area at Palmer Substation, and three cold-water fisheries cross the ROW. No permanent impacts are proposed in any of these locations and no new stormwater discharges are anticipated. Construction-phase stormwater will comply with the NPDES CGP and will be addressed through the use of BMPs such as straw bales, straw wattles, siltation fencing, compost socks, and/or chip bales.

Standard 7: *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable.*

This standard does not apply as this Project does not qualify as a redevelopment project as defined in the MWPA Regulations.

Standard 8: *A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

The Project will require coverage under the NPDES 2022 CGP due to anticipated disturbance of over an acre of land. As required, the Proponent will develop a detailed SWPPP for the Project that will include an adequate soil erosion, sediment, and turbidity control plan to prevent the migration of soil and sediment from disturbed areas to adjacent wetlands and waterbodies. The contractor will also be required to follow BMPs as outlined in National Grid's EG-303NE Environmental Guidance document.

Standard 9: *A Long-Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed*.

This standard does not apply; no stormwater management systems are proposed.

Standard 10: *All illicit discharges to the stormwater management system are prohibited*.

This standard does not apply; no stormwater management systems are proposed.

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- Existing O-15N Transmission Line
- 100-Year FEMA Floodplain
- Watercourse (Non-delineated)
- Town Boundary

1:60,000

0 2,500 5,000 10,000 Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 3.1: Floodplain and Water Resources Map
Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 6/24/2024

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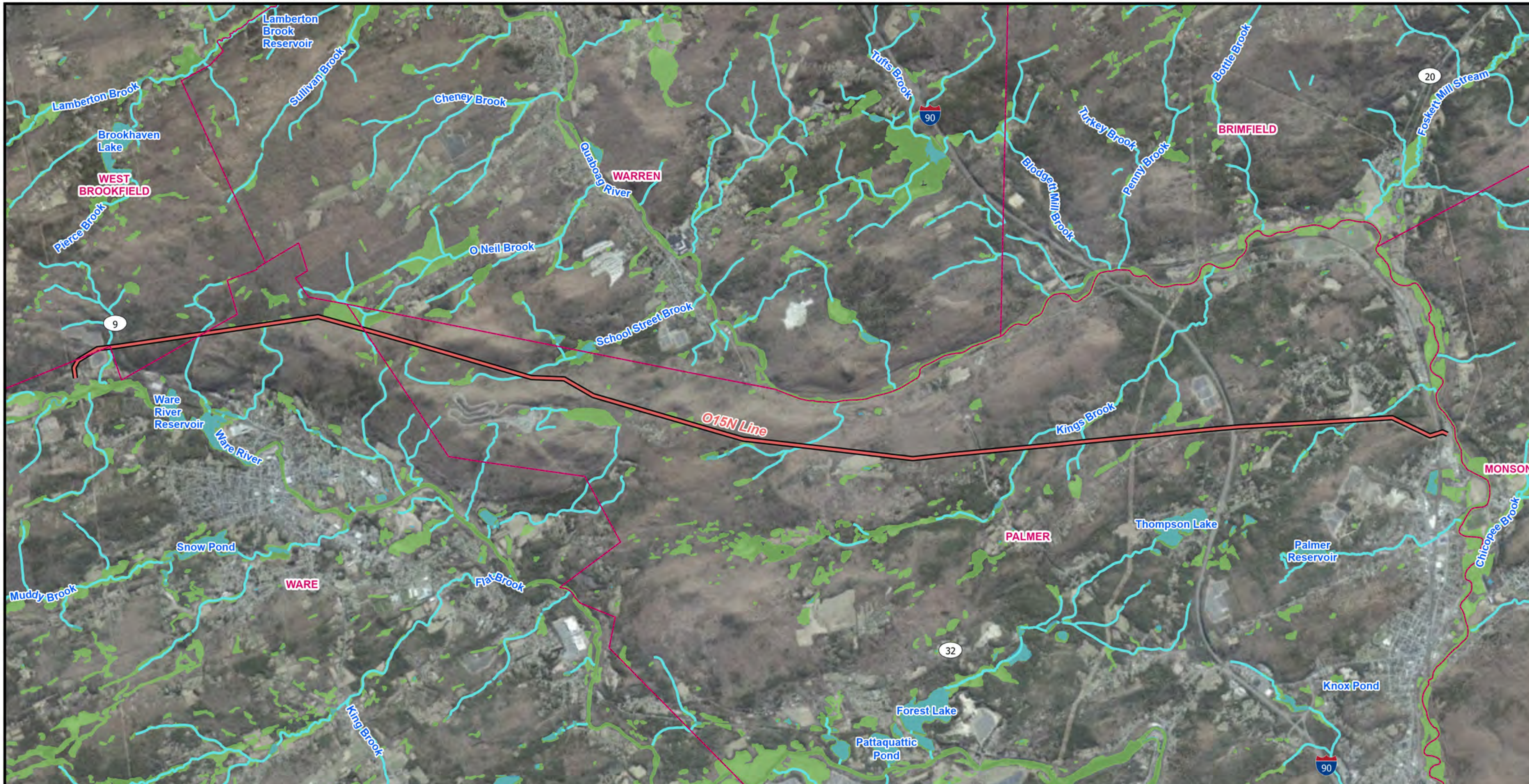

Existing O-15N Transmission Line
Town Boundary
Watercourse (Non-delineated)
Waterbody
DEP Wetlands

N

1:60,000

0 2,500 5,000 10,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 3.2: Wetlands
Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 6/24/2024

nationalgrid

vhb

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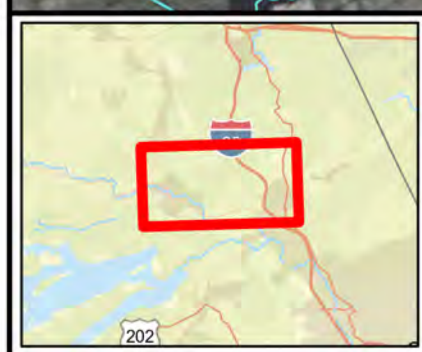

- Existing O-15N Transmission Line
- Watercourse (Non-delineated)
- Town Boundary
- NHESP Potential Vernal Pools
- NHESP Certified Vernal Pools
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Priority Habitats of Rare Species

1:60,000

0 2,500 5,000 10,000

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 3.3: Protected Species Habitats
Page 1 of 1

Source: MassGIS,National Grid,VHB

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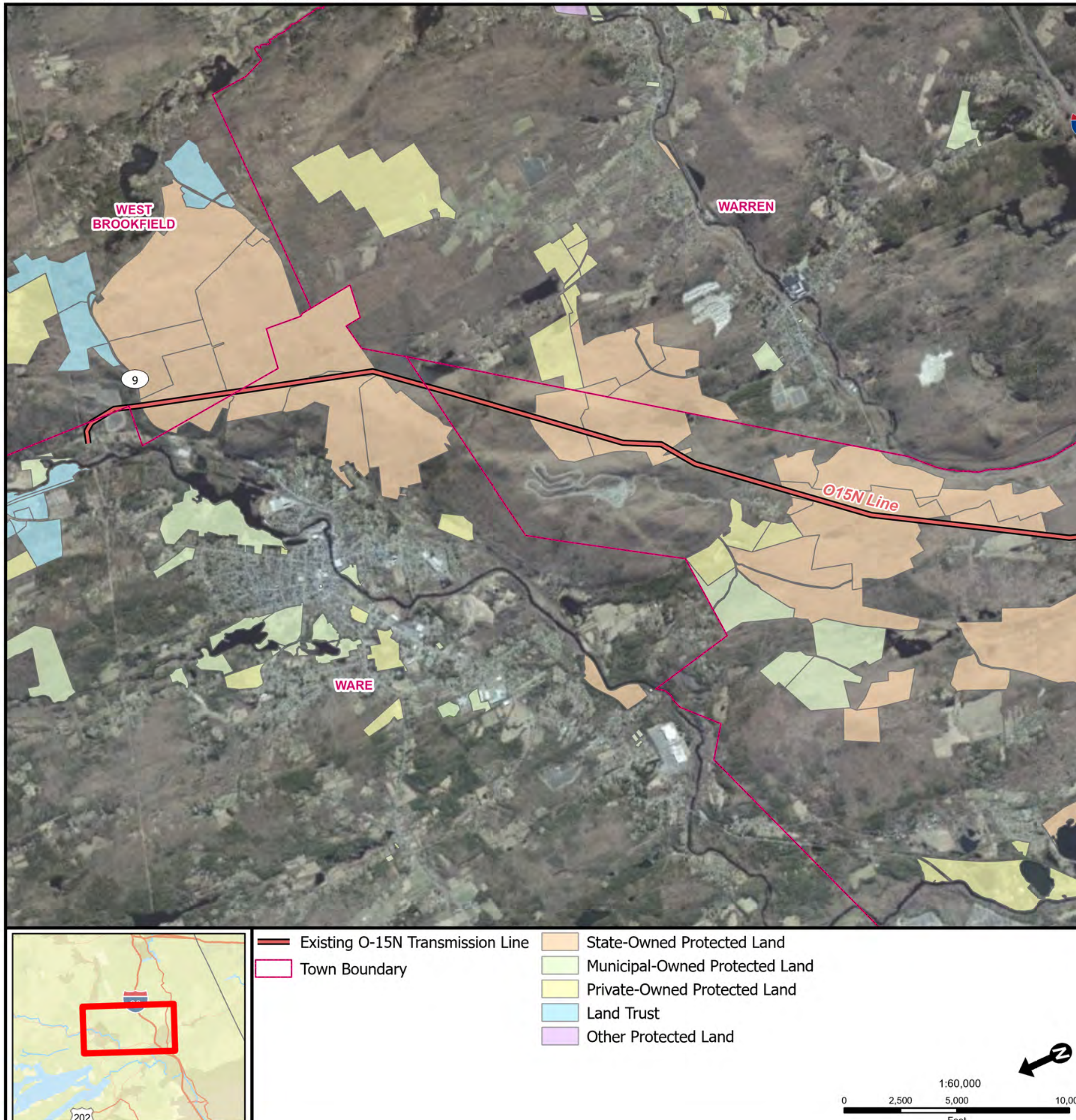


Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 3.4: Protected Open Space
Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 6/24/2024

nationalgrid

vhb

4

Climate Change Preparedness and Resiliency

This chapter identifies the Project Site's vulnerability to the effects of climate change, describes the applicable climate change adaptation planning, and details the proposed adaptation and resiliency measures at the structures and site levels.

The proposed Project is part of the Proponent's efforts to ensure the sustainability and reliability of the region's electrical infrastructure in the face of growing demand for electricity and the changing climate. The Project will result in a more climate-ready and resilient transmission system that can withstand more extreme weather events, address existing system capacity shortages and increasing demand, and support future interconnection of renewable energy projects.

The increased capacity of the Rebuilt Lines will allow it to support higher volumes of currently active and forecasted renewable energy resources in this region. This long-term view aligns with the State Hazard Mitigation & Climate Adaptation Plan, which anticipates that electricity consumption during summer may triple, and preliminary results of the ISO-NE 2050 Transmission Study, point toward a long-term need for additional capacity across the New England transmission system to support the anticipated electric load growth driven by regional commitments for renewable and clean energy, GHG reduction, and net-zero carbon policies.

The Project is not anticipated to generate any GHG emissions associated with stationary or mobile sources when operational. Limited air quality impacts are anticipated during the construction of the Project which are temporary in nature. Emissions from construction equipment and transport of construction materials will be minimized in accordance with Massachusetts' anti-idling law, G.L. c. 90, § 16A, c. 111, §§ 142A–142M, and 310 C.M.R. 7.11. The Company limits vehicle idling time to five minutes except when engine power is necessary for delivery of materials or to operate accessories to the vehicle, such as power lifts. The Proponent requires contractors to use ultra-low-sulfur diesel ("ULSD") in off-road diesel vehicles. The Proponent will also comply with MassDEP's Diesel Retrofit Program. Other measures proposed to minimize air quality impacts during construction are described in further detail in Section 5.3.2 of Chapter 5, *Environmental Justice and Public Health*, and Section 6.2.4 of Chapter 6, *Construction Period Impacts*.

4.1 Regulatory Context

4.1.1 Draft MEPA Climate Change Adaptation and Resiliency Policy

MEPA requires that projects study the environmental consequences of their actions, and that they take all feasible measures to avoid, minimize, or mitigate damage to the environment. To address climate change adaptation, the EEA released the MEPA Interim Protocol on Climate Change Adaptation and Resiliency (the "MEPA Interim Protocol"), effective October 1, 2021. It describes how projects should assess and mitigate the risks and vulnerabilities that are likely to result from climate change impacts.

4.1.2 RMAT Climate Resilience Tool

The MEPA Interim Protocol requires addressing the output report from the State's Resilient Massachusetts Action Team (RMAT) Climate Resilience Design Standards Tool, which utilizes the Massachusetts Coast Flood Risk Model (MC-FRM). This is an interactive web-based tool that automates the Commonwealth's available climate change data and provides a preliminary climate risk screening and planning recommendations for projects. The output report is provided in Appendix D.

4.2 Projected Climate Conditions and Vulnerability Assessment

King's Brook, which has an associated floodplain mapped by the Federal Emergency Management Agency (FEMA), passes through the Project Site in Palmer. FEMA has mapped 100-year floodplains as shown on FIRM map number 25013C0267E with an effective date of July 16, 2013 (refer to Figure 4.1 for a map of FEMA floodplains). Base Flood Elevations were not recorded on this map.

The Proponent consulted the RMAT Tool for this Project. The Tool assigns climate risks based on three variables: sea level rise and storm surge, extreme precipitation including urban flooding and riverine flooding, and extreme heat. According to the preliminary analysis, the Project Site is at high risk from extreme precipitation and extreme heat. It is not exposed to sea level rise/storm surge.

4.2.1 Extreme Precipitation Events

RMAT identified that the Project would have "High Exposure" to extreme precipitation events based on the following inputs and factors:

- Maximum annual daily rainfall exceeds 10 inches within the overall Project's useful life;
- No historic flooding (urban or riverine) at the Project Site;
- No increase to impervious area;
- Existing impervious area of the Project Site is less than 10%;

- Part of the Project Site is within a mapped FEMA floodplain (Refer to Figure 4.1 for the FEMA Floodplain), outside of the Massachusetts Coast Flood Risk Model (MC-FRM);
- Project is more than 500 feet from a waterbody; and
- The Project is not likely susceptible to riverine erosion.

The RMAT Report recommends a target planning horizon of 2070 and a return period of 50 years (2% annual chance event). A Tier 3 stormwater analysis utilizing a projected 24-hr total precipitation depth of 9.4 inches is recommended.

4.2.2 Temperature

The Project was determined to have "High Exposure" to extreme heat events due to the following inputs/factors:

- 30+ day increase in days over 90 degrees Fahrenheit within the Project's useful life;
- Between 10% and 40% of the existing Project Site has canopy cover; and
- Project Site located within 100 feet of an existing water body.

The RMAT Report recommends a target planning horizon of 2070.

4.3 Potential Site Resiliency Measures

Transmission lines typically have a lifespan of more than 80 years, which exceeds the recommended planning horizon. No new impervious surfaces are proposed and no stormwater impacts are anticipated. The ROW is vegetated and will continue to allow stormwater infiltration, and the proposed transmission structures are designed to withstand rain, ice, and wind.

The Project will be made more resilient through installation of steel structures, and state-of-the-art conductors that respond well to corrosion and operate at higher maximum operating temperatures. Further, the Project’s engineering design used structure loading criteria required by the National Electrical Safety Code (“NESC”), 220 CMR 125, and National Grid Design Loads for Overhead Transmission Structures. The NESC load criteria require consideration of combined ice and wind district loading, extreme wind conditions, and extreme ice with concurrent wind conditions.

The Proponent incorporated resiliency measures into site and structure design considerations. With regards to flooding, the new structures will be located outside of any regulatory floodways and will be installed at least 14 feet below grade. The conductors will be at least 25 feet above grade, high enough to avoid potential flood waters. Increased heat could cause the transmission line itself to operate at higher temperatures and require adjustment to a higher ampacity; the Proponent anticipates that this will have a marginal impact on the life of the assets.

5

Environmental Justice and Public Health

In compliance with Chapter 8 of the Acts of 2021, *An act creating a next-generation roadmap for Massachusetts climate policy*, which became effective on June 24, 2021, and with EEA's updated Environmental Justice Policy (together, the "EJ Policy"), this EENF must indicate whether any Environmental Justice (EJ) populations located within one mile of the Project Site are reasonably likely to be adversely impacted by the Project.

EEA defines EJ as "the equal protection and meaningful involvement of all people and communities" regarding environmental issues, including the equitable allocation of benefits and burdens. The EJ Policy builds upon Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, which "directs federal agencies to identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, to the greatest extent practicable and permitted by law."

In accordance with the EJ Policy, the Proponent consulted EEA's Massachusetts 2020 Environmental Justice Populations Map (EJ Maps Viewer) to identify the presence of EJ populations as an initial screening tool for identifying potential EJ populations under the EJ Policy. It derives from the 2020 U.S. Census (for EJ block groups) and 2015 American Community Survey 5-Year Estimates (for English isolation criteria).

EJ Populations in Massachusetts are defined as:

A. A neighborhood that meets one or more of the following criteria:

   i. The annual median household income is not more than 65 percent of the statewide annual median household income;

   ii. Minorities comprise 40 percent or more of the population;

   iii. 25 percent or more of households lack English language proficiency; or

iv. Minorities comprise 25 percent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income; or

B. A geographic portion of a neighborhood designated by the Secretary as an environmental justice population in accordance with law.

5.1 Compliance with Public Involvement Protocol

In compliance with the MEPA Protocol for Public Involvement for Environmental Justice Populations ("Public Involvement Protocol"), effective January 1, 2022, this section describes measures taken by the Proponent to provide meaningful engagement with surrounding EJ populations. The Public Involvement Protocol requires identifying and describing the characteristics of EJ populations within five miles of the Project Site.

5.1.1 Identification of EJ Populations

The Project is not expected to exceed MEPA Review Thresholds related to air quality and is not expected to generate 150 or more average daily trips of diesel trucks over the duration of a year. Therefore, the area of study for EJ impacts, or "Designated Geographic Area" (DGA), for the Project is the one-mile radius from the Project Site. Regardless, the Public Involvement Protocol requires identification of populations within five miles.

The Project is not directly located within any EJ populations. Within a one-mile radius of the Project Site, the following EJ populations are found:

› Income – at least 25 percent of households have a median household income 65 percent or less than the state median household income.

Within a five-mile radius of the Project Site, the above EJ populations are present, along with:

› Minority and Income – the block group minority population is greater than 40 percent or the block group minority population is greater than 25 percent and the median household income of the municipality containing the block group, is less than 150 percent of the state median household income, and also have the attributes of the "Income" population defined above.

Refer to Tables 5-1 and 5-2 below for a breakdown of census block group and census tract by EJ category, and Figure 5.1 for a graphic showing EJ populations in the vicinity of the Project.

Table 5-1 Environmental Justice Populations within 1 Mile of the Project Site

Census Block Group	Census Tract	EJ Category	Town, County	Median Household Income	Total Minority Population	Households with English Isolation
3	8201.01	Income	Ware, Hampshire County	$41,731	14.0%	0.0%
1	7611	Income	Warren, Worcester County	$50,128	10.0%	0.0%
3	8137.02	Income	Monson, Hampden County	$49,000	9.0%	0.0%

Notes Data is from EEA's EJ Maps Viewer. 2020 environmental justice block groups data was obtained from https://www.mass.gov/info-details/massgis-data-2020-environmental-justice-populations. Languages spoken in Massachusetts data was obtained from the American Community Survey 2011-2015 5-year estimates, Table B16001.

Table 5-2 Environmental Justice Populations within 5 Miles of the Project Site

Census Block Group	Census Tract	EJ Category	Town, County	Median Household Income	Total Minority Population	Households with English Isolation
3	8201.01	Income	Ware, Hampshire County	$41,731	14.0%	0.0%
2	8201.02	Income	Ware, Hampshire County	$29,250	19.0%	0.0%
3	8201.02	Minority and Income	Ware, Hampshire County	$33,889	25.0%	3.0%
1	7611	Income	Warren, Worcester County	$50,128	10.0%	0.0%
3	7611	Income	Warren, Worcester County	$48,711	13.0%	0.0%
3	7241	Income	West Brookfield, Worcester County	$36,913	11.0%	0.0%
2	7231	Income	Hardwick, Worcester County	$39,205	12.0%	0.0%
3	8137.02	Income	Monson, Hampden County	$49,000	9.0%	0.0%
4	8101	Income	Palmer, Hampden County	$39,736	17.0%	0.0%
2	8102	Income	Palmer, Hampden County	$47,163	10.0%	2.0%

Notes Data is from EEA's EJ Maps Viewer. 2020 environmental justice block groups data was obtained from https://www.mass.gov/info-details/massgis-data-2020-environmental-justice-populations. Languages spoken in Massachusetts data was obtained from the American Community Survey 2011-2015 5-year estimates, Table B16001.

5.1.2 MEPA Language Criteria

According to the "Languages Spoken in Massachusetts" tab of MEPA's EJ Maps Viewer, there are no census tracts within the DGA (one-mile radius) nor within the five-mile radius of the Project Site wherein five percent or more of the population report that they do not speak English "very well." If requested, the Proponent can provide Spanish-language oral interpretation at the MEPA Site Consultation public meeting and any subsequent public/community meetings held during the MEPA review process to ensure meaningful community engagement.

5.2 Assessment of Existing Public Health Conditions

5.2.1 Department of Public Health Vulnerable Health Criteria

To understand existing disproportionate health vulnerabilities faced by EJ populations within the DGA, the Massachusetts Department of Public Health EJ Tool (the "DPH EJ Tool"),[1] was used to identify Vulnerable Health EJ Criteria within the community. The DPH EJ Tool provides information at the community level (defined as municipalities). These criteria include four environmentally related health indicators to determine populations that may have higher than average rates of environmentally related health outcomes: heart attack, elevated blood lead, low birth weight, and childhood asthma.

At the municipal level, the DPH EJ Tool indicates that the Town of:

› Ware meets the Vulnerable Health EJ criteria for low birth weight, elevated blood lead prevalence, and childhood asthma, but not for heart attack;

› Palmer meets the criteria for elevated blood lead prevalence and heart attack but does not meet the criteria for childhood asthma and low birth weight; and

› West Brookfield does not meet the criteria for heart attack. The DPH EJ Tool does not show data for other parameters in the West Brookfield community.

At the census tract level, the DPH EJ Tool also indicates that:

› The census tract in Ware containing a small portion of the Project Site meets the criteria for elevated blood lead levels and low birth weight; and

› The census tract in Palmer containing a majority of the Project area meets the criteria for elevated blood lead levels but not for low birth weight.

The tool does not show data for other parameters in census tracts located within the Project Site. As detailed below in Section 5.3, the Project is not likely to exacerbate the rate of these environmentally related health outcomes as it will not result in any additional traffic or GHG emissions, nor will it introduce any lead or other health impacts related to these criteria.

5.1.1.1 Potential Sources of Pollution

The DPH EJ Tool was also consulted to identify potential sources of pollution that may have impacted, or may currently impact, EJ populations within one mile of the Project Site. These include the following Major Air and Waste Facilities:

› Large Quantity Toxic Users – 2

› Large Quantity Generators – 1

› MassDEP Tier Classified 21E Sites – 1

› MA Tier II Facilities – 10

› MassDEP Sites with Activity and Use Limitations (AUL) – 1

1 Commonwealth of Massachusetts. 2021. *MA DPH Environmental Justice Tool.* https://matracking.ehs.state.ma.us/Environmental-Data/ej-vulnerable-health/environmental-justice.html

- Wastewater Treatment Plants – 1
- Underground Storage Tanks – 3
- EPA Facilities – 1

The potential sources of pollution identified above are not located on the Project Site. The Project will not exacerbate any potential environmental risks posed by the facilities above.

5.2.2 U.S. EPA EJ Screen

The U.S. Environmental Protection Agency's (EPA) "EJ Screen"[2] was also reviewed to identify existing public health conditions surrounding the Project Site within the DGA (the "Project Buffer Area"). The EJ Screen report provides a percentile ranking by census block group compared against statewide averages for 12 environmental indicators (listed below).[3] The report generated by this tool (included in Appendix E) indicates the following percentile rankings for the Project Buffer Area:

1. 83rd percentile for Particulate Matter (PM) 2.5
2. 88th percentile for Ozone
3. 10th percentile for NATA Diesel PM
4. 13th percentile for Nitrogen Dioxide (NO_2)
5. 12th percentile for Toxic Releases to Air
6. 4th percentile for Traffic Proximity (count of vehicles per day at major roads divided by the distance)
7. 33rd percentile for Lead Paint Indicator (percent of housing built before 1960)
8. 55th percentile for Superfund Proximity (count of National Priorities List/Superfund sites divided by the distance)
9. 0th percentile for RMP Proximity (count of facilities with Risk Management Program divided by the distance)
10. 4th percentile for Hazardous Waste Proximity (count of transfer, storage, and disposal facilities (TSDFs) and Large Quantity Generators (LQGs) divided by the distance)
11. 17th percentile for Underground Storage Tanks (USTs)
12. 13th percentile for Wastewater Discharge Indicator (toxicity-weighted concentration/meter)
13. 0th percentile for Drinking Water Non-Compliance

The Buffer Report (Appendix E) indicates that the indicators listed below were shown to be at or above the 80th percentile of the statewide average for EJ populations within the DGA. It is useful to

[2] United States Environmental Protection Agency. 2024 version. EJScreen. Retrieved: 07/30/24 from https://ejscreen.epa.gov/mapper/

[3] EJScreen was developed by EPA to highlight places that may be candidates for further review, analysis, or outreach to support the agency's environmental justice work. The EPA notes that the environmental indicators are only screening-level proxies for actual exposures or health risks, and that screening-level results do not, by themselves, determine the existence or absence of environmental justice concerns in a given location; do not provide a risk assessment; and have other significant limitations. EJScreen is not designed to take into account quantifiable cumulative or synergistic effects. https://www.epa.gov/ejscreen/purposes-and-uses-ejscreen Accessed 07/30/24.

note that Massachusetts has much stronger environmental regulations compared to the rest of the U.S. This is demonstrated by the PM2.5 indicator, where the Project's Buffer Zone is over 83rd percentile for the state but only in the 19th percentile for the country.

- **PM 2.5** – This indicator measures the potential exposure to inhalable particles that are 2.5 microns or smaller in size. PM exposure has been linked to a range of health impacts, including premature death in people with pre-existing heart or lung disease, asthma attacks, heart attacks, irregular heartbeat, decreased lung function and other respiratory health issues. It is important to remember that the air toxics data presented in the EJ Screen report provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations.

  The PM 2.5 concentration in the Project Buffer Area (7.03 $\mu g/m^3$) is higher than the average concentrations in the state (6.52 $\mu g/m^3$) but lower than the average concentrations in the USA (8.45 $\mu g/m^3$).

- **Ozone (O_3)** – This indicator measures how much ground-level ozone human beings might be exposed to, calculated as the annual mean of the ten highest daily maximum 8-hour ozone concentration in air. The ozone indicator in EJScreen is a measure of potential exposure but not a measure of risk. Ozone at ground level is a harmful air pollutant because of its effects on people and the environment and it is the main ingredient in smog.

  The ozone concentration in the Project Buffer Area (39.2 ppb) is higher than the average concentrations in the state (37.9 ppb) but lower than the average concentrations in the USA (41 ppb).

5.3 Compliance with EJ Impact Policy

This section examines how Project impacts affect EJ populations versus non-EJ populations. No long-term impacts to soil, bedrock, vegetation, surface water, groundwater, wetland resources, or air quality will occur from the Project. The Proponent will implement measures to avoid, minimize, and mitigate potential environmental impacts throughout the entire Project alignment, including where it is within one mile of mapped EJ populations. These include, but are not limited to, designing the project to avoid wetlands and waterways to the greatest degree possible, use of construction matting in wetlands to reduce soil disturbance and protect water quality, and implementation of a SWPPP to avoid impacts to receiving waters from sediment laden stormwater runoff or from spills or other inadvertent releases of fuels, oils, or other hazardous materials used in equipment or as incidental use during construction.

Since the nature and severity of Project impacts are minimal on all populations, including EJ populations, the Project will not materially exacerbate any existing unfair or inequitable environmental or public health burden impacting the EJ population. Overall, the Project will improve transmission system infrastructure and comply with comprehensive regional plans for maintaining electric transmission reliability in New England, for EJ and non-EJ Populations alike.

5.3.1 Climate Change Vulnerability

The Proponent utilized the Resilient Massachusetts Action Team (RMAT) Tool to determine potential climate risks to the surrounding communities. The RMAT Tool identified the Project Site as having a high exposure to extreme precipitation-urban flooding and extreme heat. As noted in the Interim Protocol for Analysis of Project Impacts on Environmental Justice Populations (the "Project Impacts Protocol"), a high-risk rating for extreme precipitation could indicate elevated climate risks for EJ populations that immediately surround the Project Site (i.e., within the Project boundaries). The Project will not create or exacerbate risks associated with extreme precipitation or urban flooding. No new impervious area is proposed, and the Project will comply with all applicable Massachusetts Stormwater Standards as required per the Massachusetts Wetlands Regulations at 310 CMR 10.05(6)(k) through (q). Therefore, although the Project Site is susceptible to future climate conditions, elevated climate risks to EJ populations which would create an unfair or inequitable environmental burden are not anticipated. The Project Impacts Protocol notes that the risk rating for extreme heat should not be used as a definitive indicator of elevated climate risks.

5.3.2 Traffic

The Project is not anticipated to generate any new permanent vehicular/diesel trips. The volume of traffic generated during construction is not expected to be large enough to significantly affect traffic flow on public ways along the Project route. There may be temporary traffic impacts associated with material deliveries and large equipment mobilization to the ROW and with conductor stringing across public and private roadways, but these are not anticipated to be significant. Contractors will access the ROW directly from existing public ways; this traffic will be spread out across the roads that cross the ROW along its 10.35-mile length.

Any impacts will be minimized through implementation of various shift schedules for both arriving trucks and site personnel that minimize the number of cars and trucks on the road at certain times. This includes avoiding rush hour traffic when possible and implementation of a Traffic Management Plan (TMP) that will seek to optimize arrivals/departures as well as Project Site access improvements. Early identification of construction truck routing will be considered to avoid the EJ populations within the vicinity of the Project Site.

Any necessary closures at roadway crossings to pull the conductor overhead will be temporary and a traffic detail will be used to ensure the safety of the public. During construction, the Company will also adhere to the State Highway Access Permit requirements issued by the Massachusetts Department of Transportation for the overhead crossings of Route 20, Interstate 90, and Route 9. Refer to Section 6.2.9 for more details.

5.3.3 Air Quality

The Project is not anticipated to generate any air quality emissions associated with stationary or mobile sources. Equipment used during construction of the Project may include: concrete trucks, dump trucks to transport fill materials to and from work sites, bulldozers, excavators, backhoes and graders to place fill materials or to make cuts to achieve the proper profile and line/bucket trucks for installing structures, conductor, and OPGW. 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.

Vehicle idling will be minimized in accordance with Massachusetts' anti-idling law, G.L. c. 90, § 16A, c. 111, §§ 142A–142M, and 310 C.M.R. 7.11. The Company limits vehicle idling time to five minutes except when engine power is necessary for delivery of materials or to operate accessories to the vehicle, such as power lifts.

The Proponent requires contractors to use ultra-low-sulfur diesel (“ULSD”) in off-road diesel vehicles. The Proponent will also comply with MassDEP’s Diesel Retrofit Program. The Program requires that all diesel-powered non-road construction equipment with 50 or more horsepower used for 30 or more days during Project construction will either be EPA Tier 4–compliant or will have EPA-verified (or equivalent) emission control devices installed. Such devices include oxidation catalysts or other comparable technologies.

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, and environmental inspections will be conducted on a weekly basis.

5.3.4 Stormwater Management and Erosion/Sedimentation Control

The Project will be constructed in compliance with the USEPA National Pollutant Discharge Elimination System (“NPDES”) Construction General Permit and a Stormwater Pollution Prevention Plan (“SWPPP”) will be developed and implemented involving a series of construction BMPs to reduce the risk of erosion and sedimentation disturbances due to construction activities. Additionally, the Project will be constructed in compliance with the Massachusetts Wetlands Protection Act and the MassDEP Stormwater Regulations. The only applicable standard for the Project is Standard #8 - Construction Period Pollution Prevention and erosion and sediment controls (E&S controls). To comply with this requirement and the developed SWPPP, the Proponent will install E&S controls and employ dewatering as needed for new pole installations. E&S controls may include straw wattles, silt fence, straw bales or other similar products. Furthermore, daily inspections of all work areas and erosion controls will be conducted by construction crews and weekly inspections will be performed by an experienced environmental scientist. Compliance with MassDEP’s Stormwater Management Standards will be demonstrated in the local Notice of Intent filings.

5.3.5 Temporary Construction Period

Potential impacts associated with construction activities include noise, air quality, water quality, traffic, debris, and stormwater pollution. All construction impacts will be temporary and will be minimized through compliance with National Grid’s Environmental Guidance document for ROW Access, Maintenance and Construction Best Management Practices for New England (EG303-NE). Chapter 6, *Construction Period Impacts*, describes construction-period impacts in more detail, with a focus on EJ populations in Section 6.2.10.

5.4 Enhanced Public Involvement

As described previously in Section 1.6 of Chapter 1, *Project Description*, and in the sections below, the Proponent has a strong track record of community engagement and inclusion and will continue these efforts as part of the public review process for the Project. The Proponent has taken proactive steps to enhance community involvement and engagement during the planning of the Project.

As part of its stakeholder outreach plan, the Proponent has promoted and will continue to promote public involvement by the EJ populations located within one mile of the Project Route through the use of Project fact sheets, website content, meeting invitations, and Spanish-language translation services upon request.

The Proponent will examine potential Project impacts and continue outreach to EJ community members as the Project advances through the MEPA review process and development phases to support participation by the EJ community.

Outreach measures include, but will not be limited to, the following:

› Conducted community engagement to solicit early feedback on the Project prior to submission of this EENF filing as described in further detail in Section 1.6 of Chapter 1, *Project Description*;
› Provided advanced notification of the Project with the EENF filing;
› Continue to engage the community throughout the MEPA review processes;
› Provide Spanish-language translation and interpretation services upon request;
› Distribute electronic copies of all MEPA filings (and hard copies, if requested) to the MEPA determined EJ CBOs and tribal organizations; and
› Make hard copies of all MEPA filings available at the local public libraries – Young Men's Library Association in Ware, Palmer Public Library in Palmer, and Merriam-Gilbert Public Library in West Brookfield – located in the vicinity of the Project Site.

5.4.1 Prior To/Concurrent with the EENF Filing

As per the requirements stated under Section II of the Public Involvement Protocol, "Measures to Enhance Public Involvement Prior to Filing ENF" the Proponent has made a meaningful effort to engage with the community through expanded outreach prior to this EENF filing. As recommended in the protocol to ensure enhanced public outreach, the Proponent has taken measures including:

› Held community meetings and Project presentations to discuss the Project as described in further detail in Section 1.6 of Chapter 1, *Project Description*;
› Launched a project website (https://www.palmertowareimprovementproject.com/index.htm) to publicly broadcast project information and provide another location to access public filings;
› Completed the 45-day advanced notification of the Project by circulating the MEPA EJ Screening Form (Appendix E) to the MEPA determined EJ CBOs and tribal organizations identified in Appendix A on April 15 and July 16, 2024;
› Published the EENF public notice in the *Worcester Telegram* newspaper;
› Provided a hard copy of the EENF filing at local library locations within approximately one mile of the Project Site, including the Young Men's Library Association in Ware, Palmer Public Library in Palmer, and Merriam-Gilbert Public Library in West Brookfield.

5.1.2.1 Pre-filing Consultation

The Proponent held a pre-filing meeting with the MEPA Office on May 23, 2024. During this meeting, the Proponent and MEPA staff discussed the need for Environmental Justice Protocol compliance as the Project Site is located within one mile of an EJ population, and the Proponent provided an overview of the Project and the proposed public outreach strategy.

5.4.2 Post-EENF Filing

Following the filing of this EENF, the Proponent will hold a public site consultation to present the Project to the MEPA office, state agencies, and the public. This presentation will also provide the attendees with the opportunity to ask questions about the Project. This will provide the public direct access to the Proponent and project team, allowing them to inquire about Project specifics and better understand how impacts will be mitigated. Even though there are no Census Tracts within one mile of the Project Site in which there are "Languages other than English spoken by 5% or more of the population who do not speak English very well," the Proponent can offer Spanish-language translation services if requested. The Proponent will also invite state, tribal, and local community groups to the virtual site consultation.

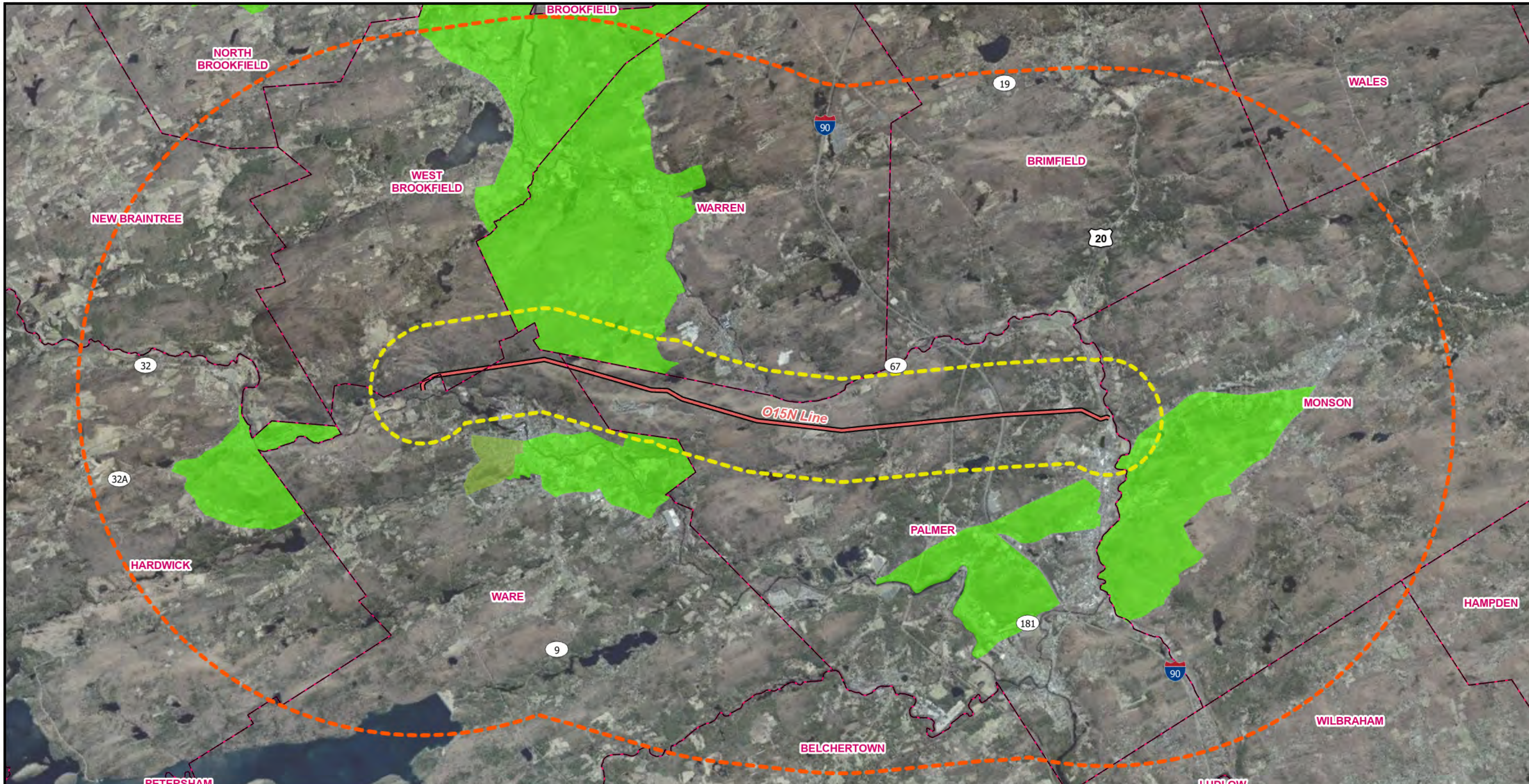
Table 5-3 below presents a summary of the proposed outreach plan that will be implemented during the MEPA review process. This plan was developed through guidance provided in the Public Involvement Protocol.

Table 5-3 Public Engagement Outreach Plan

Outreach Type	Timing	Action
Launch Project website	Prior to filing the EENF	› Includes location to submit contact information for development updates › Include the URL in other outreach materials › Include Project hotline and email address
Dissemination of a written Project summary with basic Project details	Prior to filing the EENF	› Distribute the EJ Screening Form to the EJ CBO List
Use of community-specific media outlets to publicize the Project	Prior to and concurrent with filing the EENF	› Open House invitations posted in *The Journal Register*, *Ware River News*, and *Quaboag Current* › Publish public notice in the *Worcester Telegram* newspaper
Present Project to municipal officials	Prior to filing the EENF	› Conducted presentations for the Ware Board of Selectmen and Palmer Town Council (refer to Section 1.6 for details) › Provided digital copy of presentation to West Brookfield Board of Selectmen
Hold community meetings during weekend or evening hours, at accessible locations near public transportation, and/or through zoom	Pre- and Post-filing EENF	› Held two open houses prior to filing the ENF (refer to Section 1.6 for more details) › Will offer Spanish-language translation services upon request, prior to meeting
Provide oral interpretation at public meetings (upon request)	Pre- and Post-filing EENF	› Upon request
Ensure outreach to the public is communicated in clear, understandable language and in a user-friendly format	Ongoing	› Project website and Project summary flyer to support this effort.
Disseminate information through social media channels	Ongoing	› Project website to support this effort.

Outreach Type	Timing	Action
Establish a local information repository that is convenient and accessible for the EJ Population where information related to the Project can be obtained	Ongoing	› Project website to support this effort.
Provide continued, regular communications with the community	Post-filing EENF	› Will provide quarterly updates to interested parties
Provide construction notifications and updates	Post-filing EENF	› Will provide pre-construction notifications to abutters and other interested parties › Will provide periodic updates on the Project website › Will send Project closeout notification when construction is complete

Path: \\vhb.com\gis\proj\Wat-EV\15773.00 NGrid O15N ACR\Project\O15N ACR.aprx



Existing O-15N Transmission Line
1-mi Buffer from ROW
5-mi Buffer from ROW
Town Boundary

EJ Block Groups
Income: at least 25% of households have a median household income 65% or less than the state median household income
Minority and Income

1:120,000
0 5,000 10,000 20,000
Feet

O-15N Siting Petition
Ware, West Brookfield, and Palmer, MA
Figure 5.1: Environmental Justice
Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 7/29/2024

nationalgrid
vhb

6

Construction Period Impacts

The Project has been designed to balance the ability to construct and maintain the Project in the most efficient manner possible, thereby minimizing the duration of construction-period impacts, while also minimizing the Project footprint. A description of the general construction sequence of the Project is provided in Section 1.3.2 of Chapter 1, *Project Description*.

This chapter includes a discussion of the anticipated construction activities for the Project, and the associated temporary impacts and mitigation proposed to reduce impacts. Specifically, this chapter provides the following:

- The projected construction schedule for construction of various elements and phases of the Project; and
- Anticipated construction-period impacts and proposed mitigation measures to reduce such temporary impacts relative to noise, air quality, water quality, construction waste and traffic.

6.1 Construction Schedule

The Project is anticipated to be developed and constructed in a single phase of approximately 16 months. The following summarizes associated activities during construction:

- Road improvements/civil work start – Q3 2027
- Transmission line construction start – Q3 2027
- Substantial completion – Q4 2028

6.2 Construction Impacts

6.2.1 Wetlands, Water Resources, and Vernal Pools

The Project's wetland, watercourse, and vernal pool impacts have been minimized to the greatest extent practicable by using the ROW associated with the Existing Line and existing access ways where feasible and locating structures outside of wetland resource areas. However, due to the linear nature of the corridor, and terrain and span limitations between structures, certain wetland impacts cannot be avoided. Construction will result in temporary and permanent impacts to wetland resources. Permanent impacts to BVW will occur as a result of the installation of the proposed steel structures. Temporary impacts will occur from the installation of construction matting for access roads and work pads and pull pads; these areas will be restored to pre-existing conditions upon completion of construction. There are no anticipated permanent impacts to Bank or LUWW. Temporary impacts are anticipated to RFA and BZ from the construction of temporary work pads in upland areas and construction matting for access roads and work pads in wetland resource areas. Permanent impacts are expected to occur in RFA and BZ from the construction of upland access roads.

To reduce the impacts associated with the construction and operation of the Project, the Proponent has incorporated design measures to minimize permanent impacts, and BMPs to minimize temporary alterations associated with construction. Typical BMPs include straw bales, straw wattles, siltation fencing, compost socks, and/or chip bales. In addition to using the existing ROW, design measures include using existing access routes and avoiding the placement and construction of structures and access in wetlands and watercourses where possible. This has resulted in the avoidance and minimization of impacts to wetlands, watercourses, and vernal pools to the greatest extent practicable, with only 113 square feet of permanent impacts proposed in BVW, no permanent impacts in LUWW, and no impacts anticipated at all in vernal pools.

Additional impact minimization measures include using temporary construction mats for wetland access and work pads instead of permanent grading and gravel fill. As described in Chapter 3, *Natural Resources and Stormwater Management*, the Proponent will install and maintain erosion and sediment controls throughout construction, as well as other typical measures described in National Grid's BMPs. For unavoidable wetland impacts, the Proponent will provide 1:1 wetland replication as required under state regulations.

6.2.2 Rare Species Habitat

The Project has been designed to minimize impacts to rare species to the maximum possible extent. Construction impacts to rare plant habitat will consist of temporary and permanent impacts from the construction of access roads, work pads, and pull pads. Existing access will be used where possible, but it will be necessary to construct new access roads in Priority Habitat to facilitate safe construction and future maintenance. Although approximately 2.3 acres of permanent impact from access road construction and structure installation will occur within Priority Habitat, only six locations will result in direct impacts to known listed plant or host plant locations. Similarly, although there will be 0.06 acres of permanent impact within Estimated Habitat, due to the maintained nature of ROW vegetation, no impacts are anticipated to the state-listed vertebrate animal. In addition to access road construction there will be temporary impacts to both Priority and Estimated habitat from work pad construction, pull pad construction, construction matting, and from grading associated with both access road and work pad construction. Approximately 17.7 acres of temporary impact will occur within Priority Habitat and 0.8 acres of temporary impact will occur in Estimated Habitat. All areas of temporary disturbance will be restored once construction is complete. The Proponent will work with NHESP to identify appropriate construction-phase protection measures for state-listed species.

6.2.3 Soil Management

Crushed stone aprons/tracking pads will be used at all access entrances to public roadways as needed to minimize the migration of soils off-site from construction equipment. Areas of exposed soil that will remain inactive for more than 14 days, or where construction activities have temporarily or permanently ceased, will be stabilized. Stockpiles that will remain inactive for more than 14 days will be seeded and mulched immediately after its formation and will be sloped at less than 2:1. Vegetative cover will be established by broadcast seeding, applying straw mulch, and maintaining erosion controls until revegetation is achieved. Upon completion of final grading, any areas not covered by pavement, other forms of stabilization, or other methods of landscaping will be seeded with an approved native seed mix. The seeded surfaces will be covered with a layer of straw mulch or bonded fiber matrix. Any construction spoils will be spread on site or if they need to removed will be disposed of at an approved facility.

6.2.4 Air Quality/Dust

Contractors will be required to implement air quality and dust control measures on-site throughout the construction period in compliance with National Grid’s EG303-NE guidance document. The following list of management practices may be used on an as-needed basis on-site:

- Tire cleaning areas at construction vehicle entrances and exits;
- Water sprays during excavation, stockpiling, and loading of demolition and soil materials for removal;
- Site watering to mitigate wind erosion;
- Street sweeping of adjacent local roadways to address potential sediment accumulation;
- Secure covering of piles of excavated materials;
- Properly secured covers on truck cargos during materials transport; and
- Minimization of the free drop height of excavated or aggregate material during earthwork operations.

Construction-phase emissions will be limited in compliance with state programs; please refer to Section 5.3.2 for more details.

6.2.5 Noise

The estimated noise levels from the use of various types of equipment during construction range from 80 dBA to 98 dBA at a distance of 50 feet from the construction activity. The closest residence is approximately 18 feet away from the O15N ROW in Palmer. Residences within 50 feet, 100 feet, 200 feet, and 300 feet of the Existing Lines may potentially be impacted by construction noise during one or more phases of construction. However, typical sound levels of construction noise experienced at any given residence will be temporary and intermittent.

To the extent practicable, the Proponent will comply with the noise ordinances in the municipalities within which the Project is proposed. Construction activities will occur primarily during standard daytime hours (7:00 AM to 7:00 PM, Monday to Friday). Some work tasks, once started, may require continuous operation until completion. Work requiring scheduled outages 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. In these instances, NEP will seek advanced approval from the applicable municipality and provide notice to abutters.

The Project will implement mitigation measures to reduce or minimize noise from construction activities. The CMP will address noise impacts and mitigation.

Specific construction period noise mitigation measures include the following:

- Comply with applicable Town By-Laws;
- Maintain equipment in good working condition and use appropriate noise muffler systems;
- Require that construction vehicles and equipment maintain their original engine noise control equipment;
- Noise sources that may operate continually during the day, such as generators or air compressors, will be located away from populated areas to the extent possible;
- The Proponent and Project contractors will comply with state law (G.L. c. 90, § 161A) and MassDEP regulations (310 CMR 7.11(1)(b)), which limit vehicle idling to no more than five minutes, to the greatest extent feasible based upon the construction task, type of equipment/vehicle, and weather conditions (with 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);
- Limit construction activities to normal working hours and minimize off-hour work to the extent practicable;
- Implement traffic management techniques during construction to mitigate roadway traffic noise impacts; and
- Where construction takes place adjacent to residences, the Proponent will notify landowners in advance of construction and will provide a point of contact for Project related questions and concerns.

6.2.6 Sensitive Receptors

Sensitive receptor land uses are defined as public facilities including hospitals, elder care facilities, schools, horse farms, cemeteries, daycares, district courts, nursing homes, police stations, fire stations, and places of worship. An analysis of potential sensitive receptors was conducted using publicly available data from MassGIS identifying the locations of hospitals, schools, long term care facilities police stations, fire stations and other public facilities. Parcel zoning and land use data was analyzed to identify other potential sensitive receptors. Additionally, Google Maps was reviewed to identify any potential sensitive receptors that were not identified through the GIS analysis. No sensitive receptors were identified within 0.5 miles of the Project ROW. As a result, no impacts to sensitive receptors are anticipated.

6.2.7 Historic and Archaeological Resources

The Proponent contracted Gray & Pape Heritage Management ("GPHM") to conduct a cultural resource due diligence and archaeological sensitivity assessment of the Project. No archaeological resources were identified within the ROW, and one above-ground historic resource was identified within 0.25 miles of the ROW in Palmer consisting of the nineteenth-century Blanchard House (PAL.509). The National Register status of the Blanchard House is unevaluated; regardless, no impacts are anticipated to this resource due to its distance from the Project.

The Project will be subject to review under Section 106 of the National Historic Preservation Act ("Section 106") and will require a permit from the USACE. The Project will also be subject to review by the MHC under G.L. c. 9, §§ 26–27C. As required, a copy of this EENF has been provided to MHC for their review and comment. The Proponent will coordinate with the USACE and MHC to incorporate avoidance and/or minimization measures as needed to avoid adverse effects to potential NRHP-eligible or -listed cultural resources. As part of the USACE Section 404 permit review, and pursuant to Section 106, the Proponent and USACE will also consult with Tribal Historic Preservation Officers (THPOs) that express an interest in cultural resources that may be affected by the Project. A letter notification and copy of the due diligence review was sent on April 13, 2023, to the THPOs for the Wampanoag Tribe of Gay Head (Aquinnah), the Mashpee Wampanoag Tribe, and the Narragansett Indian Tribe.

The Proponent will continue to coordinate with GPHM, in consultation with MHC, THPOs, and the USACE, to avoid and minimize impacts to cultural resources. If they become necessary, any protection or avoidance measures required to avoid or minimize impacts to significant resources will be outlined in an Avoidance and Protection Plan. Procedures to handle unanticipated discoveries during construction will be specified as part of a Post Review Discoveries Plan.

6.2.8 Construction Waste

After the Rebuilt Line has been placed into service, the existing structures will be removed. The majority of existing structures are comprised of wood pole structures. Wood pole structures will be removed in their entirety unless the complete removal of the pole will create an adverse impact to environmentally sensitive areas. The Project's construction manager will implement a waste management plan to divert Project-related construction waste material from landfills through recycling and salvaging where practicable.

The existing steel H-frame structures will be salvaged. Conductors and insulators will also be salvaged and any equipment and debris that cannot be recycled will be transported to an appropriate off-site disposal facility. Handling of such materials will be performed in compliance with all applicable federal, state, and municipal environmental laws and regulations. In the event that subsurface contamination exceeding Massachusetts Contingency Plan ("MCP") reporting thresholds is encountered, MassDEP will be notified, and the contamination managed in accordance with the MCP.

6.2.9 Construction Traffic and Transportation

Limited temporary construction-related traffic impacts are anticipated over the construction period.

Construction of the Project along the Project Route will not result in a significant increase in traffic or material impacts to existing traffic patterns. During construction, the main impacts will occur when stringing transmission conductors over road crossings and at ROW construction access locations. At the ROW access locations, construction equipment and personnel will enter and exit the ROW from public roads and temporarily increase traffic. Since the various construction tasks will occur at different times and locations, traffic at these entry roadways will be intermittent. Generally, the larger construction equipment will enter the ROW once while working in a specific area; however, multiple trips may be conducted when delivering materials such as construction matting or stone. Smaller vehicles such as pickup trucks carrying construction workers will access the ROW daily.

Additional impacts, including lane closures or temporary traffic stops, are anticipated when conductors and shield wire need to be strung over public roadways. At such times, boom trucks may be set up in travel lanes, shoulders, or medians to serve as support to the lines as they are attached to the permanent transmission line structures. In addition, construction equipment may be necessary to install temporary guard structures. Traffic will be stopped for a short period of time to allow a rope to be manually pulled across the roadway. Conductor will then be attached to this rope and pulled above the roadway onto the temporary guard structures; traffic typically will be able to flow while the conductors are attached to the structures. Line stringing will be required along the Project Route across 11 roadway crossings. Permits from MassDOT will be required for this work at state highway crossings.

Along local roadways, the Proponent will coordinate with the municipalities on requirements for work hours, signage, and police details.

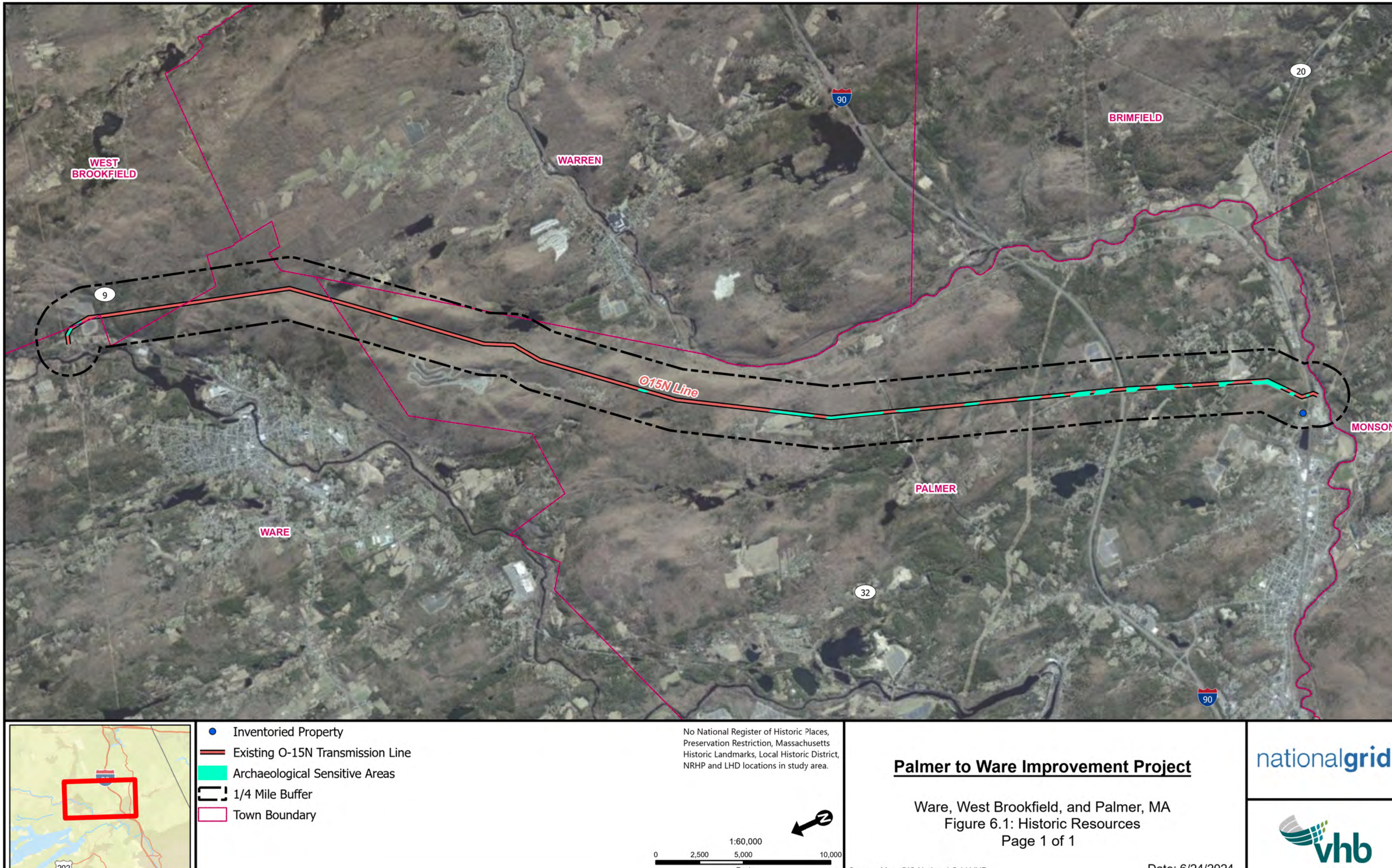
Prior to beginning construction, the Proponent will work closely with the municipalities and MassDOT to develop construction Traffic Management Plans ("TMPs"), which include construction-phase traffic controls, and to minimize the impacts of construction on the traveling public. Implementation of a well-designed TMP will reduce the potential for traffic disruptions and inconvenience to drivers. The TMP may include closures to travel lanes and/or roadway shoulders in order to set up the work zone. All TMP work will conform to the Manual of Uniform Traffic Control Devices and MassDOT standards.

6.2.10 Construction Period Impacts on EJ Populations

The Project is proposed within the existing ROW, thereby minimizing adverse environmental impacts. No long-term impacts to soil, bedrock, vegetation, surface water, groundwater, wetland resources, or air quality will occur. NEP will be implementing measures to avoid, minimize, and mitigate potential environmental impacts throughout the entire Project alignment, including where it is within one mile of mapped EJ populations. These include, but are not limited to, designing the project to avoid wetlands and waterways to the greatest degree possible, use of construction matting in wetlands to reduce soil disturbance and protect water quality, and implementation of a SWPPP to avoid impacts to receiving waters from sediment laden stormwater runoff or from spills or other inadvertent releases of fuels, oils, or other hazardous materials used in equipment or as incidental use during construction.

As mentioned in Section 5.3 of Chapter 5, *Environmental Justice and Public Health*, since the nature and severity of Project impacts are minimal on all populations, including EJ populations, the Project will not materially exacerbate any existing unfair or inequitable environmental or public health burden impacting the EJ population. Overall, the Project will improve transmission system infrastructure and comply with comprehensive regional plans for maintaining electric transmission reliability in New England, for EJ and non-EJ Populations alike.

Path: \\vhb.com\gis\proj\Wat-EV\15773.00 NGrid O15N ACR\Project\O15N ACR.aprx



- Inventoried Property
- Existing O-15N Transmission Line
- Archaeological Sensitive Areas
- 1/4 Mile Buffer
- Town Boundary

No National Register of Historic Places, Preservation Restriction, Massachusetts Historic Landmarks, Local Historic District, NRHP and LHD locations in study area.

N

1:60,000

0 2,500 5,000 10,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 6.1: Historic Resources
Page 1 of 1

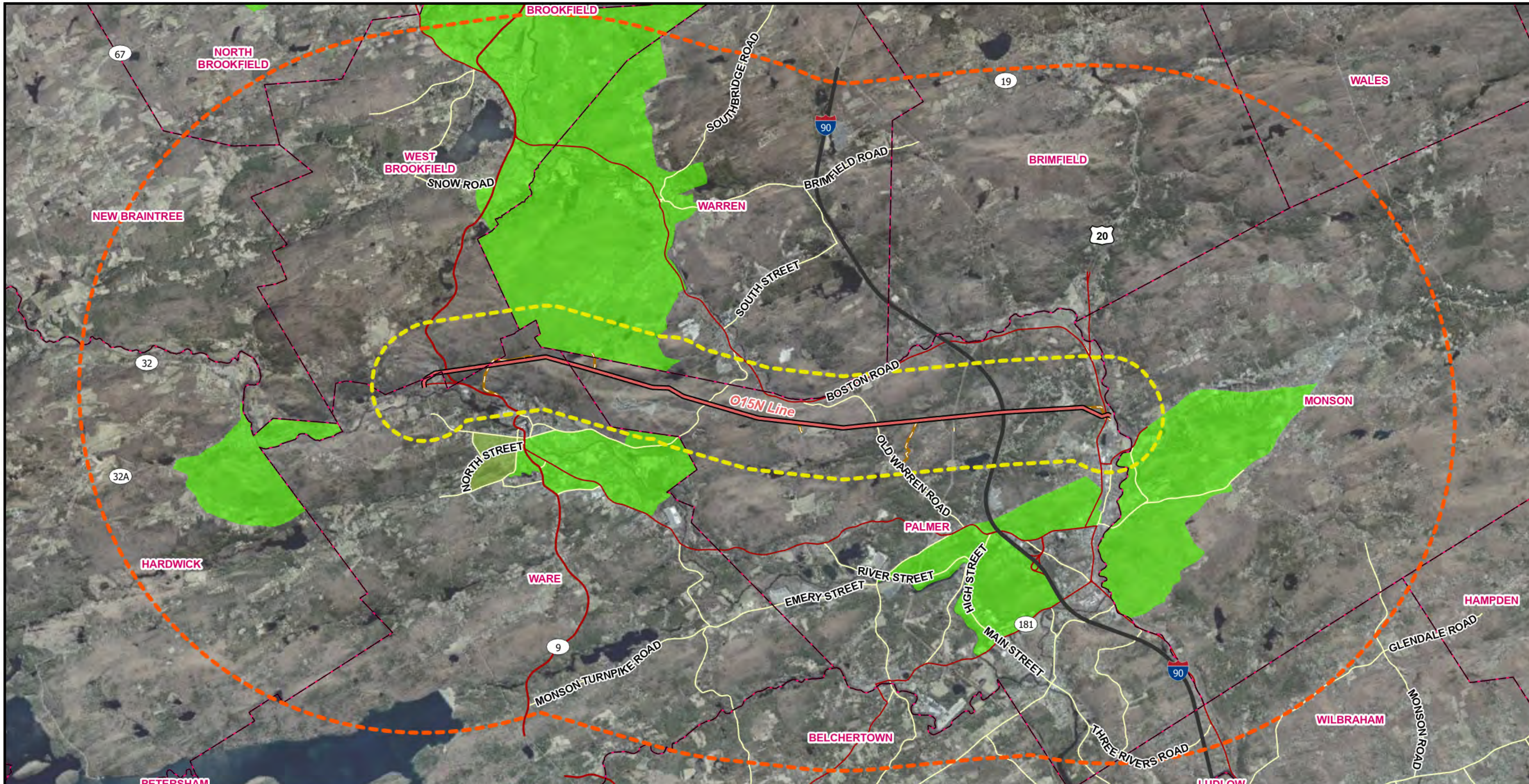
Source: MassGIS,National Grid,VHB

Date: 6/24/2024

nationalgrid

vhb

Path: \\vhb.com\gis\proj\Wat-EV\15773.00 NGrid O15N ACR\Project\O15N ACR.aprx



Existing O-15N Transmission Line
Interstate Highway
Urban or Rural Principal Arterial
Urban Principal or Rural Minor Arterial
Off-ROW Access
Class 5 and 6 Roads
1-mi Buffer from ROW
5-mi Buffer from ROW
Town Boundary

EJ Block Groups

Income: at least 25% of households have a median household income 65% or less than the state median household income

Minority and Income

1:120,000

0 5,000 10,000 20,000

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 6.2: Construction Truck Routes
Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 7/29/2024

nationalgrid

vhb

7

Mitigation and Draft Section 61 Findings

This chapter provides an overview of the measures proposed to mitigate the impacts of the Project and draft Section 61 Findings.

7.1 Proposed Mitigation

The Project will avoid, minimize, or mitigate damage to the environment to the maximum extent practicable. The Proponent commits to the measures summarized in Table 7-1 below. Implementation is the responsibility of the Proponent except where otherwise noted.

Table 7-1 Mitigation Summary Table

Mitigation Measure	Responsible Party	Estimated Cost	Timing/ Schedule	State Permit/Action
Wetlands				
Use construction mats for work in wetlands in accordance with USACE Construction Mat BMPs.	Contractor	Included in Project Costs	Construction	MassDEP WQC
Install and maintain erosion and sediment control BMPs in accordance with the USEPA NPDES CGP, any WQC conditions, and EG303-NE.	Contractor	Included in Project Costs	Construction	MassDEP WQC
Conduct regular inspections in accordance with NPDES CGP and any WQC conditions.	Proponent/ Contractor	Included in Project Costs	Construction	MassDEP WQC
Construction staging and material storage areas will be located outside of wetlands and waterways.	Contractor	Included in Project Costs	Construction	MassDEP WQC

Mitigation Measure	Responsible Party	Estimated Cost	Timing/ Schedule	State Permit/Action
Stabilize any exposed soil or stockpiles that will remain inactive for more than 14 days.	Contractor	Included in Project Costs	Construction	MassDEP WQC
Restore and revegetate areas disturbed by construction.	Contractor	Included in Project Costs	Construction	MassDEP WQC
Provide 1:1 replacement for permanent wetland impacts.	Proponent	Included in Project Costs	Construction	MassDEP WQC
Rare Species				
Prepare Protection Plans for state-listed species.	Proponent	Included in Project Costs	Prior to Construction	MESA
Implement protection measures in accordance with Protection Plans (may include time-of-year restrictions, surveys, avoidance fencing, etc.).	Contractor	Included in Project Costs	Construction	MESA
Restore and revegetate areas of temporary disturbance.	Contractor	Included in Project Costs	Construction	MESA
Stormwater				
Employ SWPPP including implementation of construction-period BMPs such as erosion controls and appropriate dewatering methods to avoid and minimize erosion and sedimentation.	Contractor	Included in Project Costs	Construction	MassDEP WQC
Regularly inspect and monitor discharges in accordance with the NPDES Construction General Permit to avoid indirect impacts due to construction.	Proponent/ Contractor	Included in Project Costs	Construction	MassDEP WQC
Temporary Construction Impacts				
Construction Traffic › Develop a TMP in close coordination with the municipalities to minimize construction-related traffic impacts to the greatest extent possible, including to vehicular traffic, public transit, bicyclists, and pedestrians. › Develop a TMP that will conform to the Manual of Uniform Traffic Control Devices and MassDOT standards › Notify residents and business abutting impacted roadways ahead of road closures and detours.	Proponent	Included in Project Costs	Prior to Construction, During Construction	MassDOT Access Permit
Construction Air Quality › Install tire cleaning areas at construction vehicle entrances and exits. › If required, utilize water sprays during excavation, stockpiling, and loading	Contractor	Included in Project Costs	Construction	None

Mitigation Measure	Responsible Party	Estimated Cost	Timing/ Schedule	State Permit/Action
of demolition and soil materials for removal. › Use site watering as required to mitigate wind erosion. › Implement street sweeping of adjacent local roadways to address potential sediment accumulation › Securely cover piles of excavated materials. › Properly secure covers on truck cargos during materials transport. › Minimize the free drop height of excavated or aggregate material during earthwork operations. › Comply with Massachusetts anti-idling law and MassDEP Diesel Retrofit Program.				
Construction Noise › Coordinate work hours with local authorities, particularly for any activities outside the typical work window (7:00 AM to 7:00 PM Monday to Friday). › Construction equipment must have properly operating noise muffler systems. › Construction vehicles and equipment must maintain their original engine noise control equipment. › Locate continuous noise sources, such as generators or air compressors, away from populated areas to the extent possible. › Limit construction activities to normal working hours and minimize off-hour work to the extent practicable. › Implement appropriate traffic management techniques during construction to mitigate roadway traffic noise impacts. › Ensure proper operation and maintenance, and prohibit excessive idling, of construction equipment engines as required by MassDEP regulation 310 CMR 7.11.	Proponent/ Contractor	Included in Project Costs	Prior to Construction, During Construction	None

Mitigation Measure	Responsible Party	Estimated Cost	Timing/ Schedule	State Permit/Action
› Notify abutting residential landowners in advance of construction and provide contact information for questions/concerns.				
Construction Waste › Any wood, metals, gypsum, cardboard and plastic will be segregated and sent to recycling facilities to the extent practicable. › Salvage existing steel H-frame structures, conductors, and insulators. › Send all construction debris to a solid waste sorting facility for separation of any recyclable materials.	Contractor	Included in Project Costs	Construction	None
Historic and Archaeological Resources › Coordinate with GPHM, in consultation with MHC, THPOs, and the USACE, to avoid and minimize impacts to cultural resources. › If necessary, outline protection or avoidance measures to significant resources in an Avoidance and Protection Plan. › Develop a Post Review Discoveries Plan to handle unanticipated discoveries during construction.	Proponent	Included in Project Costs	Prior to Construction	None

7.2 Draft Section 61 Findings

7.2.1 MassDOT Access Permit

D R A F T   O N L Y
Findings Pursuant to
MGL Chapter 30, Section 61

Project Name: Palmer to Ware Improvement Project

Project Location: Palmer, Ware, West Brookfield

Project Proponent: New England Power Company

Project Description

The Project will rebuild an existing 10.35-mile-long overhead transmission line to address widespread damage to the existing structures, improve telecommunications between the two substations, and improve reliability of the transmission line. The transmission line will be moved to the center of the existing right-of-way (ROW), completely replacing the existing structures, conductor, and shield wire. Work will include vegetation management, upgrading existing access, and creating new access as required to construct and maintain the rebuilt line. The line will be rebuilt with steel structures and will initially be operated at 69kV but designed to allow future operation at 115kV to support long term electric load growth.

Project Impacts and Mitigation

The Project will not result in impacts to transportation infrastructure under Commonwealth of Massachusetts jurisdiction that require mitigation related to capacity or operational improvements. Due to construction over Route 20, Interstate 90 (the Massachusetts Turnpike), and Route 32, State Highway Access Permits (M.G.L. c. 81 § 21/M.G.L. c. 85 § 2) must be obtained.

Limited temporary construction-related traffic impacts are anticipated over the construction period. Construction of the Project along the Project Route will not result in a significant increase in traffic or material impacts to existing traffic patterns. During construction, the main impacts will occur when stringing transmission conductors over road crossings and at ROW construction access locations. Prior to beginning construction, the Proponent will work closely with the municipalities and MassDOT to develop construction Traffic Management Plans ("TMPs"), which include construction-phase traffic controls, and to minimize the impacts of construction on the traveling public. Implementation of a well-designed TMP will reduce the potential for traffic disruptions and inconvenience to drivers. The TMP may include temporary closures to travel lanes and/or roadway shoulders in order to set up the work zone. All TMP work will conform to the Manual of Uniform Traffic Control Devices and MassDOT standards.

Section 61 Findings

This Section 61 Finding for the Project has been prepared in accordance with the provisions of M.G.L. Chapter 30, Section 61 and 301 CMR 11.07(6)(k).

The potential environmental impacts of the Project, as characterized and quantified in the Expanded Environmental Notification Form (EENF), are incorporated by reference into this Section 61 Finding. To the greatest extent practicable, the Proponent has taken all feasible measures to avoid and/or minimize adverse environmental impacts of the Project. Throughout the planning and environmental review process, the Proponent has worked to develop measures to mitigate impacts of the Project to the extent practicable. With the implementation of the proposed mitigation, and cooperation with state agencies, the Massachusetts Department of Transportation (MassDOT) finds that there are no significant unmitigated impacts.

For the reasons stated above, MassDOT hereby finds that pursuant to M.G.L. c. 30, § 61, the construction of the Project as described above, and with the implementation by the Proponent of the noted mitigation measures, all practicable means and measures will be taken to avoid or minimize adverse environmental impacts related to the Project.

Agency: ____

Commissioner: ____

Date: ____

7.2.2 Massachusetts Department of Environmental Protection – Water Quality Certificate

DRAFT ONLY
Findings Pursuant to
MGL Chapter 30, Section 61

Project Name: Palmer to Ware Improvement Project

Project Location: Palmer, Ware, West Brookfield

Project Proponent: New England Power Company

Project Description

The Project will rebuild an existing 10.35-mile-long overhead transmission line to address widespread damage to the existing structures, improve telecommunications between the two substations, and improve reliability of the transmission line. The transmission line will be moved to the center of the existing right-of-way (ROW), completely replacing the existing structures, conductor, and shield wire. Work will include vegetation management, upgrading existing access, and creating new access as required to construct and maintain the rebuilt line. The line will be rebuilt with steel structures and will initially be operated at 69kV but designed to allow future operation at 115kV to support long term electric load growth.

Project Impacts and Mitigation

Based on the current design, the Project will include 204,891 square feet of discharge of dredged or fill material in Waters of the U.S. within the Commonwealth, which is subject to state water quality certification under 33 U.S.C. 1251. The Project will include 113 square feet of permanent fill, and 199,967 square feet of temporary impacts, to BVW; and 4,811 square feet of temporary impacts to LUWW. The Project will not result in any activity that would require conformance with the stream crossing provisions. The Project will not result in any anticipated impact to a certified or field identified vernal pool and does not propose fill within an Outstanding Resource Water, nor is it subject to any other categories identified at 314 CMR 9.04.

The Project has been designed to avoid and minimize adverse permanent and temporary impacts to Waters of the U.S. to the greatest extent practicable. During construction, erosion and sediment controls will be utilized to protect resource areas. The Proponent will provide 1:1 replacement in compliance with 314 CMR 9.06(2) for permanent impacts.

Section 61 Findings

This Section 61 Finding for the Project has been prepared in accordance with the provisions of M.G.L. Chapter 30, Section 61 and 301 CMR 11.07(6)(k).

The potential environmental impacts of the Project, as characterized and quantified in the Environmental Notification Form (EENF), are incorporated by reference into this Section 61 Finding. To the greatest extent practicable, the Proponent has taken all feasible measures to avoid and/or minimize adverse environmental impacts of the Project. Throughout the planning and environmental review process, the Proponent has worked to develop measures to mitigate impacts of the Project to the extent practicable. With the implementation of the proposed mitigation, and cooperation with state agencies, the Massachusetts Department of Environmental Protection (MassDEP) finds that there are no significant unmitigated impacts.

For the reasons stated above, MassDEP hereby finds that pursuant to M.G.L. c. 30, § 61, the construction of the Project as described above, and with the implementation by the Proponent of the noted mitigation measures, all practicable means and measures will be taken to avoid or minimize adverse environmental impacts related to the Project.

Agency: ______________________________

Commissioner: ______________________________

Date: ______________________________

7.2.3 Massachusetts Department of Public Utilities

DRAFT ONLY
Findings Pursuant to
MGL Chapter 30, Section 61

Project Name: Palmer to Ware Improvement Project

Project Location: Palmer, Ware, West Brookfield

Project Proponent: New England Power Company

Project Description

The Project will rebuild an existing 10.35-mile-long overhead transmission line to address widespread damage to the existing structures, improve telecommunications between the two substations, and improve reliability of the transmission line. The transmission line will be moved to the center of the existing right-of-way (ROW), completely replacing the existing structures, conductor, and shield wire. Work will include vegetation management, upgrading existing access, and creating new access as required to construct and maintain the rebuilt line. The line will be rebuilt with steel structures and will initially be operated at 69kV but designed to allow future operation at 115kV to support long term electric load growth.

Project Impacts and Mitigation

Wetland Resource Areas

Based on the current design, the Project will include the following wetland resource area impacts:

- BVW: 113 square feet of permanent fill / 199,967 square feet of temporary impacts
- LUWW: 4,811 square feet of temporary impacts
- Bank: 2,617 linear feet of temporary impacts
- RFA: 4,534 square feet of permanent impacts / 93,989 square feet of temporary impacts

The Project will not result in any activity that would require conformance with the stream crossing provisions. The Project will not result in any anticipated impact to a certified or field identified vernal pool and does not propose fill within an Outstanding Resource Water.

The Project has been designed to meet all applicable performance standards, and to avoid and minimize adverse permanent and temporary impacts to wetland resource areas, to the greatest extent practicable. During construction, erosion and sediment controls will be utilized to protect resource areas. The Proponent will provide 1:1 replacement in compliance with 314 CMR 9.06(2) and 310 CMR 10.55(4) for permanent impacts to BVW.

State-Listed Species

The Massachusetts Natural Heritage & Endangered Species Program (NHESP) has identified areas of known Priority Habitat and Estimated Habitat within the Project ROW for one vertebrate animal, one invertebrate animal, and three vascular plants. In Estimated Habitat, the Project will result in 0.06 acres of permanent impact from access road construction and structure installation, and 0.8 acres of temporary impact from construction matting for work pads, pull pads, and access. In Priority Habitat, the Project will result in 2.3 acres of permanent impact from access road construction and structure installation, and 17.7 acres of temporary impact from construction matting for work pads, pull pads, and access. However, based on field surveys, there are only six locations across the 3.96 miles of Priority Habitat within the ROW where direct impacts may result to known listed plant or host plant locations. Similarly, although there will be 0.06 acres of permanent impact within Estimated Habitat, due to the maintained nature of ROW vegetation, no impacts are anticipated to the state-listed vertebrate animal. The Proponent will continue to refine design to avoid and minimize impacts to listed species to the greatest extent possible.

The Proponent will work with NHESP staff through the MESA review process to determine appropriate Protection Plans for each state-listed rare species. Measures included within the state-listed species Protection Plans could include time-of-year restrictions, pre-construction surveys, and/or use of temporary avoidance fencing during construction. Final protection measures will be developed through coordination with the Division.

If NHESP staff determines that construction along the O15N line would result in a "take," then the Proponent will file for and meet the performance standards for the issuance of a Conservation Management Permit ("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.

Section 61 Findings

Based upon its review of the MEPA documents, the permit applications, and Massachusetts Regulations, the Massachusetts DPU finds that the terms and conditions to be incorporated into the "Final Decision" required for this Project constitute all feasible measures to avoid damage to the environment and will minimize and mitigate such damage to the maximum extent practicable for those impacts subject to the Massachusetts DPU's authority. Implementation of the mitigation measures will occur in accordance with the terms and conditions set forth in the "Final Decision."

Agency: ______________________________________

Commissioner: ________________________________

Date: ____

Appendix A

MEPA Distribution List

MEPA Distribution List

Below is a list of all agencies and persons to whom the Proponent circulated the EENF, in accordance with 301 CMR 11.16(3) and the Public Involvement Protocol.

State and Regional Agencies and Officials

Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114
mepa@mass.gov

MEPA Office
Attn: EEA EJ Director
100 Cambridge Street, Suite 900
Boston, MA 02144
MEPA-EJ@mass.gov

Department of Environmental Protection
Attn: Commissioner's Office
One Winter Street
Boston, MA 02108
helena.boccadoro@mass.gov

DEP/Western Regional Office
Attn: MEPA Coordinator
State House West – 4th Floor
436 Dwight Street
Springfield, MA 01103
Catherine.Skiba@mass.gov
Sean.Gonsalves@mass.gov

Massachusetts Department of Transportation- Boston
Public/Private Development Unit
10 Park Plaza Suite #4150
Boston, MA 02116
MassDOTPPDU@dot.state.ma.us

Massachusetts Department of Transportation
District #2
Attn: MEPA Coordinator
811 North King Street
Northampton, MA 01060
bao.lang@dot.state.ma.us
garrett.postema@dot.state.ma.us

Massachusetts Historical Commission
Attn: Brona Simon
The MA Archives Building
220 Morrissey Boulevard
Boston, MA 02125
brona.simon@state.ma.us

Natural Heritage and Endangered Species Program
Division of Fisheries & Wildlife
1 Rabbit Hill Road
Westborough, MA 01581
emily.holt@mass.gov
melany.cheeseman@mass.gov

Department of Energy Resources
Attention: MEPA Coordinator
100 Cambridge Street, 10th Floor
Boston, MA 02114
paul.ormond@mass.gov

Energy Facilities Siting Board
Attn: MEPA Coordinator
One South Station
Boston, MA 02110
andrew.greene@mass.gov

Pioneer Valley Planning Commission (PVPC)
Attn: Gary Roux
60 Congress Street, 1st Floor
Springfield, MA 01104
gmroux@pvpc.org (Hard copy provided)

Massachusetts Division of Fisheries & Wildlife
Connecticut Valley District Manager
Attn: Joe Rogers
341 East Street
Belchertown, MA 01007
Joseph.E.Rogers@mass.gov

Local Agencies and Officials

Town of Palmer
Barbara A. Barry (Town Council President)
bbarry@townofpalmer.com
Heidi Mannarino (Town Planner)
hmannarino@townofpalmer.com
Justin Enright (Palmer Conservation Commission)
jenright@townofpalmer.com
Nicole Gauthier (Health Inspector)
ngauthier@townofpalmer.com

Town of West Brookfield
Board of Selectmen
bos@wbrookfield.com
Melinda Czub (Planning Board Secretary)
mczub@wbrookfield.com
Pamela Skowyra (Conservation Commission Clerk)
pskowyra@wbrookfield.com
Board of Health
boh@wbrookfield.com

Town of Ware
Stuart B. Beckley (Town Manager)
sbeckley@townofware.com
Paralee Smith (Director of Planning & Community Development)
psmith@townofware.com
John M. Prenosil (Conservation Agent)
jprenosil@townofware.com
Andrea Crete, RS, MPH (Director of Public Health)
acrete@townofware.com

Town of Monson (EJ Community)
Select Board
Patricia Oney (Chair)
poney@monson-ma.gov

Town of Warren (EJ Community)
Board of Selectmen
selectmen@warren-ma.gov

Libraries

Young Men's Library Association
37 Main Street
Ware, MA 01082

Palmer Public Library
1455 N Main Street
Palmer, MA 01069

Merriam-Gilbert Public Library
3 W Main Street
West Brookfield, MA 01585

Statewide Environmental Justice Community Based Organizations

Mass Rivers Alliance	The Trust for Public Land
Neighbor to Neighbor	Browning the GreenSpace
Environment Massachusetts	Environmental League of MA
Unitarian Universalist Mass Action Network	Ocean River Institute
Clean Water Action	Mass Land Trust Coalition
Sierra Club MA	Conservation Law Foundation
Appalachian Mountain Club	Community Action Works
Mass Audubon	

Indigenous Organizations

Chappaquiddick Tribe of the Wampanoag Nation	Chappaquiddick Tribe of the Wampanoag Nation, Whale Clan
Nipmuc Nation (Hassanamisco Nipmucs)	North American Indian Center of Boston
Massachusetts Commission on Indian Affairs (MCIA)	Pocassett Wampanoag Tribe
Herring Pond Wampanoag Tribe	Massachusetts Tribe at Ponkapoag

Federally Recognized Tribes

Mashpee Wampanoag Tribe	Wampanoag Tribe of Gay Head (Aquinnah)
Stockbridge-Munsee Tribe	

Local Community Based Organizations

Connecticut River Conservancy	Public Health Institute of Western Massachusetts

Appendix B

Plan Set

Plan Set

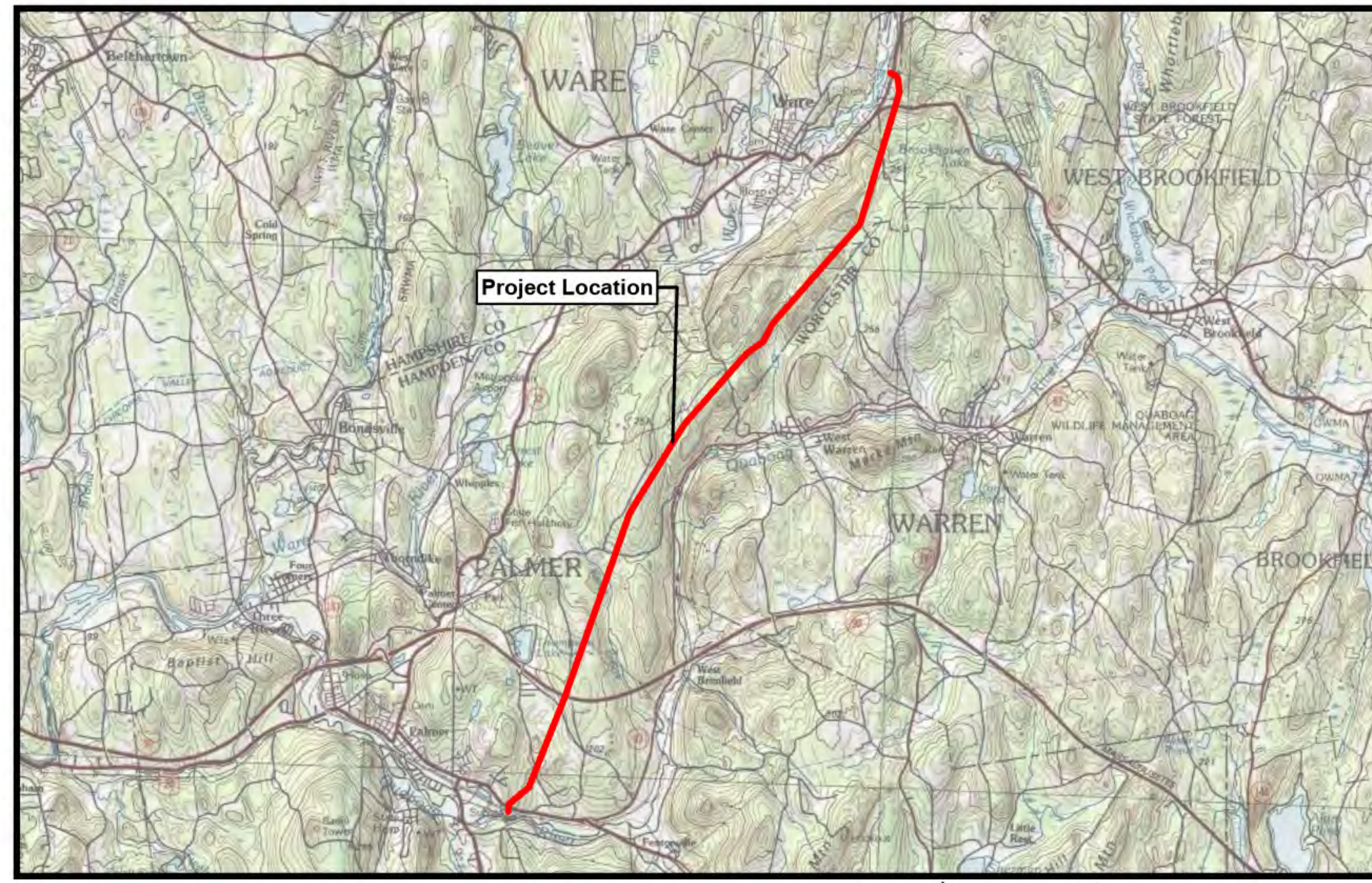
Issued for: Asset Condition Refurbishment
Date Issued: 8/15/2024

Sheet Index

Number	Drawing Title	Latest Issue
1	Index Map	8/15/2024
2-38	Environmental Resources Area Reference	8/15/2024

Palmer to Ware Improvement Project

Ware to Palmer, MA



Site Location Map

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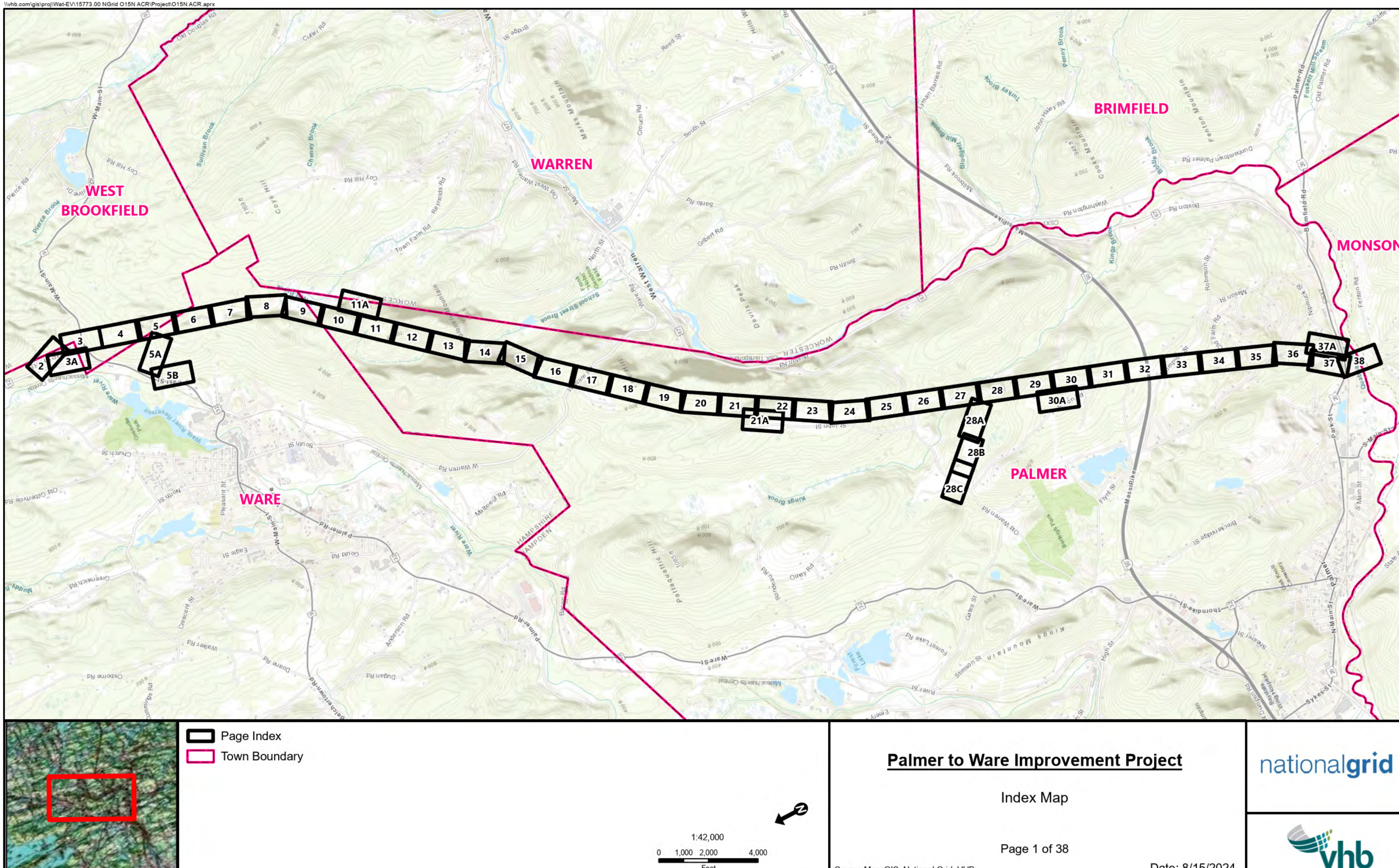

Palmer to Ware Improvement Project

Index Map

Page 1 of 38

Source:MassGIS, National Grid, VHB

Date: 8/15/2024

nationalgrid

vhb

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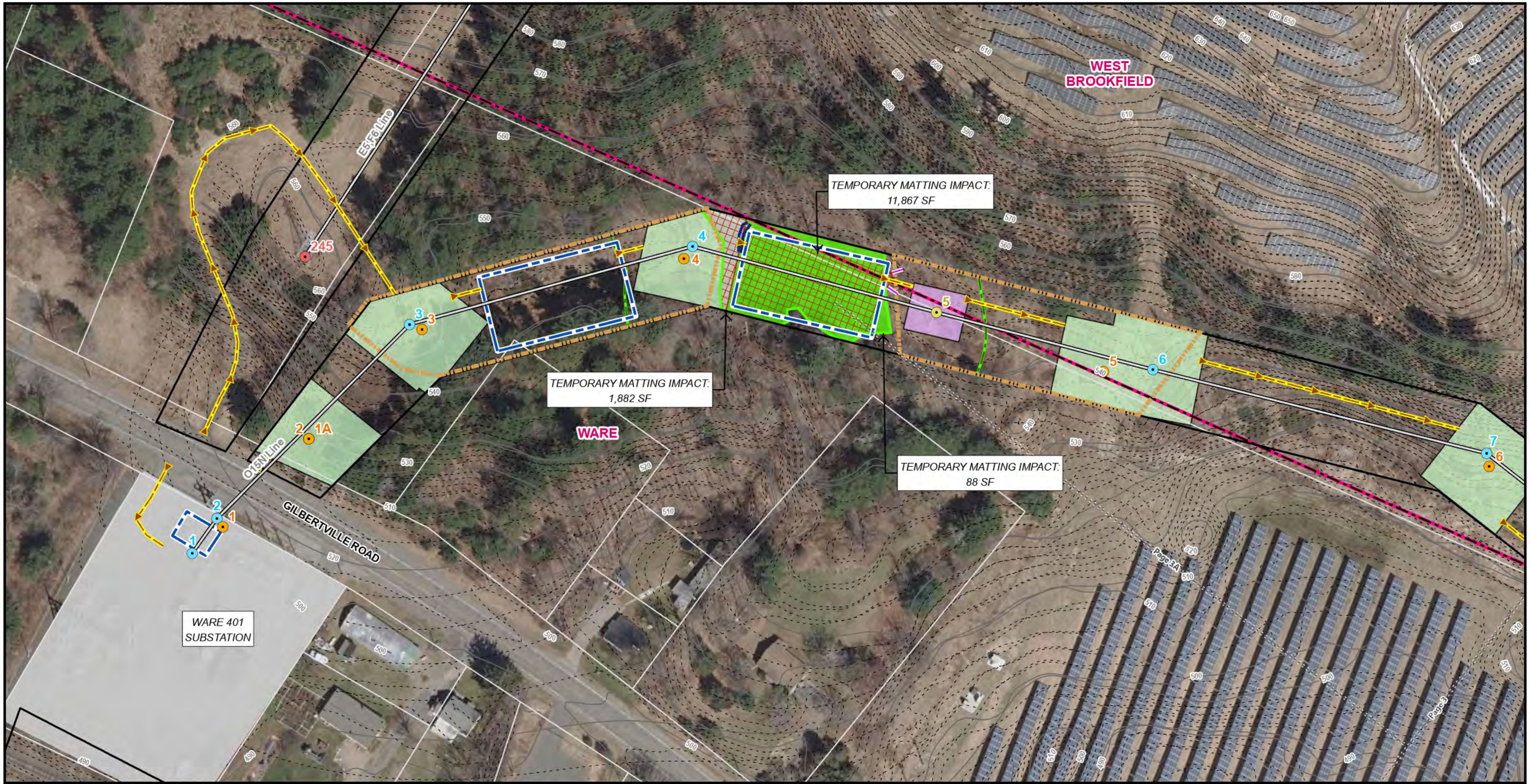

- Proposed Structure
- Structure to be Replaced
- Structure to be Removed
- Overhead Transmission Line
- Proposed Access
- Existing Access
- Off-ROW Access
- Permanent Workpad
- Temporary Workpad
- MA DFW Coldwater Fisheries Resources
- 100-ft Buffer Zone
- 200-ft Riverfront Area
- Watercourse (Non-delineated)
- Delineated Top of Bank
- Delineated Wetland Edge
- DEP Wetlands
- Archaeological Sensitive Areas
- NHESP Potential Vernal Pools
- NHESP Certified Vernal Pools
- NHESP Priority Habitats of Rare Species
- NHESP Estimated Habitats of Rare Wildlife
- Approved Wellhead Protection Areas (Zone II)
- Interim Wellhead Protection Areas (IWPA)
- Pull Pad
- Grading Area
- Culvert
- Ditch
- Stonewall
- Limit of Disturbance
- Erosion and Sediment Control Barrier
- Match Line
- 2' Contour
- 10' Index Contour
- Parcel Boundary
- Town Boundary

1:1,200

0 25 50 100

Feet

Palmer to Ware Improvement Project

Natural Resources Plan Set

Page 2 of 38

Source: MassGIS, National Grid, VHB

Date: 8/15/2024

nationalgrid

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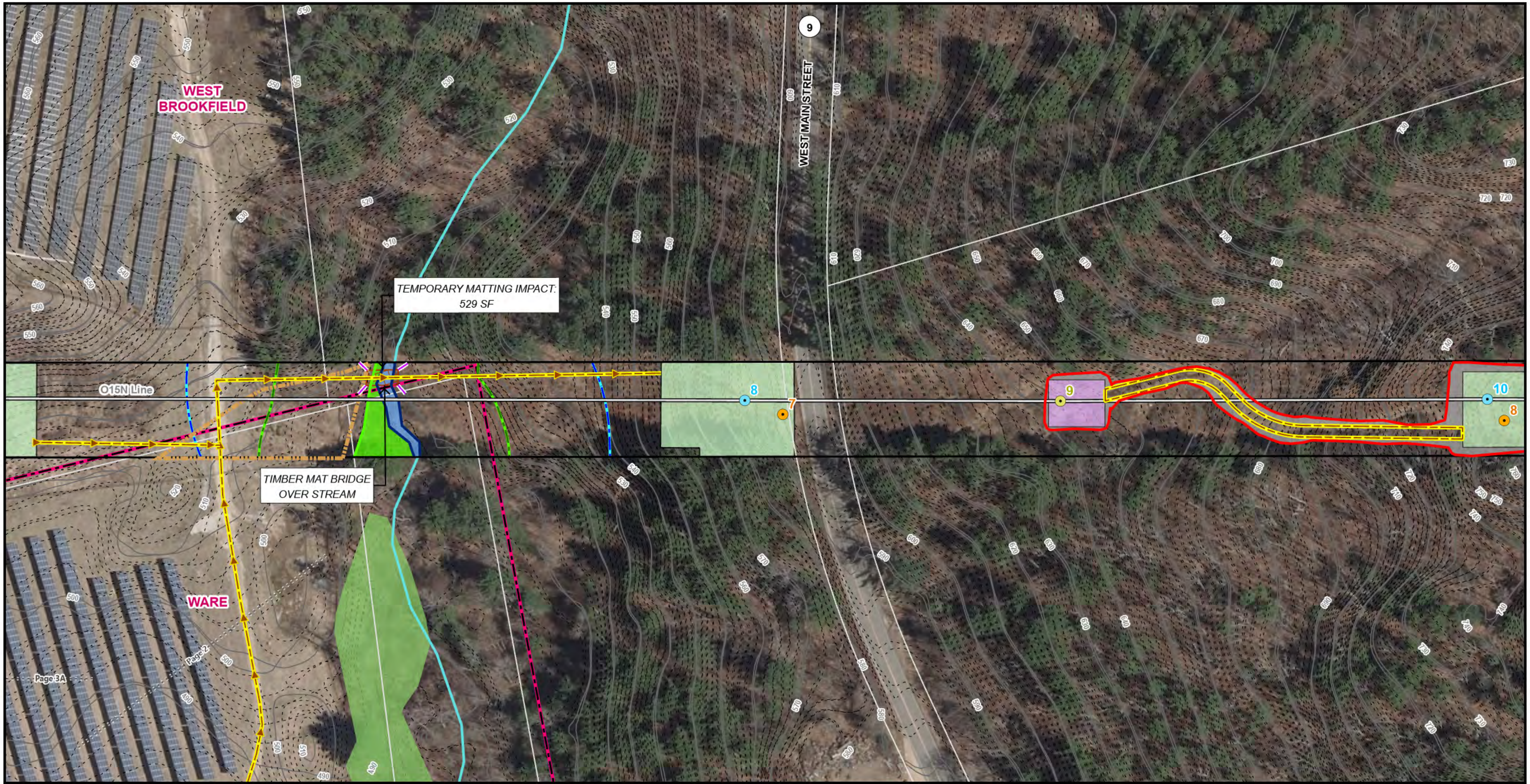

Proposed Structure
Structure to be Replaced
Structure to be Removed
Overhead Transmission Line
Proposed Access
Existing Access
Off-ROW Access
Permanent Workpad
Temporary Workpad
MA DFW Coldwater Fisheries Resources
100-ft Buffer Zone
200-ft Riverfront Area
Watercourse (Non-delineated)
Delineated Top of Bank
Delineated Wetland Edge
DEP Wetlands
Archaeological Sensitive Areas
NHESP Potential Vernal Pools
NHESP Certified Vernal Pools
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Culvert
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Match Line
2' Contour
10' Index Contour
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Town Boundary

1:1,200

0 25 50 100
Feet

Palmer to Ware Improvement Project

Natural Resources Plan Set

Page 3 of 38

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0 25 50 100

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Palmer to Ware Improvement Project

Natural Resources Plan Set

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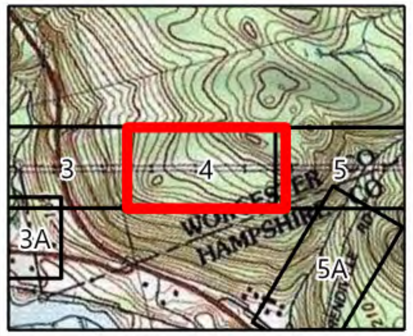

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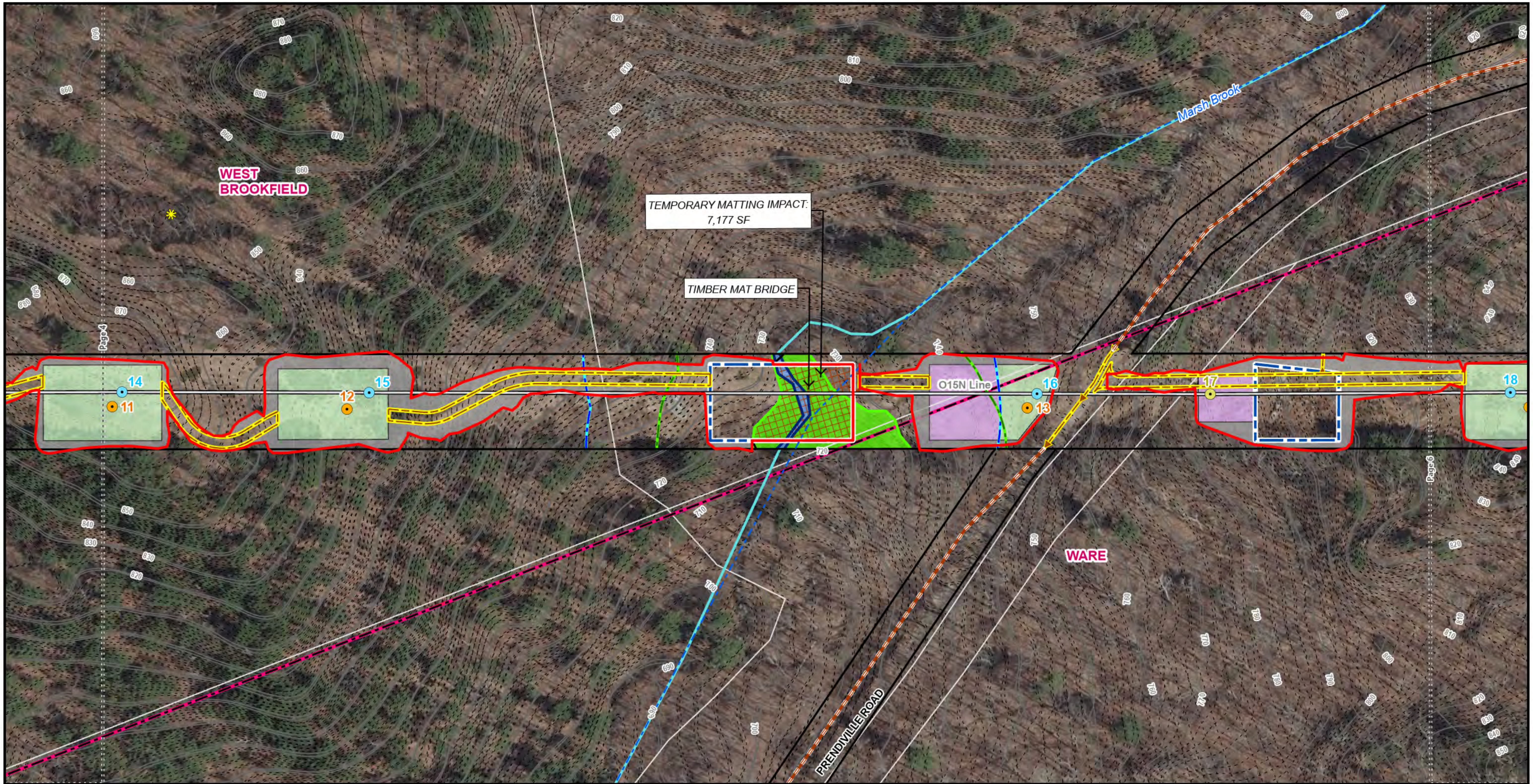

Proposed Structure	MA DFW Coldwater Fisheries Resources	NHESP Potential Vernal Pools	Culvert
Structure to be Replaced	100-ft Buffer Zone	NHESP Certified Vernal Pools	Ditch
Structure to be Removed	200-ft Riverfront Area	NHESP Priority Habitats of Rare Species	Stonewall
Overhead Transmission Line	Watercourse (Non-delineated)	NHESP Estimated Habitats of Rare Wildlife	Limit of Disturbance
Proposed Access	Delineated Top of Bank	Approved Wellhead Protection Areas (Zone II)	Erosion and Sediment Control Barrier
Existing Access	Delineated Wetland Edge	Interim Wellhead Protection Areas (IWPA)	Match Line
Off-ROW Access	DEP Wetlands	Pull Pad	2' Contour
Permanent Workpad	Archaeological Sensitive Areas	Grading Area	10' Index Contour
Temporary Workpad			Parcel Boundary
			Town Boundary

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0 25 50 100 Feet

Palmer to Ware Improvement Project

Natural Resources Plan Set

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1:1,200

0 25 50 100
Feet

Palmer to Ware Improvement Project

Natural Resources Plan Set

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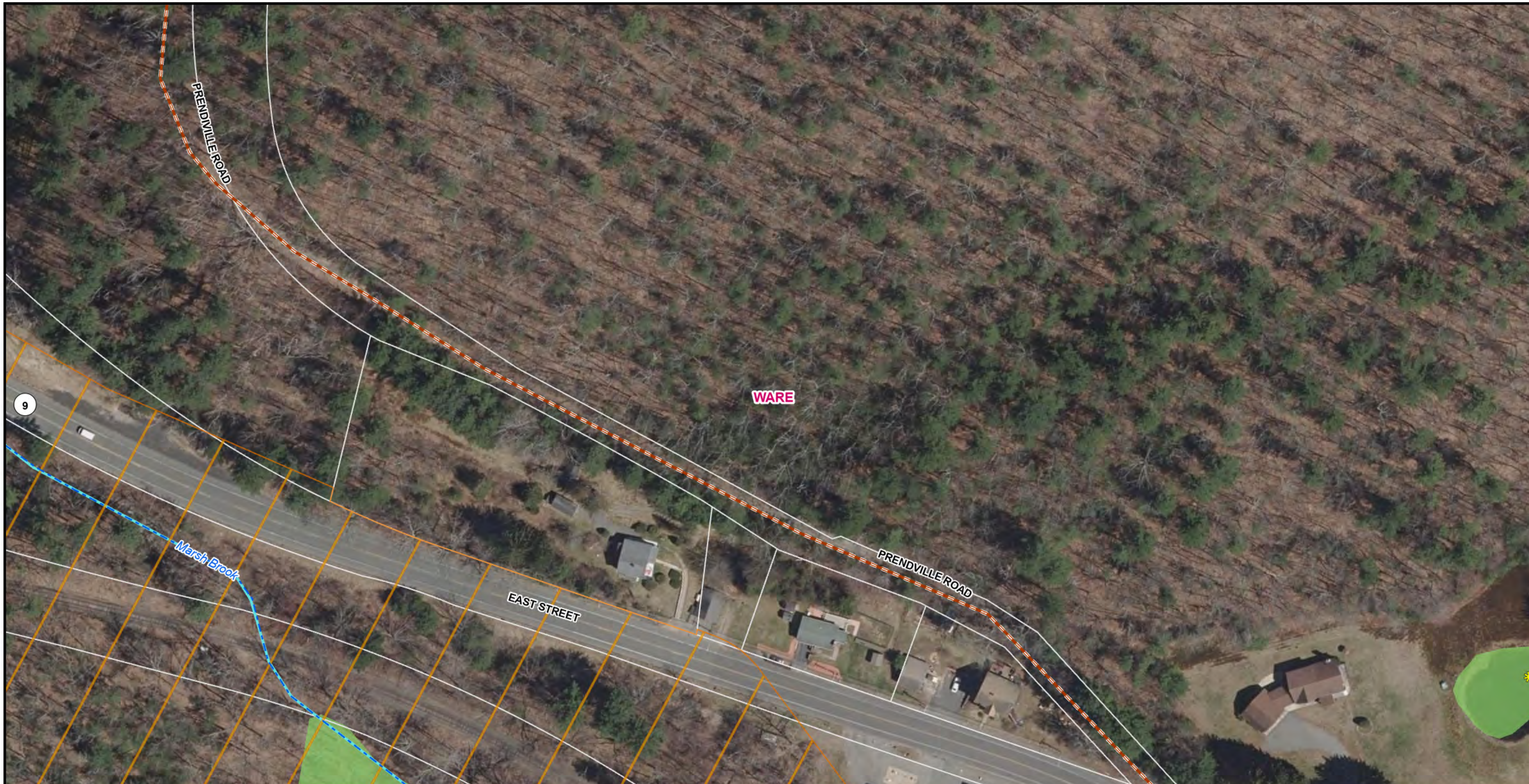

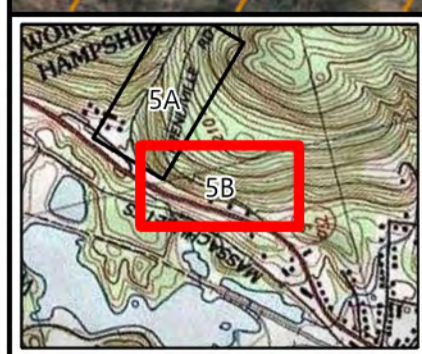

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Feet

Palmer to Ware Improvement Project

Natural Resources Plan Set

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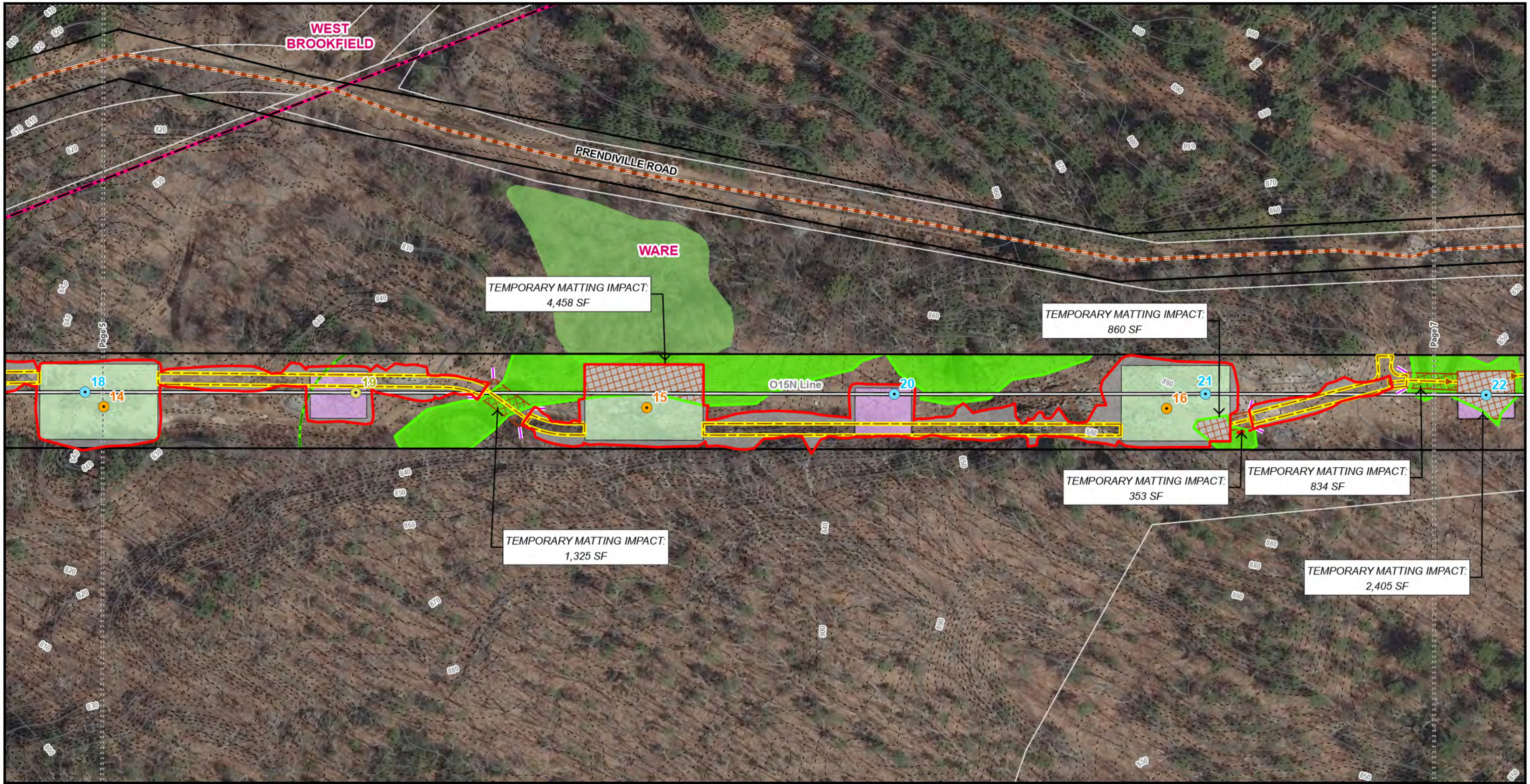

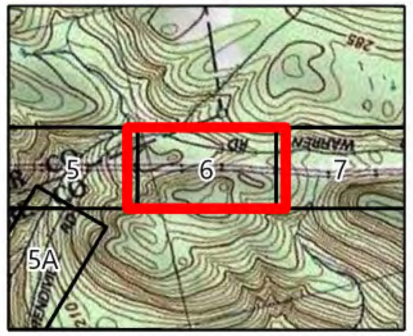

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Feet

Palmer to Ware Improvement Project

Natural Resources Plan Set

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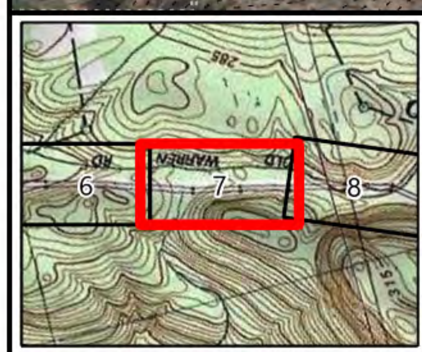

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1:1,200

0 25 50 100 Feet

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Natural Resources Plan Set

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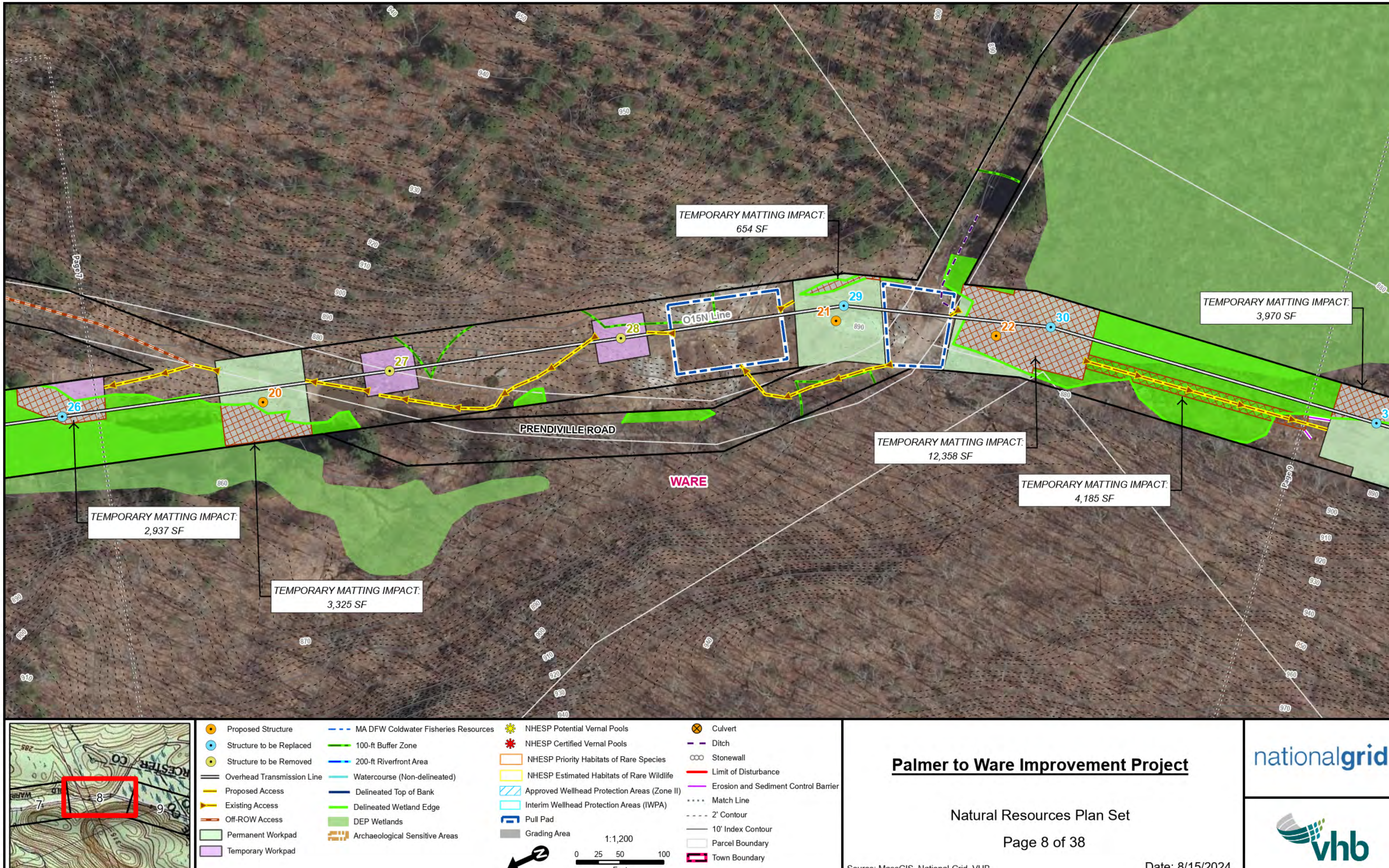

Palmer to Ware Improvement Project

Natural Resources Plan Set

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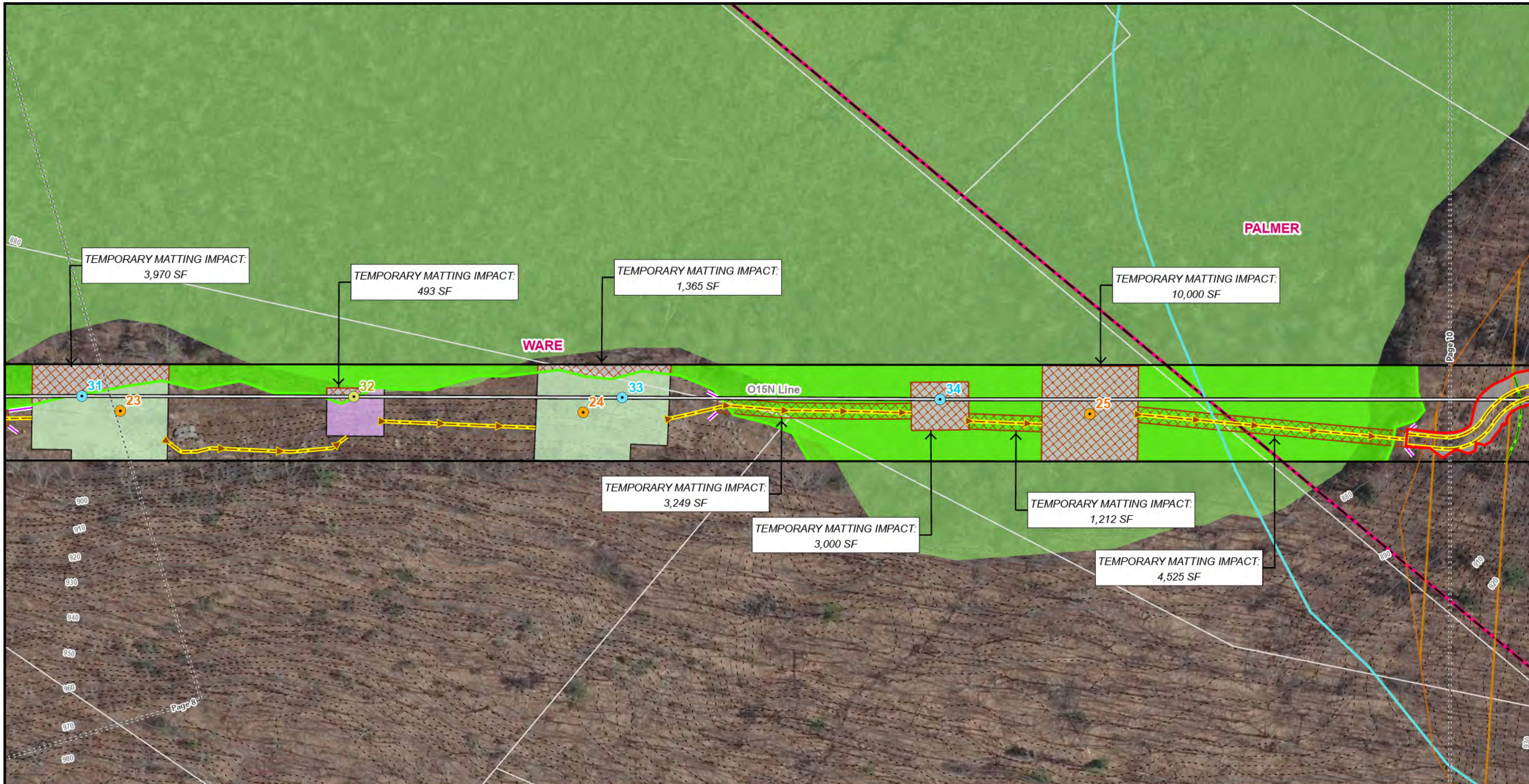

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1:1,200

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Palmer to Ware Improvement Project

Natural Resources Plan Set

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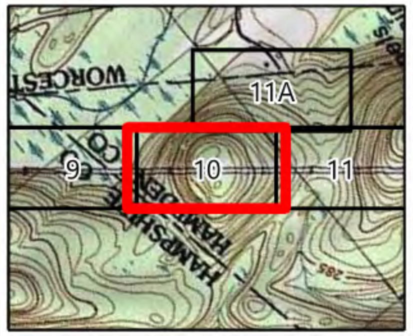

Proposed Structure
Structure to be Replaced
Structure to be Removed
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2' Contour
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1:1,200

0 25 50 100
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Palmer to Ware Improvement Project

Natural Resources Plan Set

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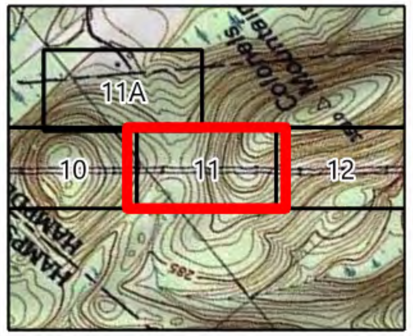

Proposed Structure	MA DFW Coldwater Fisheries Resources	NHESP Potential Vernal Pools	Culvert
Structure to be Replaced	100-ft Buffer Zone	NHESP Certified Vernal Pools	Ditch
Structure to be Removed	200-ft Riverfront Area	NHESP Priority Habitats of Rare Species	Stonewall
Overhead Transmission Line	Watercourse (Non-delineated)	NHESP Estimated Habitats of Rare Wildlife	Limit of Disturbance
Proposed Access	Delineated Top of Bank	Approved Wellhead Protection Areas (Zone II)	Erosion and Sediment Control Barrier
Existing Access	Delineated Wetland Edge	Interim Wellhead Protection Areas (IWPA)	Match Line
Off-ROW Access	DEP Wetlands	Pull Pad	2' Contour
Permanent Workpad	Archaeological Sensitive Areas	Grading Area	10' Index Contour
Temporary Workpad			Parcel Boundary
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1:1,200

0 25 50 100

Feet

Palmer to Ware Improvement Project

Natural Resources Plan Set

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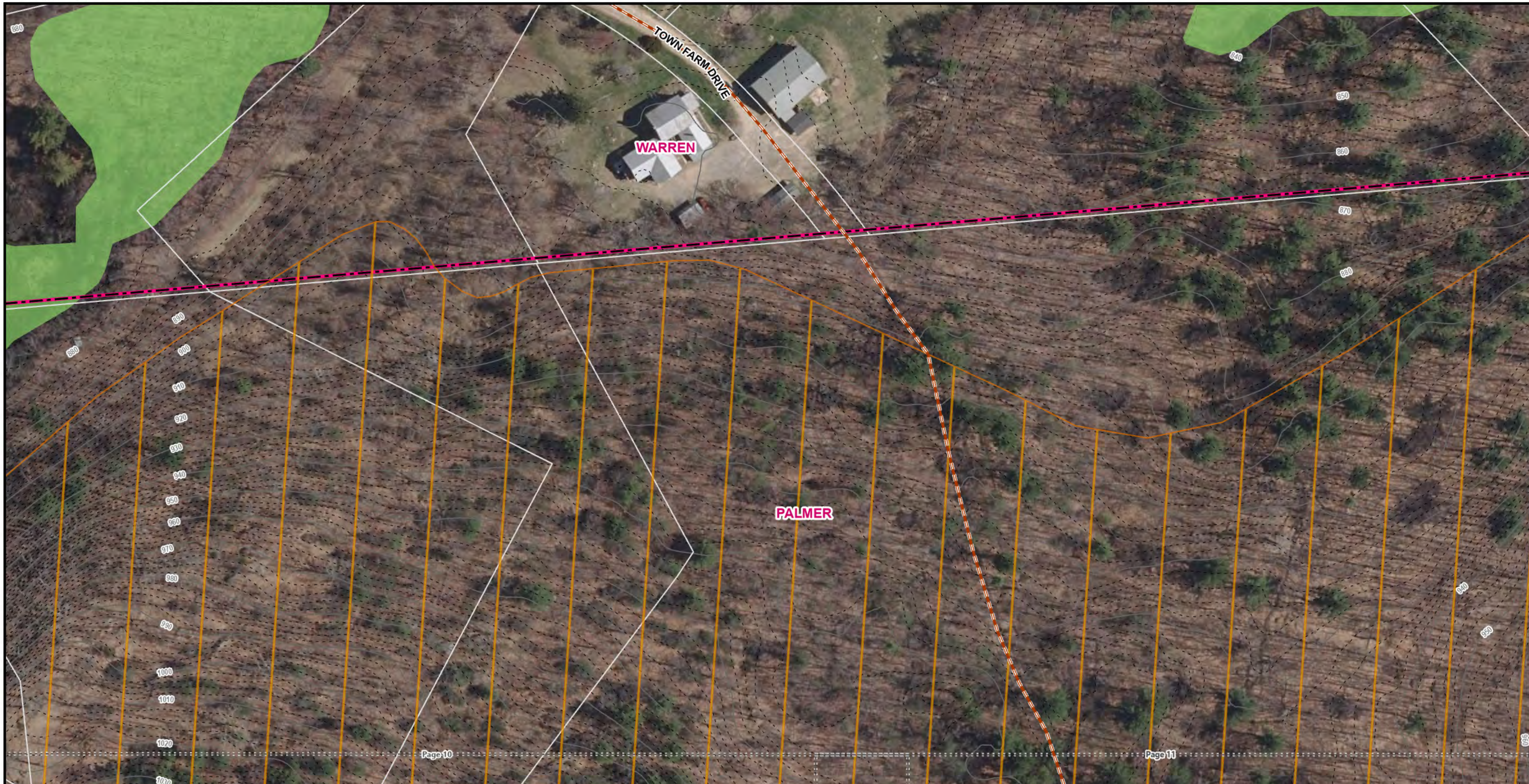

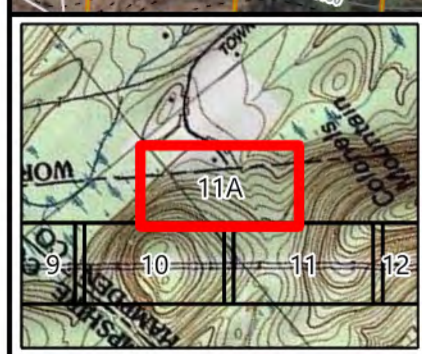

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Palmer to Ware Improvement Project

Natural Resources Plan Set

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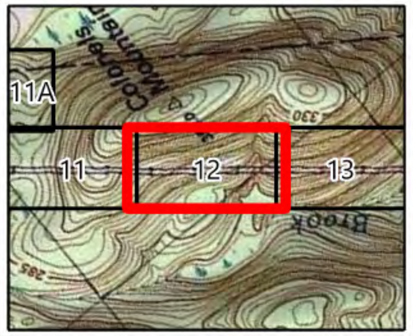

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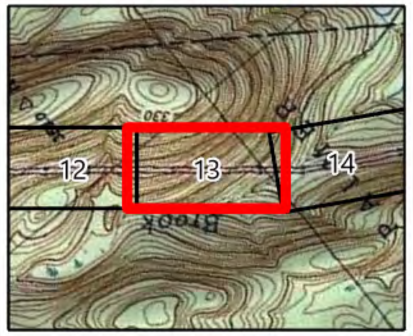

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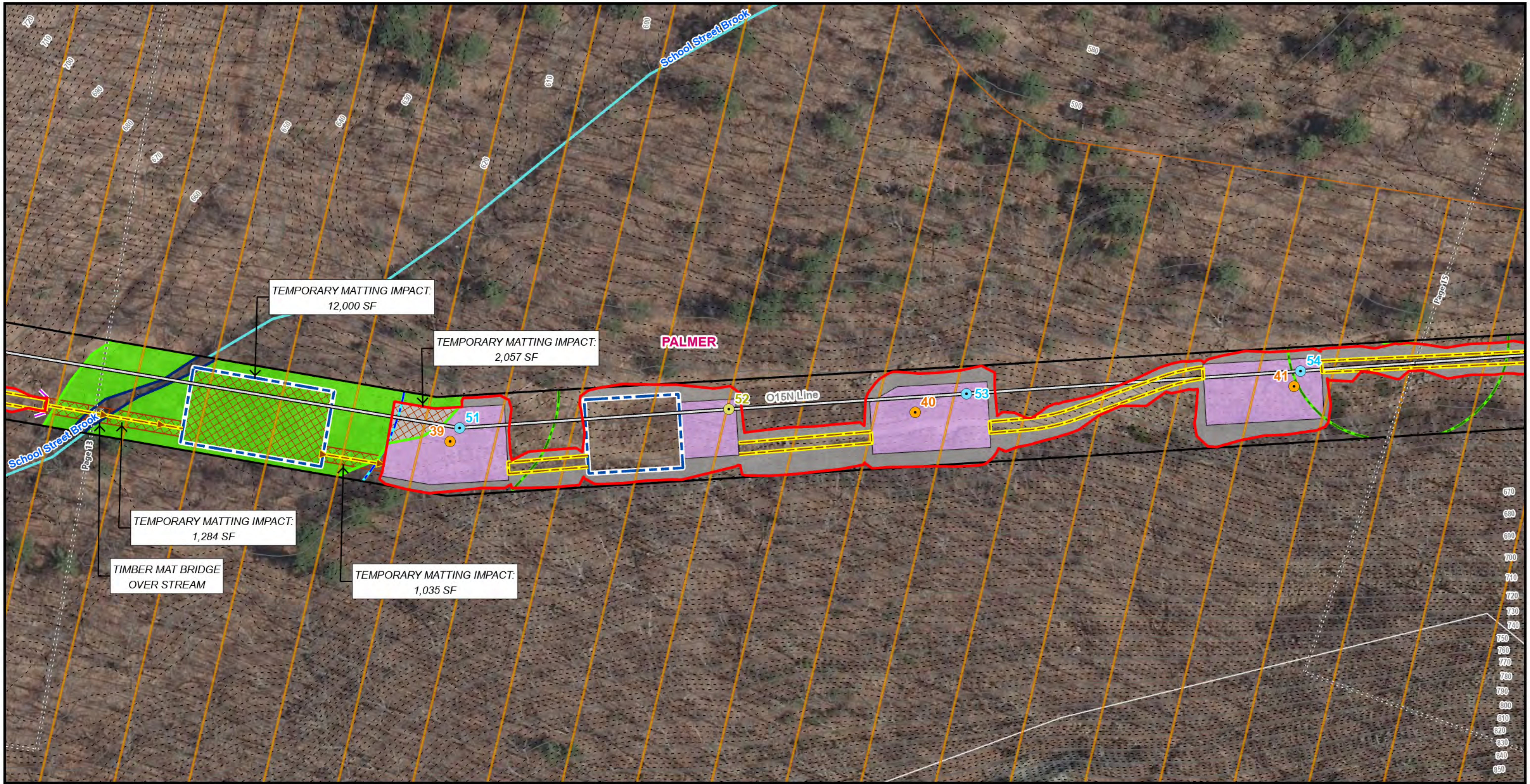

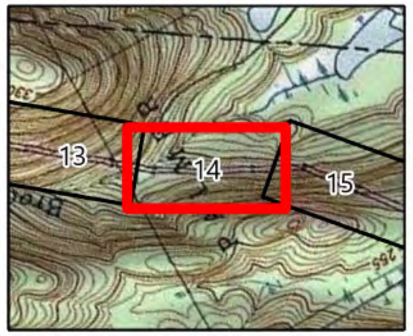

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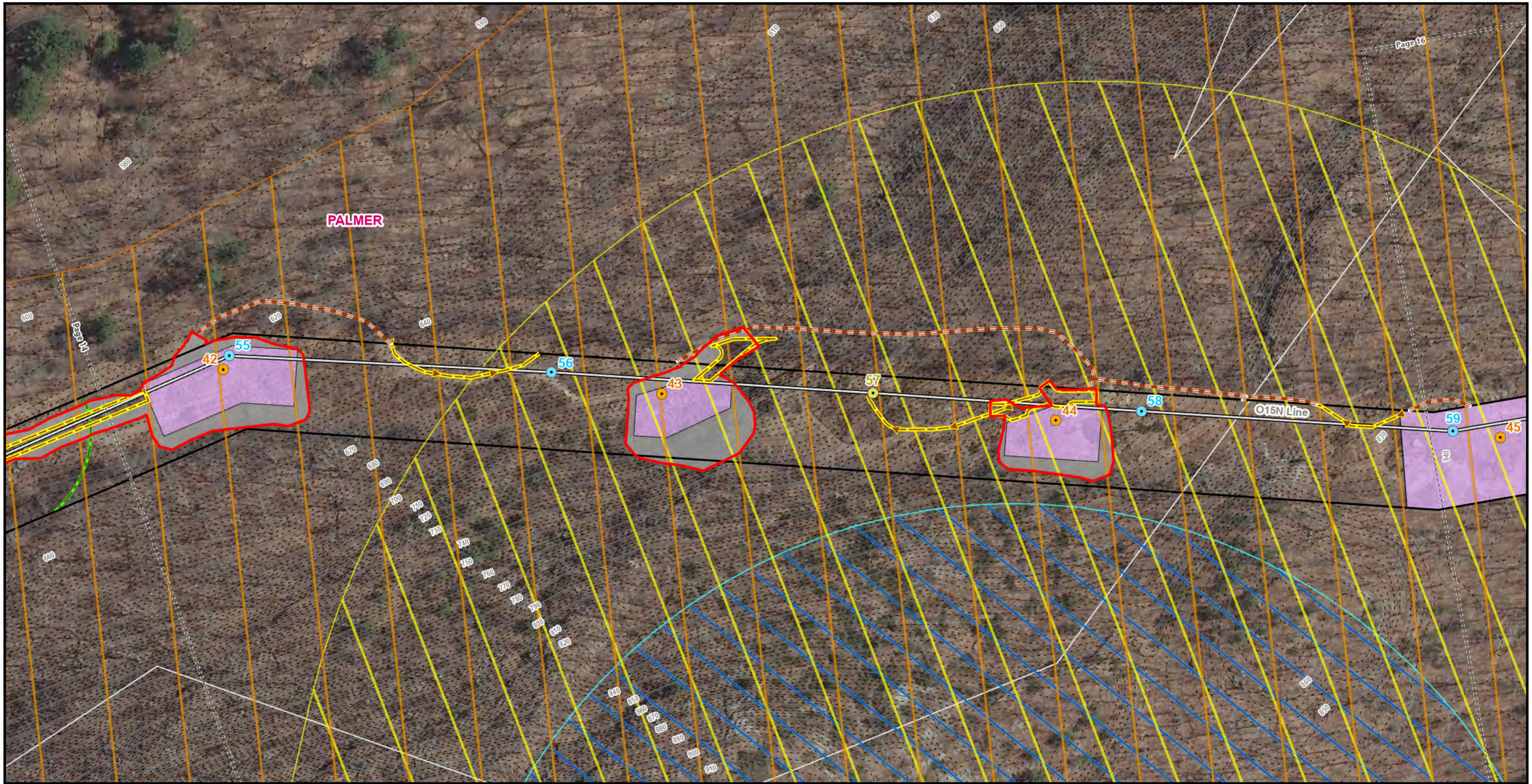

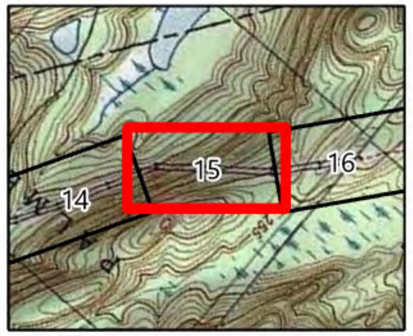

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- Ditch
- Stonewall
- Limit of Disturbance
- Erosion and Sediment Control Barrier
- Match Line
- 2' Contour
- 10' Index Contour
- Parcel Boundary
- Town Boundary

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0 25 50 100

Feet

Palmer to Ware Improvement Project

Natural Resources Plan Set

Source: MassGIS, National Grid, VHB

Date: 8/15/2024

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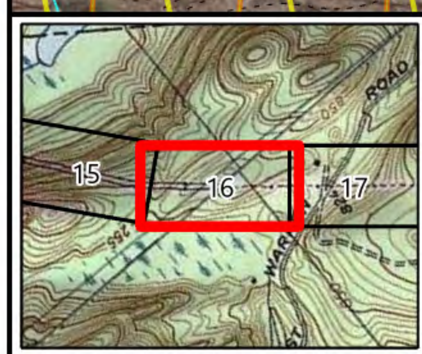

- Proposed Structure
- Structure to be Replaced
- Structure to be Removed
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- Existing Access
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- Temporary Workpad
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Feet

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Source: MassGIS, National Grid, VHB

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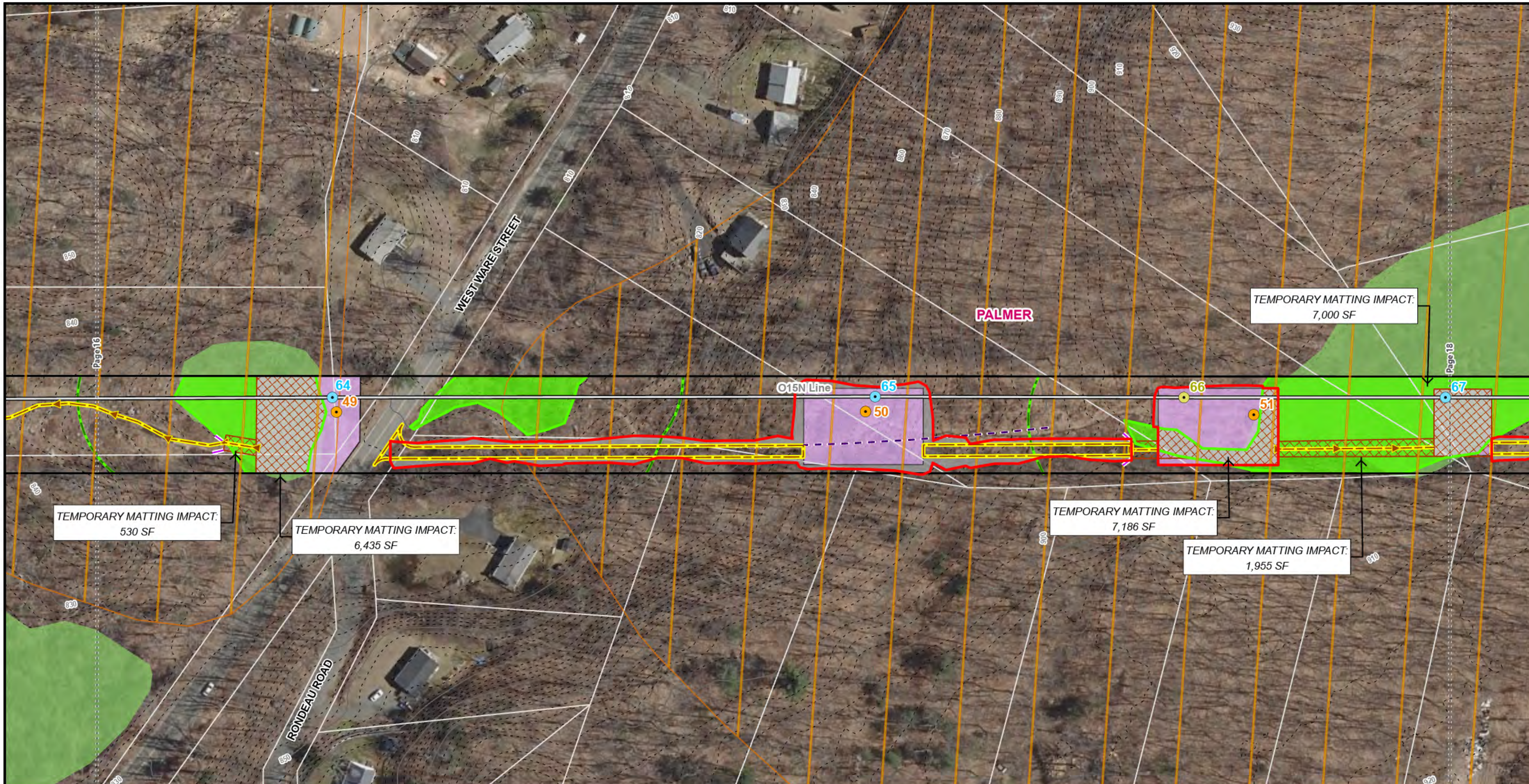

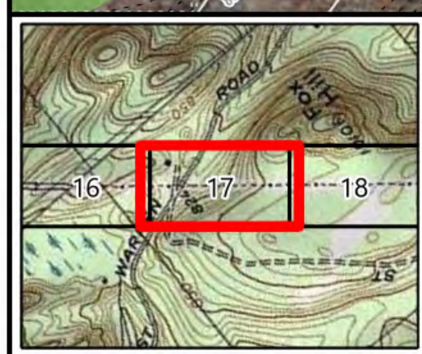

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Source: MassGIS, National Grid, VHB

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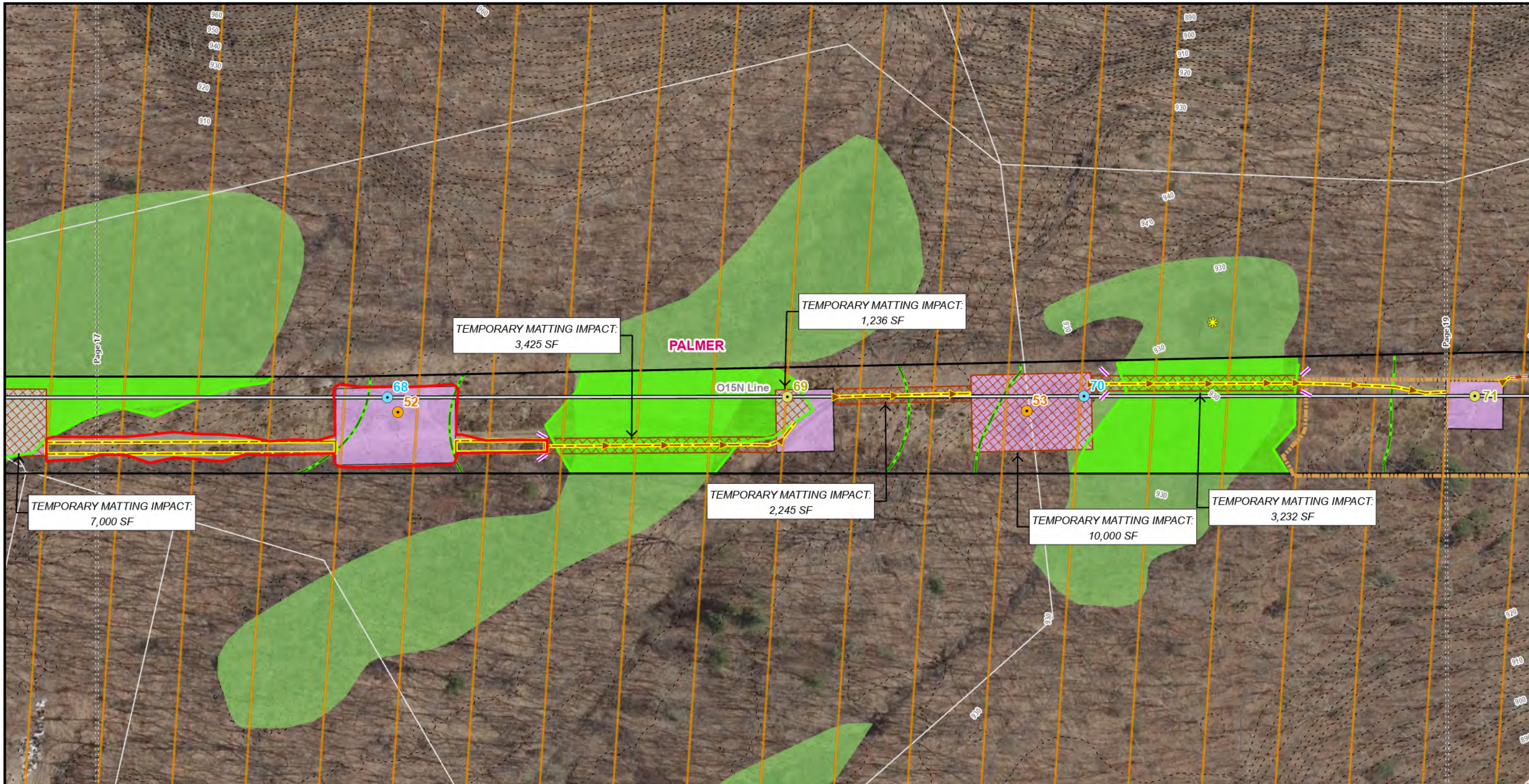

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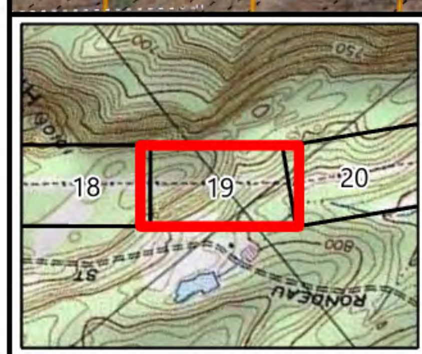

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0 25 50 100 Feet

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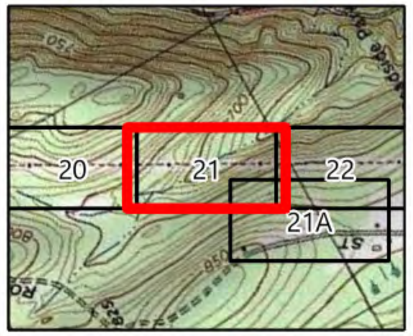

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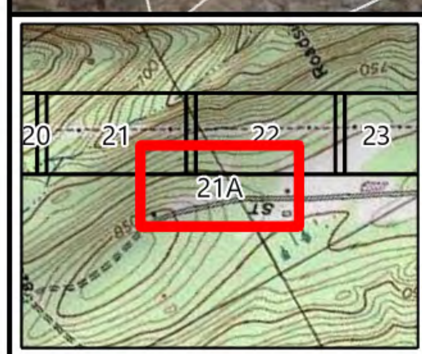

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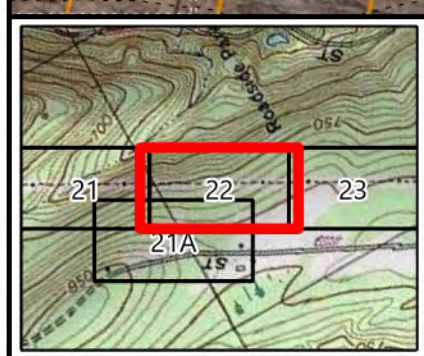

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1:1,200

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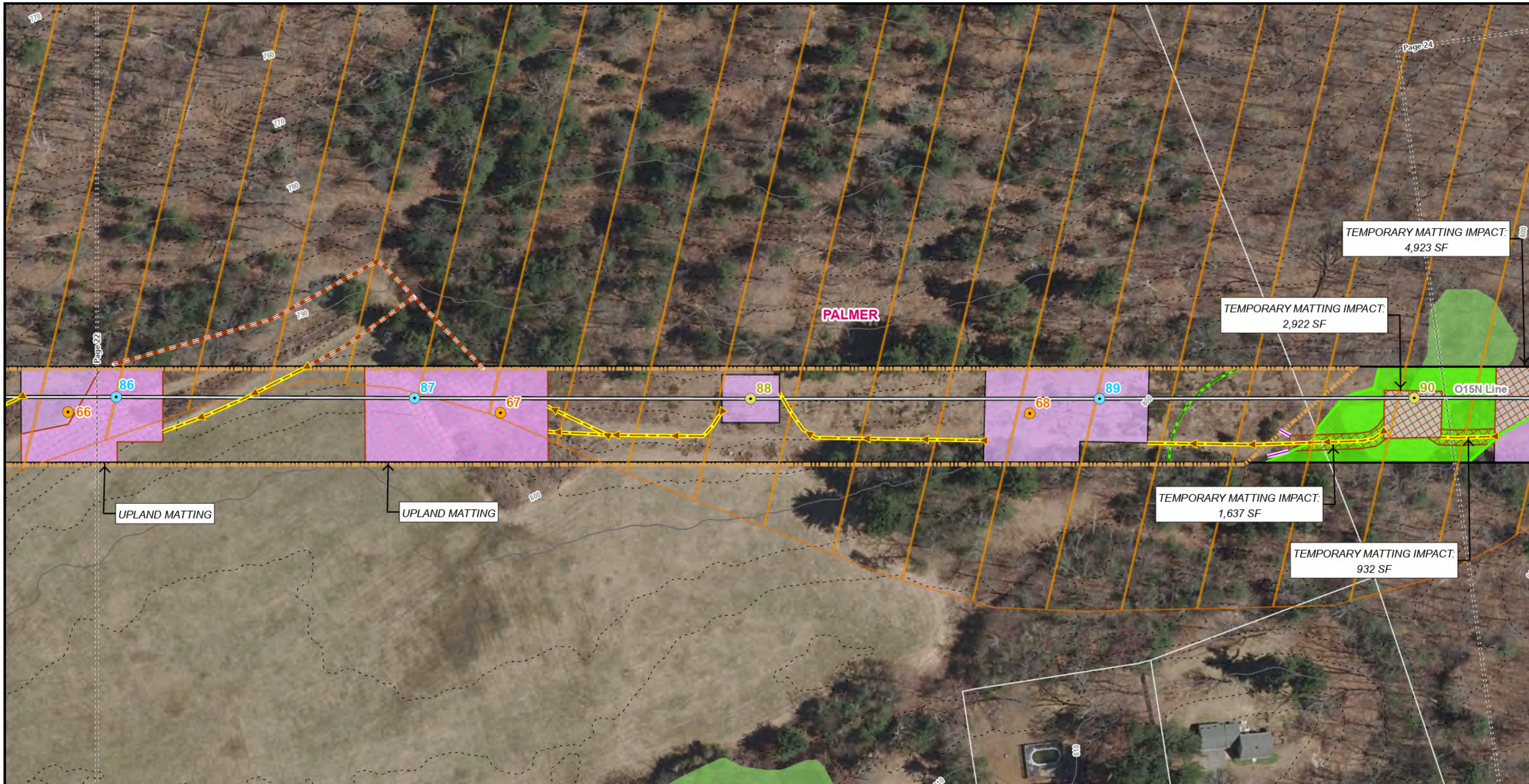

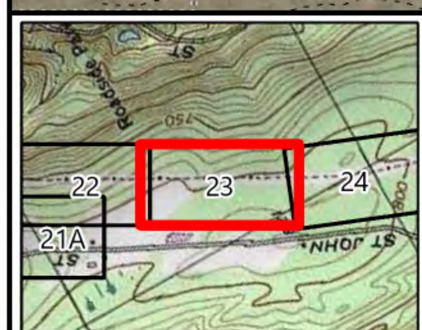

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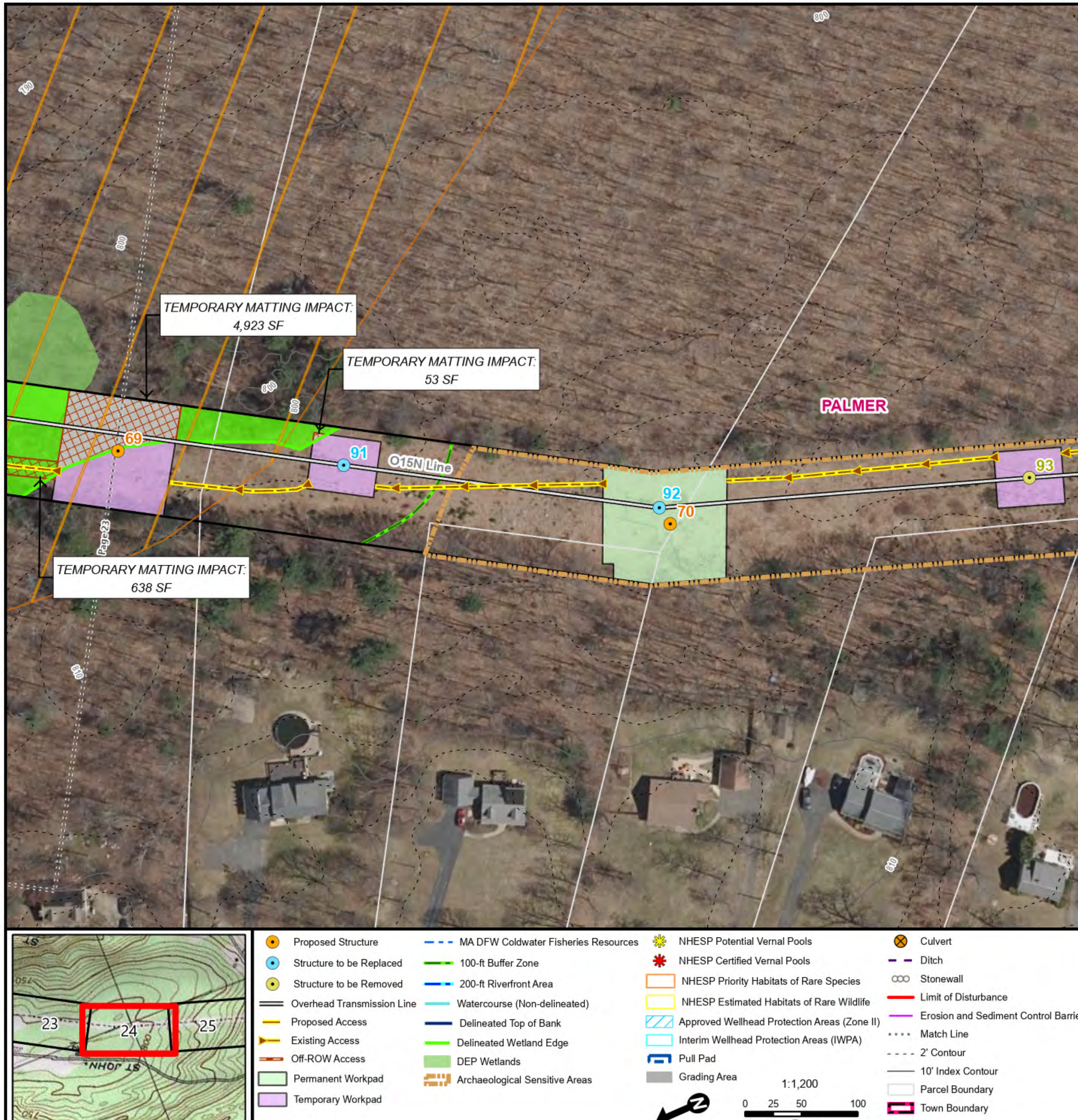

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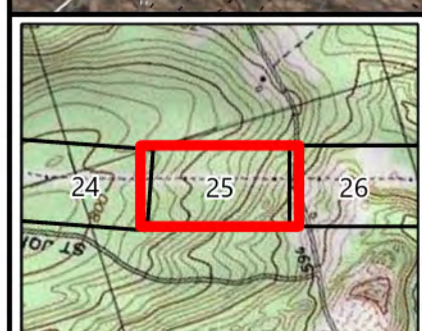

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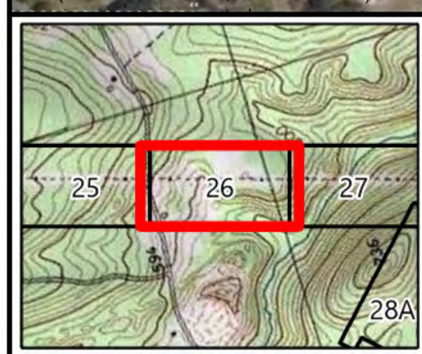

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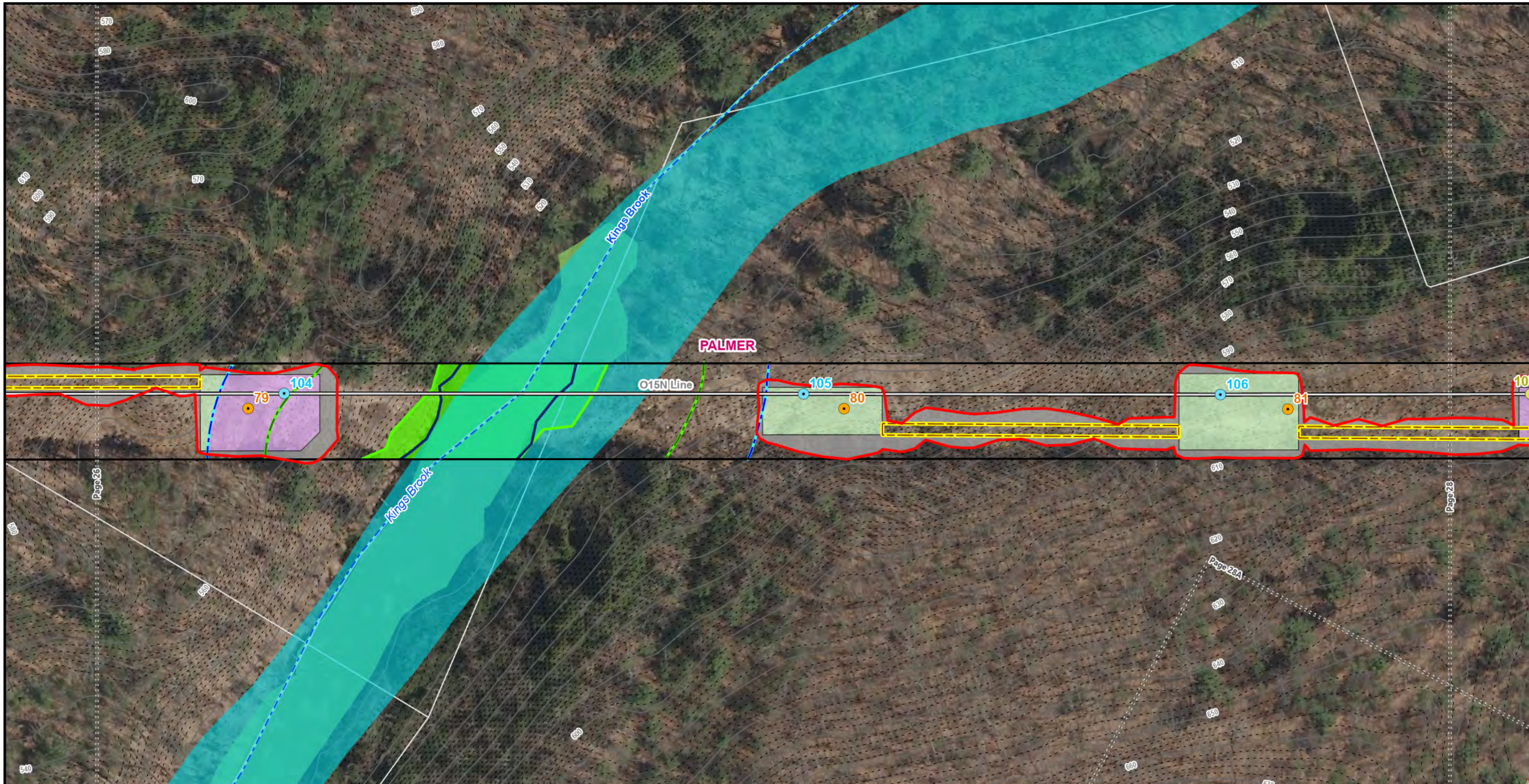

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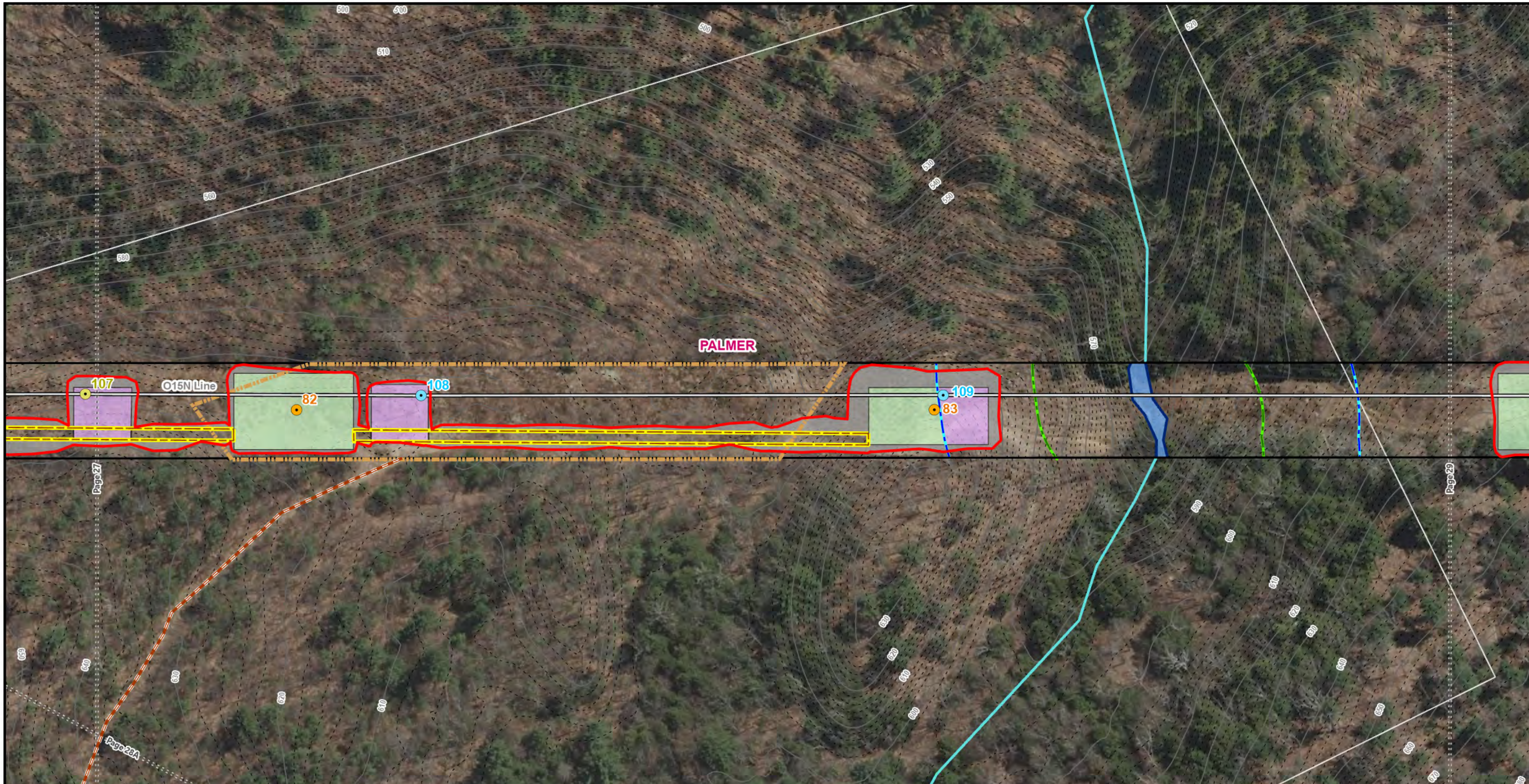

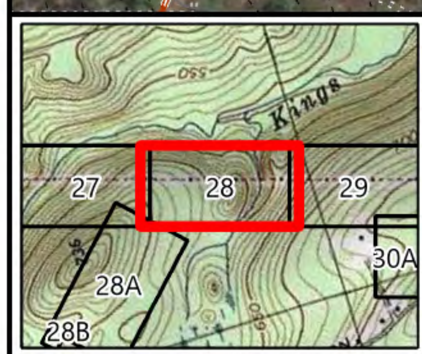

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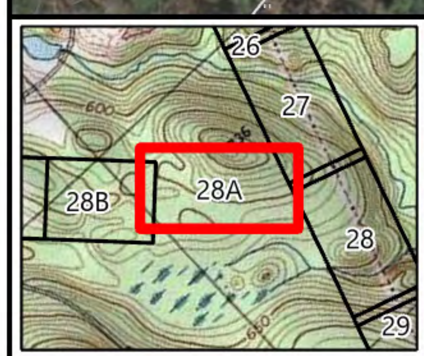

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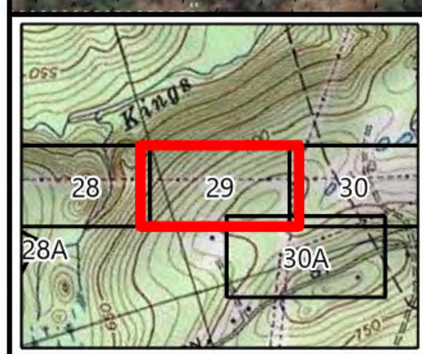

Proposed Structure
Structure to be Replaced
Structure to be Removed
Overhead Transmission Line
Proposed Access
Existing Access
Off-ROW Access
Permanent Workpad
Temporary Workpad
MA DFW Coldwater Fisheries Resources
100-ft Buffer Zone
200-ft Riverfront Area
Watercourse (Non-delineated)
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Delineated Wetland Edge
DEP Wetlands
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NHESP Estimated Habitats of Rare Wildlife
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Grading Area
Culvert
Ditch
Stonewall
Limit of Disturbance
Erosion and Sediment Control Barrier
Match Line
2' Contour
10' Index Contour
Parcel Boundary
Town Boundary

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Palmer to Ware Improvement Project

Natural Resources Plan Set

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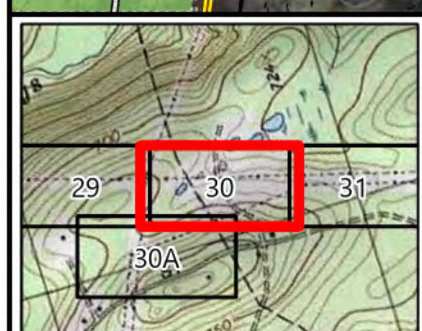

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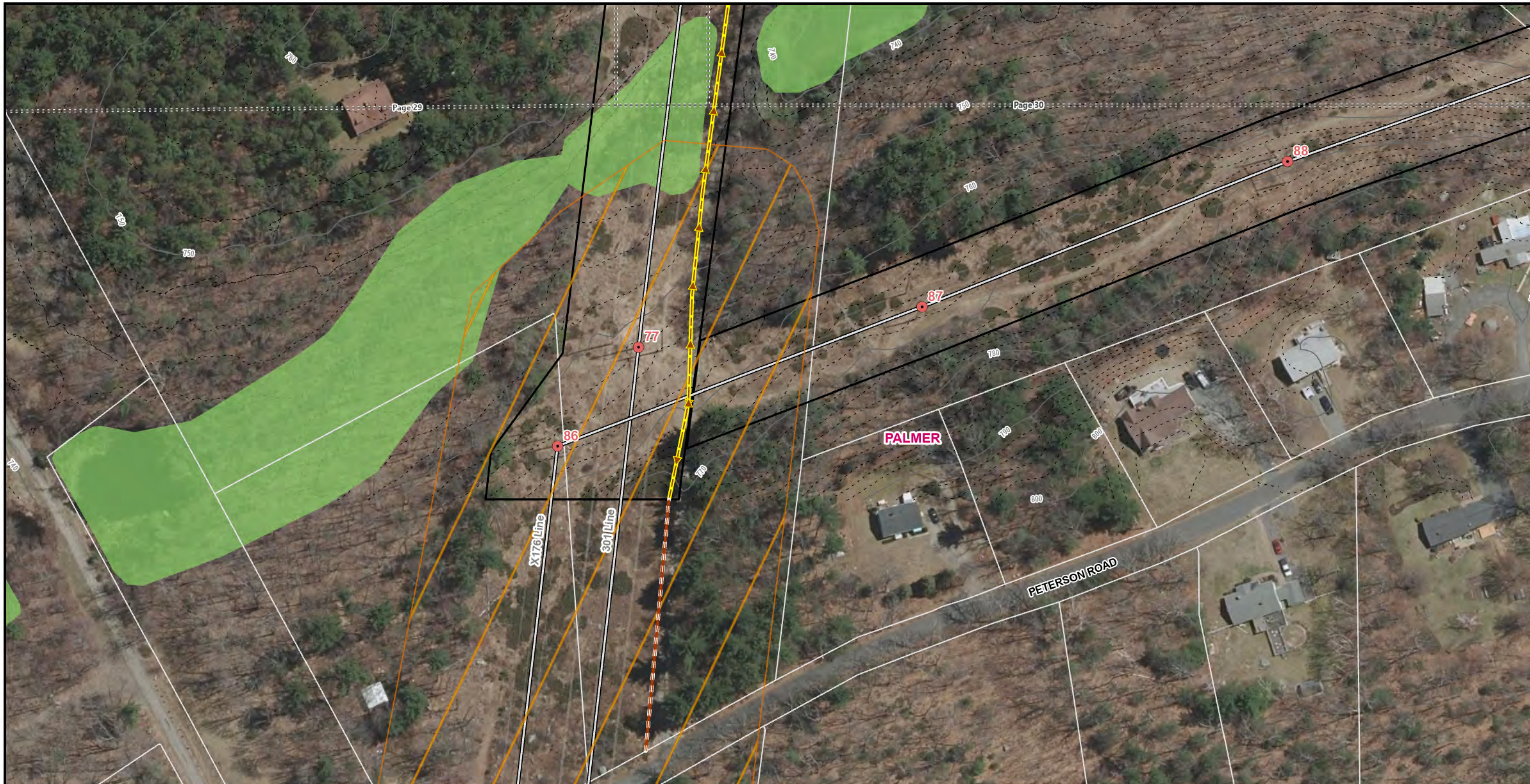

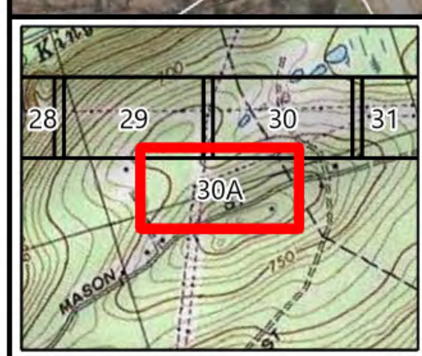

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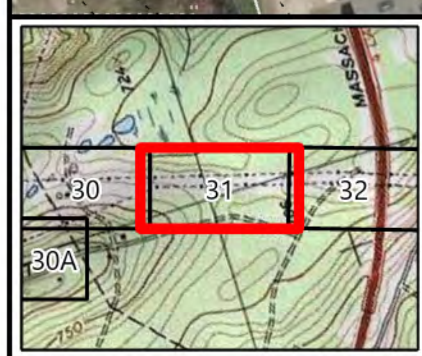

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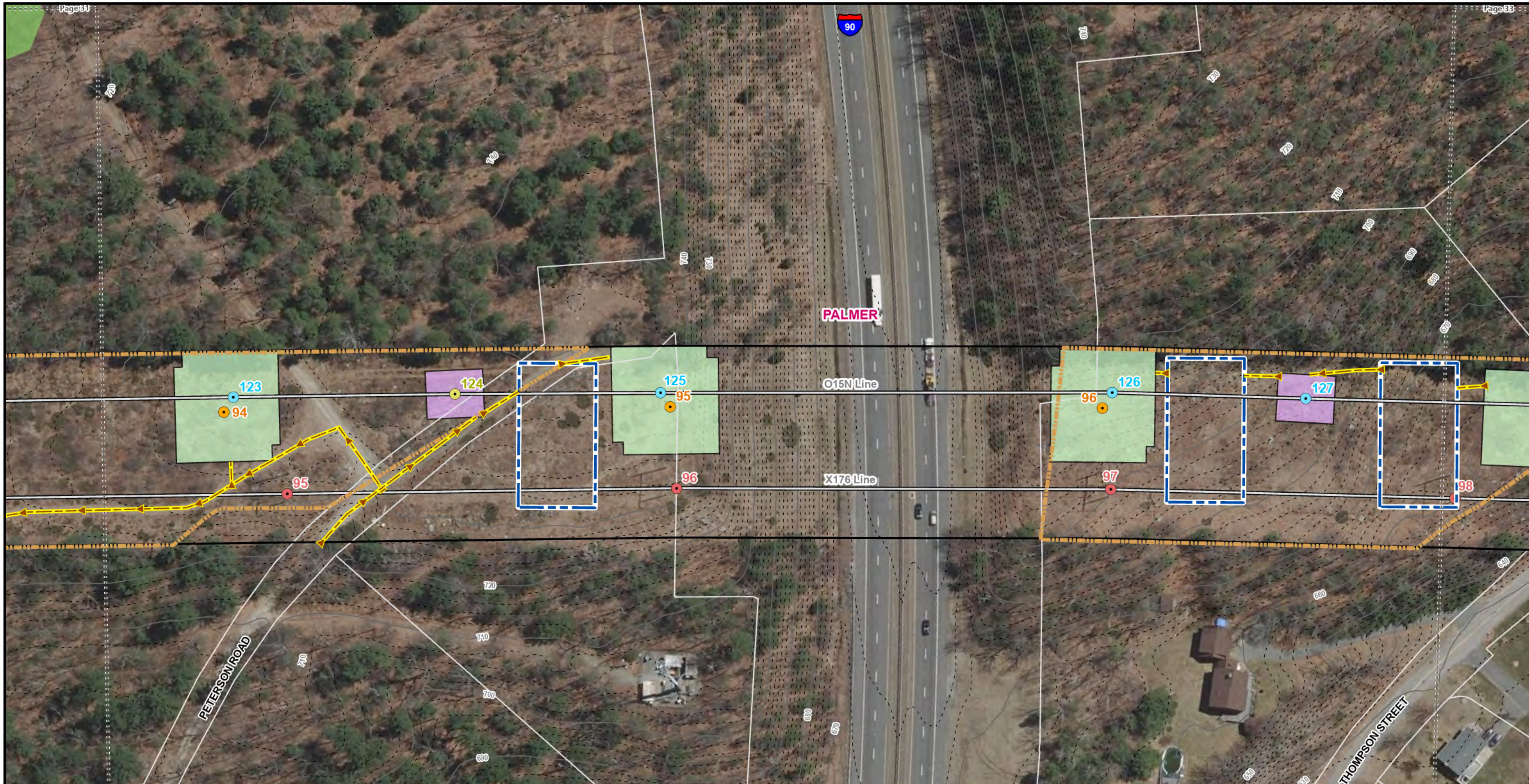

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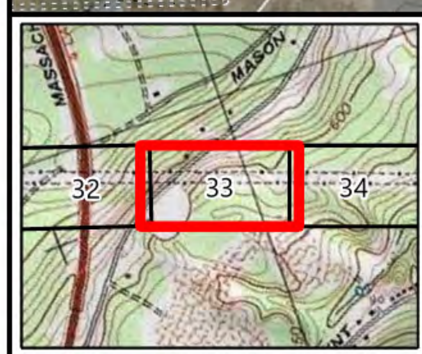

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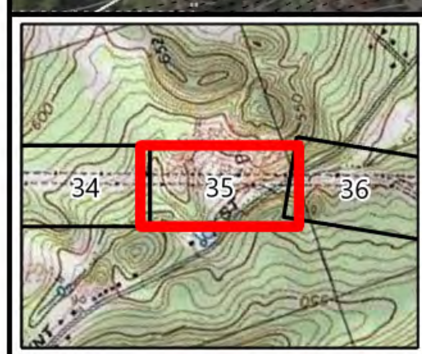

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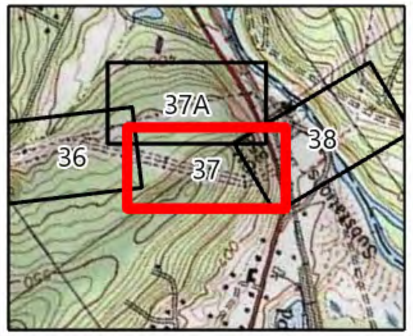

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Structure to be Replaced	100-ft Buffer Zone
Structure to be Removed	200-ft Riverfront Area
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Permanent Workpad	Archaeological Sensitive Areas
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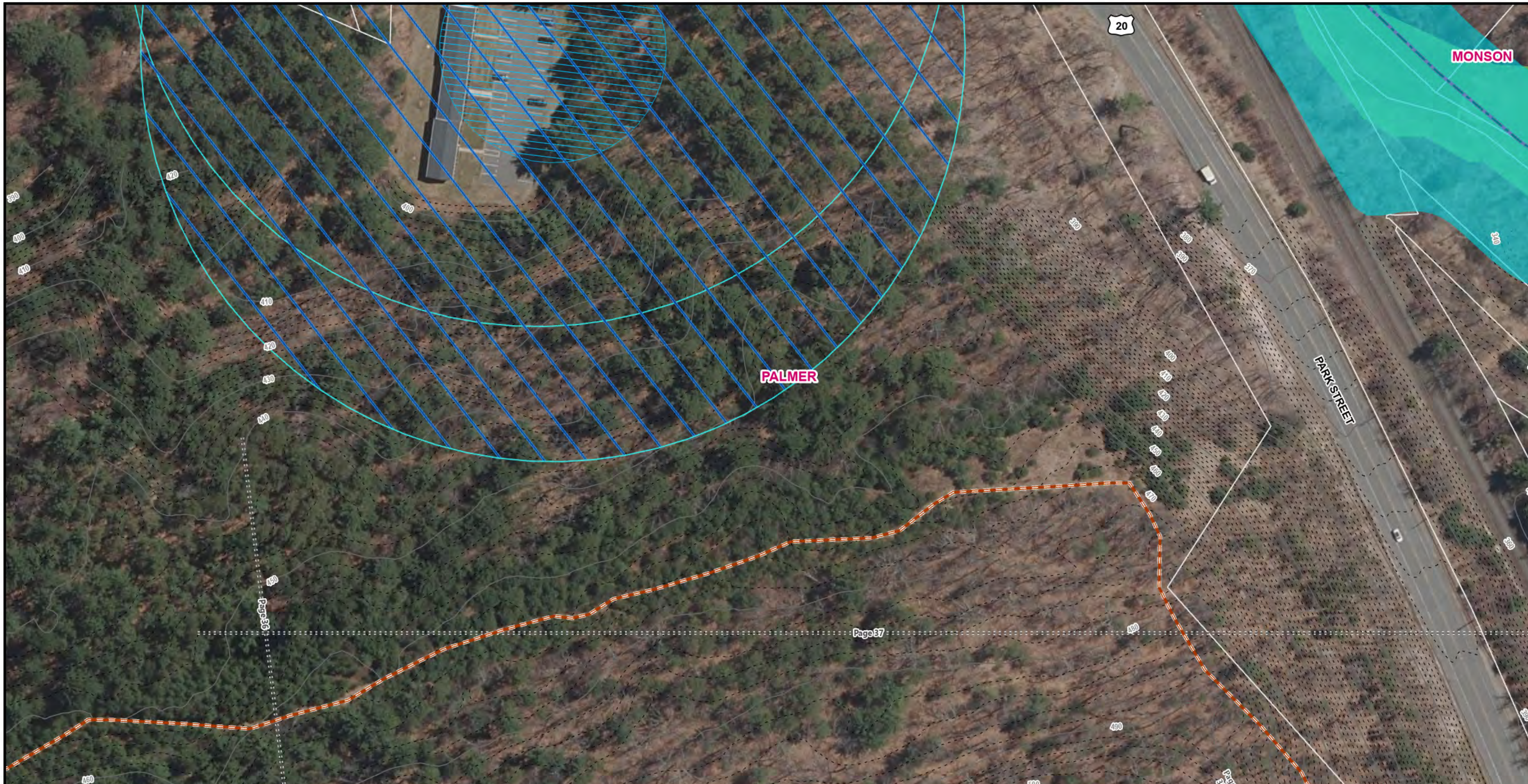

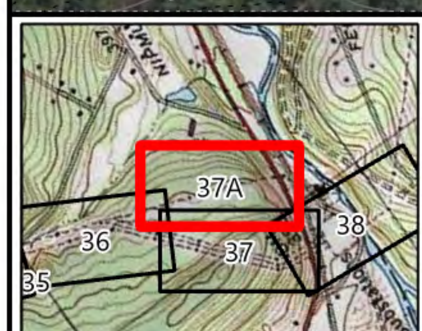

- Proposed Structure
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Appendix C

Maintenance and Construction Best Management Practices for New England (EG-303NE)

SUBJECT	REFERENCE
ROW Access, Maintenance and Construction Best Management Practices for New England	EP-3; Natural Resource Protection

PURPOSE/OBJECTIVE:
This document provides National Grid personnel, consultants and contractors with Best Management Practices (BMPs) for conducting work on electric and natural gas transmission and distribution rights-of-ways (ROWs) and substations in New England.

WHO:
These BMPs are to be followed by all personnel conducting work on Company electric and gas ROWs and substations in New England. These BMPs do not apply to Company employees and contractors performing routine vegetation management activities that are not a part of construction or re-construction projects. Employees and contractors maintaining vegetation on Company ROWs and substations must follow the National Grid ROW Vegetation and Substation Vegetation Management Plans.

DEFINITIONS:

Refer to **Glossary** in **Appendix 1** and **Acronyms** in **Appendix 2**.

WHAT TO DO:

1.0 Project Planning

Prior to the start of any project (proposed new facilities or maintenance of existing facilities), the Project Engineer or other project planner shall determine whether any environmental permits or approvals are required, per the state-specific EG-301 environmental checklists. Any questions regarding which activities may be conducted in regulated areas or within environmentally sensitive areas shall be referred to the National Grid Environmental Scientist or Project Environmental Consultant.

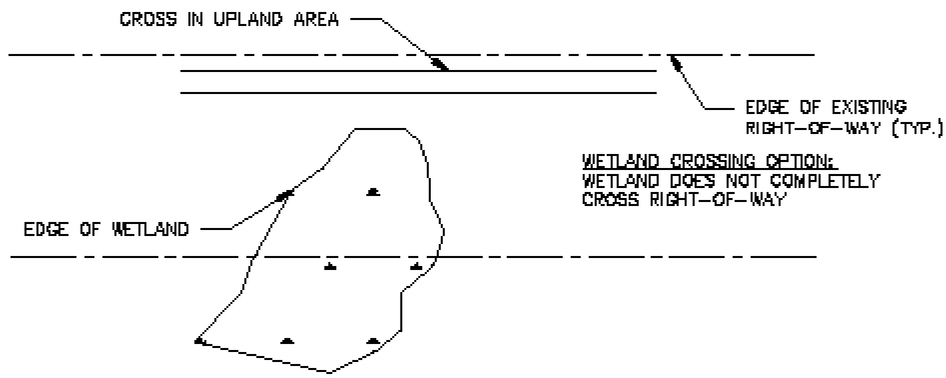
All new construction and maintenance projects shall follow clear and enforceable environmental performance standards, which is the purpose for which these BMPs have been compiled.

1.1 Avoidance and Minimization

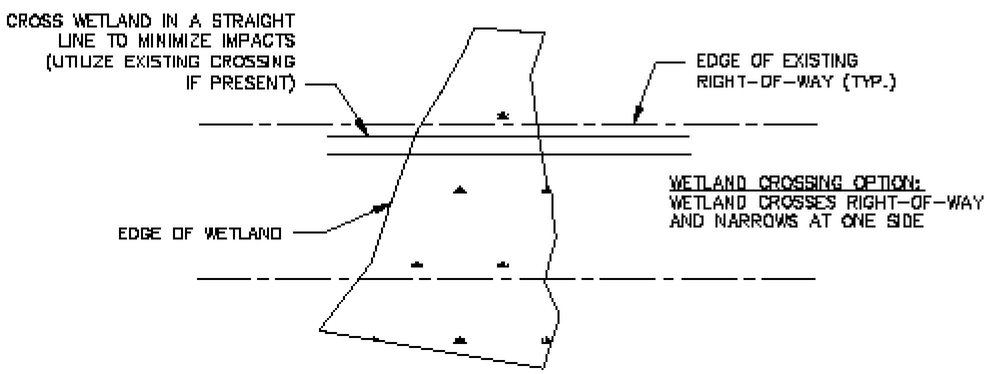
Measures shall always be taken to avoid impacts to wetlands, waterways, rare species habitats, known below and above ground historical/archeological resources and other environmentally sensitive areas. If avoidance is not possible, then measures shall be taken to minimize the extent of impacts. Alternate access routes or staging areas shall always be considered. Below is a list of methods that shall be considered where impacts are unavoidable:

- Use existing ROW access where available. Keep to approved routes and roads without deviating from them or making them wider.
- Off-ROW access shall never be assumed and shall be coordinated through National Grid Real Estate before being implemented.
- Where no existing ROW access is present, avoid wetlands and if a wetland crossing is necessary, cross wetlands at the most narrow point possible or at the location of a previously used crossing (if evident). Figure 1 below illustrates this minimization technique.

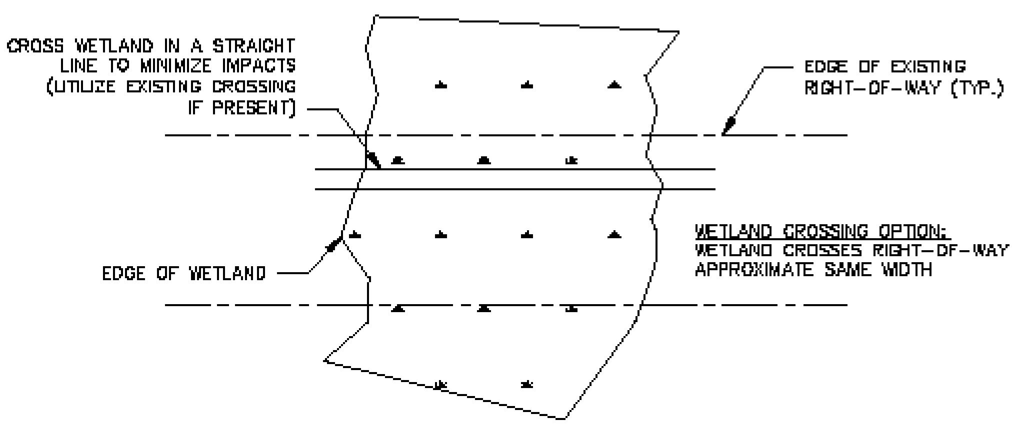
- Avoid and minimize stream crossings.
- Minimize the width of typical access roads through wetlands to a maximum width of 16 feet.
- Conduct work manually (without using motorized equipment) in wetlands, wherever possible.
- Use construction mats in wetlands to minimize soil disturbance and rutting when crossing or working within wetlands. When not using mats for access, standard vehicles shall not be allowed to drive across wetlands without the prior approval of the National Grid Environmental Scientist. Use of a low ground pressure (LGP) vehicle may be a feasible alternative to mats provided that such LGP vehicle use has been reviewed and approved by the National Grid Environmental Scientist. See Section 7.0.
- Coordinate the timing of work to cause the least impacts during the regulatory low-flow period under normal conditions, when water/ground is frozen, after the spring songbird nesting season, and, outside of the anticipated amphibian migration window (mid-February to mid-June). Refer to the United States Army Corps of Engineers (USACE) state-specific General Permit for the definition of the low-flow period in each state at: http://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/. A summary table is provided in Section 7.0.
- Seek alternative routes or work methods to minimize impact.



WETLAND AVOIDANCE
FIGURE 1a – AVOIDANCE



WETLAND AVOIDANCE
FIGURE 1b – MINIMIZATION
(CROSSING AT NARROWEST LOCATION)



WETLAND AVOIDANCE
FIGURE 1c – MINIMIZATION
(CROSSING UNIFORM WIDTH IN A STRAIGHT LINE)

1.2 Historically Significant Areas

Areas that have been identified as historically and/or culturally significant shall be avoided in accordance with site-specific avoidance plans, as applicable. Refer to the project-specific Environmental Field Issue (EFI) for any applicable avoidance plans or consult with the National Grid Environmental Scientist. Demarcation of these areas to be avoided shall use staked orange snow fencing or an equivalent physical barrier (not just ribbon flagging) and signage. Refer to Section 14.0 for signage guidance.

1.3 Rare Species Habitat

Work within areas that have been identified as mapped rare species habitat shall follow site-specific requirements, as applicable. In Massachusetts, maintenance activities within mapped habitat (known as Priority Habitat of Rare Species) shall follow the BMPs outlined in the Natural Heritage Endangered Species Program (NHESP)-approved National Grid Operation and Maintenance Plan. Work in mapped rare species habitat may require, at a minimum, turtle training for crews and sweeps of work areas for turtles, botanist identification of rare plant locations and avoidance of these locations, and protection of vernal pools, all prior to the start of work. Demarcation of these areas to be avoided (e.g., rare plant populations, overwintering turtles, nests) shall use staked orange snow fencing or an equivalent physical barrier (not just ribbon flagging) and signage. Refer to Section 14.0 for signage guidance.

Where new substations are being constructed or existing substations are undergoing a rebuild or expansion, and the substations are located in mapped rare turtle habitat, project team members should consider fenceline improvements or measures needed to prevent/eliminate turtle entrance into the substation or allow multiple points for easy egress such that turtles are not trapped within the substation fenceline.

Other requirements may apply in NH, VT and RI. Refer to the project-specific EFI for any applicable measures or consult with the National Grid Environmental Scientist.

1.4 Meetings

Pre-permitting meetings shall take place early in the project development process to determine what permits are triggered by the proposed work and the timeline required for permitting. During these meetings, the team shall develop access plans and BMPs to be used during construction of the project.

Field / Constructability review meetings shall take place on-site to evaluate construction site access and job site set-up, to ensure that the project can proceed as permitted. It is at this point in time where work areas, pulling locations, laydown areas, parking areas, and equipment storage areas are evaluated and located. Off-ROW areas under consideration should be included in this discussion.

Prior to submitting permit plans to regulatory authorities, the construction group (contractor or National Grid) shall review the plans for final sign off.

Pre-construction meetings are typically held prior to the commencement of all work to appoint responsible parties, discuss timing of work, and further consider options to avoid and/or minimize impacts to sensitive areas. These meetings can occur on- or off-site and shall include all the willing and available stakeholders (i.e., utility employees, contractors, consultants, inspectors, and/or monitors, and regulatory personnel). Training of crews and supervisors of the EFI, Stormwater Pollution Prevention Plan (SWPPP), rare species, and other permit requirements shall be conducted at a pre-construction meeting.

Pre-job briefings shall be conducted daily or otherwise routinely scheduled meetings shall be conducted on-site with the work crew throughout the duration of the work. These meetings are a way of keeping everyone up to date, confirming there is consensus on work methods and responsibilities, and ensuring that tasks are being fulfilled with as little impact to the environment as possible.

The Project Environmental Scientist/Monitor and Construction Project Manager shall communicate regularly (e.g. weekly or bi-weekly meetings or phone conversations) to discuss the work completed since last communication (i.e. work locations, wetland impacts, equipment used, and unexpected delays or work conditions). These meetings or calls shall include the expected schedule of construction for the upcoming week, the long term construction plans, and planned methods for working near/in wetlands. Both the Project Environmental Scientist/Monitor and Construction Project Manager shall work together so the Project complies with all environmental permits and regulations. When changes to the Project scope or agreed work plan are proposed they shall be done so with the final approval of the National Grid Environmental Scientist.

1.5 Communication of Project Specific Environmental Requirements

Project specific environmental concerns, to include sensitive resources, permits, approved access and time-of-year or other restrictions, shall be communicated to the project team and be included as part of the Pre-Bid and Pre-Construction Meetings. Project specific requirements shall be communicated to the project manager/construction manager/engineering group using the following guidelines:

<u>Environmental Field Issue</u> – The EFI will be a full document consisting of narrative, project permits, access and matting plans. A table summarizing pertinent (but not all) permit conditions and the responsible party for those conditions shall be included in the EFI. Copies of all permits should be included as attachments. This will be prepared for most projects with multiple permits or large, complex projects (siting board, Section 404, 401 WQC, SWPPP). There shall be EFI training at the pre-construction meeting. The National Grid EFI template is located in **EI-303NE**.

<u>Simplified Environmental Field Issue</u> – The Simplified EFI is a memorandum containing environmental resources present, project permit(s), access and matting plans and a table summarizing relevant permit conditions and responsible party for those conditions. Copies of all permits should be included as attachments. The Simplified EFI will be prepared for most projects with 1 or 2 permits (Order of Conditions, S404 Cat 1). The Simplified EFI should also be provided for projects that have environmental resources present, but the scope of the project does not trigger environmental permitting (e.g., the scope of work qualifies for maintenance exemption(s)). The resources present

shall be discussed at the Pre-Bid and Pre-Construction meetings and any changes in scope will require additional review by the National Grid project team.

E-mail delivery of Permit and any Sediment/Erosion control or BMP plan – For those projects with only one permit (eg., MA Order of Conditions, RI DEM permit, RI CRMC permit, NH Utility Notification) or projects with a sediment & erosion control plan (local town requirement or for exempt maintenance work), a copy of the permit and any applicable plan will be emailed to the Project Manager (and the project team where deemed necessary) to be incorporated into the Construction Field Issue.

STORMS work management system input – For STORMS work, no EFI is prepared unless multiple permits are required for the project (see guidance above). If only a MA Order of Conditions, MA Determination of Applicability, RI DEM permit, RI CRMC permit, RI SESC Approval, or NH Utility Notification is required, then the permit is attached in the Documents tab and conditions noted in Remarks/Comments section. Standard STORMS boilerplate language is located in **EI-303NE**.

1.6 Timing of Work

Regulatory authorities may place seasonal or time-of-year restrictions on project construction elements. These time-of-year restrictions may be state or permit-specific, and shall be adhered to.

Work during frozen conditions. Activities conducted once wetland areas are frozen sufficient to minimize rutting and other impacts to the surrounding environment may be authorized by the National Grid Environmental Scientist. Work during this time also generally reduces disturbance of aquatic and terrestrial wildlife movement by avoiding sensitive breeding and nesting seasons. When not using mats for access, vehicles shall not be allowed to drive across wetlands without the prior approval of the National Grid Environmental Scientist.

Work during the regulatory low-flow period. Conducting work during the low-flow period can reduce impacts to surface water and generally avoids spawning and breeding seasons of aquatic organisms. If the water is above normal seasonal levels, adjustments to work activities and methods are required.

1.7 Alternate Access

1.7.1 Manual Access

In some cases such as for smaller projects, work areas can be accessed manually. This includes access on foot through upland and shallow wetland areas, access by boat through open water or ponded areas, and climbing of structures where possible. Smaller projects, such as repair of individual structures, or parts of structures, that do not categorically require the use of heavy machinery, shall be accessed manually to the greatest extent practicable.

1.7.2 Use of Overhead/Aerial Access

Using helicopters can be expensive and is not always feasible, but it may be appropriate in some situations in order to get workers and equipment to a site that otherwise may be very difficult to access. The use of overhead and/or aerial equipment may be beneficial for work in areas where larger water bodies, deep crevices, or mountainous areas hinder ground access. The landing area for helicopters shall be reviewed for environmentally sensitive resources. Use of helicopters requires Project Manager and Senior Management approval.

2.0 Inspection, Monitoring and Maintenance

All construction practices and controls shall be inspected on a regular basis and in accordance with all applicable permits and local, state, and federal regulations to avoid and correct ANY damage to sensitive areas.

The construction crews shall be responsible for completing daily inspections, and IMMEDIATELY bring any **damage or observed erosion, or failed erosion controls** to the attention of the Person-In-Charge and the National Grid Environmental Scientist. Where applicable and/or as directed by environmental permits issued for the project, the Project Environmental Consultant shall conduct weekly (at a minimum) inspections of the project work areas and shall document their inspection using the Stormwater, Wetlands & Priority Habitat Environmental Compliance Site Inspection / Monitoring Report form found in **Appendix 3** and issue the report within 24 hours. The Person-in-Charge shall work with the National Grid Environmental Scientist and the Project Environmental Consultant to determine when and how the repairs shall be made.

Project-specific Action Logs and Long-Term Restoration Logs are prepared as needed by the National Grid Environmental Scientist or the Project Environmental Consultant to track issues and/or repairs and assign responsible parties.

3.0 Best Management Practices

The BMP sections presented in this EG address access, construction, snow and ice management, structures in wetlands, access road maintenance and repair, clean-up and restoration standards, ROW gates, field refueling and maintenance operations, management of spills/releases, and a summary of key construction BMPs.

Note that BMPs shown on any permit drawings for a specific project may need to be revised and or supplemented during the execution of a project based on unforeseen or unexpected factors such as extreme weather or unknown subsurface conditions. It is the responsibility of the Contractor to work with the National Grid Environmental Scientist and/or the Project Environmental Consultant to identify necessary changes and to ensure that construction-related impacts to wetlands, water bodies and other environmentally sensitive areas are avoided.

Any deviation from the approved BMPs shown in the EFI and/or SWPPP plans shall be communicated immediately to the National Grid Environmental Scientist as it may require additional permitting or could result in a permit violation.

3.1 Wetland Boundary Demarcation

Prior to the start of any activity conducted under an environmental permit, wetland boundaries shall be reviewed. Flagging for wetland boundaries, stream banks and other resource areas shall be refreshed as needed. This may become particularly important when the original flagging was placed in previous seasons and now may have become obscured.

3.2 Sedimentation and Erosion Controls

Appropriate sedimentation and erosion control devices shall be installed at work sites, in accordance with permit conditions and/or regulatory approvals, and as needed to prevent adverse impacts to water resources and adjacent properties.

The overall purpose of such controls is to prevent and control the movement of disturbed soil and sediment from work sites to adjacent, undisturbed areas, and particularly to water resources, public roads and adjacent properties. All proprietary controls shall be installed per manufacturer's recommendations and specifications.

Appropriate sedimentation and erosion control devices include but are not limited to: silt fencing, straw bales, wood chip bags, straw wattles, compost socks, erosion control blankets, mulch, slope interruption practices, flocculent powder/blocks and storm drain/catch basin inlet protection. Such controls shall be installed between the work area and environmentally sensitive areas such as wetlands, streams, drainage courses, roads and adjacent property when work activities shall disturb soils and result in a potential for causing sedimentation and erosion.

In Massachusetts, use of monofilament-encased wattles shall be avoided in mapped Priority Habitat for snakes and amphibians. For projects with work within mapped Priority Habitat for snakes and amphibians, wattles that are encased in a sock, hemp, fiber, or movable jute netting are required to prevent entrapment. Also, "wildlife gaps" should occur every 50 feet, if possible, given wetland permit conditions. This spacing of the wattles allows snakes and amphibians to move across the ROW. Refer to the Amphibian and Reptile BMPs in **Appendix 4**.

Staked straw bales often serve as the demarcation of the limits of work and/or sensitive areas to be avoided. Work shall never be conducted outside the limit of erosion controls without prior approval from the National Grid Environmental Scientist.

Project plans depict proposed erosion controls, however field conditions may warrant additional practices be implemented (e.g., wet conditions, frozen conditions, poorly drained soils, steep slopes, materials used for work pads, transition areas to construction mats, number of trips across work areas, etc.).

Any deviation from the approved erosion controls shown in the EFI and/or SWPPP plans needs to be communicated immediately to the National Grid Environmental Scientist as it may require additional permitting or result in a permit violation.

Appendix 4 provides typical sketches of common sedimentation and erosion controls. If a SWPPP is required for the project, maintenance and inspection of erosion controls shall follow the SWPPP requirements. Sedimentation and erosion controls shall be properly maintained and inspected on a periodic basis, until work sites are properly stabilized and restored. Inspections shall be documented using the Inspection Form "Storm Water, Wetlands & Priority Habitat Environmental Compliance Site Inspection/Monitoring Report" (**Appendix 3**).

The sequence and timing of the installation of sedimentation and erosion control measures is critical to their success. Sedimentation and erosion controls shall be installed prior to commencing construction activities that may result in any soil disturbance or cause otherwise polluted site runoff. Inspection of these devices may be required by the National Grid Environmental Scientist or by regulators prior to the start of work. The installation of water bars and other erosion control measures shall be installed shortly thereafter.

3.3 Concrete Wash Outs

Concrete wash outs shall be used for management of concrete waste. Concrete and concrete washout water shall not be deposited or discharged directly on the ground, in wetlands or waterbodies, or in catch basins or other drainage structures. Where possible, concrete washouts shall be located away from wetlands or other sensitive areas. Consult the National Grid Environmental Scientist on proposed concrete wash out locations prior to their use. Following the completion of concrete pouring operations, the wash outs shall be disposed of off-site with other construction debris. Refer to BMPs in **Appendix 4**.

3.4 Construction Activities in Standing Water

The use of silt curtains or turbidity barriers may be required when working in or adjacent to standing water such as ponds, reservoirs, low flowing rivers/streams, or coastal areas. Silt curtains and turbidity barriers prevent sediment from migrating beyond the immediate work area into the resource areas.

Coffer dams constructed using sheet piling or large sandbags (Trade names such as "the Big Bag" or "DamItDams") may be used to temporarily isolate and contain a work area in standing water.

When working in standing water, an oil absorbent boom, in addition to a silt curtain or other temporary barrier, shall be placed around the work area for spill prevention.

Work in drinking water reservoirs or other waters may require extensive regulatory agency review, even for maintenance work, which could result in additional time required for permitting, review and material procurement prior to the start of work.

3.5 Dewatering

Where excavations require the need for dewatering of groundwater or accumulated stormwater, the water shall be treated before discharge. Appropriate controls include dewatering basins, flocculent blocks, filter bags, filter socks, or weir tanks. Schematics of these BMPs are included in **Appendix 4**. Water trucks or fractionation tanks may be utilized if watertight containers are desired for controlled on-site discharge or for off-site discharge into an approved dewatering area when site restrictions make it difficult to utilize other dewatering methods on-site. Dewatering discharge water shall never be directed into wetlands, streams/rivers, other sensitive resource areas, catch basins, other stormwater devices, or substation Trenwa trenches. Dewatering flow shall be controlled so that it does not cause scouring or erosion through the use of a dewatering basin, filter sock, or equivalent. If it is determined that the chosen controls are not appropriately filtering the fine sediment from the dewatering pumpate then the National Grid Environmental Scientist shall be notified immediately and the controls shall be revised or supplemented.

When establishing a dewatering basin, consideration should be given to the anticipated volume of water and rate of pumping in determining the size of the dewatering basin. Dewatering basins shall be constructed on level ground. Once pumping commences, the basin shall be monitored frequently to assure that the rate of water delivery to the structure is low enough to prevent water from flowing, unfiltered, over the top of the basin walls. The basin shall be monitored throughout the dewatering process because the rate of filtration shall decrease as sediment clogs the filter fabric. If the basin is not appropriately filtering the fine sediment from the dewatering pumpate then the basin may need to be supplemented with a flocculent block. Field conditions shall dictate how often the basin should be inspected.

Distance to sensitive areas, direction of flow (toward or away from protected, or sensitive areas, such as wetlands, ponds, or streams), amount of vegetative ground cover between the basin and nearby sensitive areas, ground conditions (ledge, frozen, etc.), volume of water being pumped, and pump-rate, are some of the factors to be considered when determining an inspection frequency. Clogged filter fabric shall be replaced and accumulated sediment shall be removed as necessary from the basins to maintain efficacy.

Any new dewatering location (not previously reviewed and approved by the National Grid Environmental Scientist during project planning or permitting) shall be reviewed and the discharge location approved by the National Grid Environmental Scientist before use.

Complex projects that require large scale dewatering shall require individual review by the National Grid Environmental Scientist and may trigger additional permitting.

Dewatering in areas of known chemical contamination may require a separate NPDES permit, or other approval, and treatment or containment system. Consult with the National Grid Environmental Scientist.

3.5.1 Overnight Dewatering

Some projects may necessitate 24-hour dewatering for on-site construction activities. Overnight dewatering will be evaluated on a case-by-case basis by the National Grid Environmental Department.

If it is necessary to conduct overnight dewatering on a project, a dewatering plan must be submitted to the Environmental Department for review and approval **5 business days prior to beginning dewatering activities**. Sufficient knowledge of flow, discharge, and re-infiltration rate of water must be obtained and submitted for review. The Environmental Department

may require monitored dewatering for a period of time in order to provide this data in support of a request for 24-hour dewatering. The dewatering plan must include at a minimum:
1. Location of dewatering system, system components (basin, frac tank, etc), and materials.
2. Location of discharge and distance from closest wetland.
3. Location of erosion controls. A secondary perimeter of erosion controls will be required around the dewatering system for overnight dewatering.
4. Peak flow, discharge rate and re-infiltration rates.
5. Visual monitoring plan for discharge. Expected duration of dewatering.
6. Emergency provisions if overnight, unattended dewatering is proposed.

3.5.2 Dewatering Clean Up/Restoration

Basins shall be cleaned and removed as soon as dewatering is complete. Sediment removed from the dewatering basin shall be allowed to dry before being disposed of by evenly spreading it over unvegetated upland areas where erosion is not a concern if clean or removing it from the site for proper disposal. Off-site trucking of wet soils is prohibited. The sediment disposal area shall be approved by the National Grid Environmental Scientist or the Project Environmental Consultant prior to use. Stabilization measures shall also need to implemented and approved by the National Grid Environmental Scientist or the Project Environmental Consultant. Soils/sediments shall be dewatered and dried to the point practicable for either on-Site reuse or off-Site transport.

3.6 Check Dams

Check dams are a porous physical barrier installed perpendicular to concentrated storm water flow. They are used to reduce erosion in a swale by reducing runoff energy (velocity), while filtering storm water, thereby aiding in the removal of suspended solids.

Check dams should only be used in small drainage swales that shall not be overtopped by flow once the dams are constructed. These dams should not be placed in streams. Check dams are typically installed in ROWs or on other construction sites prior to the start of soil disturbing work. Per the Rhode Island Soil Erosion and Sediment Control Handbook, no formal design is required for a check dam if the contributing drainage area is 2 acres or less and its intended use is shorter than 6 months; however, the following criteria should be adhered to when specifying check dams.

- The drainage area of the ditch or swale being protected should not exceed 10 acres.
- The maximum height of the check dam should be 2 feet.
- The center of the check dam must be at least 6 inches lower than the outer edges.
- The maximum spacing between the dams should be such that the toe at the upstream dam is at the same elevation as the top of the downstream dam.

Per the NHDES stormwater manual, the use of check dams should be limited to swales with longitudinal slopes that range between 2 to 5 percent that convey drainage from an area less than 1 acre. Existing conditions that exceed these limitations should be assessed in the field and discussed with the National Grid Environmental Scientist to determine the viability of this BMP for the specific application. Check dams are often comprised of stone, straw bales, sand bags, or compost/silt socks. Use of check dams should be coordinated with the National Grid Environmental Scientist to ensure that the material selection, spacing and construction method are appropriate for the site. Check dams composed of biodegradable materials (e.g. straw bales or wattles, wood chip bags) may require periodic replacement for continued proper functioning[1]. Refer to BMPs in **Appendix 4**.

3.7 Water Bars

Water bars should be used on sloping ROWs to divert storm water runoff from unstabilized or active access roads when needed to prevent erosion. Surface disturbance and tire compaction promote gully formation by increasing the concentration and velocity of runoff. Water bars are constructed by forming a ridge or ridge and channel diagonally across the sloping ROW. Each outlet should be stable. The height and side slopes of the ridge and channel are designed to divert water and to allow vehicles to cross. When siting water bars, consideration shall be given to the sensitivity of the area receiving the diverted runoff. For example, runoff should not be directed into a wetland, waterbody, other environmentally sensitive areas, or to private property or public roadways. Refer to BMPs in **Appendix 4**.

3.8 Retaining Walls

In some situations, retaining walls comprised of concrete blocks, gabions, boulders or other comparable materials may be required to stabilize the shoulder of existing access roads and/or supplement required erosion controls. Installation of such measures shall not be allowed as a maintenance activity. Should these controls be considered for a project, it shall be reviewed by the National Grid Environmental Scientist, as design and additional permitting may be required.

3.9 Slope Stabilization

Temporary slope stabilization practices help to keep exposed, erodible soils stabilized while vegetation is becoming established. Acceptable temporary slope stabilization practices may include the use of erosion control blankets, or hydraulic erosion control. Erosion control blankets, often comprised of natural fibers (e.g., jute, straw, coconut, or other degradable materials) are a useful slope stabilization, erosion control and vegetation establishment practice for ditches or steep slopes. Blankets are typically installed after final grading and seeding for temporary or permanent seeding applications. Hydraulic erosion control practices, including Bonded Fiber Matrix or hydroseed with a soil stabilizer (e.g., tackifier and/or mulch) may be an acceptable or desirable alternative form of temporary slope stabilization. For all practices, manufacturer's specifications should be followed for installation depending on slope and other field conditions. Consult the National Grid Environmental Scientist prior to selecting and installing any slope stabilization practices. Refer to BMPs in **Appendix 4**.

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[1] Grass growth on a biodegradable type check dam is evidence that the material is decomposing. While this doesn't mean it is no longer functioning, it means it may be in a weakened condition and could potentially fail under high flow velocity. It is acceptable for grass to be growing on a stone check dam.

3.10 Maintenance of Sedimentation and Erosion Controls

Sedimentation and erosion controls shall be maintained in good operational condition during the course of the work. This includes, but is not limited to, replacing straw bales that are no longer in good condition, re-staking straw bales, replacing or re-staking silt fence, and removing accumulated sediment. Remove sediment before it has accumulated to one half the height of any exposed silt fence fabric, straw bales, other filter berm, check dams or water bars. Accumulated sediment shall be removed from sedimentation basins to maintain their efficacy. Manage the removed sediment by evenly spreading it over unvegetated upland areas where erosion is not a concern, by stockpiling and stabilizing, or by disposing of off-site. Stabilization measures shall also need to be implemented and approved by the National Grid Environmental Scientist or the Project Environmental Consultant. Where a SWPPP has been prepared for a specific site, the guidelines documented therein shall govern the management of sediment.

4.0 Right-of-Way (ROW) Access

Whenever possible, access shall be gained along existing access routes or roads within the ROW. However, in some cases there is no existing access. In many cases, temporary access can be utilized. The following practices provide general guidance on accessing a ROW. Check with a National Grid Environmental Scientist to determine if any environmental permitting is required before utilizing a temporary access.

Note that the building of new roads or enlargement of existing roads is **prohibited** unless this activity is allowed by a project-specific permit, and the new roads appear on the Site Plans that were authorized in the regulatory approvals.

4.1 Off-ROW Access

Off-ROW access shall be evaluated for wetlands, rare species, cultural resources and other potential sensitive receptors, as applicable. National Grid Real Estate and Stakeholder Relations shall also be contacted as soon as possible once off-ROW access is determined to be needed.

4.2 Stabilized Construction Entrance/Exit for Access to ROWs from Public or Private Roads

A suitable (minimum 15-foot wide by 50-foot long) construction entrance/exit shall be installed at the intersection of the ROW access road/route with public/private paved roads, or other such locations where equipment could track mud or soil onto paved roads. The construction entrance/exit should be comprised of clean stone installed over a geotextile fabric. Geotextile fabric may be omitted for permanent construction entrances/exits on a case-by-case basis with the approval of the National Grid Environmental Scientist. Refer to BMPs in **Appendix 4**.

Construction entrance areas shall be monitored and maintained to ensure that stone or other material is not deposited onto the roadway, causing a safety concern. Where track-out of sediment has occurred onto a roadway, it shall be swept off the road by the end of that same work day.

If a construction entrance/exit is clogged with sediment and no longer functions, the sediment and stone may require removal and replacement with additional clean stone (clean stone refreshment) to ensure this tracking pad is performing its intended function adequately. Heavier traffic use may require this clean stone refreshment multiple times throughout a project. Reinforcement of these stabilized construction entrance/exits with asphalt binder or asphalt millings is not likely to be considered "maintenance" and may trigger additional permitting requirements[2]. In some cases, heavily used construction entrances/exits may benefit from the installation of a 5-15 foot strip of asphalt binder or asphalt millings closest to the paved roadway to capture any stone that is tracked from the stone apron. Such cases shall be evaluated on an individual basis with the National Grid Environmental Scientist.

Once work is complete, the construction entrance/exit shall either be removed or retained, depending upon future maintenance-related access needs, property ownership, and/or project-specific approvals. If removed, the area shall be graded, seeded (if adequate root and seed stock are absent) and mulched. Proper approvals for leaving access roads in place shall be obtained; contact the National Grid Environmental Scientist and Property Legal.

4.3 Maintenance of Existing Access Roads

In many cases, the existing access road may need to be maintained to allow passage of the heavy equipment required for scheduled maintenance work. Access roads cannot deviate from the approved and permitted access plans. Maintenance of these roads may include adding clean gravel or clean crushed stone to fill depressions and eroded areas. This activity shall be conducted only within the width of the existing access road footprint and does not include widening existing access roads

If gravel begins to migrate onto the existing vegetated road shoulder, this gravel shall be removed during the project and/or after the completion of use of the road to ensure the road fill is not spreading into adjacent resource areas, or resulting in the road becoming much wider than its pre-existing or permitted condition. In some areas of mapped rare species habitat or other sensitive areas where project-specific permit conditions require the prevention of the migration of sediments into adjacent resources, an engineered stabilization system (e.g., GeoWeb or similar) may be suitable to prevent sedimentation while allowing for unrestricted wildlife migration.

In Massachusetts, any proposed widening of access roads in turtle Priority Habitat would require individual consultation with NHESP and, depending on the level of impact proposed, may require a Project Review filing. The limited filling of ruts or potholes is compatible with the National Grid Operation and Maintenance Plan approved by NHESP under the Massachusetts Endangered Species Act, however, severely rutted access roads in turtle Priority Habitat that require extensive linear feet of stone for safe passage will require individual consultation with NHESP.

[2] Depending on the road, use of an asphalt binder or asphalt millings as a construction entrance/exit may trigger state or local permit requirements.

Major reconstruction projects may require multiple permits. In all cases, the fill to be used for existing access roads shall be clean and free of construction debris, trash or woody debris. Use of processed gravel may be approved by the Person-In-Charge and the National Grid Environmental Scientist, on a case-by-case basis. If clean stone is used then addition of more erosion controls may not be necessary.

4.5 Maintenance of Existing Culverts

Damaged culverts may not be repaired or replaced without consulting with the National Grid Environmental Scientist to determine if a permit is required. For functioning culverts, care shall be taken to protect adjacent wetlands and watercourses by installing appropriate sedimentation and erosion controls around the downstream end of the culvert. Culverts shall be repaired/replaced in kind and shall not be changed in size unless approval has been obtained from the National Grid Environmental Scientist. In-kind replacement is replacement using the same material, functional inverts, diameter and length as the existing culvert. Changes to any of these characteristics shall require permitting. Installation of any **new** culvert is not allowed without obtaining all necessary permits first. Refer to BMPs in **Appendix 4**.

If, at the time of anticipated replacement, there is heavy flow through the culvert, the Person-In-Charge shall consult with the National Grid Environmental Scientist, to verify whether the culvert shall be replaced at that time. Water may need to be temporarily diverted during culvert repair/replacement. There typically are seasonal restrictions limiting both the replacement of existing culverts as well as installation of new culverts to the low-flow period. The low-flow period can vary from state to state. If any unexpected conditions are encountered during culvert replacement, the National Grid Environmental Scientist shall be contacted immediately prior to the work being completed for additional consultation.

4.6 Temporary Construction Access over Drainage Ditch or Swale

In some situations, construction access from paved roads onto ROWs may require the crossing of drainage ditches or swales along the road shoulder. In these situations, the installation of construction mats, mat bridges or temporary culverts may facilitate construction access over the ditches or swales. These culverts shall be temporary only, sized for peak flow, and shall be removed after construction is complete. Consult with the National Grid Environmental Scientist prior to installation. In addition, if access over existing culverts may require extending the culvert, consult with the National Grid Environmental Scientist. Refer to BMPs in **Appendix 4**.

4.7 Construction Material along ROW

After preparing a site by clearing and/or installing any necessary erosion and sediment controls and prior to the start of construction, material such as poles, cross-arms, cable, insulators, stone and other engineered backfill materials may be placed along the ROW, as part of the project. The stockpiling of stone and other unconsolidated material on construction mats shall be avoided, if determined necessary due to access and work pad constraints, the material must be placed on a geotextile fabric and be properly contained with a sedimentation barrier such as straw wattle. No construction material shall be placed in wetlands or other sensitive resource areas unless authorized by the National Grid Environmental Scientist or Project Environmental Consultant.

5.0 Winter Conditions

5.1 Snow Management

Refer to **Appendix 6** for the current Snow Disposal Guidelines.

5.2 De-Icing

Where allowed, calcium chloride is preferred as a de-icing agent when applied according to manufacturer's guidelines in upland areas. Sand shall be used on construction mats through wetland areas.

Consult with the National Grid Environmental Scientist on de-icing agents when working in a facility or substation close to resource areas. Many municipalities have specific requirements for de-icing agents allowed within 100 feet of wetland resources and other sensitive areas.

5.3 Snow and Ice Management on Construction Mats

Proper snow removal on construction mats shall avoid the formation of ice. To avoid the formation of ice, snow shall be removed from construction mats before applying sand. Prior to their removal from wetlands, sand shall be collected from the construction mats and disposed of in an upland area. A round street sweeping brush mounted on the front of a truck may be an effective way to remove snow from construction mats. Propane heaters may also be suitable solutions for snow removal and/or de-icing of construction mats.

Once construction mats are removed, wetlands shall be inspected for build up of sand that may have fallen through construction mats. Care shall be taken to inspect wetland crossings as each mat is removed to ensure sand is properly removed and disposed of off-site.

6.0 Construction Mats

The use of construction mats allows for heavy equipment access within wetland areas. The use of construction mats minimizes the need to remove vegetation beneath the access way and helps to reduce the degree of soil disturbance and rutting in soft wetland soils. Construction mats most often used by National Grid are wooden timbers bolted together typically into 4-ft by 16-ft sections, wooden lattice mats, or composite mats. In some cases, construction mats or other mats are used for staging or access in upland areas based on site conditions (e.g., agricultural field access). Refer to BMPs in **Appendix 4**.

Typically construction mats may be installed on top of the existing vegetation, however in some instances cutting large woody vegetation may be required. Check with National Grid Environmental Scientist prior to cutting or clearing vegetation for construction mat placement.

Where an extended period of time has lapsed since wetland delineation and start of construction, and new vegetative growth has concealed wetland flagging or flagging is simply no longer obviously visible, wetland boundaries should be re-flagged where necessary prior to the installation of matting.

Follow the approved plans in the EFI for construction mat installation and do not deviate from the plans. **Any deviation from the approved plans needs to be communicated immediately to the National Grid Environmental Scientist as it may require additional permitting, require stopping the project or result in a permit violation or revocation.**

6.1 Construction Mats and Mowing

Close coordination with the mowing contractor shall be required to ensure that access plans are followed, and construction mats are utilized when necessary. Sometimes mowing contractors may have to work off the leading edge of a construction mat to mow in order to lay the next construction mat and continue further into the wetland. Under no circumstances shall trees or shrubs be allowed to be pulled out of the wetland by the root ball. The root ball of trees and shrubs shall remain intact. Chipping debris and excessive amounts of slash shall not be placed in wetlands or other resource areas. In some instances, it may be beneficial to pile a reasonable amount of slash within a nearby upland area to create habitat for wildlife. This activity shall be approved by the National Grid Environmental Scientist.

6.2 Stream Crossings and Stream Bank Stabilization

Stream crossings shall be bridged with construction mats or other temporary minimally-intrusive measures unless fording is acceptable for the site and is authorized by the National Grid Environmental Scientist. Care shall be taken when installing a construction mat bridge to insure that the stream bed and banks are not damaged during installation and removal and that stream flow is not unduly restricted. Where stream width allows, construction mats shall be installed to span the watercourse in its entirety without stringer placement in the water or any restriction of stream flow. Environmental permits may be required to cross or disturb protected waters, depending upon state-specific regulatory requirements. Refer to BMPs in **Appendix 4**. Immediately following construction mat removal, all stream banks shall be stabilized and restored to prevent sedimentation and erosion.

6.3 Cleaning of Construction Mats

Mats shall be certified clean by the vendor prior to installation. The vendor shall use the certification form provided as **Appendix 5** to document compliance. Clean is defined as being free of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials prior to being brought to the project site. Any equipment or timber mats that have been placed or used within areas containing invasive species within the project site shall be cleaned of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials at the site of the invasive species prior to being moved to other areas on the project site to prevent the spread of invasive species from one area to another[3]. **Mats shall be cleaned prior to being removed at the completion of the project: exceptions to this requirement**

[3] On ROW projects where multiple wetlands may be dominated by the same invasive species, cleaning may not be required for movement along the ROW. Check with the National Grid Environmental scientist for guidance.

may be made on a case-by-case basis. Consult with the National Grid Environmental Scientist prior to discharging or disposing of any waste water or waste material from the cleaning of construction mats.

6.4 Stone Removal for Construction Mat Placement

For situations where the matting contractor determines that stones or boulders must be removed or relocated within wetland areas in order to install safe and level structure work pads or access roads the boulders shall be moved in a manner which does not result in significant soil disturbance (i.e., pushing with a bull dozer is not allowed). The boulders shall not be placed on any existing vegetated areas within wetlands or within vernal pools. When numerous boulders shall be removed from a wetland area, they shall be deposited in an upland area outside of the flagged wetland limits, outside of any cultural resource areas and outside of any RTE species populations. Any boulders that shall be placed within buffers (In MA, the 100-foot buffer zone, and in RI, the 50-foot Perimeter Wetland, 100-foot or 200-foot Riverbank Wetlands) shall be placed to avoid causing soil disturbance and they shall be within an approved limit of work. When there is a significant number of boulders that need to be removed, the National Grid Environmental Scientist shall be consulted for guidance.

6.5 Transition onto Mats

Erosion controls and stone or wood chip ramps shall be installed to promote a smooth transition to and minimize sediment tracking onto construction mats. Geotextile may be added beneath stone or wood chip transitions to facilitate removal, as necessitated by site or permit conditions. Mat transitions shall be removed once construction mats have been removed and during restoration. Refer to BMPs in **Appendix 4**.

6.6 Construction Material on Mats

The stockpiling of stone, drill spoils and other unconsolidated material on construction mats shall be avoided unless determined necessary due to access and work pad constraints. Additional controls, such as watertight mud boxes and geotextile/filter fabric over or between construction mats shall be considered for stockpile management. If material is placed on construction mats and falls through into wetlands, the material must be removed by hand. Saturated soils shall be allowed to dewater prior to off-site transport for sufficient time to ensure that water/sediment is not deposited onto construction mats or public roads during transport. Heavy machinery shall not be left overnight on mats located within floodplain unless approved by the National Grid Environmental Scientist, the machinery is still in use, and removal of the equipment requires the use of additional equipment to move it and would increase vehicle trips in/ou of wetlands. In these situations and when approved by the National Grid Environmental Scientist, the equipment shall be secured against vandalism and secondary containment measures shall be employed where feasible. Mat anchoring shall be evaluated, see below.

6.7 Mat Anchoring

The National Grid Environmental Scientist and Project environmental consultant shall indicate to the project team when mat anchoring may or shall be necessary. The matting contractor will propose the method of mat anchoring, which will be approved by the National Grid Environmental Scientist and the

National Grid Construction Supervisor. The need for anchoring should be noted in the project EFI, on the project access and matting plans, and in the scope of the bid document (if externally sourced).

Anchoring of construction mats should be considered when any of the following conditions are presented at a project work location:

Location	Considerations
Stream crossings Shorelines of Ponds/Lakes Wetlands Floodplains	When located in a mapped flood area (A). When mapped 100-year flood elevations (AE) are greater than 2 ft above existing grades. Where past flash flood events have occurred. Where steep terrain is present or surrounds the project location. When mats will be in place during hurricane season for greater than 2 weeks.
Tidal areas	When located in a Velocity (V or VE) Zone. When mats will be in place during a moon tide cycle. When mats will be in place during hurricane season for greater than 2 weeks.

Examples of mat anchoring are provided below, but the implementation methods for anchoring mats are not limited to these examples. Where anchoring is determined to be necessary, the matting contractor should propose a method suitable based on field conditions and that takes crew safety, slip/trip/fall hazards, size of matting footprint, and other project and site-specific factors into consideration. Refer to BMPs in **Appendix 4**.

Limited sets of mats

- Cable or rope in chain pockets and run linearly, or
- Linear ropes anchored using helical screws, manta ray anchors, or posts.

Larger sets of mats or those without chain pockets

- Chain link fence posts or other posts driven in along mat edge every 3-4 feet and ropes then laced across mats between opposing posts before storm event, or
- Anchor bolts added to mats, then cable is laced between bolts and tied to helical or manta ray anchor.

6.8 Corduroy Roads

Corduroy roads are a wetland crossing method where logs are cut from the immediate area and used as a road bed to prevent rutting from equipment crossing. This technique is designed to be used in areas of wetland crossings where there is no defined channel or stream flow and should never be used in streams. Corduroy logs shall be placed in the narrowest area practicable for crossing with the logs placed perpendicular to the direction of travel across wet area. The use of corduroy logs shall only be in emergencies when approved by the National Grid Environmental Scientist or when they have been specifically permitted as part of a project. Refer to BMPs in **Appendix 4**.

6.9 Construction Mat Removal

Once construction mats are removed, wetlands shall be inspected for build up of sand or other materials that may have fallen through construction mats. Care shall be taken to inspect wetland crossings as each mat is removed to ensure any materials are properly removed and disposed of off-site.

6.10 Utility Air Bridging

In ROWs where other utility facilities (including but not limited to gas, oil, fiber optic, electric, water, and sewer) are co-located within the transmission ROW, bridging may be required to cross those facilities. The project team shall coordinate with the respective utility company prior to determining if bridging or permanent crossings are required.

7.0 LGP Equipment Use

Only when approved by the National Grid Environmental Scientist on a case-by-case basis shall equipment with a LGP **psi that meets the state-specific USACE General Permit requirement when loaded** be allowed to access through wetlands. Refer to the state-specific General Permit for the definition of LGP in each state at: http://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/, or to the summary table provided below. The National Grid Environmental Scientist's approval of the use of LGP equipment through wetlands depends on several criteria including:

- Time of year. LGP equipment use may be allowed if weather and field conditions at the time of construction are suitable to eliminate/minimize the concern of rutting or other impacts. Frozen, frozen snow pack, low flow, drought conditions, or unsaturated surface soil conditions are typically acceptable conditions. Spring and fall construction, due to the typical higher precipitation, are not suitable times of year for LGP equipment use.
- Number of trips. Multiple trips through a wetland have shown to increase the potential for damage and require matting. LGP equipment use shall likely only be approved if trips are limited to one trip in and one trip out.
- Type of wetland system. Some wetlands have harder soils/substrate, and may be passable without causing significant damage. Some of the wetlands along National Grid ROWs have existing hard bottom roads that have been vegetated over time and may be traversed with LGP equipment without construction mats.
- Emergencies. LGP equipment use may be allowed during emergency or storm conditions for outage restoration.
- State-specific USACE General Permit Performance Standards. The standard is for no impact to the wetland, which may be obtained by using LGP equipment **when loaded**). "*Where construction requires heavy equipment operation in wetlands, the equipment shall either have low ground*

pressure (as specified in the USACE GP), or shall not be located directly on wetland soils and vegetation; it shall be placed on construction mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation."

- Local bylaws. Municipal wetland bylaws, where applicable, shall be reviewed for prohibitive conditions or applicable performance standards.

LGP equipment is prohibited in the following resources areas:

- Stream crossings
- State listed-species habitat
- Outstanding Resource Waters (ORWs)
- Vernal pools
- Archaeological sensitive areas

Where LGP equipment use is desired in lieu of construction mats, the construction supervisor should identify these areas on marked-up access plans. A site visit with the Project Environmental Monitor should be scheduled to assess if the proposed locations are potential candidates. The Project Environmental Monitor will document potentially suitable locations and dismiss others as unsuitable.

ACOE New England District General Permit Requirements

State	Restrictions	Maximum PSI (when loaded) for Use without Mats	Reference
MA	*One of the following must apply:* Equipment operated within wetlands shall: a) Have low ground pressure; b) Be placed on timber mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation; or c) Equipment must be operated on adequately dry or frozen conditions such that shear pressure does not cause subsidence of the wetlands immediately beneath equipment and upheaval of adjacent wetlands.	3 psi	MA General Permit, General Condition 13
NH	*One of the following must apply:* Equipment operated within wetlands shall: a) Have low ground pressure; b) Be placed on timber mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation; or c) Be operated on frozen wetlands.	4 psi	NH General Permit, General Condition 17
VT	*One of the following must apply:* Equipment operated within wetlands shall: a) Have low ground pressure; b) Be placed on timber mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation; or c) Be operated on frozen wetlands such that shear pressure does not cause subsidence of the wetlands immediately beneath equipment and upheaval of adjacent wetlands. Note: Written authorization from the Corps required to waive the use of mats during frozen or dry conditions.	3 psi	Vermont General Permit, General Condition 14
RI	*One of the following must apply:* Equipment operated within wetlands shall: a) Have low ground pressure; b) Be placed on timber mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation; or c) Be operated on frozen wetlands such that shear pressure does not cause subsidence of the wetlands immediately beneath equipment and upheaval of adjacent wetlands.	6 psi	Rhode Island General Permit, General Condition 15

State	Restrictions	Maximum PSI (when loaded) for Use without Mats	Reference
	Note: Written authorization from the Corps required to waive the use of mats during frozen or dry conditions.		

Due to the fact that ground conditions may change between the time of the evaluation and construction, LGP equipment approval is required **at the time of construction for each wetland crossing** and shall be dependent upon the above conditions. In addition, LGP equipment use and approval shall be assessed by the National Grid Environmental Scientist or Project Environmental Monitor during construction on a continuing basis

Once a location is approved for the use of LGP equipment:

- The Construction Supervisor must check-in with the Project Environmental Monitor at least two weeks before construction begins to ensure conditions remain suitable for LGP equipment use, and weather conditions are favorable.
- The Project Environmental Monitor must observe the equipment when in use.
- LGP equipment use shall cease immediately if field conditions are found to be unsuitable (i.e. soil rutting greater than six inches or the destruction of vegetation root systems beyond the capacity of natural revegetation).
- **If wetlands damage occurs, the use of the LGP equipment shall be suspended, and the wetlands be restored.**
- Any LGP equipment used within areas containing invasive species within the project site shall be cleaned of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials at the site of the invasive species prior to being moved to other areas on the project site to prevent the spread of invasive species from one area to another.

8.0 Soil Disturbing Activities

8.1 Dust Control

Cutting activities shall be conducted to minimize the impacts of dust on the surrounding areas. Dust suppression is an important consideration. Water or other National Grid approved equivalent in accordance with the manufacturer's guidelines may be used for dust control along ROWs in upland areas. During application of water for dust control, care shall be taken to ensure that water does not create run-off or erosion issues. Refer to BMPs in **Appendix 4.**

8.2 Clearing

Clearing is not allowed without specific permission as it constitutes soil disturbance under several regulatory programs and may trigger permitting by increasing the project's footprint of disturbance. If clearing is required for a project, the limit of clearing shall be established with flagging or construction fencing and/or erosion controls. Clearing shall be done in accordance with project specific permits. Following the completion of clearing, the limits of work shall be re-established. Refer to BMPs in **Appendix 4**.

8.3 Grubbing

Grubbing is not allowed without specific permission as it constitutes soil disturbance under several regulatory programs and likely triggers permitting by increasing the project's footprint of disturbance. If grubbing is required for a project, the limit of grubbing shall be re-established after clearing has been completed. The area of grubbing shall be identified with flagging or construction fencing and/or erosion controls. Grubbing shall be conducted in accordance with project-specific permits.

8.4 Blasting, Noise and Vibration Control

If blasting is anticipated, the project team, including the National Grid Environmental Scientist, shall be consulted. If possible, plan work in residential areas to avoid noisy activities at night, weekends or during evenings. Emergency work in residential areas should be carried out in such a way as to keep noise to a minimum at night and weekends. Equipment should be maintained as per the manufacturer's guidance to minimize noise and vibration.

Work plans must consider local noise ordinances and provide specific controls to ensure noise levels are maintained within specified limitations.

8.5 Site Grading

The work site shall not be graded other than in accordance with project permits. Any proposed grading shall be reviewed by the National Grid Environmental Scientist for wetlands, rare species habitat, areas of cultural and historical significance, and other environmentally sensitive areas prior to start of work. In some cases, additional testing for cultural or historical resources may be triggered by proposed grading; alternatives to grading may be sought due to protracted time frame of obtaining the permit associated with testing and performing the testing. Grading outside of a regulated area shall be kept to the minimum extent necessary for safe and efficient operations and shall comply with the project permit plans.

Grading shall be performed in a manner which does not increase the erosion potential at the Site (e.g., terraces or slope interruptions shall be utilized). Graded sites shall be promptly stabilized by applying a National Grid approved seed mix (if adequate root and seed stock are absent), and mulching with hay, straw or cellulose (use straw or cellulose hydromulch where the potential introduction of invasive plant species is of concern) to reduce erosion and visual impact, as soon as possible following completion of work at the site. Grading within a regulated area shall be subject to the review and approval of the National Grid Environmental Scientist.

In some municipalities, site grading activities require the prior approval of the Town Engineer, Building and Zoning Official, or Public Works Director. Local ordinances or bylaws should be reviewed for applicable restrictions and permitting thresholds

8.6 Grounding Wells

The installation of grounding wells shall require erosion controls and proper soil management. Due to the typical depth required for grounding wells (typically 50 to 200 feet or more), erosion controls shall be installed around the proposed well location when working in buffer zone, in proximity to sensitive resources or near slopes. Also, dewatering basins may be required for the proper management of groundwater. The National Grid Environmental Scientist shall be consulted for the disposal of any excess soil.

8.7 Counterpoise and Cathodic Protection

The installation of counterpoise or cathodic protection shall require erosion controls and proper soil management. The National Grid Environmental Scientist shall be consulted for the disposal of any excess soil.

8.8 Work Pads

When work pads are being constructed, only clean material shall be used in their construction. Work pads shall only be constructed in areas approved by the National Grid Environmental Scientist and shown on the approved permit access plans.

8.9 Site Staging and Parking

During the project planning and permitting process, locations shall be identified for designated crew parking areas, material storage, and staging areas. Where possible, these areas should be located outside of buffer zones, watershed protection areas, and other environmentally sensitive areas. Any proposed locations shall be evaluated for all sensitive receptors and for new projects requiring permitting, shall be incorporated onto permitting and access plans.

8.10 Soil Stockpiling

Soil stockpiles shall be located in upland areas and, if in close proximity to wetlands and wetland buffers, shall be enclosed by staked straw bales or another erosion control barrier. The stockpiling of stone, drill spoils and other unconsolidated material on construction mats shall be avoided unless determined necessary due to access and work pad constraints. Additional controls, such as watertight mud boxes and geotextile/filter fabric over or between construction mats shall be considered for stockpile management. If material is placed on construction mats and falls through into wetlands, the material must be removed by hand. Saturated soils shall be allowed to dewater prior to off-site transport for sufficient time to ensure that water/sediment is not deposited onto construction mats or public roads during transport.

8.11 Top Soil/High Organic Content Soil

When the work site requires excavation and grading, the top soil shall be stockpiled separately from the material excavated. This top soil shall be spread as a top dressing over the disturbed area during restoration of the site.

In some instances where work is occurring within wetlands, high organic content soil may be displaced. Such high organic content soil shall be segregated from other excavated materials and stockpiled for use in wetland restoration areas. Care shall be taken to minimize the handling of high organic content soil. Preferably, the soil shall be stockpiled in one location until it is moved to the restoration area.

9.0 Stone Wall Dismantling and Re-building

Removal or alteration of stonewalls shall be avoided, whenever possible. As appropriate, some stonewalls removed or breached by construction activities shall be repaired or rebuilt. Rebuilt stone walls shall be placed on the same alignment that existed prior to temporary removal, to the extent that it shall not interfere with operations. The removal and rebuilding of stone walls requires approval from the National Grid Environmental Scientist and Property Legal, and may require several weeks lead time for coordination. Note that not all states allow this technique and that dismantling may not be allowed at all due to quality or significance of the wall. Once a stone wall has been identified as requiring dismantling, the following procedures shall be followed:

- Identify stone wall that is required to be temporarily dismantled and notify project team that a site visit is warranted to review the stone wall.
- The National Grid Environmental Scientist, with support from Property Legal and/or cultural/historical consultant, shall determine if permitting or additional permissions are required prior to dismantling stone wall.
- Once permit or permissions have been received, full documentation of wall dimensions (measurements and photographs) shall be submitted to the National Grid Environmental Scientist. Documentation of the wall dimensions shall be marked onto a copy of the applicable EFI access plan (or equivalent plan) with a useful reference for future locating such as GPS coordinates and/or measurement from a permanent reference point (closest structure location or closest cross street, etc.). The wall shall be photographed from all sides with a written description of the photograph (i.e. southern side of wall looking north). In addition, documentation of the length of wall to be dismantled shall be recorded. Take special care to note if granite property bounds (or other marker) are located within the wall so additional survey can be accomplished prior to dismantling in cases where the stone wall represents a property boundary. Site visits by project team (which shall include the National Grid Environmental Scientist) are a mandatory requirement prior to dismantling.
- No dismantling shall take place until documentation has been submitted to the National Grid Environmental Scientist and approved as sufficient documentation.
- Stones from the wall shall be removed from the work area and temporarily stored in nearby location, away from wetlands; buffer zones; rare species habitat and other historical/archeological concerns.
- Avoid dismantling via the “bulldozer” method when possible as this method makes it nearly impossible to rebuild the wall in the same alignment due to its uncontrolled nature. Dismantling shall be conducted either by hand, with stones stacked as they are removed, or on less “sensitive” walls to use an excavator with a thumb to grab each stone and build a stockpile. Significant ground disturbance below the wall shall be avoided.

- Once construction and access in the area has been completed, the wall shall be rebuilt to pre-dismantled conditions or better. If rebuilding a stone wall can not be placed on the same alignment that existed prior to temporary removal, approval from the National Grid Environmental Scientist and Property Legal is required. **Note that if the wall represents a legal property boundary or is historically or culturally significant (or was previously determined to be in a very high quality condition), a professional stone masonry company may be required to document wall alignment, and conduct the dismantling and rebuilding.**

10.0 Avian Nest Removal

Avian nest removal shall be done in accordance with EG-304. Consult the National Grid Environmental Scientist prior to removing any nests. There are seasonal restrictions of the removal of avian nests and federal or state permits may be necessary prior to removal.

11.0 Drilling Fluids and Additives

When installing subsurface structures, there may be a need to utilize drilling aids such as slurries, borehole sealants, and other additives. All necessary steps shall be taken by National Grid personnel and contractors to prevent potential adverse effects on drinking water aquifers, groundwater quality, and wetlands when utilizing drilling aids. Efforts should be made to utilize natural bentonite clay-type materials, in place of polymer-based drilling aids. Regardless of the specific product type, the following requirements shall be met:

- Drilling aids must be NSF certified and manufactured to NSF-ANSI 60 standards. https://www.nsf.org/newsroom_pdf/NSF-ANSI_60_watemarked.pdf
- Product use must be in accordance with manufacturer's specifications and instructions.
- National Grid personnel or their contractor shall provide all the necessary information regarding the proposed product to be used to National Grid's Environmental Sustainability, Compliance and Licensing & Permitting Department as early as possible in the project planning phase. If the work is being performed by a contractor, this information must be included as part of their initial bid package.
- If polymer-based products are proposed for use, product information shall be included in all related environmental regulatory filings and frac-out plans, if possible.
- A qualified individual shall be designated who will confirm/verify and document the specific use of a drilling aid at each location. This will include add-mix ratios, surface area treated, volume of water within excavation, volumes/weight of additives used, and any other measurements specified by the manufacturer. No mixing will be allowed in the drilled shaft excavation.
- The Contractor or National Grid crew performing the work is responsible for neutralizing all drilling products, as applicable, in accordance with the manufacturer's specifications. This shall be performed following removal from the excavation and while held in holding tanks. A

qualified person shall be designated by the Contractor who will confirm/verify and document the appropriate neutralization activity at each location, as necessary.

- Waste drilling aids (neutralized or not) or soils that may have come into contact with drilling aids will not be disposed of on National Grid properties, discharged to any ground surface or subsurface, waterbodies, wetlands or placed on 3rd party properties.
- All product use must be completed in strict adherence with the management, storage, mixing, transporting, disposing and any other requirements of state and federal regulatory approvals and permits, as applicable.
- Relevant documentation shall be maintained by the Contractor or National Grid crew performing the work, and shall include volume of material treated and disposed and the location/facility at which it was disposed.
- National Grid will not be identified as the disposal generator for any polymer based slurry waste or additives generated by Contractor activities.
- The Contractor or National Grid crew performing the work assumes full responsibility for the safe storage of all polymers and additives during use and also assumes full responsibility for improper use and application of said polymers and additives that are deemed to have contravened aquifer and/or groundwater quality.
- National Grid reserves the right to refuse and terminate the use of any specific drilling aid at any time.

Regardless of the type of drilling aid utilized, the Contractor or National Grid crew performing the work is responsible for properly treating, containerizing, testing, transporting and disposing of any/all fluids and solids generated during their activities. All wastes must be disposed of in accordance with federal and state regulations. Relevant documentation shall be maintained and shall include volume of material treated and disposed and the location/facility at which it was disposed.

12.0 Water Withdrawal for Geotechnical Investigations

The use of water during geotechnical drilling operations may be required, and is most common during the “drive and wash” drilling technique, where 4- or 6-inch diameter casing is driven into the ground, and the soil inside the casing is washed out using a pump and hollow rods. Soil samples are generally collected at periodic intervals using a split spoon sampler (e.g., every 5 vertical feet).

The National Grid Environmental Scientist and/or Project Environmental Monitor may approve withdrawals from wetlands and waterways on a case-by-case basis should the geotechnical team advise no other options are available. Generally, the amount of water required for withdrawal is between 100 and 200 gallons, and the water is then recycled continuously in the drilling process. Certain scenarios may require additional water usage if water is lost down the boring (e.g., lost due to bedrock fractures during rock coring). The following general guidance should be adhered to when determining whether water withdrawals may be allowed during geotechnical investigations on the ROW. Approval from the National Grid Environmental Scientist and/or Project Environmental Monitor is required prior to initiating water withdrawals during geotechnical investigations.

- Withdrawals from perennial streams, ponds, lakes and large wetlands systems are preferred over small isolated wetlands to ensure the water level, water table, and hydroperiod are not affected. Prior to start of work, the Contractor shall identify which water source they prefer to withdraw from. The National Grid Environmental Scientist and/or the Project Environmental Monitor will confirm whether these sources are appropriate.
- Care should be taken to avoid alteration of wetlands or the beds and banks of surface waters. Examples of alterations include, but are not limited to, the following:
    (a) the changing of pre-existing drainage characteristics, flushing characteristics, salinity distribution, sedimentation patterns, flow patterns and flood retention areas;

    (b) the lowering of the water level or water table;

    (c) the destruction of vegetation; and

    (d) the changing of water temperature, biochemical oxygen demand (BOD), and other physical, biological or chemical characteristics of receiving waters.
- Wetlands and waterways providing habitat for rare species should be avoided unless all other options are exhausted. Under no circumstances should water be withdrawn from a Vernal Pool.
- Withdrawal pipes or stingers should be elevated off the bottom of wetlands and streams during the duration of pumping. Additionally, fabric or screening should be covering the withdrawal pipes to eliminate inadvertent harm to wildlife.
- Withdrawals should be performed in a manner that does not damage vegetation, disturb sediment, or result in the release of temporary or permanent fill material (e.g., sediment, spoils, or turbid water) into the wetland/waterway. Additional detail from geotechnical experts may be required to solidify BMP recommendations.
- Any water used for geotechnical drilling operations (including water withdrawn from surface water, brought on-site, or from other sources) shall be discharged into the open borehole or to an upland area such that the water infiltrates to the ground and is not discharged to a wetland or surface water resource area. Consultation with the National Grid Environmental Scientist and/or the Project Environmental Monitor is required if this is not feasible. At no time should water withdrawals result in a temporary or permanent fill/discharge of material (e.g. sediment, spoils, or turbid water) into the wetland or waterway.
- If water sourcing options is not determined prior to mobilization, necessary water shall be brought in by tank truck. Should withdrawal from surface water sources become necessary during soil boring work, the National Grid Environmental Scientist and/or the Project Environmental Monitor shall be notified prior to beginning withdrawal. If initial withdrawal from surface water is approved by the National Grid Environmental Scientist and/or the Project Environmental Monitor, the driller may withdraw from the surface water, as long as the above criteria are met.
- If excessive water withdrawal is necessary, the National Grid Environmental Scientist and/or the Project Environmental Monitor shall be consulted to determine whether the water source is appropriate for withdrawal.
- In New Hampshire, withdrawals made from state-owned property require written permission from

the agency with primary responsibility for monitoring and/or maintaining the site.

13.0 Gates

When not in use, gates shall be locked with a company-approved lock or double locked with the property owner's lock. New gates may be installed during a project, however, installation of a gate requires permission from the property owner, and may require environmental permitting. Consult with National Grid Real Estate and the National Grid Environmental Scientist prior to installing a new gate, as well as with the appropriate engineering department for the current company gate specifications. Refer to BMPs in **Appendix 4**. Installation of ROW access restrictions (e.g., stone, bollards, other) at road crossings also require consultation with the National Grid Environmental Scientist and Property Legal.

14.0 Signage

Specific signage may be required by permits or be specified in the EFI to limit access in certain sensitive areas. Signs shall be used to clarify allowed access and sensitive areas, such as:

- "No snow stockpiling beyond this point";
- "Approved access (to structures A-F)";
- "Do not cross this area until construction mats are in place";
- "No vehicle crossing";
- "Areas to avoid"; and
- "Environmentally Sensitive Area – Keep Out."

Signs shall be used in conjunction with snow fencing or other physical barriers as demarcation for sensitive areas (e.g., rare species areas, sensitive archeological locations, etc.) that need to be protected and avoided by construction activities. In addition, permit signs required by the regulatory agencies shall be present (i.e. MADEP, RIDEM, EPA (SWPPP), ACOE, etc) at construction sites and/or ROW access points. Construction signage shall be installed and maintained by the contractor performing the work during the project. Absence of signage does not eliminate the need to comply with access plans, permit conditions, and other regulatory requirements. Refer to BMPs in **Appendix 4**.

15.0 Refueling and Maintenance Operations

15.1 Spill Prevention and Response Plan

Spill controls shall be provided on every field vehicle. Bulk storage of fuels (55 gallons or greater) shall be approved by the National Grid Environmental Scientist prior to being brought on site. The need for a field spill plan shall be evaluated specific to the project for regulatory requirements under SPCC regulations or local ordinances. A field spill plan would include information on fuels and oils being used, approximate amounts in each container or type of equipment, location, fueling location, secondary containment, response and notification procedures, including contact phone numbers, etc. All personnel shall be briefed on spill prevention and response prior to the commencement of construction. The state-specific EI-501 and EG-502 shall be followed in the event of a spill.

Typical construction activities do not require the use or storage of large quantities of oil or hazardous materials (i.e., greater than 55 gallons). However, oil and/or hazardous materials (OHM) may be required in limited quantities to support construction or vehicle operations. Best practices shall be followed in the use and storage of OHM which include but are not limited to: storage and refueling greater than 100 feet from resource areas; maintenance of spill response equipment at work locations sufficient to handle incidental releases from operating equipment; general training for on-site personnel for spill clean up response for incidental releases of OHM; and contracting with an on-call spill response contractor that is capable of managing incidental and significant releases of OHM. There may situations that additional precautions shall be required for the storage or use of OHM (i.e., within wellhead protection areas, GA/GAA areas, Zone IIs). Storage of OHM shall be done in accordance with any applicable regulatory requirements.

15.2 Field Refueling

Small equipment such as pumps and generators shall be placed in small swimming pools or on absorbent blankets/pads, to contain any accidental fuel spills. Small swimming pools with absorbent blankets/pads, and/or other secondary containment, shall be used for refueling of fixed equipment in wetlands and should be maintained to prevent accumulation of precipitation.

15.3 Grease, Oil, and Filter Changes

Routine vehicle maintenance shall not be conducted on project sites.

15.4 Other Field Maintenance Operations

When other vehicle or equipment maintenance operations (such as emergency repairs) occur, company personnel or contractors at field locations shall bring vehicles or equipment to an access location a minimum of 100 feet away from environmentally sensitive areas (e.g., wetlands or drinking water sources). A paved area, such as a parking lot or roadway, is a preferred field maintenance location to minimize the possibility of spills or releases to the environment.

Crews shall take all usual and reasonable environmental precautions during repair or maintenance operations. Occasionally, it is infeasible to move the affected vehicle or equipment from an environmentally sensitive area to a suitable access area. When this situation occurs, precautions shall be taken to prevent oil or hazardous material release to the environment. These precautions include (but are not limited to) deployment of portable basins or similar secondary containment devices, use of ground covers, such as plastic tarpaulins, and precautionary placement of floating booms on nearby surface water bodies.

15.5 Tools and Equipment

Cleaning of tools and equipment shall be conducted away from environmentally sensitive areas (such as wetlands, buffer zones or drinking water sources) to the maximum extent possible. A paved area such as a parking lot or roadway is preferred, to minimize the possibility of spill or release to the environment. Crews shall wipe up all minor drips or spills of grease and oil at field locations.

16.0 Stabilization Deadlines for Projects Subject to EPA Construction General Permit

16.1 Deadlines to Initiate Stabilization Activities (Permanent and Temporary)

Soil stabilization measures shall be implemented immediately whenever earth-disturbing activities have permanently or temporarily ceased on any portion of the project. The following are some examples of activities that constitute initiation of stabilization:

- Preparing the soil for vegetative or non-vegetative stabilization;
- Applying mulch or other non-vegetative product to the exposed area;
- Seeding or planting the exposed area;
- Finalizing the arrangements to have stabilization product fully installed in compliance with the deadlines to complete stabilization in Section 15.2 below.

16.2 Deadlines to Complete Stabilization Activities (Permanent and Temporary)

As soon as practicable, but no later than 14 calendar days or 7 calendar days (for areas discharging to a sensitive water) after the initiation of soil stabilization measures commence the following should be completed:

- For vegetative stabilization, all activities necessary to initially seed or plant the area to be stabilized; and
- For non-vegetative stabilization, the installation or application of all such non-vegetative measures.

16.3 Vegetative Stabilization (all except for arid, semi-arid, or on agricultural lands)

- Provide established uniform vegetation (e.g., evenly distributed without large bare areas), which provides 70% or more of the density of coverage that was provided by vegetation prior to commencing earth-disturbing activities. Avoid the use of invasive species as cover.
- For final stabilization, vegetative cover must be perennial; and
- Immediately after seeding or planting a disturbed area to be vegetatively stabilized, a non-vegetative erosion control must be implemented to the area while the vegetation is becoming established. Examples include; mulch and rolled erosion control products.

16.4 Vegetative Stabilization (Agricultural Lands)

- Disturbed areas on land used for agricultural purposes that are restored to their pre-construction agricultural use are not subject to vegetative stabilization standards.

16.5 Non-Vegetative Stabilization

If using non-vegetative controls to stabilize exposed portions of your site, or if you are using such controls to temporarily protect areas that are being vegetatively stabilized, you must provide effective non-vegetative cover to stabilize any such exposed portions of the site. Examples of non-vegetative stabilization techniques include, but are not limited to, rip-rap, gabions, and geotextiles.

17.0 Clean-up and Restoration Standards

The following steps shall be taken once construction has been completed at each location along the ROW or within the project site. The following are minimum guidelines for clean-up and stabilization standards. Please refer to permit conditions for project-specific related standards. Refer to the EFI for applicable permit requirements and to determine if the site needs to be reviewed and approved by the permitting authorities prior to removal of erosion controls.

17.1 Removal of Sedimentation and Erosion Controls

After all work has been satisfactorily completed and vegetation has been re-established to a minimum of 75% cover, and upon approval by the National Grid Environmental Scientist, all non-biodegradable materials (e.g., siltation fencing, straw bale strings, stakes, straw wattle mesh casing, etc.) shall be disposed of properly off-site.

Dependent on permit requirements, sedimentation and erosion controls may not be allowed to be removed until after inspection and approval by one or more permitting authority. In most cases, removed straw bales may be used to mulch disturbed areas. Remaining straw bales that do not block the flow of water may be left in place unless they are required to be removed pursuant to permit conditions. Straw bales that block the flow of water shall be removed.

Prior to project construction being completed, the project team will develop post-construction inspection intervals to ensure timely removal of temporary BMPs. BMPs will be removed when the area is stabilized, which typically occurs when the area has either naturally stabilized (75% cover), or seed and mulch that was installed has achieved 75% cover.

17.2 In-Situ Restoration

Unless otherwise specified in permits or prescribed by the National Grid Environmental Scientist or the Project Environmental Consultant, all disturbed areas, including stream banks, wetlands and access routes, shall be restored following the completion of work. When the work is completed and construction mats have been removed, the National Grid Environmental Scientist or Project Environmental Consultant shall conduct an inspection. Wetlands shall be inspected for build up of sand or other materials that may have fallen through construction mats. Care shall be taken to inspect wetland crossings carefully after construction mat removal to ensure any materials are properly removed and disposed of off-site.

<u>Restoration of Soil Compaction</u>. If rutting or soil compaction following construction mat removal is observed, the area shall be returned to pre-existing conditions, and comparable to the surrounding area, by light hand raking or by back-blading with machinery. Restoration shall be overseen by the Project Environmental Consultant or National Grid Environmental Scientist. Deep ruts (>12”) shall be filled in using available, loose soil from the work area.

Seeding and Mulching. If adequate root and seed stock are absent and have been stripped from the area, graded sites shall be promptly stabilized by applying an approved seed mix and mulching with straw to reduce erosion and visual impact. Seeding and mulching shall be completed as soon as possible following completion of work at the site. For some wetland areas, natural re-vegetation may be more appropriate than seeding disturbed sites. Wetland areas where adequate root and seed stock are absent will be seeded using an approved wetland native seed mix. For some wetland areas, natural re-vegetation may be more appropriate than seeding disturbed sites. Refer to BMPs in **Appendix 4** for seed mix tables and mulch ratio tables.

If needed, the import of quality topsoil onto the ROW will be required. Topsoil should be tested, and approved by the Project Environmental Consultant or National Grid Environmental Scientist to determine its suitability for site conditions. Fertilizers will be approved on a case-by-case basis.

For upland areas, the disturbed vegetation and soil shall be restored and stabilized[4] by regrading the area to pre-existing conditions, if needed, seeding (if adequate root and seed stock are absent) and mulching the exposed soil, and removing strings and stakes from straw bales and using broken up straw bales for the mulch. Siltation fencing, strings and stakes shall be removed for disposal as ordinary waste. Refer to BMPs in **Appendix 4** for seed mix tables and mulch ratio tables.

For sites with excess boulders, additional boulders could be used at proposed and existing gate locations to use on either side of the gates as a deterrent for unauthorized vehicle access or be placed along the edges of work pads where steep slopes are present for safety purposes. The final placement of boulders should be reviewed prior to installation with Real Estate and the National Grid Environmental Scientist or Project Environmental Consultant.

Unless otherwise specified in Project-specific permit conditions, the National Grid Environmental Scientist or Project Environmental Consultant shall develop an inspection frequency to monitor restored areas for stabilization, germination and successful revegetation.

17.3 Invasive Species

All equipment shall be certified clean[5] utilizing the attached form (**Appendix 5**) or equivalent as approved by the vendor prior to mobilization to the work site. The vendor shall use the certification from provided as **Appendix 5** to document compliance with invasive species management BMPs. Clean is defined as being free of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials prior to being brought to the project site. Any equipment that has been placed or used within areas containing invasive species within the project site shall be cleaned of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials at the site of the invasive species prior to being moved to other areas on the project

[4] For projects subject to the 2012 CGP, stabilization is required within 14 days, or within 7 days for sensitive areas.
[5] The **Appendix 5** certification form (or equivalent as approved by National Grid Environmental Scientist) shall be used to document the clean certification

site to prevent the spread of invasive species from one area to another[6]. **Equipment shall be cleaned prior to being removed at the completion of the project: exceptions to this requirement shall be determined on a case-by-case basis.** Consult with the National Grid Environmental Scientist prior to discharging or disposing of any waste water or waste material from the cleaning of equipment.

17.4 Cleaning of Equipment

At the completion of the project, equipment shall be cleaned prior to being de-mobilized to prevent tracking of material onto roads and causing safety issues. Consult with the National Grid Environmental Scientist prior to discharging or disposing of any waste water or waste material from the cleaning of equipment.

17.5 Access Roads

Constructed gravel roads shall be left in place following project completion unless permit conditions require their removal. Refer to the specific permit conditions for these provisions. If the road is to be removed, the crushed stone and geotextile fabric shall be removed from the work site. Seeding and/or mulching of gravel roads is generally not required, unless necessary to prevent erosion. Pre-existing sandy soils within mapped rare turtle habitat shall not be seeded unless directed by the National Grid Environmental Scientist so as to not alter nesting habitat.

17.6 Stone Work Pads

Unless permit conditions or property owner's require the removal of constructed stone work pads following project completion, constructed work pads shall be left in place. Refer to the specific permit conditions for these provisions.

17.7 Construction Materials on ROWs

As soon as the structure work has been completed, all used parts and trash are to be picked up and removed from the project site. Retired poles shall be removed in accordance with National Grid Engineering Standard SP.06.01.301. In some cases, the used material from structure work may be temporarily stored at the work area by placing it out of the wetlands or other sensitive resource area until work in the adjacent areas has been completed. However, treated wood poles shall never be stored in standing water or in wetlands. If the project is cancelled, all material shall be removed from the project site. Excess material brought to the project site shall be removed upon project completion. Consult with the National Grid Environmental Scientist on whether the work site shall be restored in addition to the measures outlined above

17.8 Improved Areas

Yards, lawns, agricultural areas, and other improved areas shall be returned to a condition at least equal to that which existed at the start of the project. Off-ROW access shall never be assumed and shall be coordinated through Real Estate before being implemented. Depending on the access point, construction matting or other BMPs may be required to prevent ruts, lawn damage, or other property damage.

[6] On ROW projects where multiple wetlands may be dominated by the same invasive species, cleaning may not be required for movement along the ROW. Check with the National Grid Environmental Scientist for guidance.

Restoration following the completion of work and any use of improved areas shall be conducted in accordance with the measures outlined above.

17.9 Property Damage

All damage to property occurring as a result of a project shall be immediately repaired or replaced. In some locations, it may be desirable to document pre-existing damage prior to work commencing in that area in order to demonstrate afterwards that the damage did not result from the project. Work crews, the Project Environmental Consultant or the National Grid Environmental Scientist shall document repairs that were performed in response to damage from unauthorized vehicle use.

17.10 Overall Work Site

Upon satisfactory completion of work, the construction personnel shall remove all work-related trailers, buildings, rubbish, waste soil, temporary structures, and unused materials belonging to them or used under their direction during construction, or waste materials from previous construction and maintenance operations. All areas shall be left clean, without any litter or equipment (wire, pole butts, anchors, insulators, cross-arms, cardboard, coffee cups, water bottles, etc.) and restored to a stable condition and as near as possible to its original condition, where feasible. Debris and spent equipment shall be returned to the operating facility or contractor staging area for disposal or recycling (cardboard) as appropriate in accordance with EI-111.

17.11 Material Storage/Staging and Parking Areas

Upon completion of all work, all material storage yards, staging areas, and parking areas shall be completely cleared of all waste and debris. Unless otherwise directed or unless other arrangements have been made with an off ROW or off-property owner, material storage yards and staging areas shall be returned to the condition that existed prior to the installation of the material storage yard or staging area. Regardless of arrangements made with a landowner, all areas shall be restored to their pre-construction condition or better. Also any temporary structures erected by the construction personnel, including fences, shall be removed by the construction personnel and the area restored as near as possible to its original condition, including seeding and mulching as needed.

18.0 Notification of Emergency Work

Because it is sometimes difficult to identify wetlands and other sensitive environmental areas, the National Grid Environmental Scientist shall be notified within 24 hours or by the next working day whenever emergency off-road repair work takes place. Although the routine maintenance and emergency repair work is generally allowed, due to site conditions or the scope of the project, notification to the regulating agencies may be required.

19.0 Appendices

APPENDIX 1: Glossary
APPENDIX 2: Acronyms

APPENDIX 3:	Storm Water, Wetlands & Priority Habitat Environmental Compliance Site Inspection / Monitoring Report Form
APPENDIX 4:	BMP Drawings and Guidelines
APPENDIX 5:	Certification Sheet for Invasive Species Control
APPENDIX 6:	Snow Disposal Guidelines

Appendix 1 – Glossary

Access Road – An existing, periodically maintained road often consisting of gravel and/or exposed soils or vegetated with grasses but devoid of woody vegetation, that is visible on aerial photography and shown on ROW T-sheets. May include newly permitted permanent roads (i.e., roads to be constructed in accordance with a project-specific permit).

Access Route - A pathway previously used or proposed to be used by crews for access along the ROW. Routes may be shown on ROW T-sheets or previous project access plans but are not improved as maintained gravel/exposed soil roads. Access routes may be mown and can consist of trails utilized by recreational vehicles.

Action Logs – Project-specific log used to document action items required for permit compliance. The log identifies timeframes for completion and responsible parties. The log is typically updated by the Project Environmental Consultant or the National Grid Environment Scientist and circulated to the project team on a weekly, or more frequent, basis.

Bank – The transitional slope immediately adjacent to the edge of a surface water body, the upper limit of which is usually defined by a break in slope, or, for a wetland, where a line delineated in accordance with applicable state and federal regulations that indicates a change from wetland to upland.

BMP – Best Management Practice. Individual engineered constructions or operating procedures intended to minimize and mitigate soil disturbance, erosion, sedimentation, turbid discharges, and/or impacts to sensitive receptors.

Clean - Free of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials prior to being brought to the project site.

Clean Gravel – Gravel is a type of coarse-grained soil that consists of small stones and other mineral particles. Clean Gravel shall meet the requirements in accordance with National Grid Standard Construction Specification for Electric Stations (Engineering Standard SP.08.00.001) Clean Gravel will not have fine materials that could lead to a turbid discharge.

Clean Stone (Crushed Stone) – Clean Stone (Crushed Stone) shall meet the requirements in accordance with National Grid Standard Construction Specification for Electric Stations (Engineering Standard SP.08.00.001). Clean Stone will not have fine materials that could lead to a turbid discharge.

Clearing – The cutting of trees and large bushes by hand and/or mechanical means.

Compost Socks – Tubular devices comprised of non-degradable, photodegradable, or biodegradable mesh tubing containing organic compost matrix. Compost socks are effective for intercepting site runoff, trapping sediment, and treating for soluble pollutants by filtering stormwater runoff. . Compost socks are a useful sedimentation control device along construction site perimeters, as check dams in drainage channels, as a slope interruption practice on long and/or steep slopes, and around drain or street curb inlets.

Construction Mats **- C**onstruction, swamp, and timber mats ("construction mats") are generic terms used to describe structures that distribute equipment weight to minimize disturbance to wetland soil and vegetation while facilitating passage and providing work platforms for workers and equipment. They are comprised of sheets or mats made from a variety of materials in various sizes.

Corduroy Road – Corduroy roads are cut trees and/or saplings with the crowns and branches removed, and the trunks lined up next to one another.

Dewatering Basin – An established containment area for saturated materials and pumped discharges. This measure is used for the purpose of de-watering soils prior to transport off site or for use in another location on site, and for allowing suspended sediment to settle out of pumped discharges.

Detention/Retention Basin – A detention/retention basin is designed for the purpose of detaining or retaining water. A dewatering basin is a form of detention basin

Dewatering – Use of a system of pumps, pipes and temporary holding dams to drain or divert waterways or wetlands, or lower the groundwater table before and during excavation activities.

Drainage Ditch or Swale – A clearly noticeable channel that is typically dry, except after precipitation events. Intermittent and perennial streams and rivers are not included in this definition.

Dredge – To dig, excavate, or otherwise disturb the contour or integrity of sediments in the bank or bed of a wetland, a surface water body, or other area within the regulating bodies' jurisdiction.

Dredge Spoils – Material removed as the result of dredging.

Embankment – A protective bank constructed of mounded earth or fill materials located between a roadway (or rail bed) and a seasonal stream or other wetland.

Environmental Field Issue – Document that contains copies of all project-specific environmental permits and summarizes all environmental permit conditions. The EFI is prepared by the Project Environmental Consultant or the National Grid Environment Scientist and copies are provided to the Project Manager, Construction Supervisor(s), and other team members as appropriate.

Environmental Monitoring Records – Examples of checklists and/or monitoring reports suggested for use by the Company Environmental Engineer to document conformance of the project with this Environmental Guidance and or project specific permit/license conditions.

Environmental Scientist – Formerly Environmental Engineer. The National Grid Environmental Department representative for the project or the territory where the work is located. For a map of Environmental Department staff territories, refer to the Environmental page of the National Grid infonet.

Environmentally Sensitive Areas – Examples of environmentally sensitive areas that may be found on National Grid properties are rivers, streams, ponds, lakes, wetlands, bogs, swamps, salt marshes, rare species habitat, wellhead protection areas, cultural sites, parks, preserves, schools and as otherwise defined by Federal, State or local regulations. Refer to EG-301.

Erosion Controls – The utilization of methods to prevent soil detachment and minimize displacement or washing down slopes by rainfall or run-off. Common practices include, but are not limited to:

(a) Temporary and Permanent Seeding.

(b) Mulching, Soil Binders, Tackifiers.

(c) Erosion Control Blankets.

(d) Hydraulic Erosion Control.

Excavate/Excavation – To dig, remove, or form a cavity or a hole in an area within the department's jurisdiction.

Fill (n.) – Any rock, soil, gravel, sand or other such material that has been deposited or caused to be deposited by human activity.

Fill (v.) – To place or deposit materials in or on a wetland, surface water body, bank or otherwise in or on an area within the jurisdiction of the department.

Flats – Relatively level landforms composed of unconsolidated mineral and organic sediments usually mud or sand, that are alternately flooded and exposed by the tides and that usually are continuous with the shore.

Frozen Condition – Field conditions when the upper portion of the ground surface freezes or when areas of standing water freeze solid such that vehicle passage over these areas is supported without any resulting soil disturbance. The frozen conditions must have been affected by severe cold (maximum daily temperatures less than 32 degrees F) for a continuous 2-week period.

GAA – Rhode Island groundwater classification, groundwater resources that are known, or presumed to be suitable for drinking water use without treatment, and are located in one of the three areas described below.

a) The state's major stratified drift aquifers that are capable of serving as a significant source for a public water supply ("groundwater reservoirs") and the critical portion of their recharge area as delineated by DEM;

b) The wellhead protection area for each public water system community water supply well. Community water supply wells are those that serve resident populations and have at least 15 service connections or serve at least 25 individuals, e. g. municipal wells and wells serving nursing homes, condominiums, mobile home parks, etc.; and

c) Groundwater dependent areas that are physically isolated from reasonable alternative water supplies and where existing groundwater warrants the highest level of protection. At present only Block Island has been designated as meeting this criterion.

GA – Rhode Island groundwater classification, groundwater resources that are known, or presumed to be suitable for drinking water use without treatment. However, groundwater classified by GA does not fall within any of the three priority areas described under the GAA classification.

Grade/Grading – The movement of soil and fill material to change the elevation of the land. The term refers to the combined actions of excavating and filling to change elevation or shape.

Grubbing – The removal of stumps/roots by mechanical means during site preparation activities.

Immediately - As soon as practicable, but no later than the end of the next work day, following the day when the earth-disturbing activities have temporarily or permanently ceased.

In-kind Replacement - Replacement using the same material, functional inverts, diameter and length as the existing item. In-kind replacement includes the substitution of a structure with a similar structure in approximately the same location as is practicable, and is approximately the same in design. The design may be altered to meet applicable utility standards, and may include alternate materials designed to prolong the life of that service.

Intermittent Stream – A stream that flows for sufficient time to develop and maintain a defined channel, but which might not flow during dry portions of the year.

In the Dry – Work done either during periods of low water or behind temporary diversions, such as Earth Dike / Drainage Swale and Lined Ditches designed and installed in accordance with best management practices.

Limit of Work/Disturbance – The approved project limits within regulated areas. All project related activities in regulated areas must be conducted within the approved limit of work/disturbance. The limit of work/disturbance shall be depicted on the approved permit site plans and in the EFI plans. Where it is warranted National Grid may require that these limits be identified in the field by flagging, construction fencing, and/or perimeter erosion controls.

Long-Term Restoration Logs - Project-specific log used to document restoration required following the completion of construction or as areas of the project have been completed (i.e., segments of ROW for a multi-mile project). The log is typically updated by the Project Environmental Consultant or the National Grid Environment Scientist and circulated to the project team on a weekly basis.

Low Flow Conditions – Low water flow that generally occurs during the summer, as a result of decreased precipitation and the removal of water by increased evaporation and evapotranspiration by vegetation. Work done under low-flow conditions minimizes the potential for environmental damage. The USACE defines the calendar dates for low flow conditions in its New England state-specific Programmatic General Permits.

Low Ground Pressure – Equipment that meets the USACE GP state-specific defined Pounds per Square Inch (PSI) ground pressure when loaded. Use of LGP equipment ***requires approval*** from the National Grid Environmental Scientist.

Marsh – A wetland:

a) That is distinguished by the absence of trees and shrubs;

b) Dominated by soft-stemmed herbaceous plants such as grasses, reeds, and sedges; and

c) Where the water table is at or above the surface throughout the year, but can fluctuate seasonally.

Methods – Are the construction practices and procedures that take place through choosing the proper equipment, trucks and labor to execute the earth moving activities based on the existing conditions and implementing creative and sensitive scheduling for the daily activities.

NHESP - Natural Heritage Endangered Species Program; a department within the Massachusetts Division of Fisheries and Wildlife that is responsible for protecting the 176 species of vertebrate and invertebrate animals and 259 species of native plants that are officially listed as Endangered, Threatened or of Special Concern in Massachusetts.

Perennial – A stream that contains water at all times except during extreme drought.

Permanently Ceased – Is applicable to earth disturbance activities when clearing and excavation within any area of the Project that will not include permanent structures has been completed.

Person-in-Charge – A National Grid Project Engineer, Manager, Supervisor, Field Construction Coordinator or equivalent Contractor personnel assigned to oversee and coordinate work activities.

Processed Gravel – Processed Gravel shall meet the requirements in accordance with National Grid Standard Construction Specification for Electric Stations (Engineering Standard SP.08.00.001). Processed Gravel will not have fine materials that could lead to a turbid discharge. Gravel consisting of inert material that is hard, durable stone and is free from loam and clay, surface coatings and deleterious materials.

Regulating Body – Federal, State, or local authority that has jurisdiction over resource areas that may be impacted by company operations

Regulated Wetland Area – Those areas that are subject to federal, state or local wetland regulation, including certain buffer or adjacent areas.

Repair – The restoring of an existing legal structure by partial replacement of work, or broken, or unsound parts (Env-Wt 101.73).

Replacement – The substitution of a new structure for an existing legal structure with no change in size, dimensions, location, configuration, construction, or which conforms in all material aspects to the original structure

Right-of-Way – A corridor of land where National Grid has legal rights (either fee ownership, lease or easement) to construct, operate, and maintain an electric power line and/or natural gas pipeline and may include work on customer owned properties.

River – A watercourse that is larger than a perennial stream and flows all year long.

Routine Utility Rights-of-Way Maintenance Activity – Includes but is not limited to vegetation management and repair or replacement of existing utility structures.

Sedimentation Controls – Silt fences, straw bales, compost socks/berms and other barrier devices strategically placed to intercept and treat sediment-laden site runoff.

Sensitive Water - Includes any sediment or nutrient impaired water or a water that is identified by the state, tribe or EPA as Tier 2, 2.5 or Tier 3 for antidegradation purposes.

Siltation Curtain – An impervious barrier erected to prevent silt and sand and/or fines from being washed into a wetland, surface water body or other area of concern.

Surface Water Body or Surface Waters – Those portions of waters which have standing or flowing water at or on the surface of the ground.

Spill Prevention, Control and Countermeasure Plans – Required for site operations that involve the storage of 1,320 gallons or greater of fuel and oils, both in storage containers and stored in equipment. Response actions to spills and releases are specified in these plans.

Stormwater Pollution Prevention Plan – A site-specific, written document that, among other things: (1) identifies potential sources of stormwater pollution at a construction site; (2) describes stormwater control measures to reduce or eliminate pollutants in stormwater discharge from a construction site; and (3) identifies procedures the operator will implement to comply with the terms and conditions of EPA NPDES Construction General Permit (CGP). SWPPPs must be prepared, maintained on-site, and amended as necessary in order to obtain NPDES permit coverage for specific construction site stormwater discharges under the EPA NPDES CGP.

Temporarily Ceased - Is applicable when there are earth disturbance activities such as clearing, grading, and/or excavation that are not complete, but will be idle in one area for a period of up to 14 or more calendar days, and which will resume in the future. The 14 calendar day timeframe begins as soon as you now that construction work on a portion of the Project will be left incomplete and idle. In circumstances where there are unanticipated delays and you do not know at first how long the work stoppage will continue, the requirement to immediately initiate stabilization is triggered as soon as you know with reasonable certainty that work will be stopped for 14 or more additional calendar days.

Tidal Wetlands – A wetland whose vegetation, hydrology or soils are influenced by periodic inundation or tidal waters.

Topsoil – The uppermost part of the soil, ordinarily moved in tillage, or its equivalent in uncultivated soils and ranging in depth from 2 to 10 inches.

Turbidity – The condition in which solid particles suspended in water make the water cloudy or even opaque in extreme cases.

United States Geological Survey Topographic Map – A map that uses contour lines to represent the three-dimensional features of a landscape on a two-dimensional surface. These maps use a line and symbol representation of natural and artificially created features in an area.

Wetland – An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation (more than 50 percent) typically adapted for life in saturated soil conditions (hydric soils). Wetlands include but are not limited to swamps, marshes, bogs, and similar areas.

Work Site – An area where work is performed.

Worker – Company employee, contractor, consultant working on site.

Zone II - Massachusetts - That area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone IIs shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock , or a recharge boundary).

Appendix 2 – Acronyms

ASTM	American Society for Testing and Materials
BMP	Best Management Practices
EFI	Environmental Field Issue
EG	Environmental Guidance
EPA	Environmental Protection Agency
GA/GAA	Rhode Island Groundwater Classifications – see glossary
LGP	Low Ground Pressure
MA	Massachusetts
MA DEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
NE	New England
NH	New Hampshire
NH DES	New Hampshire Department of Environmental Services
NHESP	Natural Heritage Endangered Species Program
NPDES	National Pollutant Discharge Elimination System
OHM	Oil and/or Hazardous Materials
PSI	Pounds per square inch
RI	Rhode Island
RI DEM	Rhode Island Department of Environmental Management
RI CRMC	Rhode Island Coastal Resources Management Council
RI SESC	Rhode Island soil erosion and sediment control
ROW	Right-of-Way
RTE	Rare, Threatened or Endangered
SPCC	Spill Prevention, Control and Countermeasure
SWPPP	Storm Water Pollution Prevention Plan
TOY	Time-of-Year
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VT	Vermont

VT DEC	Vermont Department of Environmental Conservation
Zone II	Massachusetts Groundwater Protection district – see glossary

Appendix 3

See EG303NE_Appendix3_Reporting Form published separately

National Grid
Storm Water, Wetlands & Priority Habitat Environmental Compliance
Site Inspection / Monitoring Report

Project Name: ____________________ **Date:** __________

City / Town: ____________________ **Time:** __________

WO / WR # ____________________

IHC or Contractor? (Company Name): ____________________

Current Weather Conditions:

Precipitation Since Last Inspection (Date, Est. Duration and Est. Amount from Each Storm):

Activities / Structures / Locations Inspected:

Identify Locations / Activities / Structures within Designated Priority Habitat (Identify Rare species Observations, if any) and Mitigation / Restoration Measures Implemented:

Any Significant Discharges of Sediment to Water Bodies or Wetlands? (If "yes", state locations):

National Grid
Storm Water, Wetlands & Priority Habitat Environmental Compliance
Site Inspection / Monitoring Report

Compliance with SWPPP Storm Water Controls, O&M Plan, Order of Conditions or Other Applicable Environmental Requirements? (Explain if "no" for any feature inspected):

Additional BMPs or Other Corrective Action Needed and, if so, Where?

Compliance with Previous Observations?

National Grid
Storm Water, Wetlands & Priority Habitat Environmental Compliance
Site Inspection / Monitoring Report

Are Spill Control Supplies Available	**Yes**	**No**
Are Oil and / or Hazardous Materials Stored On Site?	**Yes**	**No**
If So, Are they Properly Labeled and Managed?	**Yes**	**No**
Are Wastes Stored On Site?	**Yes**	**No**
If So, Are they Properly Managed?	**Yes**	**No**

Miscellaneous (e.g., dumping?):

Comments:

Inspection Completed by (Name, Title, Company):

Inspector's Signature for Certification:

National Grid Environmental Dept. Representative - Signature for Certification:

Date:

Appendix 4 – BMPs

See EG303NE_Form1 for a list of BMPS

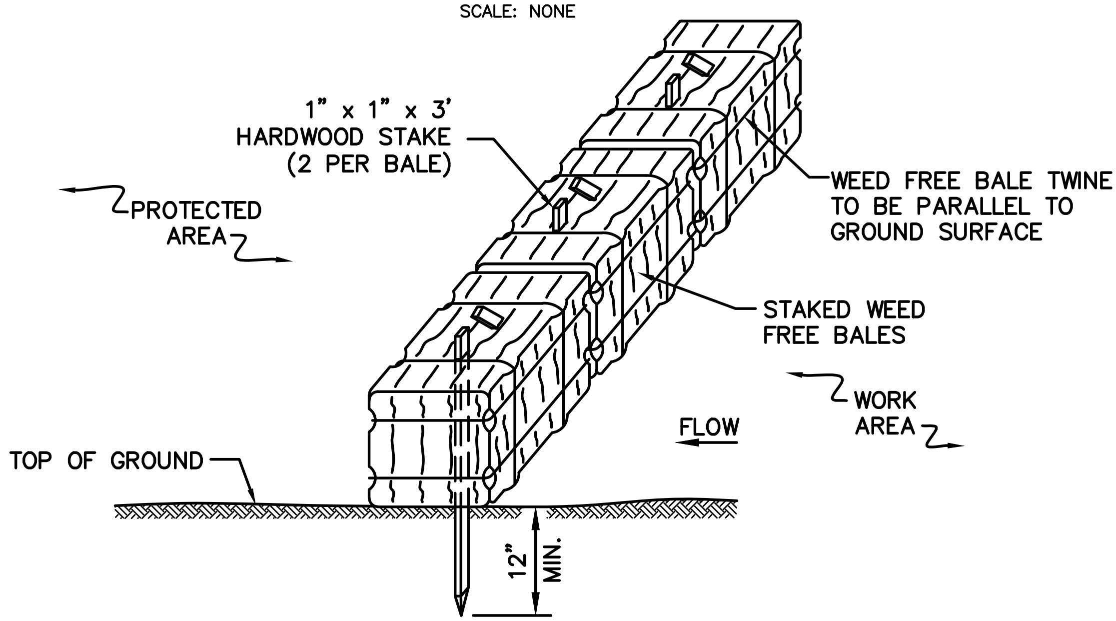
See EG303NE_Form2 for BMP details

	BMP #	Measure
Sediment & Erosion Controls	SEC-1	Weed free bale barrier
	SEC-2	Sediment control fence
	SEC-3	Silt fence / weed free barrier
	SEC-4	Silt Soxx
	SEC-5	Straw Wattle
	SEC-6	Erosion Control Blanket - Ditch
	SEC-7	Erosion Control Blanket - Slope
	SEC-8	Hydroseeding with Tackifier (slope stabilization)
	SEC-9	Mulch materials, rates and uses (from NY)
	SEC-10	Seeding options - Upland Seed Mixes
	SEC-11	Seeding options - Wetland Seed Mix
	SEC-12	Distribution Pole Erosion Control
Crossing Measures	CM-1	Prefabricated mats
	CM-2	Construction mat bridge
	CM-3	Construction mat layout (with transition)
	CM-4	Construction mat layout (with transition & BMPs)
	CM-5	Construction mat - Air Bridge
	CM-6	Corduroy road
	CM-7	Rock Ford
	CM-8	Temporary construction entrance / exit
	CM-9	Temporary construction culvert
	CM-10	Access way stabilization
	CM-11	Construction signage
	CM-12	Construction Mat Anchoring
Advanced Applications	AA-1	Reinforced silt fence
	AA-2	Sediment filter
	AA-3	Stone check dams
	AA-4	Straw / haybale check dam
	AA-5	Waterbar
	AA-6	Sandbag check dam
	AA-7	Earth dike
	AA-8	Drainage swale and lined ditch
	AA-9	Sedimentation basin
	AA-10	Dewatering basin - Small scale
	AA-11	Dewatering basin - Large scale
	AA-12	Dirtbag
	AA-13	Concrete waste sump

	AA-14	Outpak concrete washout
Advanced Applications	AA-15	Barrier fence (construction fence)
	AA-16	ROW gates / fences
	AA-17	Bollard
	AA-18	Dust control
	AA-19	Catch Basin Inlet Protection
	AA-20	Silt Sack
	AA-21	Turbidity Curtain
	AA-22	Siltsoxx Amphibian & Reptile Crossing #1
	AA-23	Siltsoxx Amphibian & Reptile Crossing #2
	AA-24	Siltsoxx Amphibian & Reptile Crossing #3
	AA-25	Cultural Avoidance

BMP DETAIL

SCALE: NONE



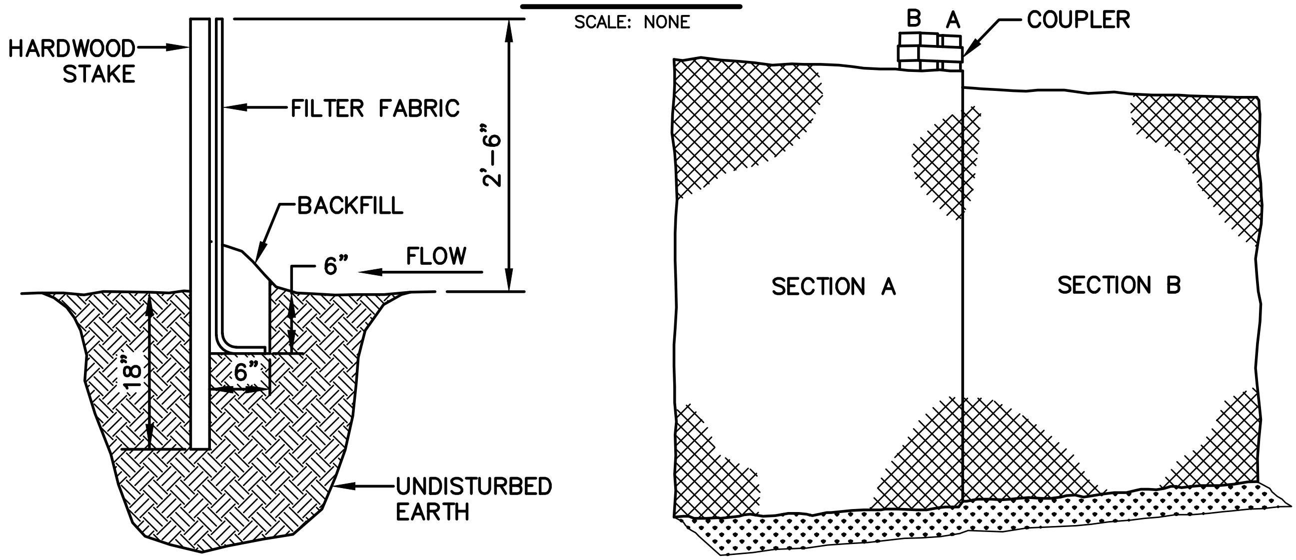
NOTES:

1. THE GROUND SHALL BE PREPARED TO PROVIDE COMPLETE CONTACT WITH THE BALES.

BMP PICTURE

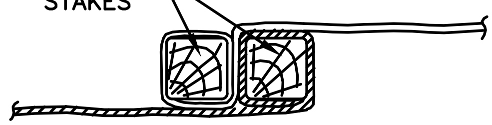
BMP DETAIL

SCALE: NONE



PROFILE

SECTION



PLAN

BMP PICTURE

File: Sediment_Fence.dwg

APPROVED BY: VICE PRESIDENT, ENVIRONMENTAL SERVICES
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SEC-2
SEDIMENT CONTROL FENCE

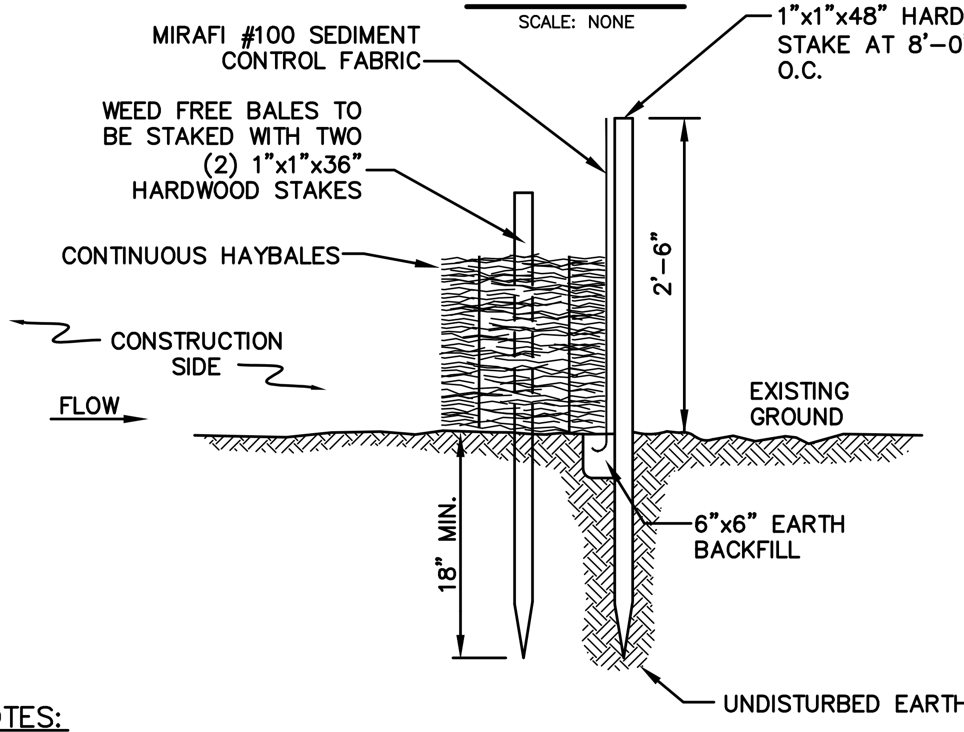
nationalgrid	ENVIRONMENTAL GUIDANCE	Doc. No.	EG-303NE
		Page: 7-3	Rev. No. 4
		Date	02/20/18

SUBJECT
Access, Maintenance and Construction
Best Management Practices

Reference
EP No. 3 - Natural Resource
Protection (Chapter 6)

BMP DETAIL

SCALE: NONE



NOTES:

1. BALES SHALL BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING THE ADJACENT BALES.
2. BALES SHALL BE SECURELY ANCHORED IN PLACE BY TWO (2) 1"X1"X36" HARDWOOD STAKES DRIVEN THROUGH THE BALES. THE FIRST STAKE IN EACH BALE SHALL BE ANGLED TOWARD PREVIOUSLY LAID BALE TO FORCE BALES TOGETHER.
3. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
4. BALES SHALL BE REMOVED AND REPLACED WHEN THEY BECOME FILLED WITH SEDIMENT AND BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
5. BALES SHALL BE REMOVED WHEN THE EMBANKMENTS STABILIZE.
6. BALES TO BE TWINE BOUND.

BMP PICTURE

File: Silt_Fence_&_Barrier.dwg

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SEC-3
SILT FENCE /
WEED FREE BARRIER

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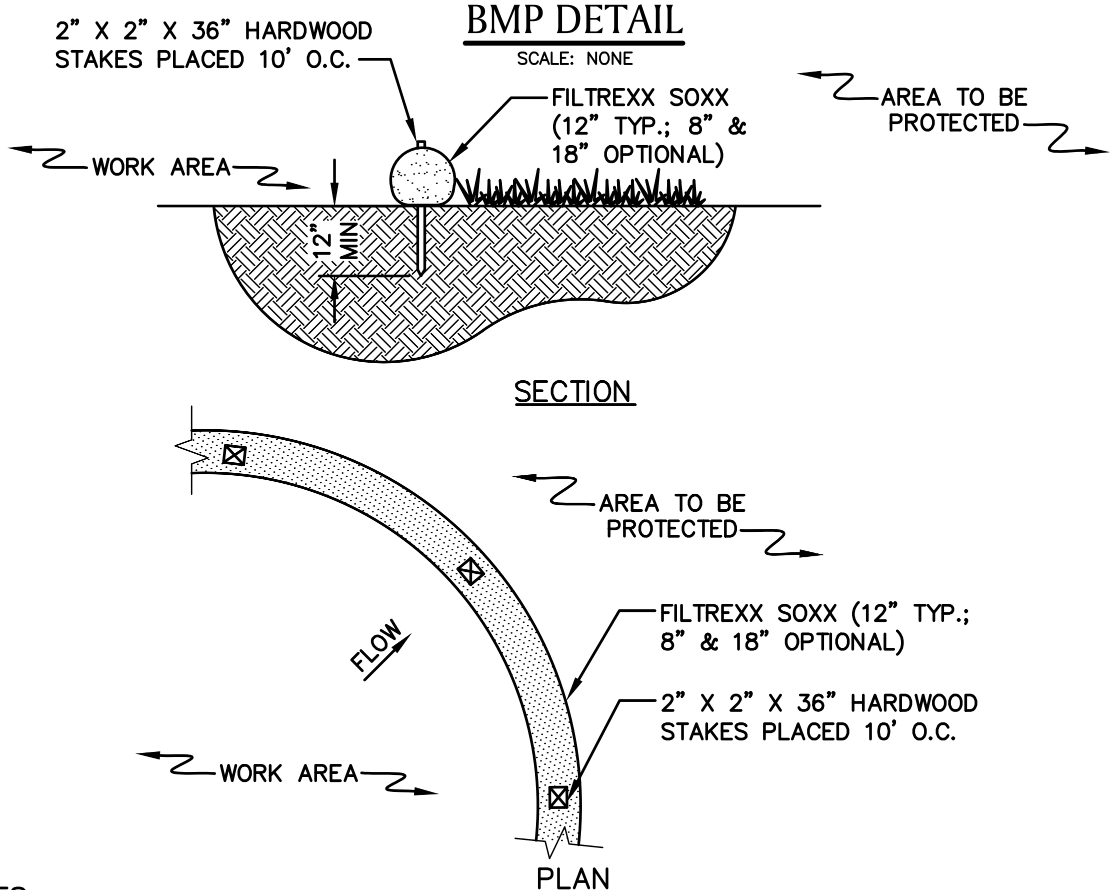
BMP DETAIL

SCALE: NONE



NOTES

1. PRODUCT TO BE FILTREXX SILT SOXX OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. ALL MATERIAL TO MEET FILTREXX SPECIFICATIONS.
3. FILTER MEDIA FILL TO MEET APPLICATION REQUIREMENTS.
4. MESH CONTAINMENT MATERIAL SHOULD BE KNITTED PHOTODEGRADABLE OR BIODEGRADABLE MATERIAL, WITH OPENING SIZES BETWEEN 1/8" – 3/8".
5. COMPOST MEDIA SHOULD HAVE PARTICLE SIZE WHERE 99% < 2", 50% > 1/2".
6. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

*** PICTURE AND DETAIL PROVIDED BY FILTREXX LAND IMPROVEMENT SYSTEMS**
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SEC-4
SILT SOXX *

File: SiltSOXX.dwg

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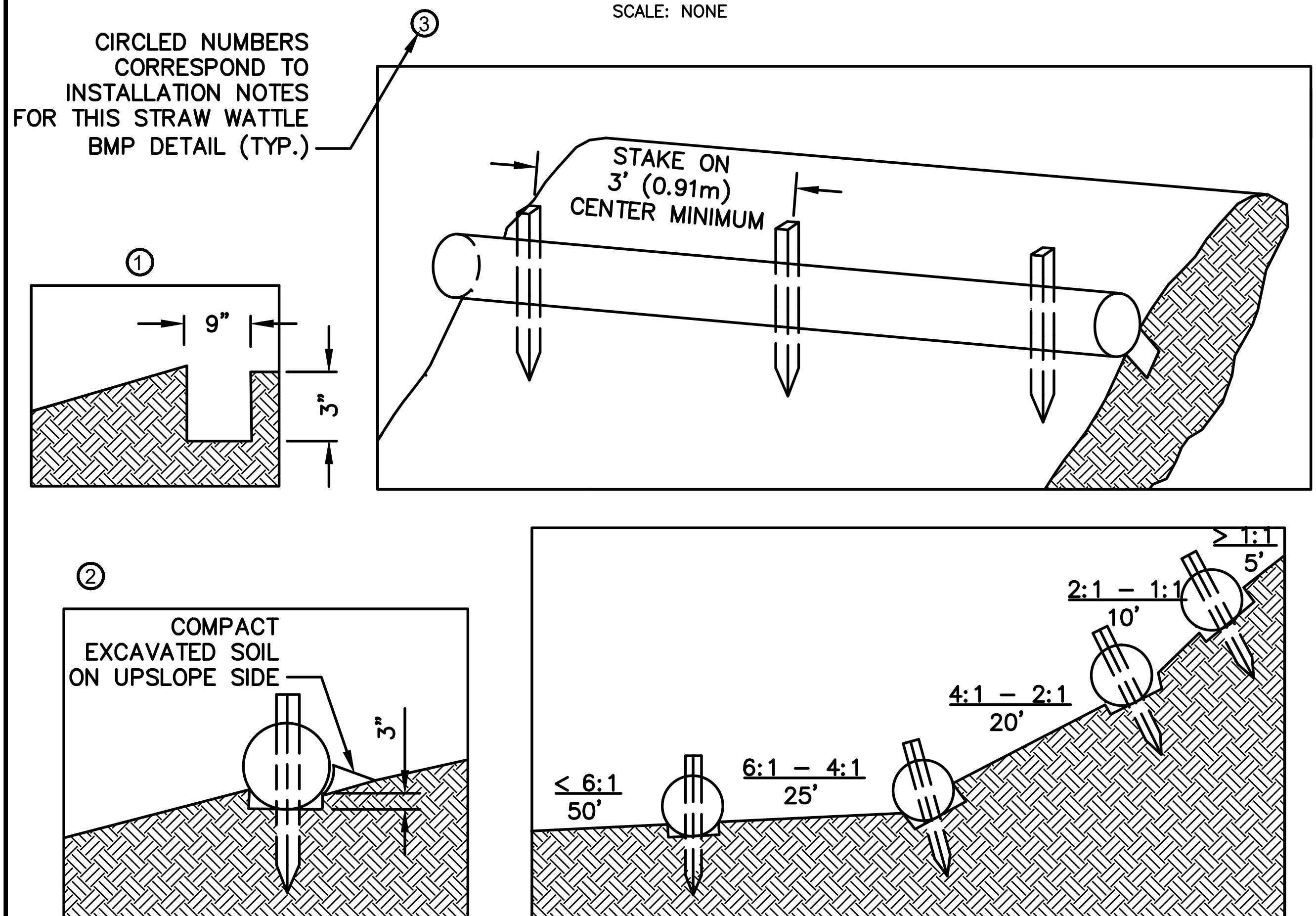
BMP DETAIL

SCALE: NONE



TYPICAL WATTLE SPACING DETAIL

NOTES:

1. PRODUCT TO BE TENSAR NORTH AMERICAN GREEN STRAW WATTLE OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. TYPICAL WATTLE SPACING BASED ON SLOPE GRADIENT. COORDINATE SPACING AND LOCATION WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
3. MINIMUM 12" DIAMETER WATTLES SHOULD BE USED FOR HIGHLY DISTURBED AREAS (I.E., HEAVILY USED ACCESS ROAD WITH ADJACENT WETLAND) AND MINIMUM 9–10" WATTLES SHOULD BE USED FOR LESS DISTURBED SOILS.

INSTALLATION NOTES:

1. BEGIN AT THE LOCATION WHERE THE WATTLE IS TO BE INSTALLED BY EXCAVATING A 2–3" DEEP X 9" WIDE TRENCH ALONG THE CONTOUR OF THE SLOPE. EXCAVATED SOIL SHOULD BE PLACED UPSLOPE FROM THE ANCHOR TRENCH.
2. PLACE THE WATTLE IN THE TRENCH SO THAT IT CONTOURS TO THE SOIL SURFACE. COMPACT SOIL FROM THE EXCAVATED TRENCH AGAINST THE WATTLE ON THE UPHILL SIDE. ADJACENT WATTLES SHOULD TIGHTLY ABUT.
3. SECURE THE WATTLE WITH 18–24" HARDWOOD STAKES EVERY 3–4' AND WITH A STAKE ON EACH END. STAKES SHOULD BE DRIVEN THROUGH THE MIDDLE OF THE WATTLE LEAVING AT LEAST 2–3" OF STAKE EXTENDING ABOVE THE WATTLE. STAKES SHOULD BE DRIVEN PERPENDICULAR TO THE SLOPE FACE.

File: Straw_Wattle.dwg

*** DETAIL AND PICTURE PROVIDED BY TENSAR NORTH AMERICAN GREEN**

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SEC-5

STRAW WATTLE * (1 OF 2)

BMP PICTURE

STRAW WATTLE – SHALLOW SLOPE (≤4:1)
(ALTERNATE STAKING)

ALTERNATE STAKING INSTALLATION NOTES:

1. ON SHALLOW SLOPES (≤4:1), STRAW WATTLE MAY BE SECURED WITH 18–24" HARDWOOD STAKES DRIVEN AGAINST THE SIDES OF THE WATTLE INSTEAD OF THROUGH. STAKES SHALL ALTERNATE SIDES, AND BE SPACED 3–4' MAX.
2. TWINE SHALL BE TIED FROM STAKE TO STAKE, CRISS–CROSSING THE STRAW WATTLE. TIE TWINE TO STAKES BELOW THE HEIGHT OF THE WATTLE.

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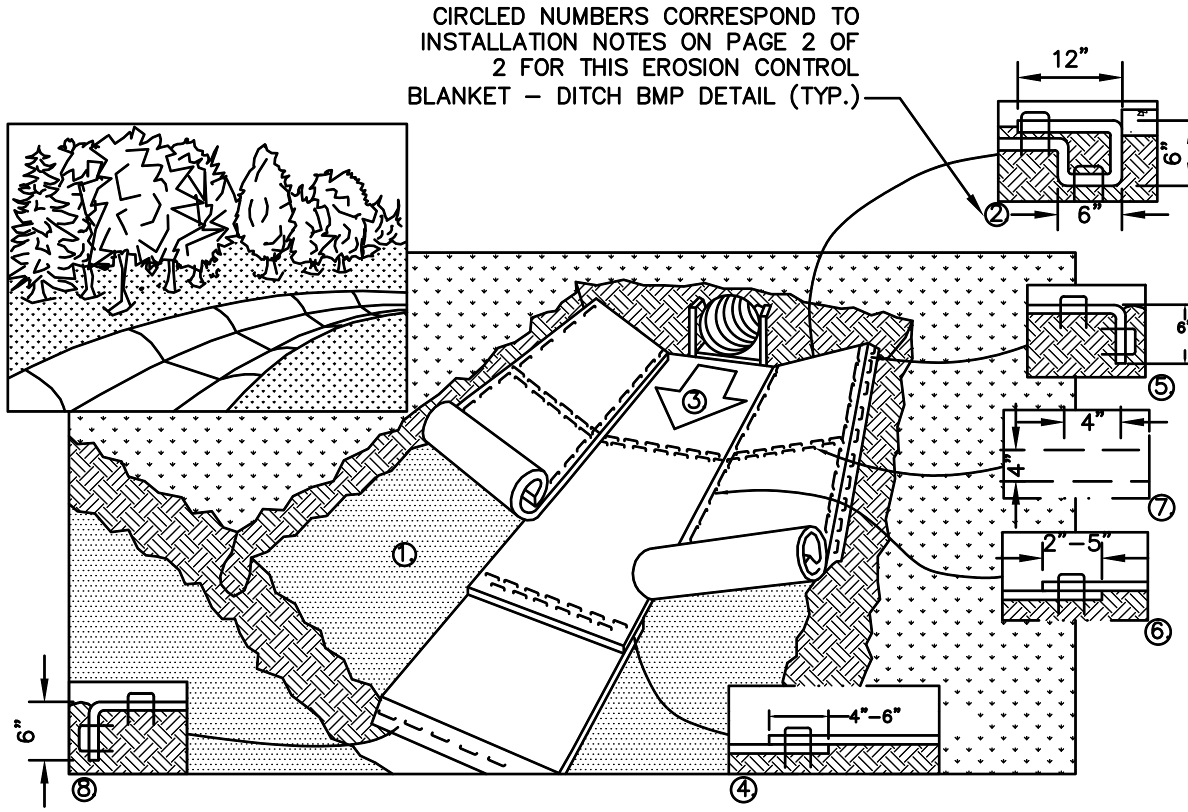
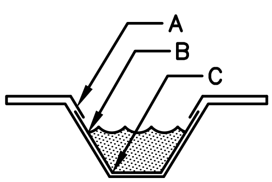
BMP DETAIL

SCALE: NONE





CRITICAL POINTS

A. OVERLAPS AND SEAMS
B. PROJECTED WATER LINE
C. CHANNEL BOTTOM/SIDE SLOPE VERTICES

NOTES:

1. PRODUCT TO BE NORTH AMERICAN GREEN EROSION CONTROL BLANKET OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. HORIZONTAL STAPLE SPACING SHOULD BE ALTERED IF NECESSARY TO ALLOW STAPLES TO SECURE THE CRITICAL POINTS ALONG THE CHANNEL SURFACE.
3. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY ANCHOR THE ROLLED EROSION CONTROL PRODUCTS (RECP's).

*** PICTURE AND DETAIL PROVIDED BY TENSAR NORTH AMERICAN GREEN**
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SEC-6
EROSION CONTROL BLANKET - DITCH * (1 OF 2)

File: Erosion_Blanket_Ditch.dwg

BMP DETAIL

INSTALLATION NOTES:

1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE CHANNEL BY ANCHORING THE RECP's IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30 CM) OF RECP's EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE RECP's WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMAPCT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF RECP's BACK OVER SEED AND COMPACTED SOIL. SECURE RECP's OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) ACROSS THE WIDTH OF THE RECP's.
3. ROLL CENTER RECP's IN DIRECTION OF WATER FLOW IN BOTTOM OF CHANNEL. RECP's WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP's MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. ™ WHEN USING THE DOT SYSTEM , STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. PLACE CONSECUTIVE RECP's END OVER END (SHINGLE STYLE) WITH A 4" – 6" (10 CM –15 CM) OVERLAP. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER TO SECURE RECP's.
5. FULL LENGTH EDGE OF RECP's AT TOP OF SIDE SLOPES MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
6. ADJACENT RECP's MUST BE OVERLAPPED APPROXIMATELY 2" – 5" (5 CM –12.5 CM) (DEPENDING ON RECP's TYPE) AND STAPLED.
7. IN HIGH FLOW CHANNEL APPLICATIONS, A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FOOT (9 M – 12 M) INTERVALS. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER OVER ENTIRE WIDTH OF THE CHANNEL.
8. THE TERMINAL END OF THE RECP's MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.

BMP PICTURE

*** PICTURE AND DETAIL PROVIDED BY TENSAR NORTH AMERICAN GREEN**

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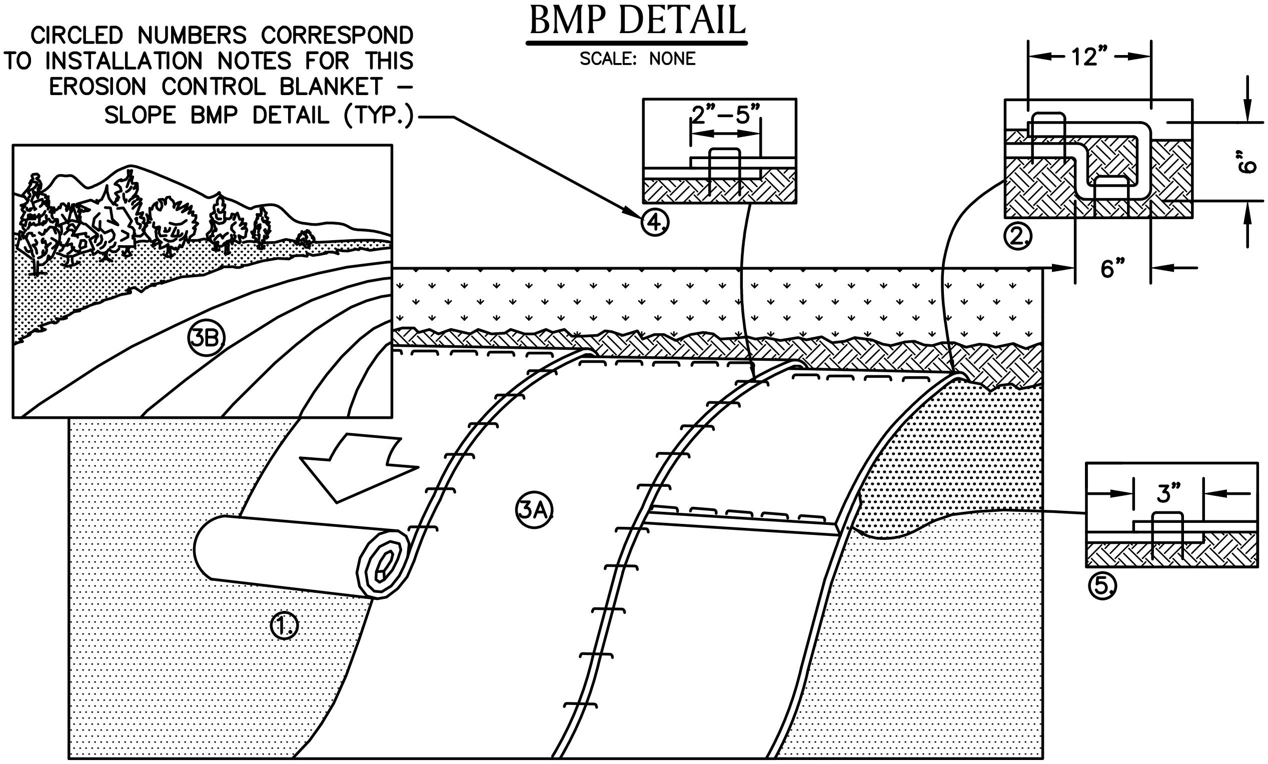
SEC-6
EROSION CONTROL BLANKET - DITCH * (2 OF 2)

BMP DETAIL

SCALE: NONE



NOTES:

1. PRODUCT TO BE NORTH AMERICAN GREEN EROSION CONTROL BLANKET OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLES OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY SECURE THE RECP's.

INSTALLATION NOTES:

1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL–O–SEED DO NOT SEED PREPARED AREA. CELL–O–SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE RECP's IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30 CM) OF RECP's EXTENDED BEYOND THE UP–SLOPE PORTION OF THE TRENCH. ANCHOR THE RECP's WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF RECP's BACK OVER SEED AND COMPACTED SOIL. SECURE RECP's OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) APART ACROSS THE WIDTH OF THE RECP's.
3. ROLL THE RECP's (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. RECP's WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP's MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES ™IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM , STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGES OF PARALLEL RECP's MUST BE STAPLED WITH APPROXIMATELY 2" – 5" (5 CM – 12.5 CM) OVERLAP DEPENDING ON RECP's TYPE.
5. CONSECUTIVE RECP's SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" (7.5 CM) OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" (30 CM) APART ACROSS ENTIRE RECP's WIDTH.

BMP PICTURE

* PICTURE AND DETAIL PROVIDED BY TENSAR NORTH AMERICAN GREEN

SEC-7
EROSION CONTROL BLANKET - SLOPE * (2 OF 2)

BMP PICTURE

NOTES:

1. COORDINATE MIXTURE TYPE AND APPLICATION AREAS WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST PRIOR TO CONSTRUCTION.
2. A MINIMUM OF 1500 LBS. PER ACRE OF A PAPER/CORN FIBER OR EQUIVALENT WITH NATURAL TACKIFIERS WILL BE USED ON SLOPES LESS THAN 3:1.
3. A BFM (BONDED FIBER MATRIX) WILL BE USED ON SLOPES GREATER THAN 2:1.
4. A FGM (FLEXIBLE GROWTH MATRIX) OR ESM (EXTREME SLOPE MATRIX) WILL BE USED ON SLOPES GREATER THAN 1:1.
5. REFER TO BMP #10 FOR SEED MIXTURE OPTIONS.

*** PICTURE PROVIDED BY TENSAR NORTH AMERICAN GREEN**
*** TACKIFIER INFORMATION PROVIDED BY FILTREXX LAND IMPROVEMENT SYSTEMS AND TENSAR NORTH AMERICAN GREEN**

SEC-8
HYDROSEEDING WITH TACKIFIER
(SLOPE STABILIZATION) *

BMP

Definition

Applying coarse plant residue or chips, or other suitable materials, to cover the soil surface.

Purpose

The primary purpose is to provide initial erosion control while a seeding or shrub planting is establishing. Mulch will conserve moisture and modify the surface soil temperature and reduce fluctuation of both. Mulch will prevent soil surface crusting and aid in weed control. Mulch is also used alone for temporary stabilization in non-growing months.

Conditions Where Practice Applies

On soils subject to erosion and on new seedings and shrub plantings. Mulch is useful on soils with low infiltration rates by retarding runoff.

Criteria

Site preparation prior to mulching requires the installation of necessary erosion control or water management practices and drainage systems.

Slope, grade and smooth the site to fit needs of selected mulch products.

Remove all undesirable stones and other debris to meet the needs of the anticipated land use and maintenance required.

Apply mulch after soil amendments and planting is accomplished or simultaneously if hydroseeding is used.

Select appropriate mulch material and application rate or material needs. Determine local availability.

Select appropriate mulch anchoring material.

NOTE: The best combination for grass/legume establishment is straw (cereal grain) mulch applied at 2 ton/acre (90 lbs./1000sq.ft.) and anchored with wood fiber mulch (hydromulch) at 500 – 750 lbs./acre (11 – 17 lbs./1000 sq. ft.). The wood fiber mulch must be applied through a hydroseeder immediately after mulching.

NOTE:

1. PICTURE DEPICTS STRAW MULCH APPLICATION (FROM MULCH SPREADER) ON STEEP SLOPE WITH AN IMPROVED DRAINAGE SWALE.
2. COORDINATE MULCH MATERIALS AND RATES WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

* BMP INFORMATION FROM "NEW YORK STANDARDS AND SPECIFICATIONS FOR EROSION AND SEDIMENT CONTROL (AUGUST, 2005)." INFORMATION OBTAINED VIA WEBSITE: http://www.dec.ny.gov/chemical/29066.html

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SEC-9

MULCH MATERIALS, RATES AND USES (FROM NY) *

UPLAND ROW RESTORATION MIX – GENERAL

Species Composition Options:

- Andropogon gerardii; Niagra Big Bluestem
- Schizachyrium scoparium; Little Bluestem
- Elymus Canadensis; Canada Wild Rye
- Elymus virginicus; Virginia Wildrye
- Lolium multiflorum; Annual Ryegrass
- Sorghastrum nutans; Indiangrass
- Chamaecrista fasciculate; Partridge Pea
- Desmodium canadense; Showy Tick Trefoil
- Helioposis helianthoides; Ox–Eye Sunflower
- Panicum virgatum; Switchgrass
- Rudbeckia hirta; Black Eyed Susan
- Poa palustris; Fowl Bluegrass
- Agrostis perennans; Upland Bentgrass
- Agrostis alba; Redtop
- Festuca rubra; Red Fescue
- Lotus corniculatus; Birds–Foot Trefoil
- Chrysanthemum leucanthem; Ox–Eye Daisy
- Aster novae–angliae; New England Aster

Example Seed Mixes:

1. Native Upland wildlife forage and Cover Meadow Mix – Ernst Conservation Seeds (ERNMX–123)
2. Eastern Ecotype Native Grass Mix– Ernst Conservation Seeds (ERNMX–177)
3. New England Native Warm Season Grass Mix – New England Wetland Plants, Inc.
4. New England Logging Road Mix – New England Wetland Plants, Inc.
5. Northeast Upland Wildflower/Restoration Erosion Mix – Southern Tier Consulting (STCMX–2)

UPLAND ROW RESTORATION MIX – DRY/ROCKY SITES

Species Composition Options:

- Festuca rubra; Red Fescue
- Schizachyrium scoparium; Little Bluestem
- Elymus Canadensis; Canada Wild Rye
- Bouteloua gracillis; Blue Grama
- Lolium multiflorum; Annual Ryegrass
- Lolium perenne; Perennial Ryegrass
- Agrostics scabra; Rough Bentgrass
- Agrostis perennans; Upland Bentgrass
- Sorghastrum nutans; Indiangrass

Example Seed Mixes:

1. New England Erosion Control/ Restoration Mix for Dry Sites – New England Wetland Plants, Inc.
2. Ernst Conservation Seeds and similar companies can create a custom seed mix matching the composition above (with site specific additions if necessary).

WETLAND ROW RESTORATION MIX

Species Composition Options:

- Agrostis stolonifera; Creeping Bentgrass
- Poa trivialis; Rough Bluegrass
- Alopecurus arundinaceus; Creeping Meadow Foxtail
- Lolium multiflorum; Annual Ryegrass
- Festuca rubra; Creeping Red Fescue
- Elymus virginicus; Virginia Wildrye
- Schizachyrium scoparium; Little Bluestem
- Andropogon gerardii; Niagra Big Bluestem
- Carex vulpinoidea; Fox sedge
- Panicum virgatum; Switchgrass
- Agrostis scabra; Rough Bentgrass
- Aster novae-angliae; New England Aster
- Eupatorium perfoliatum; Boneset
- Euthamia graminifolia; Grass Leaved Goldenrod
- Scirpus atrovirens; Green Bulrush
- Verbene hastate; Blue Vervain
- Juncus effusus; Soft Rush
- Scirpus cyperinus; Wool Grass
- Panicum clandestinum; Deertongue

Example Seed Mixes

1. New England Erosion Control/Restoration Mix for Detention Basins and Moist Sites – New England Wetland Plants, Inc.
2. Northeast Wetland Grass Seed Mix – Southern Tier Consulting (STCMX-7)
3. Ernst Conservation Seeds and similar companies can create a custom seed mix matching the composition above (with site specific additions if necessary).

GERNERAL NOTES:

1. Seed mixes described herein are intended to cover a variety of typical new england landscapes. However, site specific seed mixes will need to be evaluated in coastal or mountainous regions.
2. Seed mixes described herein are intended for general ROW restoration. Site specific wetland seed mixes may be required by local, state and/or federal regulators for certain impacts to wetlands.
3. All seed mixes are to be approved by National Grid Environmental Scientist prior to construction and must conform with all project permits.
4. Seedbed preparation and maintenance as well as temporary erosion and sediment controls are crucial to the establishment of newly seeded areas. Coordinate with National Grid Environmental Scientist on seed bed preparation and maintenance as well as temporary erosion and sediment controls prior to construction.

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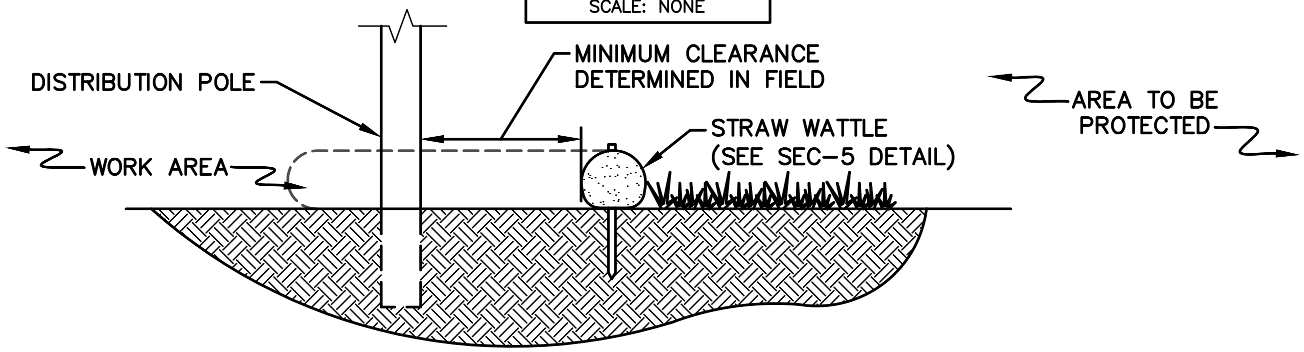
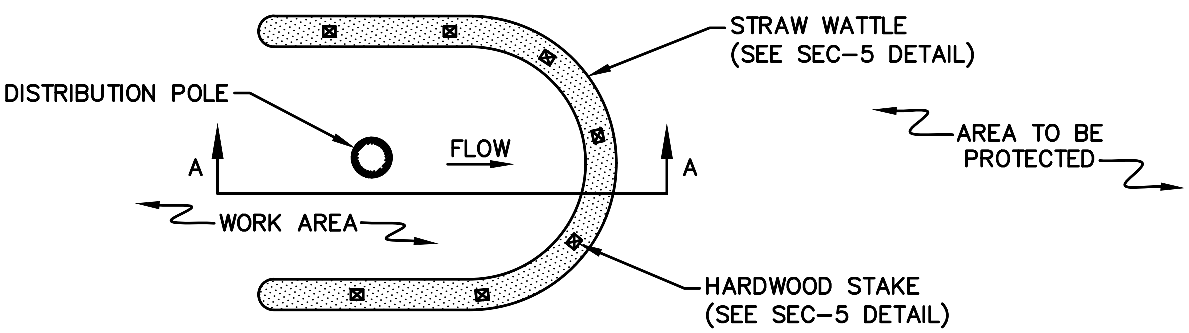
BMP DETAIL

SCALE: NONE



SECTION A-A



PLAN

NOTES

1. PRODUCT TO BE STRAW WATTLE OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST (SEE SEC-5 BMP DETAIL).
2. STRAW BALE BARRIER PER SEC-1 BMP DETAIL TO BE AN AVAILABLE ALTERNATE DEPENDING ON SITE CONDITIONS AT THE DIRECTION OF NATIONAL GRID ENVIRONMENTAL SCIENTIST (SEE FIGURE 2).
3. MINIMUM CLEARANCE BETWEEN POLE AND EROSION CONTROL TO BE DETERMINED BY CONDITIONS OF POLE INSTALLATION/REPLACEMENT WORK AND ASSOCIATED DISTURBANCE.

BMP PICTURE

FIGURE 1: TYP. STRAW WATTLE APPLICATION

FIGURE 2: ALT. STRAW BALE APPLICATION

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SEC-12
DISTRIBUTION POLE
SEDIMENT CONTROL

File: SiltSOXX.dwg

BMP PICTURE

SCALE: NONE

NOTES:

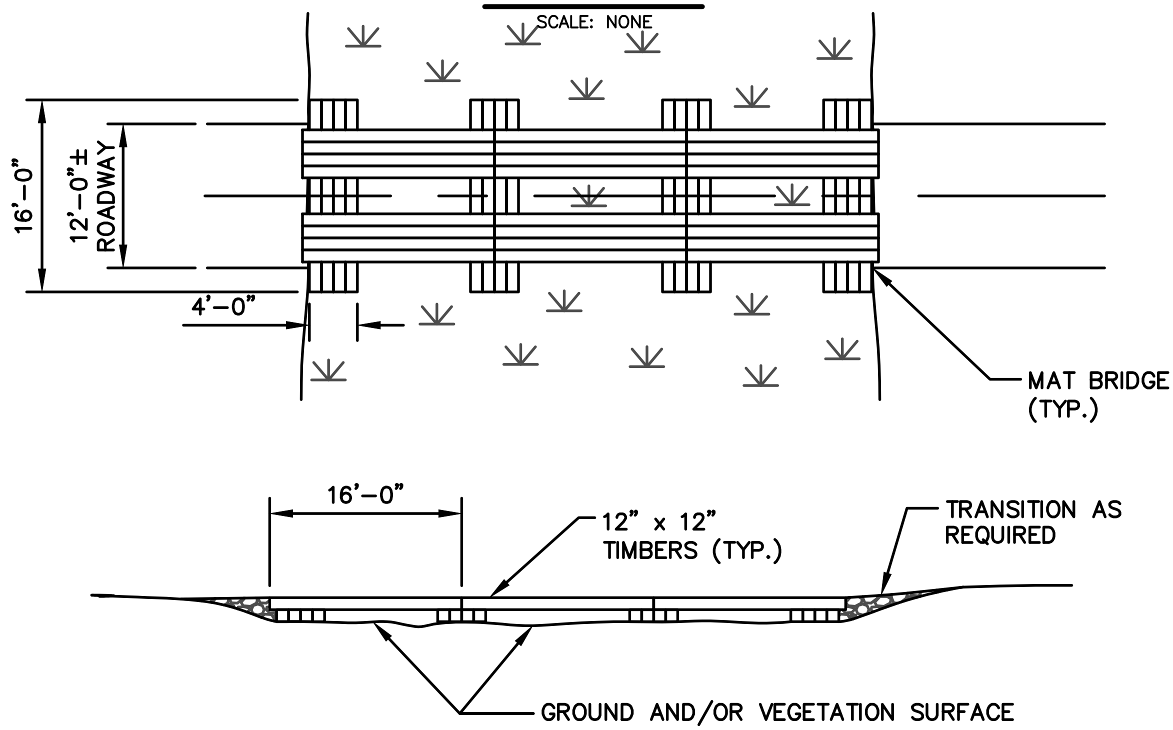
1. PRODUCT TO BE ALTURNAMATS' PREFABRICATED MATS OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. PRODUCT AVAILABLE IN 4X8' UNITS.
3. IF MATS ARE INSTALLED IN A WETLAND AREA, INSTALL EROSION CONTROLS TO CONTAIN MATERIAL UTILIZED IN THE MAT TRANSITIONS.

File: Prefab_Mats.dwg

*** PICTURE PROVIDED BY ALTURNAMATS**

CM-1
PREFABRICATED MATS *

BMP DETAIL



NOTES:

1. IF MATS ARE INSTALLED IN A WETLAND AREA, INSTALL EROSION CONTROLS TO CONTAIN MATERIAL UTILIZED IN THE MAT TRANSITIONS.

BMP PICTURE

CM-2
CONSTRUCTION MAT BRIDGE
(1 OF 2)

BMP PICTURE - SINGLE SPAN

SCALE: NONE

NOTES:

1. WHERE STREAM WIDTH ALLOWS, INSTALL CONSTRUCTION MATS TO SPAN THE WATERCOURSE IN ITS ENTIRETY WITHOUT STRINGER PLACEMENT IN THE WATER OR ANY RESTRICTION OF STREAM FLOW.

2. INSTALLATION OF THE CONSTRUCTION MAT BRIDGE SHALL NOT DAMAGE THE STREAM BED AND BANKS. WHERE POSSIBLE, FOOTERS SHALL BE PLACED PARALLEL TO THE TOP OF THE STREAM BANKS, WITH ACCESS MATTING PLACED ACROSS THE TOP OF THE STRINGERS DISTRIBUTING THE WEIGHT OF THE CONSTRUCTION EQUIPMENT.

3. AT STREAM CROSSINGS THAT CANNOT BE SPANNED BY A SINGLE SECTION OF CONSTRUCTION MATTING, AND WHERE PERMITS ALLOW, STRINGERS SHALL BE PLACED ATOP THE STREAM BED PARALLEL TO THE FLOW OF WATER.

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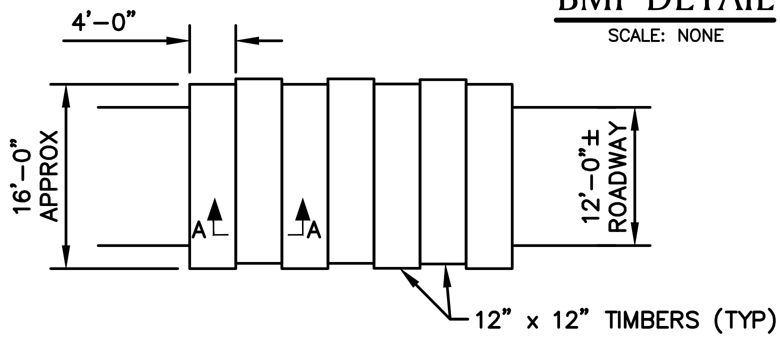
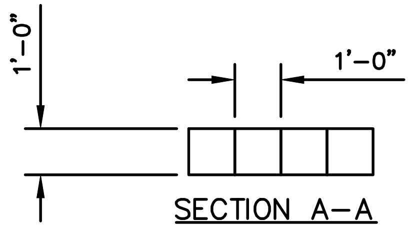
BMP DETAIL

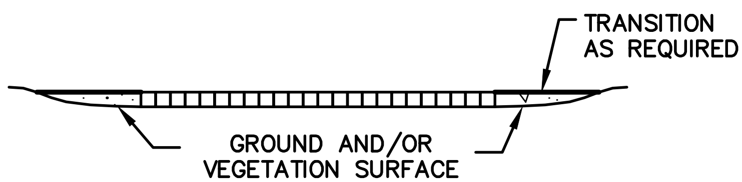
SCALE: NONE



TYPICAL PLAN VIEW



SECTION A–A
TYPICAL MAT SECTION BOLTED TOGETHER



TYPICAL SECTION VIEW

NOTES:

1. TO BE INSTALLED IF NECESSARY TO PREVENT RUTTING, TO ACCESS STRUCTURES.
2. THIS DETAIL SHOWS TYPICAL DIMENSIONS. SOME CONTRACTOR'S CONSTRUCTION MATS ARE DIMENSIONALLY DIFFERENT FROM WHAT IS SHOWN HERE.
3. DEPENDENT ON SITE CONDITIONS, MULTIPLE LAYERS OF CONSTRUCTION MATS MAY BE INSTALLED.

BMP PICTURE

File: Swamp_Mat_Layout.dwg

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CM-3
CONSTRUCTION MAT LAYOUT
(WITH TRANSITION)

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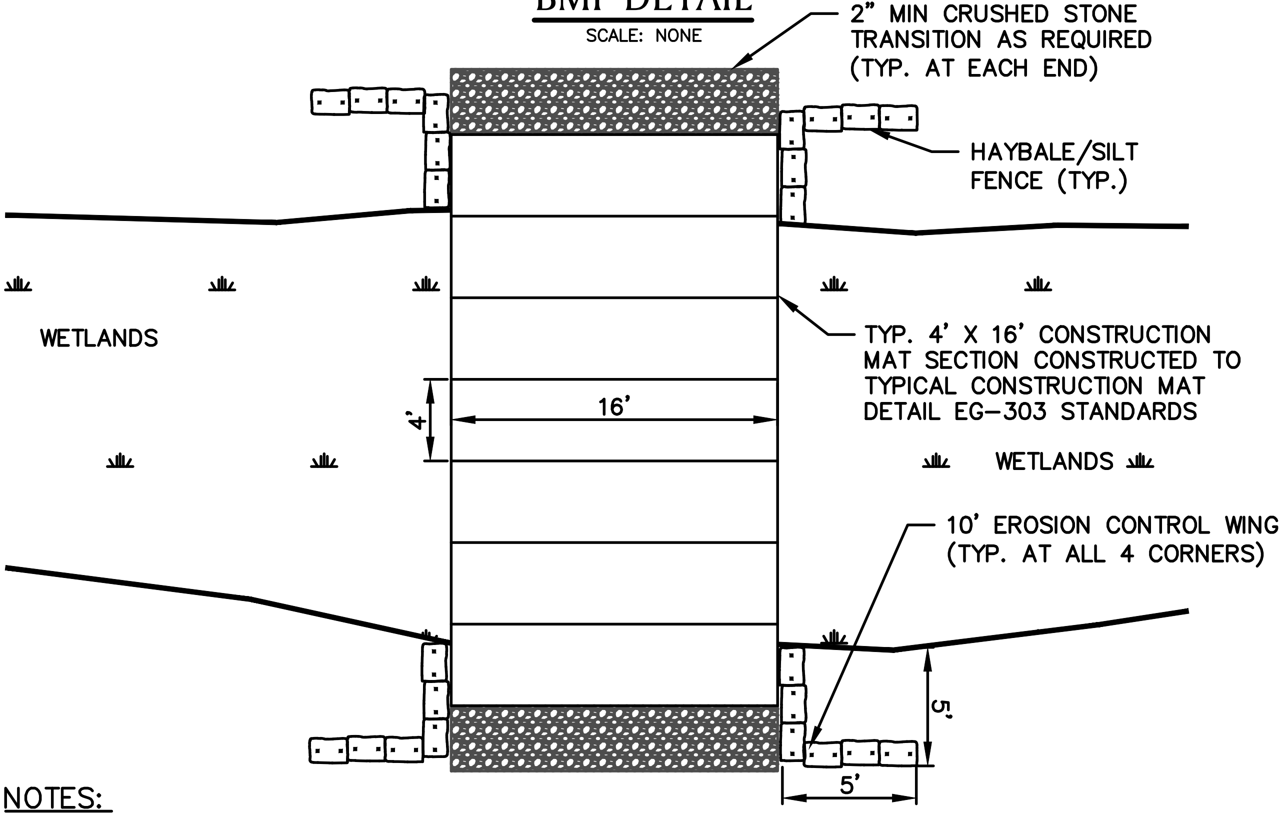
BMP DETAIL

SCALE: NONE



NOTES:
1. ADD FILTER FABRIC AS NEEDED UNDER STONE TRANSITION RAMPS.
2. ALL MEASUREMENTS AND LOCATIONS ARE APPROXIMATE.

BMP PICTURE

File: Swamp_Mat_Transition and BMPs.dwg

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CM-4
CONSTRUCTION MAT LAYOUT
(WITH TRANSITION AND BMPs)

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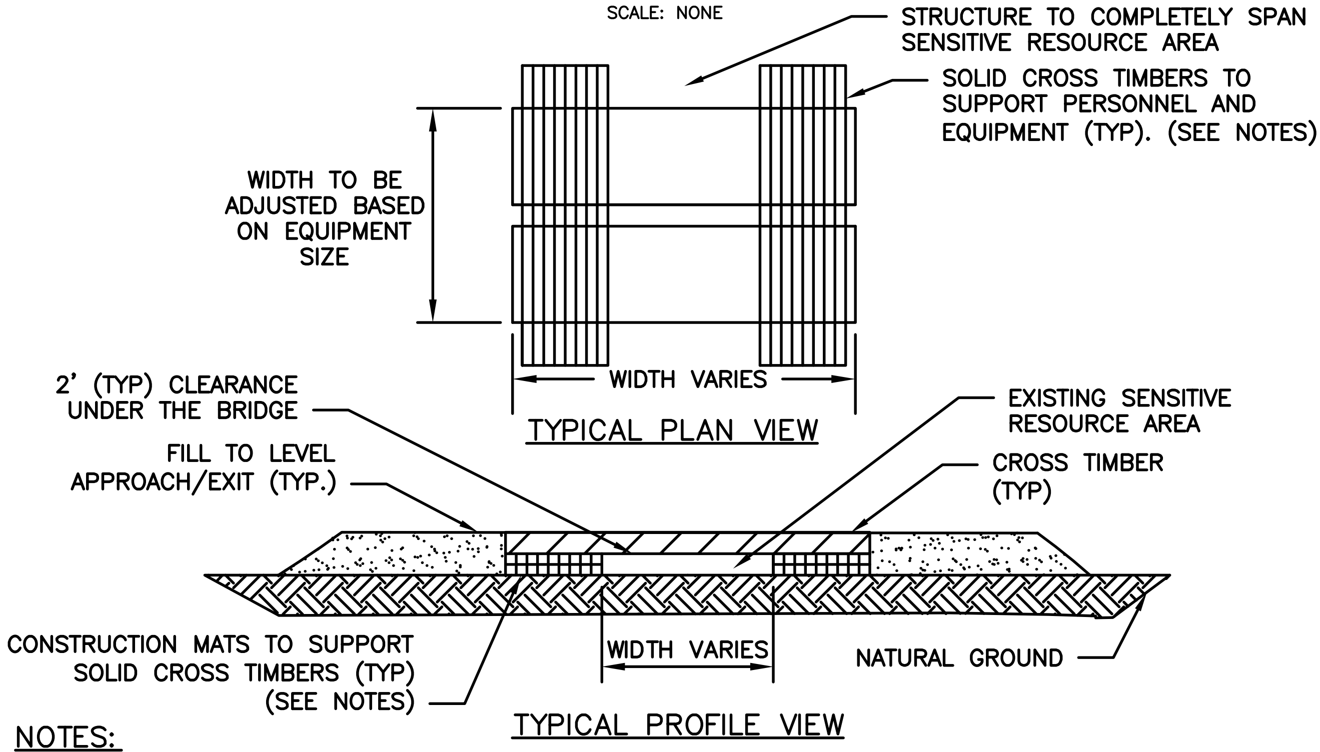
BMP DETAIL

SCALE: NONE



NOTES:

1. THE DETAIL SHOWN IS CONCEPTUAL. CONSTRUCTION MATS AND CROSS TIMBERS SHALL BE SIZED AND SELECTED BASED ON SPAN WIDTH, CROSSING EQUIPMENT AND FIELD CONDITIONS.
2. THE NUMBER OF CONSTRUCTION MATS MAY VARY DEPENDING ON THE CLEARANCE HEIGHT.
3. EQUIPMENT AND PERSONNEL LOAD SHALL BE DISTRIBUTED ON ALL TIMBERS.
4. EACH EQUIPMENT OPERATOR AND USER OF THE FIELD BRIDGE SHALL BE FAMILIAR WITH THE DESIGN AND THE MAXIMUM EQUIPMENT AND PERSONNEL LOADS.
5. THIS DETAIL MAY NOT BE APPLICABLE IN ALL FIELD CONDITIONS.
6. INSTALL EROSION CONTROLS ADJACENT TO THE CULVERT ENDS TO PROTECT THE WATERWAY FROM ROADWAY DEBRIS.

BMP PICTURE

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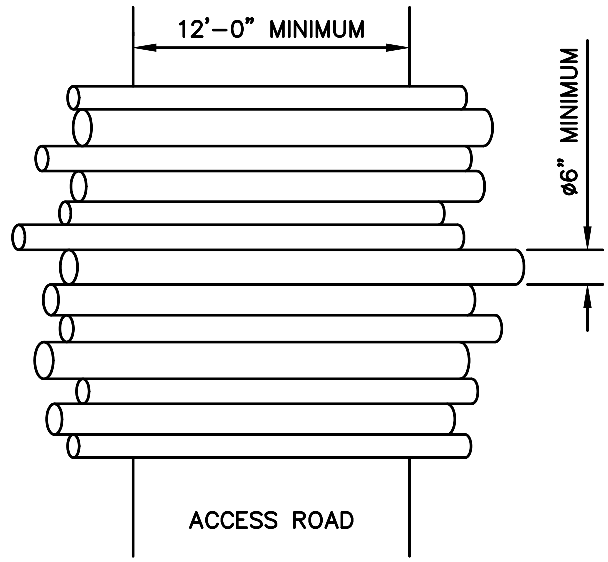
CM-5
CONSTRUCTION MAT - AIR BRIDGE

File: Swamp_Mat_AIR BRIDGE.dwg

BMP DETAIL

SCALE: NONE



RANDOM LENGTH AND DIAMETER LOGS PLACED ACROSS AN ACCESS ROAD

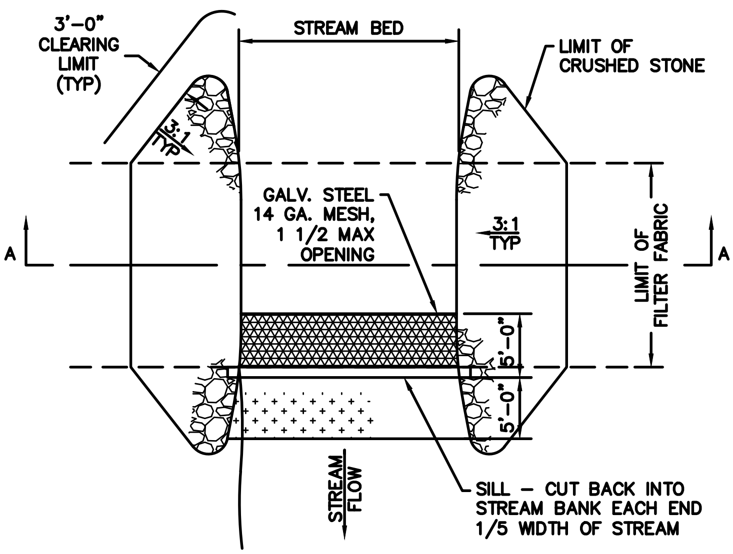
NOTE:

1. A SIMILAR BRUSH MAT INSTALLATION CONSISTING OF SMALLER DIAMETER STEMS AND LOGS CAN BE USED.
2. CORDUROY ROADS SHALL ONLY BE USED IN EMERGENCIES OR AFTER APPROVAL FROM THE PROJECT ENVIRONMENTAL CONSULTANT OR NATIONAL GRID ENVIRONMENTAL SCIENTIST.

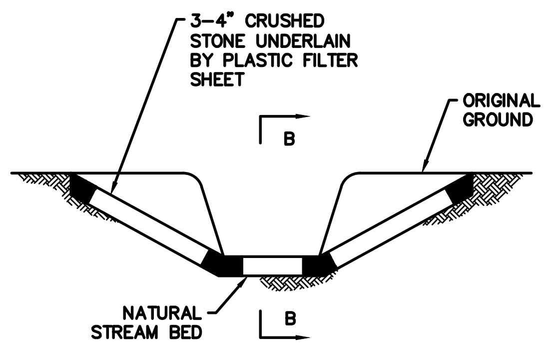
BMP PICTURE

BMP DETAIL

SCALE: NONE



PLAN VIEW



SECTION 'A–A'

BMP PICTURE

File: Rock_Ford.dwg

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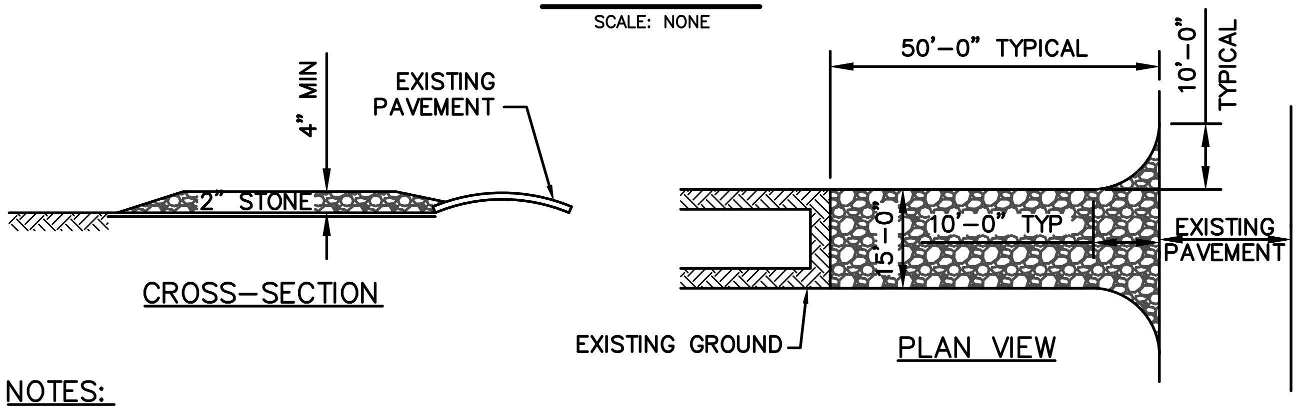
CM-7
ROCK FORD

BMP DETAIL

SCALE: NONE



NOTES:

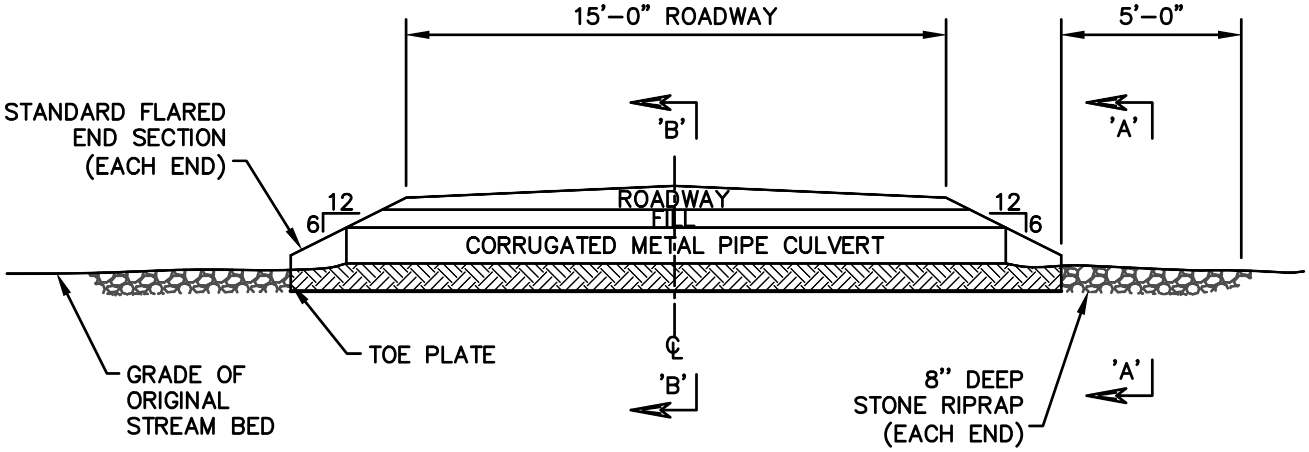
1. STONE SIZE – USE 2" STONE (MINIMUM) TO 6" STONE (MAXIMUM)
2. LENGTH – GREATER THAN OR EQUAL TO 50 FEET
3. THICKNESS – 4"
4. WIDTH – FIFTEEN (15) FOOT TYP., BUT NOT LESS THAN FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. SURFACE WATER – ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS ENTRANCE. IF PIPING IS IMPRACTICAL, MOUNTABLE BERM SHALL BE PERMITTED.
6. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH SHALL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS–OF–WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS–OF–WAY MUST BE REMOVED IMMEDIATELY.
7. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED.
8. THE CLEAN STONE SHOULD BE INSTALLED OVER A GEOTEXTILE FABRIC. GEOTEXTILE FABRIC MAY BE OMITTED FOR PERMANENT CONSTRUCTION ENTRANCES/EXITS ON A CASE–BY–CASE BASIS WITH THE APPROVAL OF THE NATIONAL GRID ENVIRONMENTAL SCIENTIST.
9. FOLLOWING CONSTRUCTION, THE CONSTRUCTION ENTRANCE/EXIT SHALL BE REMOVED AND THE AREA GRADED, SEEDED, AND MULCHED AS NEEDED. ENTRANCE/EXITS MAY REMAIN DEPENDING UPON FUTURE ACCESS NEEDS AND/OR PROJECT–SPECIFIC APPROVALS BUT REQUIRES APPROVALS FROM THE NATIONAL GRID ENVIRONMENTAL SCIENTIST AND PROPERTY LEGAL.

BMP PICTURE

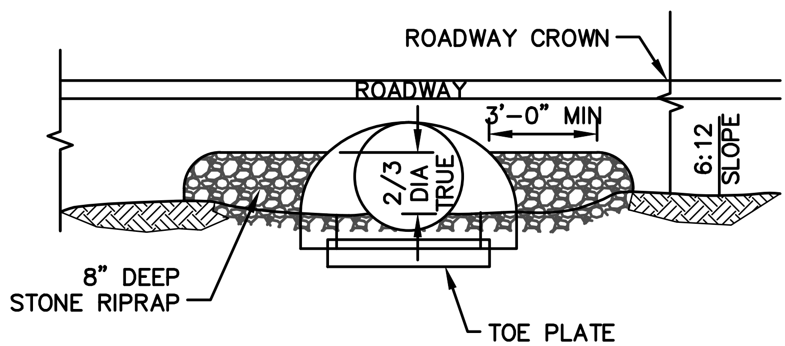
CM-8
TEMPORARY CONSTRUCTION ENTRANCE/ EXIT

BMP DETAIL

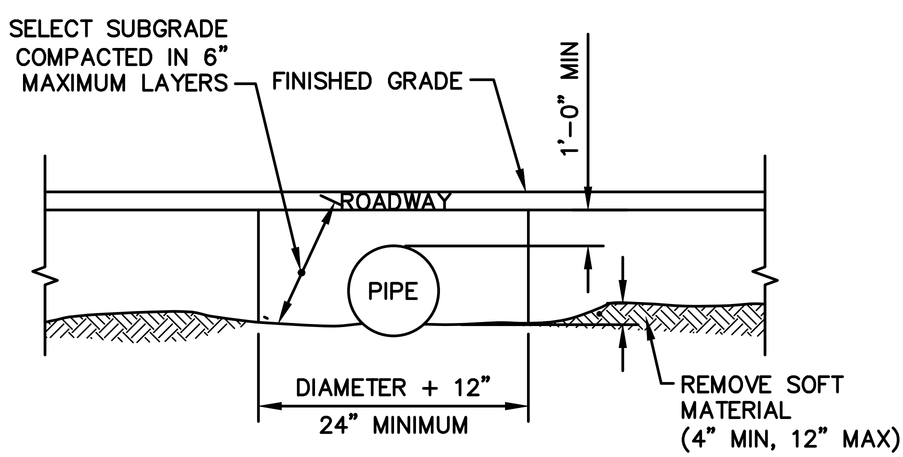
SCALE: NONE



CROSS SECTION



SECTION 'A–A'
(SAME BOTH ENDS)



SECTION 'B–B'

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CM-9
TEMPORARY CONSTRUCTION CULVERT (1 OF 2)

File: Temp_Constr_Culvert.dwg

BMP DETAIL

SCALE: NONE

NOTES:

1. CULVERT DESIGN AND LAYOUT SHALL BE COORDINATED WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST (NGES).
2. CROWN ROADWAY 1/2 INCH PER FOOT.
3. LAY THE CULVERT STRAIGHT AND AS NEARLY AS POSSIBLE ALONG THE EXISTING STREAM BED AND WITH THE INVERTS AT OR SLIGHTLY BELOW BED ELEVATION.
4. CORRUGATED METAL PIPE IS TO BE GALVANIZED STEEL, OR ALUMINIZED STEEL (TYPE 2), WITH BOLTED CONNECTORS.
5. DIAMETERS SHALL BE AS PER THE PROJECT DRAWINGS AND THE SPECIFICATION. THE PIPE GAGE SHALL BE AS FOLLOWS:

DIAMETER (INCHES)	GAGE
12" – 15"	.004"
18" – 24"	.079"
30" – 36"	.109"

6. INSTALLATION OF CULVERTS LARGER THAN 36 INCH DIAMETER SHALL REQUIRE SPECIAL ENGINEERING DESIGN.
7. SELECT SUBGRADE SHALL BE A GRANULAR MATERIAL AS DESCRIBED IN NYSDOT SPECIFICATION ITEM 203–2.02C, OR AS APPROVED BY A NGES.
8. STONE RIPRAP SHALL BE AS DESCRIBED IN NYSDOT SPECIFICATION ITEM 203–2.02D, WITH 8 INCH MAXIMUM SIZE, OR AS APPROVED BY A NGES. EXCEPT WHERE PROTECTED BY STONE, ALL EMBANKMENT SLOPES ARE TO BE STABILIZED, MULCHED AND SEEDED AS PER PROJECT SPECIFICATIONS.
9. OUTLET SHOULD BE CONFIGURED NOT TO CREATE HYDRAULIC JUMP OR PLUNGE POOL.
10. INSTALL EROSION CONTROLS ADJACENT TO THE CULVERT ENDS TO PROTECT THE WATERWAY FROM ROADWAY DEBRIS.

BMP PICTURE

BMP PICTURE

NOTE:

1. PICTURE SHOWS VIEW OF ACCESS WAY STABILIZATION ADJACENT TO A WETLAND.
2. COORDINATE STABILIZATION DESIGN AND PRODUCT WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

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BMP PICTURE


NO ACCESS – WETLAND/STREAM CROSSING MATS REQUIRED

NO ACCESS – A.) PROJECT LIMITS E.G. ROW LIMITS
B.) HISTORICAL/CULTURAL
C.) ENVIRONMENTALLY SENSITIVE E.G. THREATENED & ENDANGERED
D.) OTHER

APPROVED ACCESS

File: Construction_Signage.dwg

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CM-11
CONSTRUCTION SIGNAGE

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		Date	11/16/18

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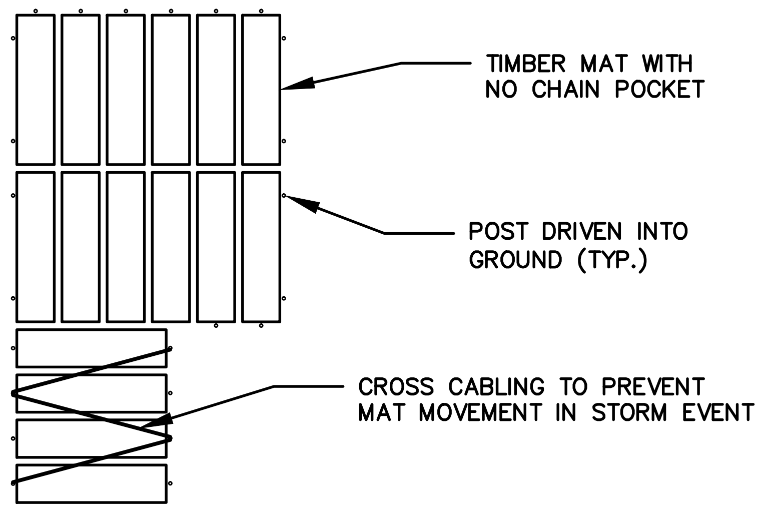
BMP DETAIL 1

SCALE: NONE



TYPICAL PLAN VIEW

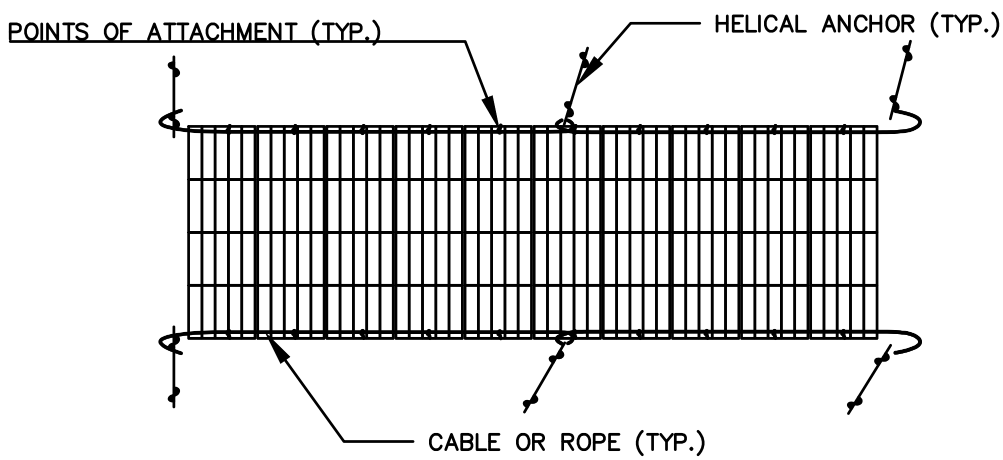
NOTES:

1. EXAMPLES OF ANCHORING ONLY. MATTING CONTRACTOR SHALL PROPOSE THE METHOD OF ANCHORING BASED ON FIELD CONDITIONS.
2. ANCHORING METHOD TO BE APPROVED BY THE NATIONAL GRID ENVIRONMENTAL SCIENTIST AND TRANSMISSION LINE CONSTRUCTION SUPERVISOR.

BMP DETAIL 2

NOTES:

1. TYPICAL HELICAL ANCHOR AND CABLE CONFIGURATION FOR MAT CONTAINMENT IN FLOODPLAINS/LAND SUBJECT TO FLOODING.
2. TYPICAL POINTS OF ATTACHMENT HEAVY STAPLES, EYE BOLTS OR OTHER SUITABLE HARDWARE TO SECURE ATTACHMENT OF MAT TO LINEAR CABLE. IF CHAIN POCKETS ARE PRESENT IN THE MATS CABLE OR ROPE CAN BE LOOPED THROUGH RODS.



File: Const_Mat_Anchoring.dwg

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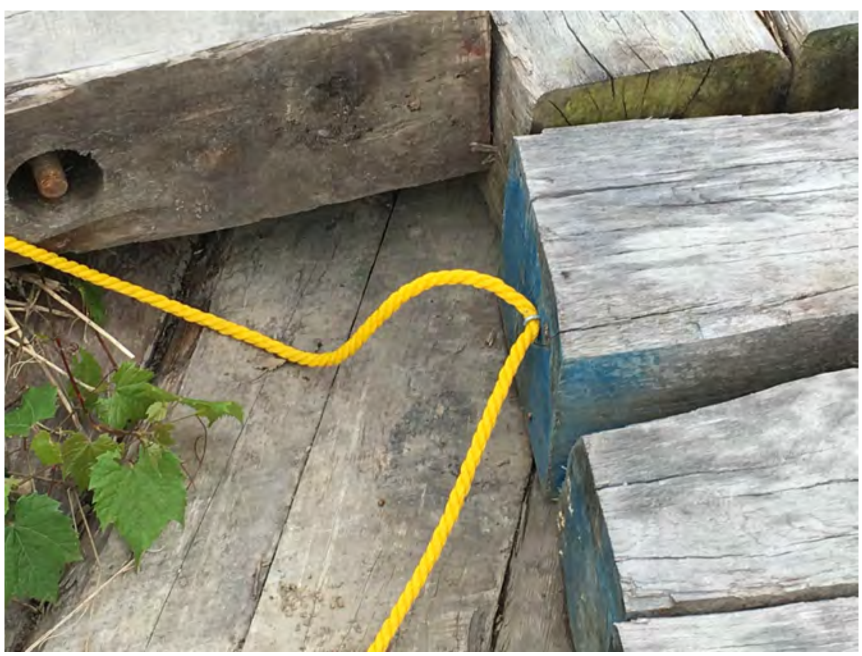
CM-12

EXAMPLE OF CONSTRUCTION MAT ANCHORING (1 OF 2)

BMP PICTURE 1

BMP PICTURE 2

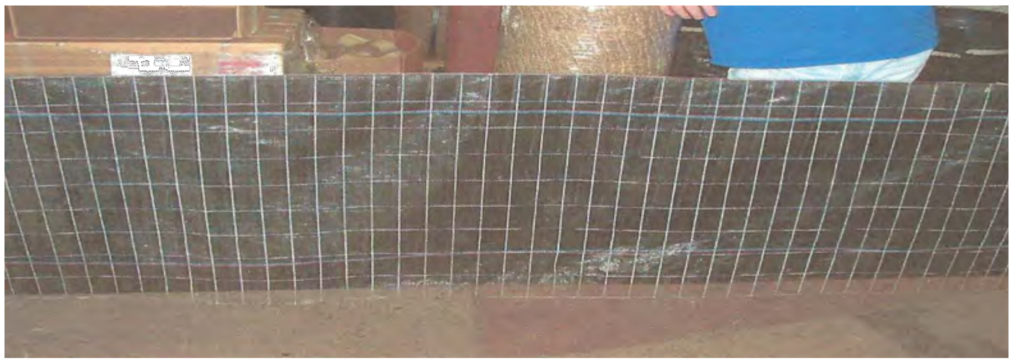


CM-12
EXAMPLE OF CONSTRUCTION MAT ANCHORING (2 OF 2)

BMP DETAIL

SCALE: NONE

WIRE BACKED SILT FENCE



MUTUAL INDUSTRIES WIRE BACKED SILT FENCE
PART # 1776-14-24
36" X 100'
36" MISF 1776 FABRIC
24" 14GA WIRE MESH
OPENING OF MESH 2" X 4"
FABRIC HOG RINGED EVERY 12"-18" ALONG THE TOP OF THE FENCE

ROLL WEIGHT 40 LBS

32 ROLLS PER PALLET

NOTES:

1. PRODUCT TO BE MUTUAL INDUSTRIES' WIRE BACKED SILT FENCE OR APPROVED EQUAL BY NATIONAL ENVIRONMENTAL SCIENTIST.
2. COORDINATE INSTALLATION METHOD AND LOCATION WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

File: Reinforced_Silt_Fence.dwg

* PICTURE AND DETAIL PROVIDED BY MUTUAL INDUSTRIES
APPROVED BY: VICE PRESIDENT, ENVIRONMENTAL SERVICES

AA-1
REINFORCED SILT FENCE *

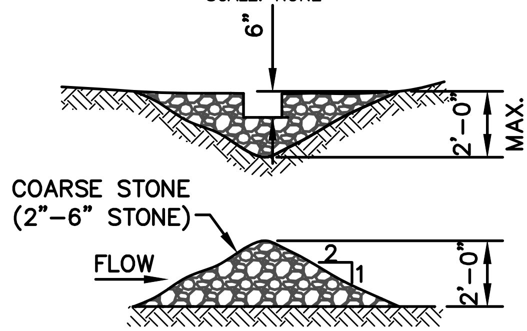
BMP PICTURE

NOTE:

1. PICTURE SHOWS SEDIMENT FILTER WITHIN A WETLAND.

BMP DETAIL

SCALE: NONE



STONE CHECK DAM

NOTES:

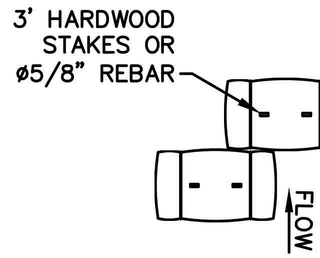
1. USE CHECK DAMS TO SLOW WATER FLOWS AND AS SMALL SEDIMENT TRAPS IN DITCHES ALONG ACCESS ROADS.
2. CLEAN SEDIMENT AND REPLACE DAMS AS NECESSARY.
3. THE CENTER OF THE CHECK DAM MUST BE AT LEAST 6" LOWER THAN THE OUTER EDGES.
4. COORDINATE SPACING WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
5. MAX. SPACING: TOE OF THE UPSTREAM DAM IS SAME ELEVATION AS TOP OF DOWNSTREAM DAM.
6. STONE SHALL BE FREE OF FINE PARTICLES TO PREVENT TURBID DISCHARGES.

BMP PICTURE

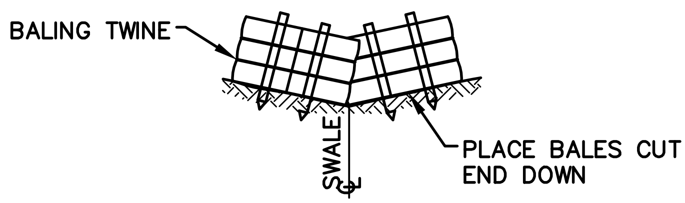
NOTE: A SMALLER STONE SIZE IS SHOWN IN THIS PICTURE.

BMP DETAIL

SCALE: NONE



PLAN VIEW



SECTION VIEW

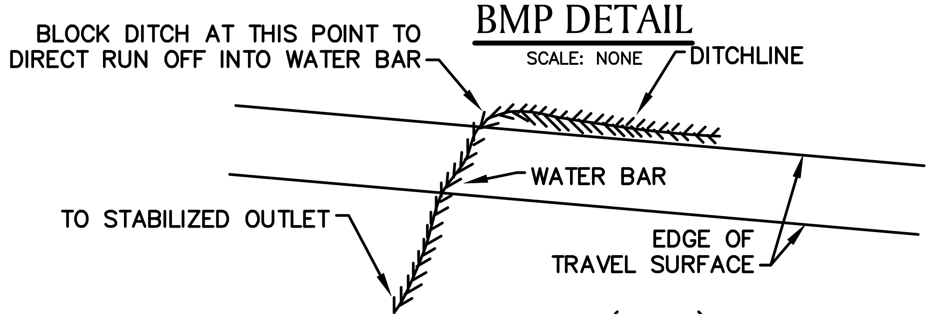
NOTES:

1. USE CHECK DAMS TO SLOW WATER FLOWS AND AS SMALL SEDIMENT TRAPS IN DITCHES ALONG ACCESS ROADS.
2. CLEAN SEDIMENT AND REPLACE DAMS AS NECESSARY.
3. COORDINATE SPACING WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

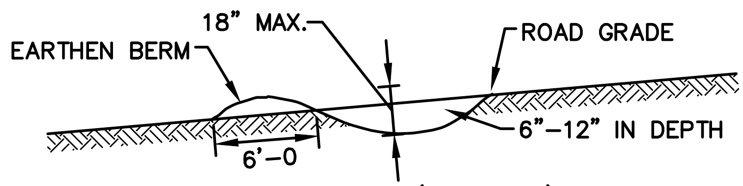
BMP PICTURE

BMP DETAIL

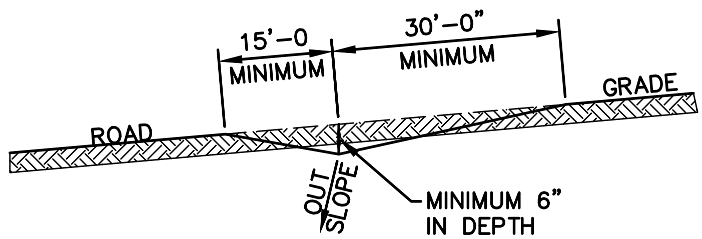
SCALE: NONE



WATERBAR (PLAN)



WATERBAR (SECTION)



DISCHARGE (SECTION)

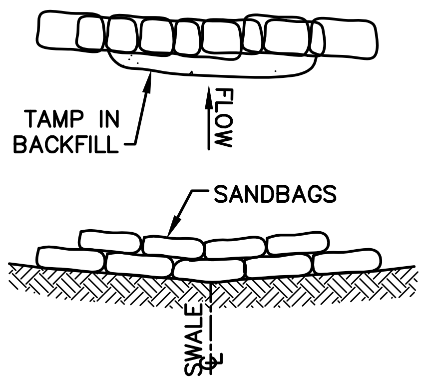
NOTE:

1. LINE WITH 2"–6" STONE UNDERLAIN BY GEOTEXTILE FILTER FABRIC, KEYED INTO ROAD SURFACE AT LEAST 10 FEET EACH SIDE OF WATERBAR.
2. COORDINATE SPACING WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

BMP DETAIL

SCALE: NONE



SANDBAG
CHECK DAM

NOTES:

1. USE CHECK DAMS TO SLOW WATER FLOWS AND AS SMALL SEDIMENT TRAPS IN DITCHES ALONG ACCESS ROADS.
2. CLEAN SEDIMENT AND REPLACE DAMS AS NECESSARY.
3. COORDINATE SPACING WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

NOTE:

1. PICTURE DOES NOT DEPICT "TAMP IN BACKFILL"

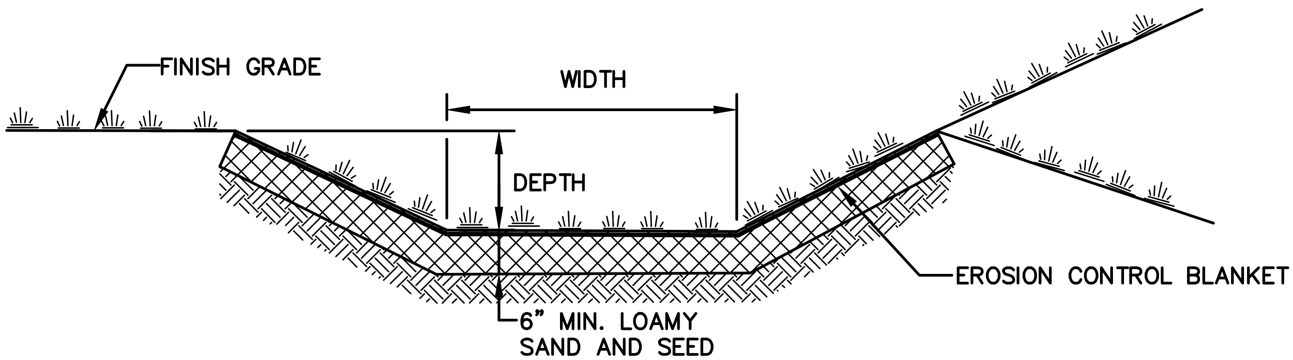
BMP PICTURE

NOTE:

1. EXACT SIZE, LOCATION AND DESIGN IS DEPENDANT ON SITE CONDITIONS, AND LOCAL AND STATE REGULATIONS. COORDINATE THIS BMP WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST PRIOR TO CONSTRUCTION.

BMP DETAIL

SCALE: NONE



NOTES:

1. WIDTH AND DEPTH OF SWALE, AND EROSION CONTROL BLANKET TYPE TO BE COORDINATED WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. REFER TO DETAILS SEC-10 AND SEC-11 FOR SEED MIXTURE OPTIONS.

BMP PICTURE

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AA-8

DRAINAGE SWALE AND LINED DITCH

File: Lined_Drainage_Swale.dwg

SUBJECT	Reference
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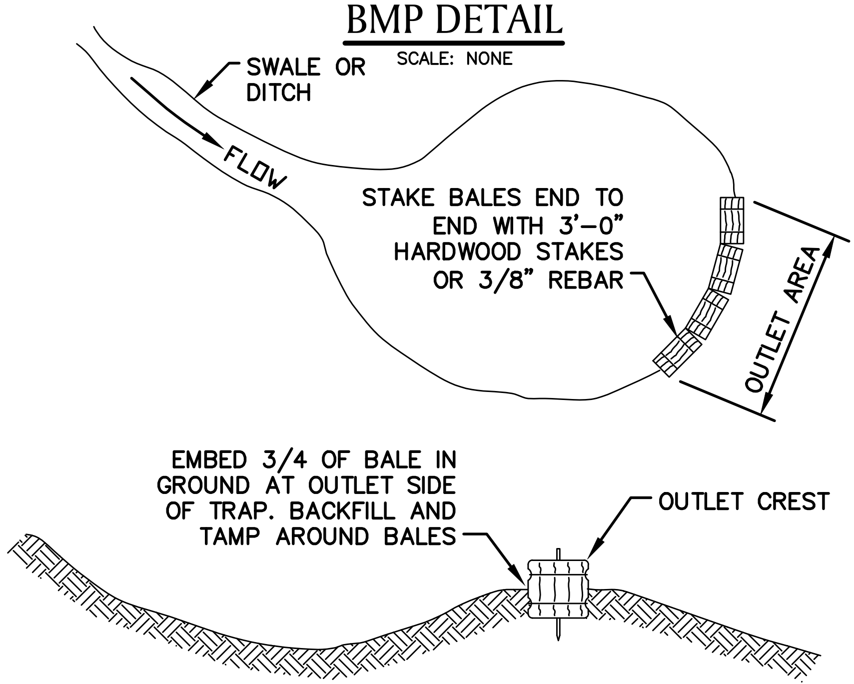
BMP DETAIL

SCALE: NONE



TYPICAL PROFILE

NOTES

1. SIZE, SHAPE AND PROFILE OF SEDIMENT WILL VARY ACCORDING TO ANTICIPATED FLOW VOLUME AND SURROUNDING TERRAIN AND SHALL BE COORDIANTED WITH THE NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. THE BASIN SHALL BE CUT BELOW THE GROUNDLINE. FILL SHALL NOT BE USED TO HOLD WATER UNLESS ROLLED AND COMPACTED.
3. OUTLET AREA IS TO REMAIN FREE OF EXCAVATION SPOILS.
4. OUTLET CREST ELEVATION SHALL BE LOWER THAN INLET ELEVATION AND AT LEAST 1'–0" BELOW THE TOP OF THE BASIN.ARMOUR SLOPES >8% IN OUTLET AREA WITH STONE OF APPROPRIATE SIZE TO PREVENT SCOUR.
5. ARMOUR SLOPES >8% IN OUTLET AREA WITH STONE OF APPROPRIATE SIZE TO PREVENT SCOUR.

BMP PICTURE

File: Sedimentation_Basin.dwg

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AA-9

SEDIMENTATION BASIN

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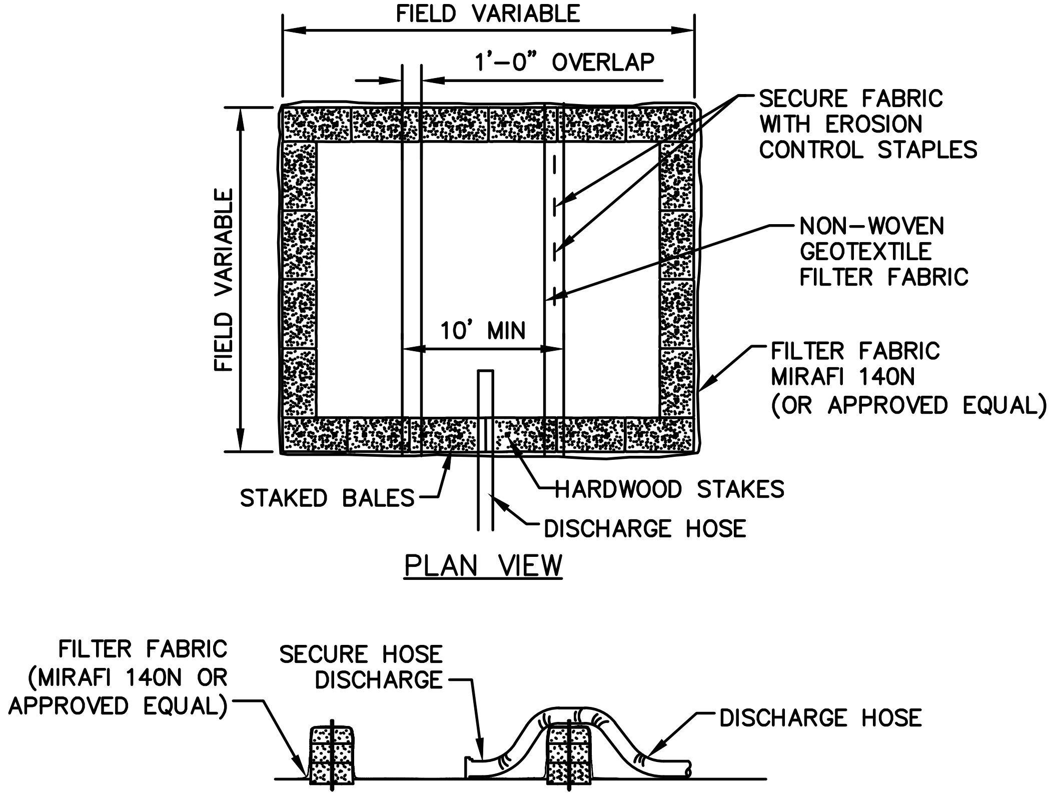
BMP DETAIL

SCALE: NONE



NOTES:

1. NUMBER OF BALES MAY VARY DEPENDING ON SITE CONDITIONS,
2. THE BASIN TO BE SIZED TO PREVENT DISCHARGE WATER FROM OVERTOPPING BASIN.
3. KEEP AS FAR FROM WETLANDS AS PRACTICAL.
4. CLEAN AND REMOVE AS SOON AS DEWATERING IS COMPLETE.

BMP PICTURE

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AA-10
DEWATERING BASIN
(SMALL SCALE)

File: Dewat_Bas_Small.dwg

BMP PICTURE

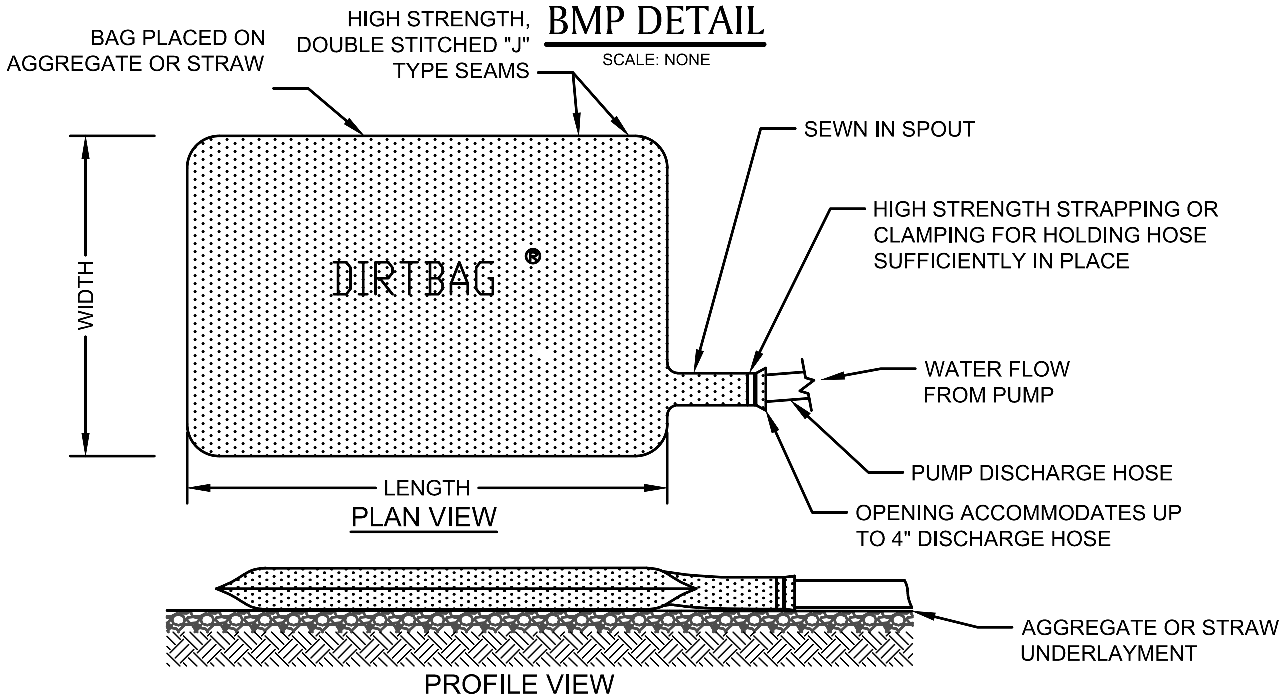
NOTE:

1. EXACT SIZE, LOCATION AND DESIGN IS DEPENDANT ON SITE CONDITIONS, AND LOCAL AND STATE REGULATIONS. COORDINATE THIS BMP WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST PRIOR TO CONSTRUCTION.

AA-11
DEWATERING BASIN -
LARGE SCALE

BMP DETAIL

SCALE: NONE



NOTE:
ONCE PUMPING COMMENCES, THE DIRT BAG SHALL BE MONITORED FREQUENTLY TO ASSURE THAT THE CONNECTIONS ARE SECURELY FASTENED AND THE RATE OF WATER DELIVERY TO THE STRUCTURE IS LOW ENOUGH TO PREVENT UNFILTERED WATER FROM FLOWING FROM THE HOSE CONNECTIONS OR BAG.

BMP PICTURE

File: Dirtbag.dwg

* PICTURE AND DETAIL PROVIDED BY ACF ENVIRONMENTAL

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AA-12
DIRTBAG *

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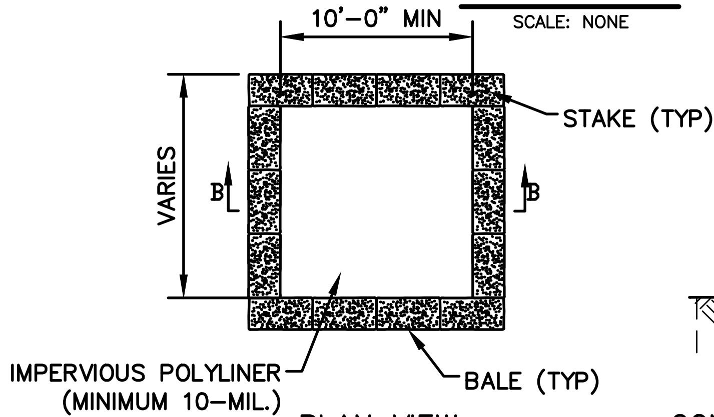
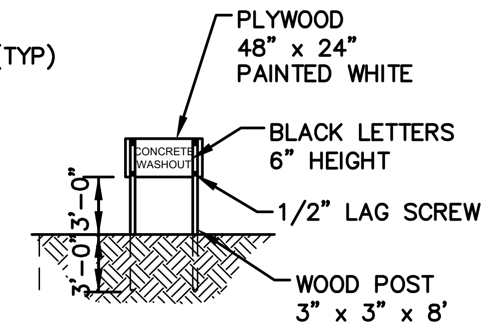
BMP DETAIL

SCALE: NONE

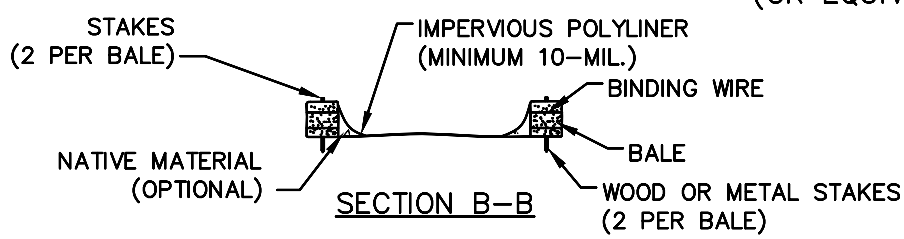


PLAN VIEW

TYPE "ABOVE GRADE"
WITH BALES



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)



SECTION B–B

NOTES:

1. NUMBER OF BALES MAY VARY DEPENDING ON SITE CONDITIONS. COORDINATE SIZE AND LOCATION OF CONCRETE WASTE SUMP WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. KEEP AS FAR FROM DRAINAGE CHANNELS AND WETLAND AREAS AS PRACTICAL.
3. SUMPS TO BE CLEANED AND WASTE CONCRETE REMOVED AND PROPERLY DISPOSED OF UPON COMPLETION OF WORK.
4. SEE ADDITIONAL NOTES ON DETAIL AA–14.

BMP PICTURE

File: Conc_Waste_Sump.dwg

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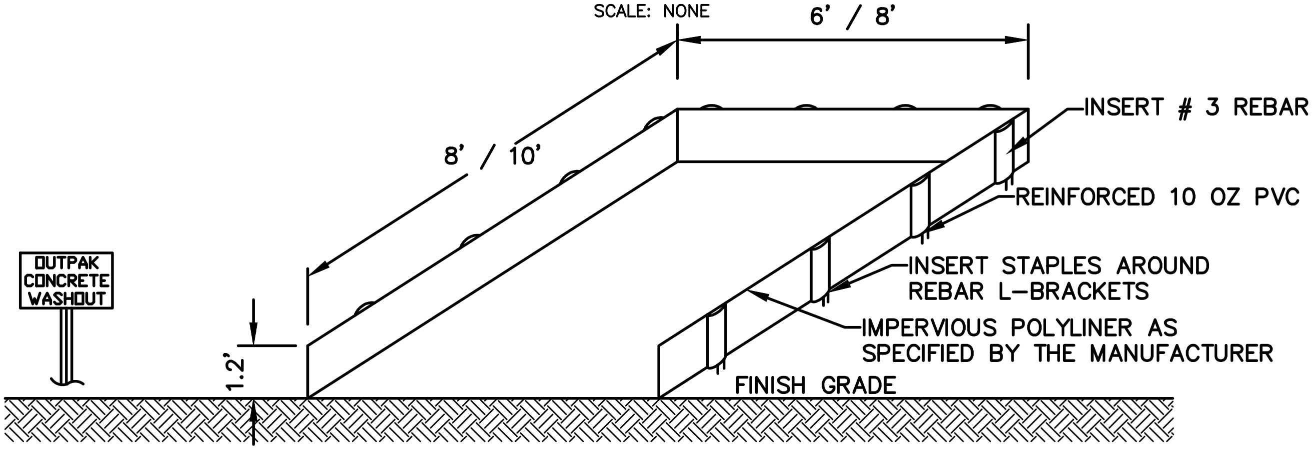
AA-13
CONCRETE WASTE SUMP

BMP DETAIL



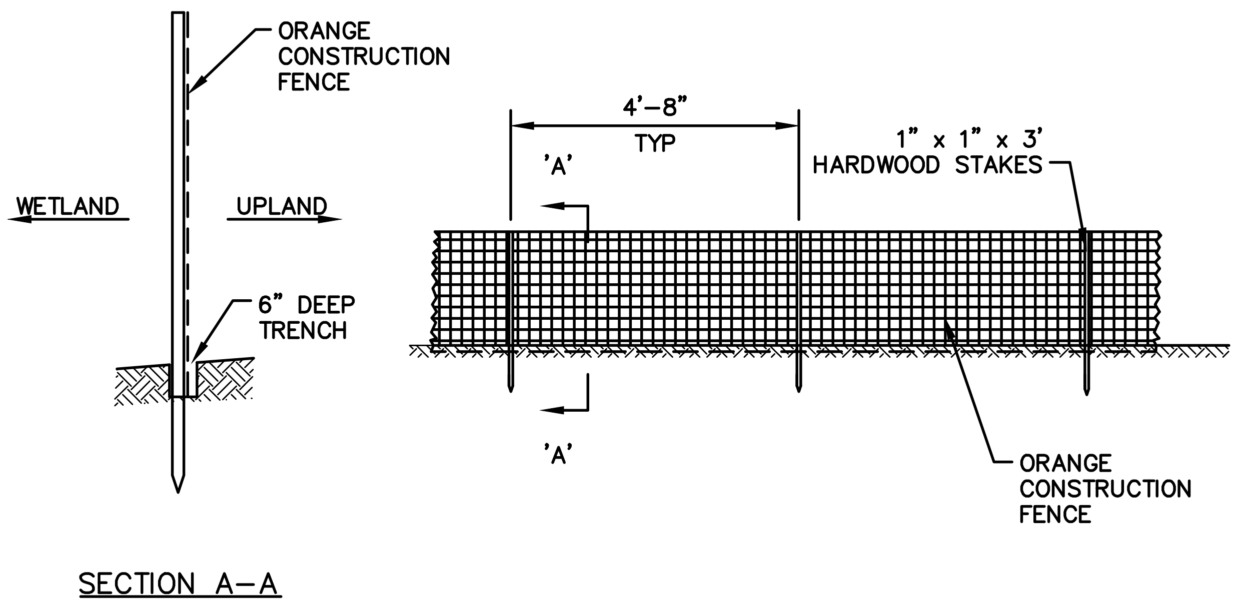
NOTES:

1. PRODUCT TO BE OUTPAK PVC CONCRETE WASHOUT OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT.
3. SIGNS SHALL BE PLACED AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT.
4. THE CONCRETE WASHOUT AREA WILL BE REPLACED AS NECESSARY TO MAINTAIN CAPACITY FOR WASTE CONCRETE AND OTHER LIQUID WASTE.
5. WASHOUT RESIDUE SHALL BE REMOVED FROM THE SITE AND DISPENSED OF AT AN APPROVED WASTE SITE.
6. DO NOT MIX EXCESS AMOUNTS OF FRESH CONCRETE OR CEMENT ON-SITE.
7. DO NOT WASH OUT CONCRETE TRUCKS INTO STORM DRAINS, OPEN DITCHES, STREETS, OR STREAMS.
8. AVOID DUMPING EXCESS CONCRETE IN NON-DESIGNATED DUMPING AREAS.
9. LOCATE WASHOUT AREA AT LEAST 50' FROM STORM DRAIN, OPEN DITCHES, OR WATERBODIES. COORDINATE LOCATION WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
10. WASH OUT WASTES INTO THE OUTPAK WASHOUT WHERE THE CONCRETE CAN SET, BE BROKEN UP, AND THEN DISPOSED OF PROPERLY.
11. A SECURE, NON-COLLAPSING, NON-WATER COLLECTING COVER MUST BE PLACED OVER CONCRETE WASHOUT PRIOR TO PREDICTED WET WEATHER TO PREVENT ACCUMULATION AND OVERFLOW OF PRECIPITATION.

BMP PICTURE

BMP DETAIL

SCALE: NONE



BMP PICTURE

AA-15
BARRIER FENCE
(CONSTRUCTION FENCE)

nationalgrid

ENVIRONMENTAL GUIDANCE

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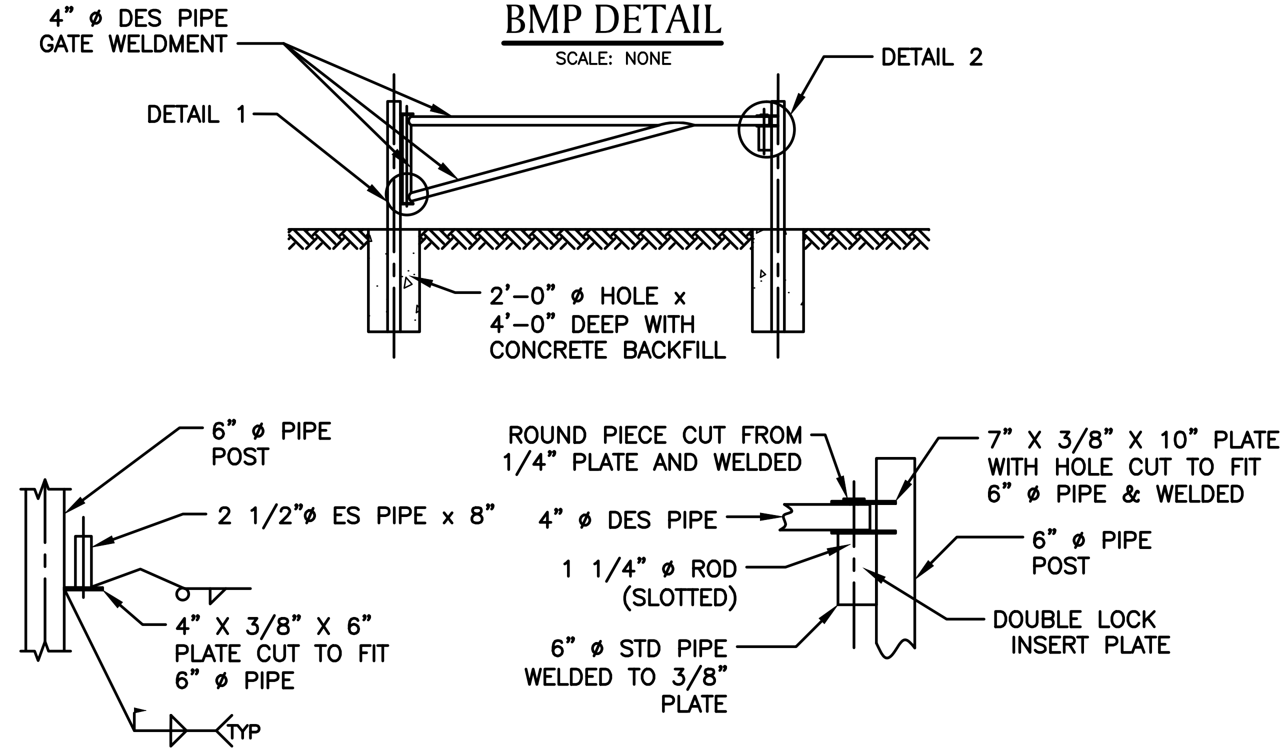
Date	02/20/18

SUBJECT
Access, Maintenance and Construction
Best Management Practices

Reference
EP No. 3 - Natural Resource
Protection (Chapter 6)

BMP DETAIL

SCALE: NONE



DETAIL 1

SIMILAR DETAIL AT TOP

DETAIL 2

NOTES:

1. ALL GATE STEEL PIPES SHALL BE IN ACCORDANCE WITH ASTM A-501, PLATES SHALL BE ASTM A-36.
2. ALL STEEL PIPES SHALL BE PRIMED WITH ZINC-CHROMATE PRIMER AND FINISHED WITH AN APPROVED OSHA "SAFETY YELLOW" TOP COAT COMPATIBLE WITH THE PRIMER AND FOR EXTERIOR EXPOSURE.
3. REFLECTORS SHALL BE SPACED AT 3 FEET ALONG THE LENGTH OF THE CROSSBAR AND BRACE
4. BACKFILL AT POSTS TO BE COMPACTED.

BMP PICTURE

File: ROW_Gates.dwg

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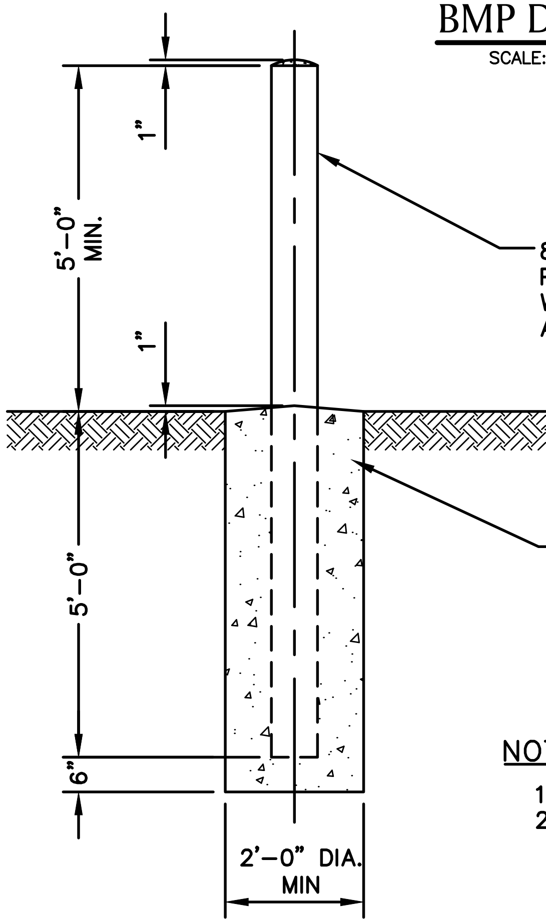
AA-16
ROW GATE / FENCE

BMP DETAIL

SCALE: NONE



NOTES:

1. ALL CONCRETE TO BE 2500 P.S.I. MINIMUM.
2. COORDINATE LOCATIONS WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

BMP

Definition

The control of dust resulting from land-disturbing activities.

Purpose

To prevent surface and air movement of dust from disturbed soil surfaces that may cause off-site damage, health hazards, and traffic safety problems.

Conditions Where Practice Applies

On construction roads, access points, and other disturbed areas subject to surface dust movement and dust blowing where off-site damage may occur if dust is not controlled.

Design Criteria

Construction operations should be scheduled to minimize the amount of area disturbed at one time. Buffer areas of vegetation should be left where practical. Temporary or permanent stabilization measures shall be installed. No specific design criteria is given; see construction specifications below for common methods of dust control.

Water quality must be considered when materials are selected for dust control. Where there is a potential for the material to wash off to a stream, ingredient information must be provided to the local permitting authority.

Construction Specifications

A. Non-driving Areas – These areas use products and materials applied or placed on soil surfaces to prevent airborne migration of soil particles.

Vegetative Cover – For disturbed areas not subject to traffic, vegetation provides the most practical method of dust control (see Section 3).

Mulch (including gravel mulch) – Mulch offers a fast effective means of controlling dust. This can also include rolled erosion control blankets.

Spray adhesives – These are products generally composed of polymers in a liquid or solid form that are mixed with water to form an emulsion that is sprayed on the soil surface with typical hydroseeding equipment. The mixing ratios and application rates will be in accordance with the manufacturer's recommendations for the specific soils on the site. In no case should the application of these adhesives be made on wet soils or if there is a probability of precipitation within 48 hours of its proposed use. Material Safety Data Sheets will be provided to all applicators and others working with the material.

B. Driving Areas – These areas utilize water, polymer emulsions, and barriers to prevent dust movement from the traffic surface into the air.

Sprinkling – The site may be sprayed with water until the surface is wet. This is especially effective on haul roads and access routes.

Polymer Additives – These polymers are mixed with water and applied to the driving surface by a water truck with a gravity feed drip bar, spray bar or automated distributor truck. The mixing ratios and application rates will be in accordance with the manufacturer's recommendations. Incorporation of the emulsion into the soil will be done to the appropriate depth based on expected traffic. Compaction after incorporation will be by vibratory roller to a minimum of 95%. The prepared surface shall be moist and no application of the polymer will be made if there is a probability of precipitation within 48 hours of its proposed use. Material Safety Data Sheets will be provided to all applicators working with the material.

Barriers – Woven geotextiles can be placed on the driving surface to effectively reduce dust throw and particle migration on haul roads. Stone can also be used for construction roads for effective dust control.

Windbreak – A silt fence or similar barrier can control air currents at intervals equal to ten times the barrier height. Preserve existing wind barrier vegetation as much as practical.

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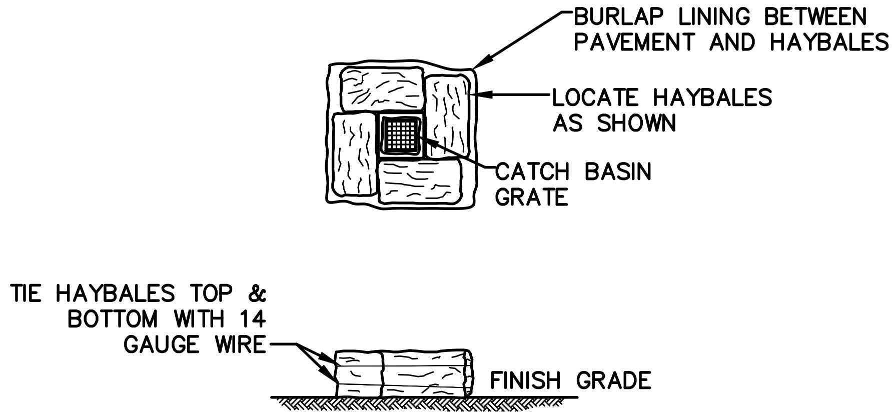
SUBJECT	Reference
Access, Maintenance and Construction Best Management Practices	EP No. 3 - Natural Resource Protection (Chapter 6)

BMP DETAIL

SCALE: NONE



NOTES:

1. SURROUND STREET DRAINAGE STRUCTURE INLET WITH HAY BALES PRIOR TO CONSTRUCTION AND MAINTAIN UNTIL CONSTRUCTION IS COMPLETED. ACCUMULATED SEDIMENTS SHALL BE REMOVED.
2. HAYBALES PLACED ON PAVEMENT SHALL HAVE BURLAP PLACED BETWEEN PAVEMENT AND HAYBALE

BMP PICTURE

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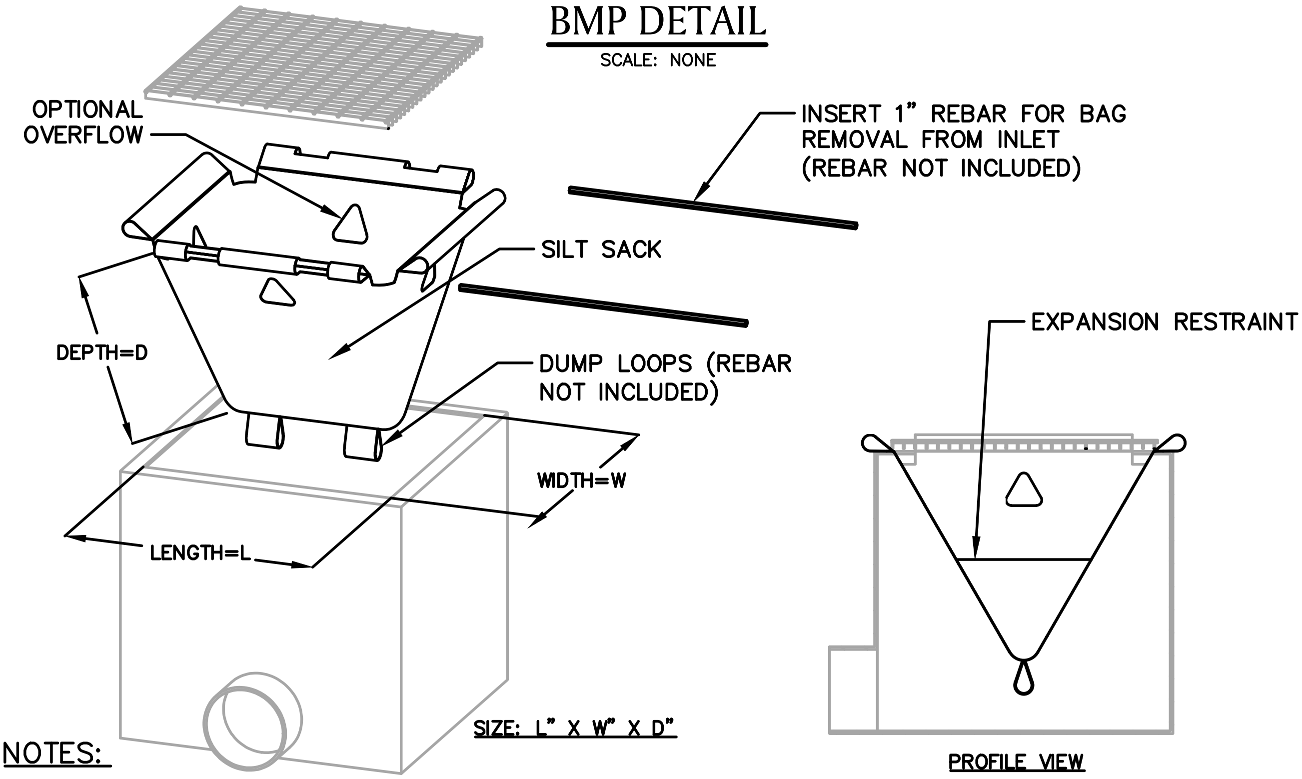
AA-19

CATCH BASIN INLET PROTECTION

File: CB_Inlet_Protection.dwg

BMP DETAIL

SCALE: NONE



NOTES:

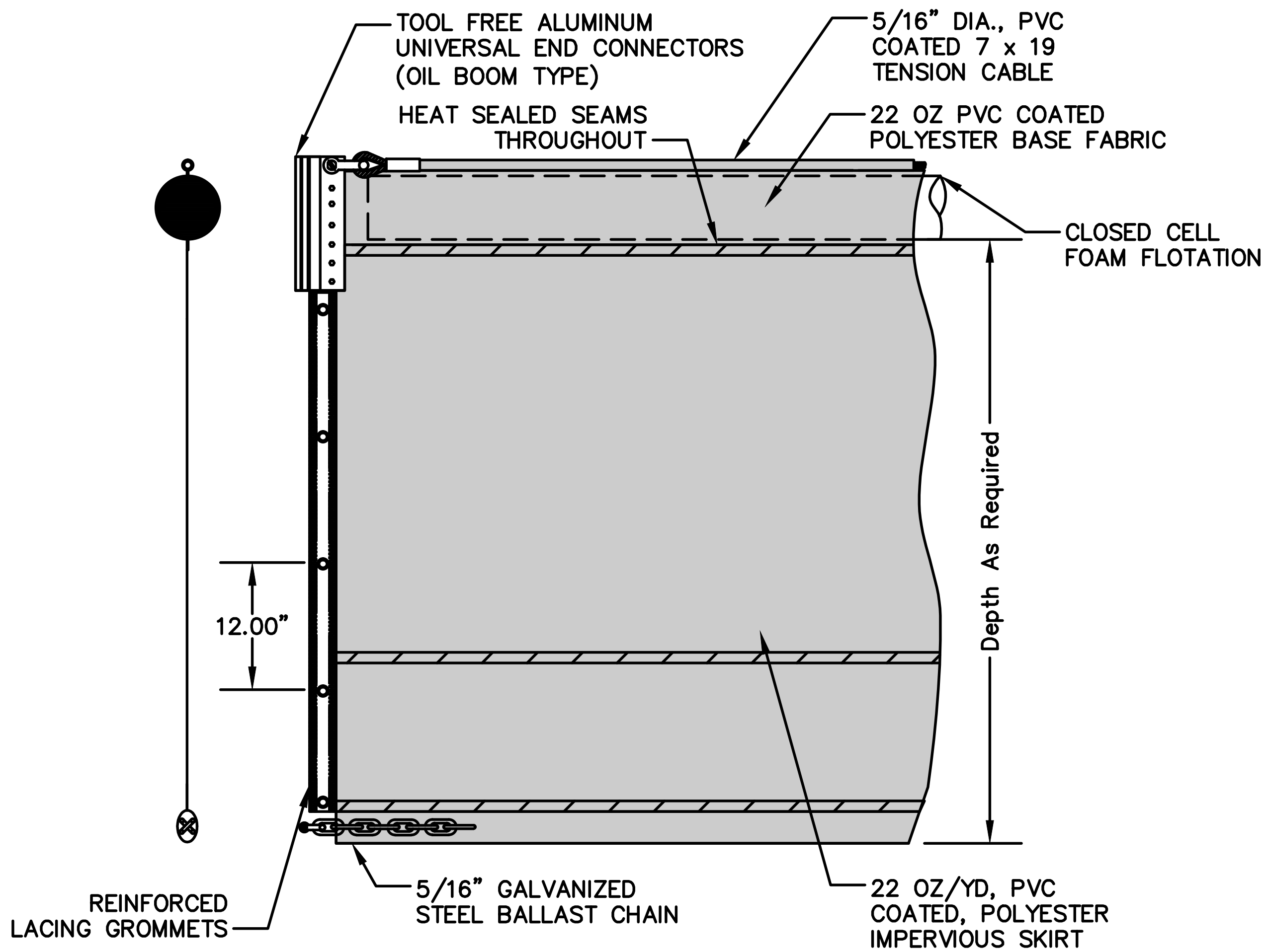
1. PRODUCT TO BE SILT SACK OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. THE USE OF A SILT SACK OPTIONAL OVERFLOW AND OVERALL DIMENSIONS ARE TO BE COORDINATED WITH A NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

AA-20
SILT SACK *

BMP DETAIL

SCALE: NONE



BMP PICTURE

*** DETAIL PROVIDED BY BROCKTON EQUIPMENT / SPILLDAM INC.**
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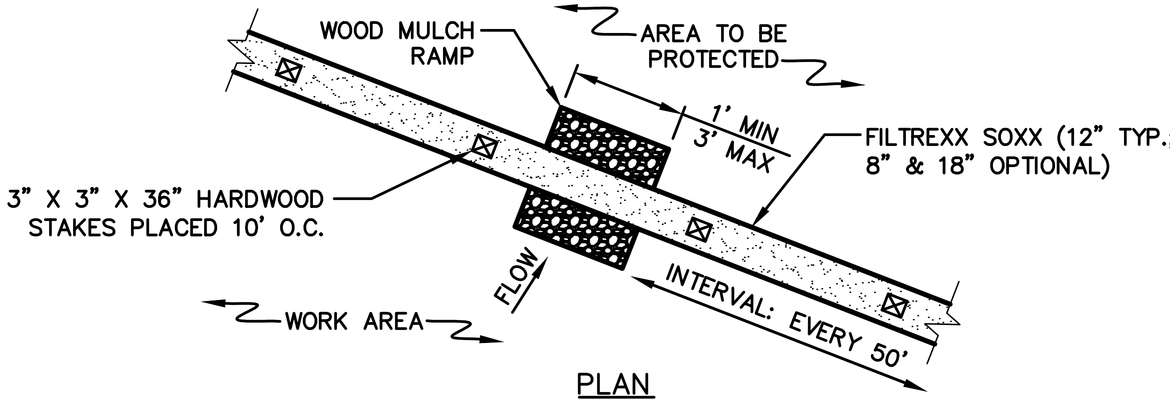
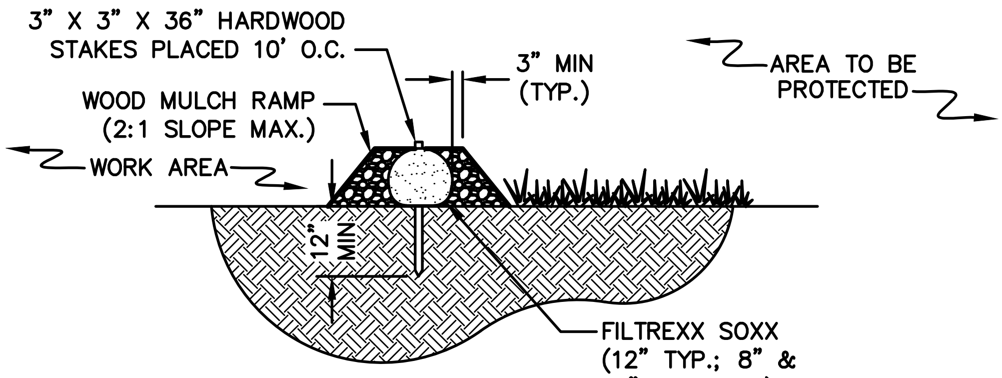
AA-21
TURBIDITY CURTAIN *

BMP DETAIL

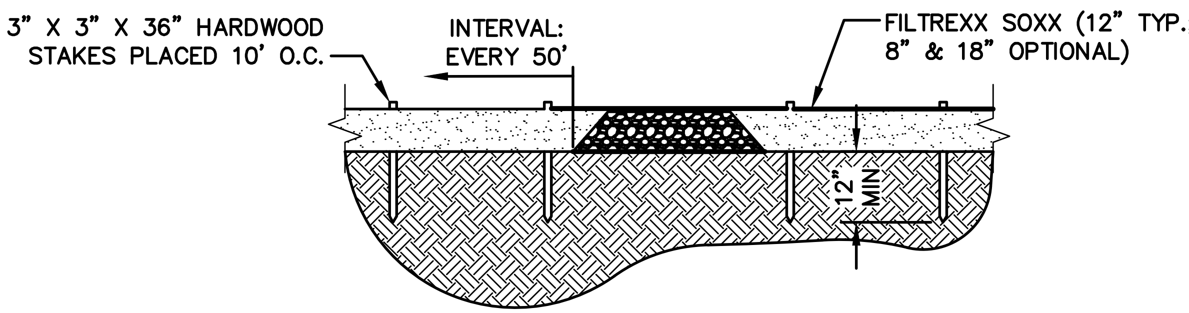
SCALE: NONE



PLAN



SECTION



PROFILE

NOTES

1. PRODUCT TO BE FILTREXX SILT SOXX OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. ALL MATERIAL TO MEET FILTREXX SPECIFICATIONS.
3. FILTER MEDIA FILL TO MEET APPLICATION REQUIREMENTS.
4. NON—MONOFILAMENT CONTAINMENT MATERIAL SHOULD BE KNITTED PHOTODEGRADABLE OR BIODEGRADABLE MATERIAL, WITH OPENING SIZES BETWEEN 1/8" – 1/4".
5. COMPOST MEDIA SHOULD HAVE PARTICLE SIZE WHERE 99% < 2", 50% > 1/2".
6. COMPOST MATERIAL TO BE DISPOSED OF ON—SITE, OR IN ACCORDANCE WITH ENVIRONMENTAL PERMITS AS APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
7. WOOD MULCH RAMP IS OPTIONAL DEPENDING ON SUBSTRATE/SITE CONDITIONS, AND TO BE APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP # AA-22
SILTSOXX AMPHIBIAN & REPTILE CROSSING #1 (1 OF 2)

BMP PICTURE

SALAMANDER AND SNAKE CROSSING #1

ALTERNATE WOOD MULCH RAMP SILTSOXX NOTES:

1. SILTSOXX, BY FILTREX INTERNATIONAL, OR APPROVED EQUAL PRODUCT SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES.
2. BMP SHOULD ONLY BE UTILIZED IN AREAS WHERE RARE SALAMANDER AND SNAKE HABITAT OCCURS, OR AT THE DIRECTION OF THE NATIONAL GRID ENVIRONMENTAL SCIENTIST.

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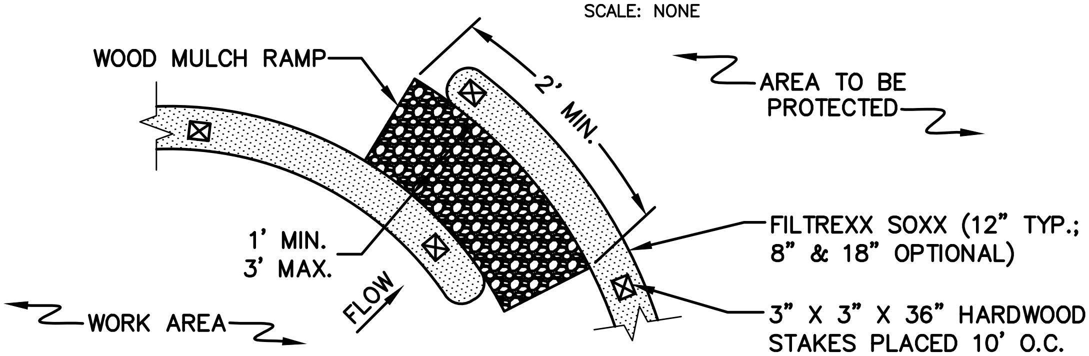
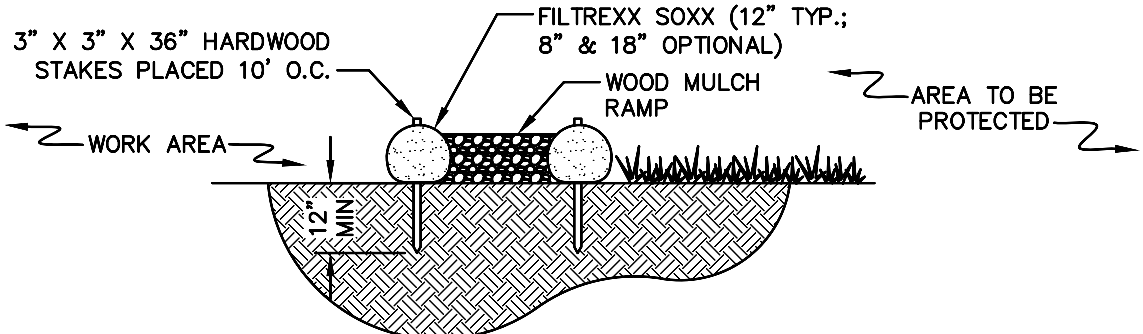
SUBJECT Access, Maintenance and Construction Best Management Practices	Reference EP No. 3 - Natural Resource Protection (Chapter 6)

BMP DETAIL

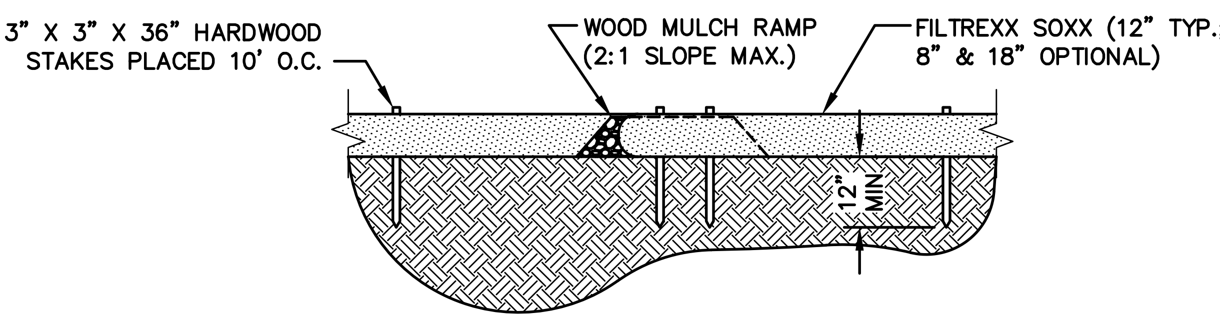
SCALE: NONE



PLAN



SECTION



PROFILE

NOTES

1. PRODUCT TO BE FILTREXX SILT SOXX OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. ALL MATERIAL TO MEET FILTREXX SPECIFICATIONS.
3. FILTER MEDIA FILL TO MEET APPLICATION REQUIREMENTS.
4. NON-MONOFILAMENT CONTAINMENT MATERIAL SHOULD BE KNITTED PHOTODEGRADABLE OR BIODEGRADABLE MATERIAL, WITH OPENING SIZES BETWEEN 1/8" – 1/4".
5. COMPOST MEDIA SHOULD HAVE PARTICLE SIZE WHERE 99% < 2", 50% > 1/2".
6. COMPOST MATERIAL TO BE DISPOSED OF ON-SITE, OR IN ACCORDANCE WITH ENVIRONMENTAL PERMITS AS APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
7. WOOD MULCH RAMP IS OPTIONAL DEPENDING ON SUBSTRATE/SITE CONDITIONS, AND TO BE APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
8. GAPS TO BE SPACED EVERY 50 FT, IF POSSIBLE GIVEN WETLAND PERMIT CONDITIONS.

File: Alternate_Siltsoxx.dwg

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BMP # AA-23
SILTSOXX AMPHIBIAN & REPTILE CROSSING #2 (1 OF 2)

BMP PICTURE

SILTSOXX AMPHIBIAN & REPTILE CROSSING #2

ALTERNATE WOOD MULCH RAMP SILTSOXX NOTES:

1. SILTSOXX, BY FILTREX INTERNATIONAL, OR APPROVED EQUAL PRODUCT SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES.
2. BMP SHOULD ONLY BE UTILIZED IN AREAS WHERE RARE SALAMANDER AND SNAKE HABITAT OCCURS OR AT THE DIRECTION OF THE NATIONAL GRID ENVIRONMENTAL SCIENTIST.

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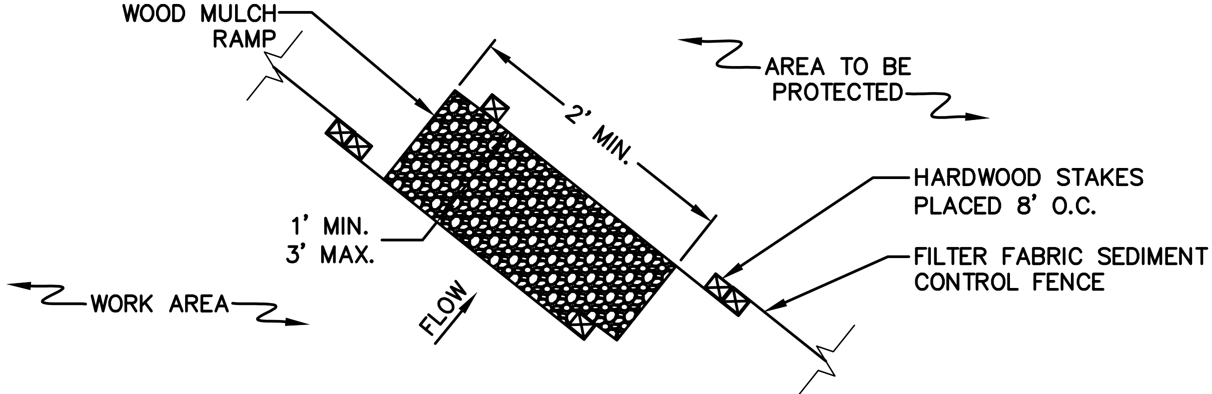
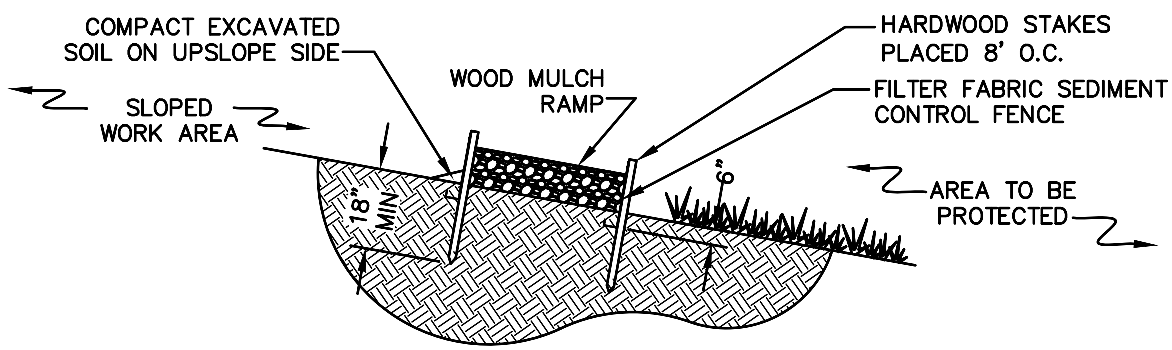
BMP DETAIL

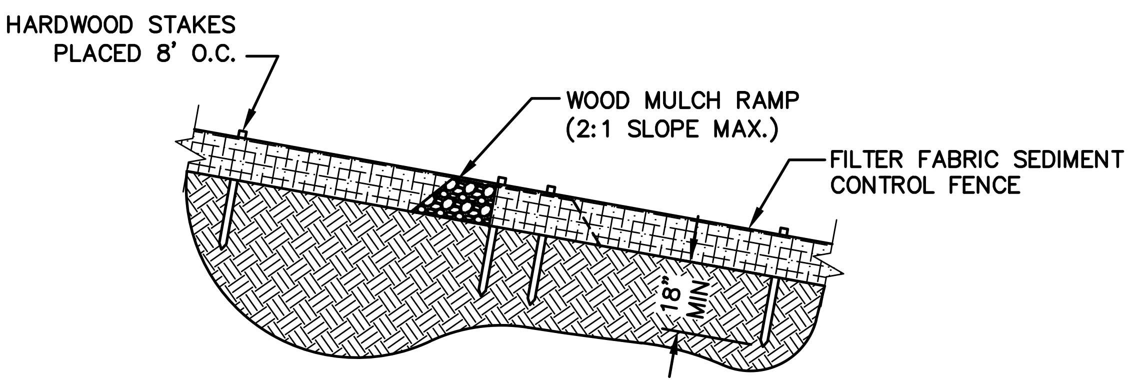
SCALE: NONE



PLAN



SECTION



PROFILE

NOTES

1. IN AREAS WHERE SLOPES OR RUN-OFF VOLUME PROHIBIT USE OF SILTSOXX, CROSSINGS CAN BE PROVIDED THROUGH TRENCHED SILT FENCE.
2. INTALL SILT FENCE TO SPECIFICATIONS IN EG303 APPENDIX 7 "SEC-2 SEDIMENT CONTROL FENCE."
3. WOOD MULCH RAMP IS OPTIONAL DEPENDING ON SUBSTRATE/SITE CONDITIONS, AND TO BE APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
4. GAPS TO BE SPACED EVERY 50 FT, IF POSSIBLE GIVEN WETLAND PERMIT CONDITIONS.

File: Alternate_Siltsoxx.dwg

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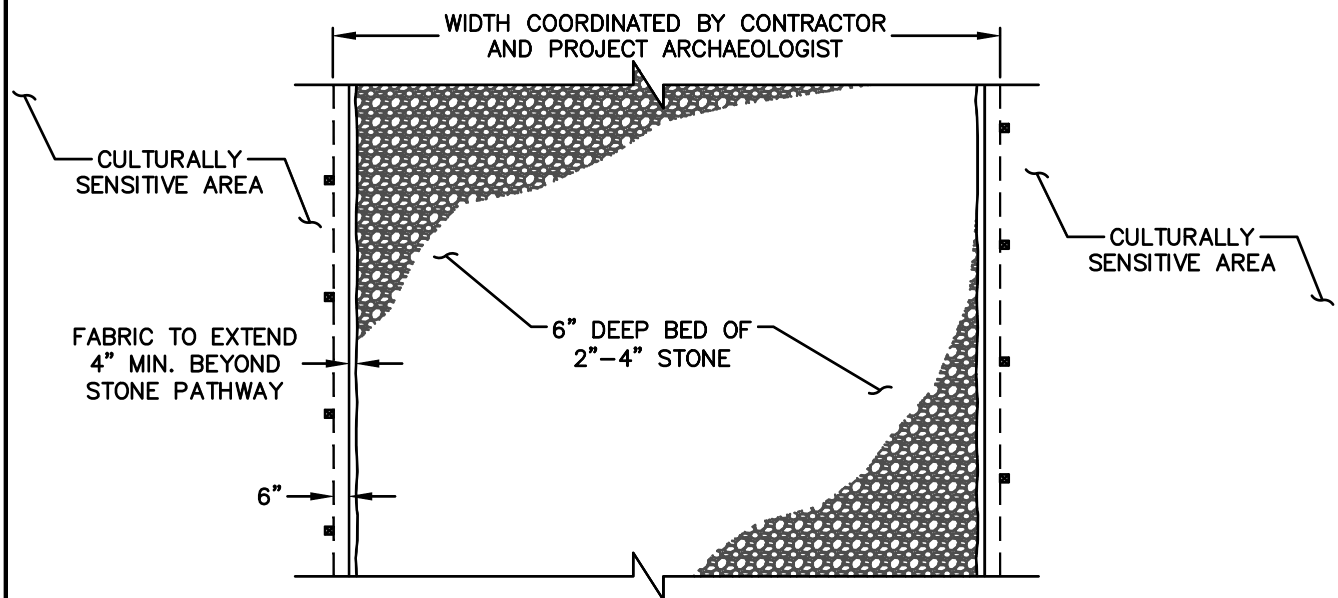
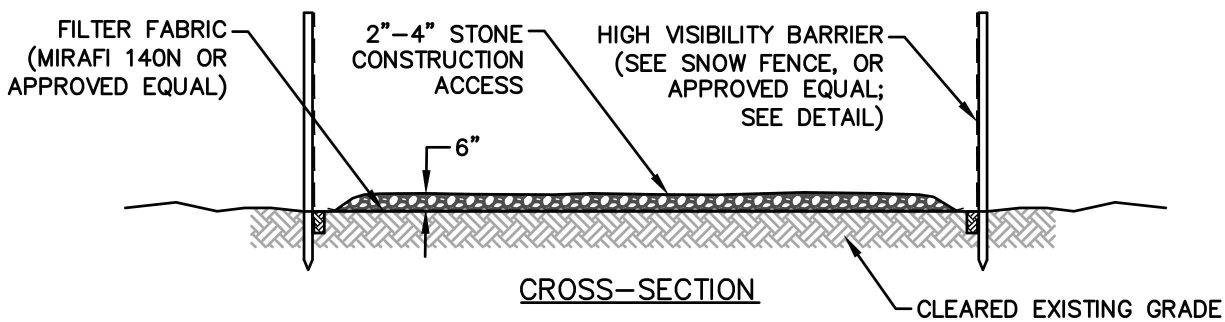
BMP # AA-24
SILT FENCE AMPHIBIAN & REPTILE CROSSING #3

BMP DETAIL

SCALE: NONE



PLAN VIEW



CROSS–SECTION

NOTES:

1. ARCHAEOLOGICAL SITE BOUNDARIES, AS DEFINED BY INTENSIVE ARCHAEOLOGICAL SURVEY AND SITE AVOIDANCE AND PROTECTION PLANS, WILL BE DEMARCATED BY STAKING BY THE PROJECT ARCHAEOLOGIST.
2. GEOTEXTILE AND STONE MAY REMAIN IN PLACE FOLLOWING CONSTRUCTION IF PERMANENT PROTECTION IS NECESSARY AND DEPENDENT ON EASEMENT RIGHTS.
3. WHERE APPROVED BY THE PROJECT–SPECIFIC SAPP, CONSTRUCTION MATTING MAY BE ADDED OVER, OR IN PLACE OF, THE FABRIC AND STONE.
4. INSTALLATION AND REMOVAL OF FABRIC AND STONE, EROSION CONTROLS, AND/OR CONSTRUCTION MATTING WILL BE MONITORED BY THE PROJECT ARCHAEOLOGIST AT EACH LOCATION(S).
5. INSTALLATION OF THESE MEASURES WILL BE CONDUCTED WITH LOW–GROUND PRESSURE VEHICLES WHERE FEASIBLE.
6. WHERE REQUIRED BY THE PROJECT–SPECIFIC SAPP, TEMPORARY, HIGH VISIBILITY PROTECTIVE FENCING (E.G., SNOW FENCE OR PLASTIC FENCE) WILL BE ERECTED ALONG THE SITE BOUNDARIES OUTSIDE OF THE WORKSPACE WITHIN THE ROW IN ORDER TO PREVENT VEHICLES FROM TRAVELING THROUGH THOSE SITE AREAS DURING CONSTRUCTION. THE PROTECTIVE FENCE WILL BE POSTED WITH "NO TRESPASSING" SIGNS, SO THAT THE SITES CAN BE AVOIDED BY ALL CONSTRUCTION RELATED ACTIVITIES. THE FENCING WILL BE REMOVED UPON COMPLETION OF THE PROJECT. THE INSTALLATION AND REMOVAL OF FENCING WILL BE MONITORED BY THE PROJECT ARCHAEOLOGIST.

BMP PICTURES

APPENDIX 5
CERTIFICATION FORM FOR INVASIVE SPECIES CONTROL

Certain permit conditions, therefore a Condition of Contracts for the Prime Contractor, any Subcontractors, and any equipment or mat vendors for ***National Grid Projects*** shall be required to Certify their equipment[7] {each piece of equipment used on site} as 'clean'[8].

___________________________________ (*name of firm*) hereby Certifies that

___________________________________ (*make, model, and/or type*)

_______________________________________ (*equipment ID tag or #)* meets the following

1. before entry on to the job site, has been sufficiently cleaned to remove all accumulated mud, debris, plant fragments, and detritus that could harbor seeds, roots, or plant fragments of so-called invasive plant species; and

2. that the above piece of equipment has neither been off-loaded nor operated in the interval between cleaning and delivery to the jobsite.

3. that equipment deployed in areas of invasive species (as identified in project plans) shall be cleaned prior to redeployment.

______________________________ (*signed*) ______________ (*dated*)

______________________________ (*printed name*) ______________________________ (*title*)

______________________________ (*Firm*)

The signed original of this form {one for each piece of equipment (or lot[9] of mats)} is to be given to the NG Construction Supervisor assigned to the project.

---

7 Equipment may include, but is not limited to bulldozers, excavators, backhoes, bucket trucks (tracked or wheeled), pulling equipment, concrete trucks, compressors, drilling equipment, and mats (composite, wood, or other materials).

8 With regard to invasive species, the definition of clean means free of accumulated mud, debris, plant fragments, and detritus that could harbor seeds, roots, or plant fragments of so-called invasive plant species.

9 Lot of mats is the number of mats that may be transported by one forwarder/truck at a time.

Appendix 6 – Snow Disposal Guidelines

See EG303NE_App6 published separately

APPENDIX 6
SNOW DISPOSAL GUIDELINES

Finding a place to dispose of collected snow poses a challenge. While we are all aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into water bodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that should be taken to minimize the impacts of snow disposal on public health and the environment.

- **DO NOT** dump snow into any water body, including rivers, the ocean, reservoirs, ponds, or wetlands. In fact, a buffer of at least 50 feet between any snow disposal area and any the high-water mark of any surface water should be kept. A silt fence or equivalent barrier should be securely placed between the snow storage area and the high-water mark. In addition to water quality impacts and flooding, snow disposed in surface waters can cause navigational hazards when it freezes into ice blocks.
- **DO NOT** dump snow within a wellhead protection area (e.g., a Zone II), in a high or medium-yield aquifer, or within 75 feet of a private well, where road salt may contaminate water supplies**. Ask an Environmental Department representative for guidance in determining if a proposed disposal area is located within one of these sensitive areas.**
- Avoid disposing of snow on top of storm drain catch basins or in storm water drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.
- All debris in a snow storage area should be cleared from the site and properly disposed of no later than May 15 of each year the area is used for snow storage.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow that is not obviously contaminated with road salt, sand, and other pollutants may be allowed near (within 50 feet) or even in certain water bodies under certain conditions.

In these dire situations, **notify the Environmental Department** so that the local Conservation Commission and the appropriate MassDEP Regional Service Center (in MA), RI DEM Office of Water Resources – RIPDES

Program (in RI), NH Department of Environmental Services – NHDES (in NH) and VT Department of Environmental Conservation - VT DEC (in VT) can be contacted before disposing of snow in a water body.

In emergency situations and after consulting an Environmental Department representative the following guidance should be followed:

- Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
- Do not dispose of snow in saltmarshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, wellhead protection areas, or other environmentally sensitive areas.
- Do not dispose of snow where trucks may cause shoreline or stream bank damage or erosion.

Appendix D

RMAT Tool Report

Climate Resilience Design Standards Tool Project Report

O15N ACR

Date Created: 2/26/2024 1:52:30 PM | Created By: kcallahan

Date Report Generated: 6/25/2024 10:44:46 PM | Tool Version: Version 1.2

Project Contact Information: Kipp Callahan (kcallahan@vhb.com)

Project Summary

Link to Project

Estimated Capital Cost: $18000000.00
End of Useful Life Year: 2076
Project within mapped Environmental Justice neighborhood: No

Ecosystem Service Benefits	Scores
Project Score	Low

Exposure	Scores
Sea Level Rise/Storm Surge	Not Exposed
Extreme Precipitation - Urban Flooding	Moderate Exposure
Extreme Precipitation - Riverine Flooding	High Exposure
Extreme Heat	High Exposure

Asset Preliminary Climate Risk Rating Summary

Number of Assets: 3

Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Urban Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
115kv Transmission Line	Low Risk	High Risk	High Risk	High Risk
Ware Substation	Low Risk	High Risk	High Risk	High Risk
Palmer Substation	Low Risk	High Risk	High Risk	High Risk

Climate Resilience Design Standards Summary

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
Sea Level Rise/Storm Surge					
115kv Transmission Line					
Ware Substation					
Palmer Substation					
Extreme Precipitation					
115kv Transmission Line	2070			50-yr (2%)	Tier 3
Ware Substation	2070			50-yr (2%)	Tier 3
Palmer Substation	2070			50-yr (2%)	Tier 3
Extreme Heat					
115kv Transmission Line	2070		90th		Tier 3

Ware Substation	2070	90th	Tier 3
Palmer Substation	2070	90th	Tier 3

Scoring Rationale - Project Exposure Score

The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. The rationale behind the exposure rating is provided below.

Sea Level Rise/Storm Surge

This project received a "Not Exposed" because of the following:

- Not located within the predicted mean high water shoreline by 2030
- No historic coastal flooding at project site
- Not located within the Massachusetts Coast Flood Risk Model (MC-FRM)

Extreme Precipitation - Urban Flooding

This project received a "Moderate Exposure" because of the following:

- Maximum annual daily rainfall exceeds 10 inches within the overall project's useful life
- No historic flooding at project site
- No increase to impervious area
- Existing impervious area of the project site is less than 10%

Extreme Precipitation - Riverine Flooding

This project received a "High Exposure" because of the following:

- Part of the project is within a mapped FEMA floodplain, outside of the Massachusetts Coast Flood Risk Model (MC-FRM)
- No historic riverine flooding at project site
- Project is more than 500ft from a waterbody
- Project is not likely susceptible to riverine erosion

Extreme Heat

This project received a "High Exposure" because of the following:

- 30+ days increase in days over 90 deg. F within project's useful life
- Between 10% and 40% of the existing project site has canopy cover
- Located within 100 ft of existing water body
- No increase to the impervious area of the project site
- No tree removal

Scoring Rationale - Asset Preliminary Climate Risk Rating

A Preliminary Climate Risk Rating is determined for each infrastructure and building asset by considering the overall project Exposure Score and responses to Step 4 questions provided by the user in the Tool. Natural Resource assets do not receive a risk rating. The following factors are what influenced the risk ratings for each asset.

Asset - 115kv Transmission Line
Primary asset criticality factors influencing risk ratings for this asset:

- Asset must be operable at all times, even during natural hazard event
- Loss/inoperability of the asset would have regional impacts
- The infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
- Inoperability of the asset would be expected to result in possible loss of life
- Inoperability will result in debilitating cascading impacts that will render other facilities, assets, or buildings inoperable and/or prevent the functionality of major regional or statewide facilities and/or delivery of critical services
- There are no hazardous materials in the asset

Asset - Ware Substation
Primary asset criticality factors influencing risk ratings for this asset:

- Asset must be operable at all times, even during natural hazard event
- Loss/inoperability of the asset would have regional impacts
- The infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
- Inoperability of the asset would be expected to result in possible loss of life
- Inoperability will result in debilitating cascading impacts that will render other facilities, assets, or buildings inoperable and/or prevent the functionality of major regional or statewide facilities and/or delivery of critical services
- There are no hazardous materials in the asset

Asset - Palmer Substation
Primary asset criticality factors influencing risk ratings for this asset:

- Asset must be operable at all times, even during natural hazard event
- Loss/inoperability of the asset would have regional impacts
- The infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
- Inoperability of the asset would be expected to result in possible loss of life
- Inoperability will result in debilitating cascading impacts that will render other facilities, assets, or buildings inoperable and/or prevent the functionality of major regional or statewide facilities and/or delivery of critical services
- There are no hazardous materials in the asset

Project Climate Resilience Design Standards Output

Climate Resilience Design Standards and Guidance are recommended for each asset and climate parameter. The Design Standards for each climate parameter include the following: recommended planning horizon (target and/or intermediate), recommended return period (Sea Level Rise/Storm Surge and Precipitation) or percentile (Heat), and a list of applicable design criteria that are likely to be affected by climate change. Some design criteria have numerical values associated with the recommended return period and planning horizon, while others have tiered methodologies with step-by-step instructions on how to estimate design values given the other recommended design standards.

Asset: 115kv Transmission Line | Infrastructure

Sea Level Rise/Storm Surge | Low Risk

Applicable Design Criteria

Projected Tidal Datums: NOT APPLICABLE

Projected Water Surface Elevation: NOT APPLICABLE

Projected Wave Action Water Elevation: NOT APPLICABLE

Projected Wave Heights: NOT APPLICABLE

Projected Duration of Flooding: NOT APPLICABLE

Projected Design Flood Velocity: NOT APPLICABLE

Projected Scour & Erosion: NOT APPLICABLE

Extreme Precipitation | High Risk

Target Planning Horizon: 2070
Return Period: 50-yr (2%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

The projected values, standards, and guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
115kv Transmission Line	2070	50-Year (2%)	9.4	Downloadable Methodology PDF

Projected Riverine Peak Discharge & Peak Flood Elevation: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Extreme Heat High Risk

Target Planning Horizon: 2070
Percentile: 90th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Projected Heat Index: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Projected Growing Degree Days: NOT APPLICABLE

Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): NOT APPLICABLE

Asset: Ware Substation Infrastructure

Sea Level Rise/Storm Surge Low Risk

Applicable Design Criteria

Projected Tidal Datums: NOT APPLICABLE

Projected Water Surface Elevation: NOT APPLICABLE

Projected Wave Action Water Elevation: NOT APPLICABLE

Projected Wave Heights: NOT APPLICABLE

Projected Duration of Flooding: NOT APPLICABLE

Projected Design Flood Velocity: NOT APPLICABLE

Projected Scour & Erosion: NOT APPLICABLE

Extreme Precipitation High Risk

Target Planning Horizon: 2070
Return Period: 50-yr (2%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

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Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Ware Substation	2070	50-Year (2%)	9.4	Downloadable Methodology PDF

Projected Riverine Peak Discharge & Peak Flood Elevation: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Extreme Heat High Risk

Target Planning Horizon: 2070
Percentile: 90th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE
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Projected Cooling Degree Days & Heating Degree Days (base = 65°F): NOT APPLICABLE

Asset: Palmer Substation Infrastructure

Sea Level Rise/Storm Surge Low Risk

Applicable Design Criteria

Projected Tidal Datums: NOT APPLICABLE

Projected Water Surface Elevation: NOT APPLICABLE

Projected Wave Action Water Elevation: NOT APPLICABLE

Projected Wave Heights: NOT APPLICABLE

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Extreme Precipitation High Risk

Target Planning Horizon: 2070
Return Period: 50-yr (2%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

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Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
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Projected Riverine Peak Discharge & Peak Flood Elevation: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Extreme Heat High Risk

Target Planning Horizon: 2070
Percentile: 90th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 3

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Projected Heat Index: APPLICABLE
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Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE
Methodology to Estimate Projected Values : Tier 3

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): NOT APPLICABLE

Project Inputs

Core Project Information

Name:	O15N ACR
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2076
Location of Project:	Palmer, Ware, W. Brookfield
Estimated Capital Cost:	$18,000,000
Who is the Submitting Entity?	Private Other VHB Kipp Callahan (kcallahan@vhb.com)
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Permitting
Is climate resiliency a core objective of this project?	No
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	Yes
Brief Project Description:	The purpose of this project is to upgrade the New England Power Company's O15N Transmission Line from a 69kv line to an 115kv system. This will help meet the commonwealth's future energy needs especially in light of the plans to further electrify the state's economy. The project will need to go through permitting through multiple agencies including the Energy Facility Siting Board, MEPA, USACE, MADEP, MA NHESP, etc.
Project Submission Comments:	

Project Ecosystem Service Benefits

No Ecosystem Service Benefits are provided by this project

Factors to Improve Output

✓ Incorporate nature-based solutions that may provide flood protection
✓ Incorporate nature-based solutions that may reduce storm damage
✓ Protect public water supply by reducing the risk of contamination, pollution, and/or runoff of surface and groundwater sources used for human consumption
✓ Incorporate strategies that reduce carbon emissions
✓ Incorporate green infrastructure or nature-based solutions that recharge groundwater
✓ Incorporate green infrastructure to filter stormwater
✓ Incorporate nature-based solutions that improve water quality
✓ Incorporate nature-based solutions that sequester carbon carbon
✓ Increase biodiversity, protect critical habitat for species, manage invasive populations, and/or provide connectivity to other habitats
✓ Preserve, enhance, and/or restore coastal shellfish habitats
✓ Incorporate vegetation that provides pollinator habitat
✓ Identify opportunities to remediate existing sources of pollution
✓ Provide opportunities for passive and/or active recreation through open space
✓ Increase plants, trees, and/or other vegetation to provide oxygen production
✓ Mitigate atmospheric greenhouse gas concentrations and other toxic air pollutants through nature-based solutions
✓ Identify opportunities to prevent pollutants from impacting ecosystems
✓ Incorporate education and/or protect cultural resources as part of your project

Is the primary purpose of this project ecological restoration?

No

Project Benefits

Provides flood protection through nature-based solutions	No
Reduces storm damage	No
Recharges groundwater	No
Protects public water supply	No
Filters stormwater using green infrastructure	No
Improves water quality	No
Promotes decarbonization	No
Enables carbon sequestration	No
Provides oxygen production	No
Improves air quality	No
Prevents pollution	No
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	No
Protects land containing shellfish	No
Provides pollinator habitat	No

Provides recreation	No
Provides cultural resources/education	No

Project Climate Exposure

Is the primary purpose of this project ecological restoration?	No
Does the project site have a history of coastal flooding?	No
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	Unsure
Does the project site have a history of riverine flooding?	Unsure
Does the project result in a net increase in impervious area of the site?	No
Are existing trees being removed as part of the proposed project?	No

Project Assets

Asset: 115kv Transmission Line
Asset Type: Utility Infrastructure
Asset Sub-Type: Energy (electric, gas, petroleum, renewable)
Construction Type: Major Repair/Retrofit
Construction Year: 2026
Useful Life: 50

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Infrastructure must be accessible/operable at all times, even during natural hazard event.
Identify the geographic area directly affected by permanent loss or significant inoperability of the infrastructure.
Impacts would be regional (more than one municipality and/or surrounding region)
Identify the population directly served that would be affected by the permanent loss or significant inoperability of the infrastructure.
Less than 100,000 people
Identify if the infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
Will the infrastructure reduce the risk of flooding?
No
If the infrastructure became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the infrastructure would be expected to result in possible loss of life
If there are hazardous materials in your infrastructure, what are the extents of impacts related to spills/releases of these materials?
There are no hazardous materials in the infrastructure
If the infrastructure became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Debilitating – Inoperability will result in cascading impacts that will render other assets inoperable and/or prevent the functionality of major regional or statewide infrastructure or delivery of critical services
If the infrastructure was damaged beyond repair, how much would it approximately cost to replace?
Between $10 million and $30 million
Does the infrastructure function as an evacuation route during emergencies? This question only applies to roadway projects.
No
If the infrastructure became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
No impact on surrounding natural resources is expected
If the infrastructure became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the infrastructure is not able to serve or operate its intended users or function)?
Government agency will no longer be able to maintain services
What are the impacts to loss of confidence in government resulting from loss of infrastructure functionality (i.e. the infrastructure asset is not able to serve or operate its intended users or function)?
Loss of confidence in Commonwealth

Asset: Ware Substation
Asset Type: Utility Infrastructure
Asset Sub-Type: Energy (electric, gas, petroleum, renewable)
Construction Type: Major Repair/Retrofit
Construction Year: 2026
Useful Life: 50

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Infrastructure must be accessible/operable at all times, even during natural hazard event.
Identify the geographic area directly affected by permanent loss or significant inoperability of the infrastructure.
Impacts would be regional (more than one municipality and/or surrounding region)
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If the infrastructure was damaged beyond repair, how much would it approximately cost to replace?

Between $10 million and $30 million

Does the infrastructure function as an evacuation route during emergencies? This question only applies to roadway projects.

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Government agency will no longer be able to maintain services

What are the impacts to loss of confidence in government resulting from loss of infrastructure functionality (i.e. the infrastructure asset is not able to serve or operate its intended users or function)?

Loss of confidence in Commonwealth

Asset: Palmer Substation

Asset Type: Utility Infrastructure

Asset Sub-Type: Energy (electric, gas, petroleum, renewable)

Construction Type: Major Repair/Retrofit

Construction Year: 2026

Useful Life: 50

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.

Infrastructure must be accessible/operable at all times, even during natural hazard event.

Identify the geographic area directly affected by permanent loss or significant inoperability of the infrastructure.

Impacts would be regional (more than one municipality and/or surrounding region)

Identify the population directly served that would be affected by the permanent loss or significant inoperability of the infrastructure.

Less than 100,000 people

Identify if the infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

The infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

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If the infrastructure became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?

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Does the infrastructure function as an evacuation route during emergencies? This question only applies to roadway projects.

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No impact on surrounding natural resources is expected

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Government agency will no longer be able to maintain services

What are the impacts to loss of confidence in government resulting from loss of infrastructure functionality (i.e. the infrastructure asset is not able to serve or operate its intended users or function)?

Loss of confidence in Commonwealth

Report Comments

N/A

Appendix E

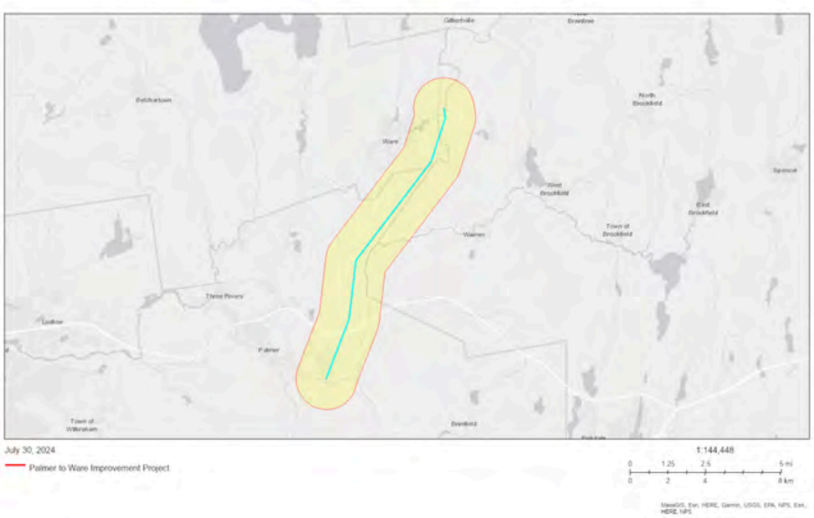
EJ Supporting Documentation

EJScreen Community Report

This report provides environmental and socioeconomic information for user-defined areas, and combines that data into environmental justice and supplemental indexes.

West Warren, MA

1 mile Ring around the Corridor
Population: 4,339
Area in square miles: 23.18



COMMUNITY INFORMATION

Low income: 16 percent
People of color: 13 percent
Less than high school education: 8 percent
Limited English households: 0 percent
Unemployment: 7 percent
Persons with disabilities: 17 percent
Male: 52 percent
Female: 48 percent
78 years Average life expectancy
$40,503 Per capita income
Number of households: 1,700
Owner occupied: 77 percent

BREAKDOWN BY RACE

White: 87%
Black: 3%
American Indian: 0%
Asian: 1%
Hawaiian/Pacific Islander: 0%
Other race: 1%
Two or more races: 4%
Hispanic: 3%

BREAKDOWN BY AGE

From Ages 1 to 4	7%
From Ages 1 to 18	18%
From Ages 18 and up	82%
From Ages 65 and up	16%

LIMITED ENGLISH SPEAKING BREAKDOWN

Speak Spanish	0%
Speak Other Indo-European Languages	100%
Speak Asian-Pacific Island Languages	0%
Speak Other Languages	0%

Notes: Numbers may not sum to totals due to rounding. Hispanic population can be of any race. Source: U.S. Census Bureau, American Community Survey (ACS) 2018-2022. Life expectancy data comes from the Centers for Disease Control.

LANGUAGES SPOKEN AT HOME

LANGUAGE	PERCENT
English	89%
Spanish	2%
French, Haitian, or Cajun	3%
Russian, Polish, or Other Slavic	2%
Other Indo-European	2%
Chinese (including Mandarin, Cantonese)	1%
Total Non-English	11%

Report for 1 mile Ring around the Corridor

Report produced July 30, 2024 using EJScreen Version 2.3

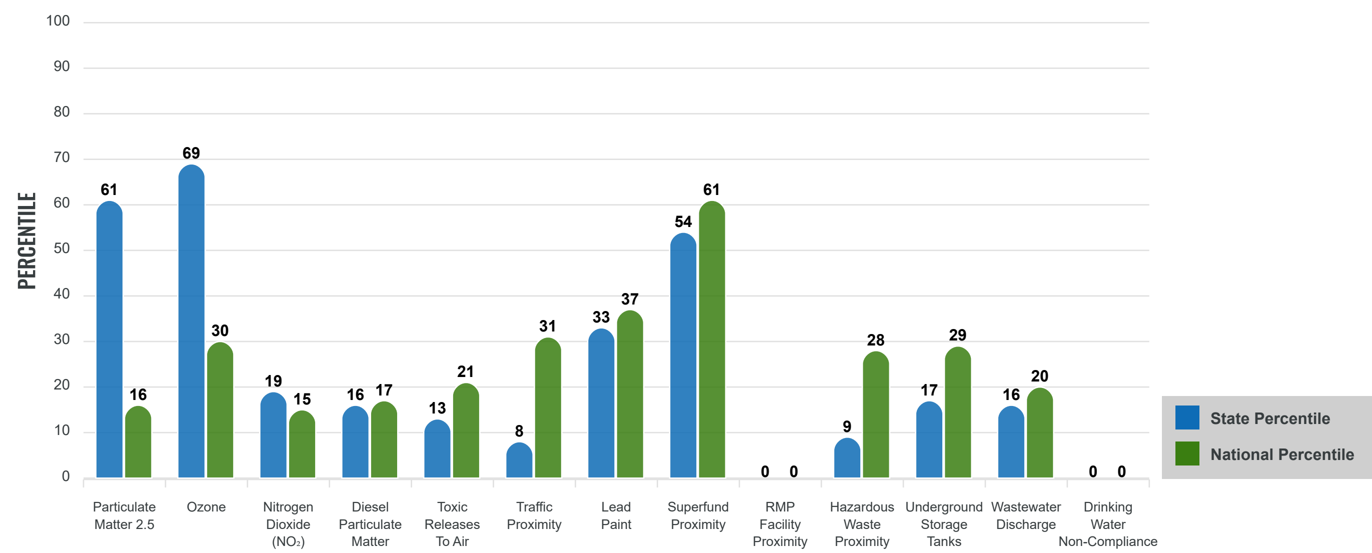
Environmental Justice & Supplemental Indexes

The environmental justice and supplemental indexes are a combination of environmental and socioeconomic information. There are thirteen EJ indexes and supplemental indexes in EJScreen reflecting the 13 environmental indicators. The indexes for a selected area are compared to those for all other locations in the state or nation. For more information and calculation details on the EJ and supplemental indexes, please visit the EJScreen website.

EJ INDEXES

The EJ indexes help users screen for potential EJ concerns. To do this, the EJ index combines data on low income and people of color populations with a single environmental indicator.

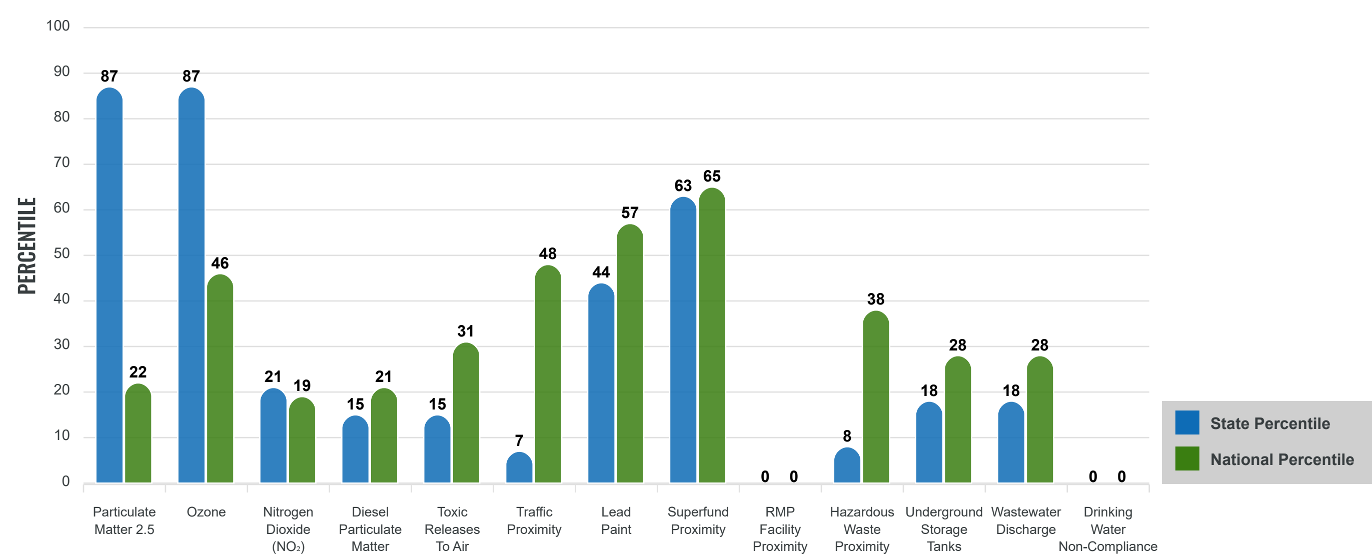
EJ INDEXES FOR THE SELECTED LOCATION



SUPPLEMENTAL INDEXES

The supplemental indexes offer a different perspective on community-level vulnerability. They combine data on percent low income, percent persons with disabilities, percent less than high school education, percent limited English speaking, and percent low life expectancy with a single environmental indicator.

SUPPLEMENTAL INDEXES FOR THE SELECTED LOCATION



Report for 1 mile Ring around the Corridor

Report produced July 30, 2024 using EJScreen Version 2.3

EJScreen Environmental and Socioeconomic Indicators Data

SELECTED VARIABLES	VALUE	STATE AVERAGE	PERCENTILE IN STATE	USA AVERAGE	PERCENTILE IN USA
ENVIRONMENTAL BURDEN INDICATORS					
Particulate Matter 2.5 (μg/m^3)	7.03	6.52	83	8.45	19
Ozone (ppb)	39.2	37.9	88	41	41
Nitrogen Dioxide (NO_2) (ppbv)	4.3	8.8	13	7.8	17
Diesel Particulate Matter (μg/m^3)	0.0774	0.176	10	0.191	19
Toxic Releases to Air (toxicity-weighted concentration)	140	2,800	12	4,600	27
Traffic Proximity (daily traffic count/distance to road)	540,000	6,100,000	4	1,700,000	41
Lead Paint (% Pre-1960 Housing)	0.38	0.51	33	0.3	65
Superfund Proximity (site count/km distance)	0.14	0.34	55	0.39	65
RMP Facility Proximity (facility count/km distance)	0	0.37	0	0.57	0
Hazardous Waste Proximity (facility count/km distance)	0.48	11	4	3.5	33
Underground Storage Tanks (count/km^2)	0.19	3.3	17	3.6	37
Wastewater Discharge (toxicity-weighted concentration/m distance)	2.2	760	13	700000	26
Drinking Water Non-Compliance (points)	0.0073	3.2	0	2.2	0
SOCIOECONOMIC INDICATORS					
Demographic Index USA	0.59	N/A	N/A	1.34	19
Supplemental Demographic Index USA	1.53	N/A	N/A	1.64	49
Demographic Index State	0.68	1.19	35	N/A	N/A
Supplemental Demographic Index State	1.69	1.52	69	N/A	N/A
People of Color	13%	31%	30	40%	26
Low Income	16%	22%	49	30%	31
Unemployment Rate	6%	5%	69	6%	68
Limited English Speaking Households	0%	6%	0	5%	0
Less Than High School Education	8%	9%	61	11%	50
Under Age 5	7%	5%	74	5%	69
Over Age 64	16%	18%	48	18%	48

*Diesel particulate matter index is from the EPA's Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

Sites reporting to EPA within defined area:

Superfund 0
Hazardous Waste, Treatment, Storage, and Disposal Facilities 0
Water Dischargers 13
Air Pollution 1
Brownfields 1
Toxic Release Inventory 0

Other community features within defined area:

Schools 0
Hospitals 0
Places of Worship 1

Other environmental data:

Air Non-attainment .... Yes
Impaired Waters .... Yes

Selected location contains American Indian Reservation Lands* .... No
Selected location contains a "Justice40 (CEJST)" disadvantaged community .... Yes
Selected location contains an EPA IRA disadvantaged community .... Yes

Report for 1 mile Ring around the Corridor

Report produced July 30, 2024 using EJScreen Version 2.3

EJScreen Environmental and Socioeconomic Indicators Data

HEALTH INDICATORS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Low Life Expectancy	21%	17%	85	20%	63
Heart Disease	5.9	5.2	73	5.8	55
Asthma	11.9	11.2	74	10.3	87
Cancer	7.4	6.9	57	6.4	68
Persons with Disabilities	16.6%	12.1%	82	13.7%	72

CLIMATE INDICATORS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Flood Risk	13%	12%	70	12%	74
Wildfire Risk	0%	0%	0	14%	0

CRITICAL SERVICE GAPS					
INDICATOR	VALUE	STATE AVERAGE	STATE PERCENTILE	US AVERAGE	US PERCENTILE
Broadband Internet	8%	9%	53	13%	41
Lack of Health Insurance	1%	3%	33	9%	6
Housing Burden	No	N/A	N/A	N/A	N/A
Transportation Access Burden	Yes	N/A	N/A	N/A	N/A
Food Desert	Yes	N/A	N/A	N/A	N/A

Report for 1 mile Ring around the Corridor

Report produced July 30, 2024 using EJScreen Version 2.3

ENVIRONMENTAL JUSTICE SCREENING FORM

Project Name	Palmer to Ware Improvement Project (the "Project")
Anticipated Date of MEPA Filing	August 15, 2024
Proponent Name	New England Power (the 'Proponent")
Contact Information	Bethany Rocha info@O15nproject.com (800) 674-9510
Project Address	Ware, West Brookfield, and Palmer, MA 01821
Project Type	Electrical Facility
Project Description	The proposed Project includes upgrades to an existing 10.35-mile-long overhead transmission line that originates at Palmer Substation #503 located southeast of downtown Palmer, crosses Route 20 and the Massachusetts Turnpike, and continues northeast until it crosses Route 9 and Route 32, terminating at the Ware Substation #501 northeast of downtown Ware. The Project will rebuild the existing line to address widespread damage to the existing structures, improved telecommunications between the two substations, and improved reliability of the transmission line. The transmission line will be moved to the center of the existing right-of-way (ROW), completely replacing the existing structures, conductor, and shield wire. Work will include vegetation management, upgrading existing access, and creating new access as required to construct and maintain the rebuilt line. The line will be rebuilt with steel structures, and will initially be operated at 69kV but designed to allow future operation at 115kV to enable future distributed energy resources interconnection and load growth in the area.
MEPA Review Thresholds	The Project is being reviewed under MEPA because it does not qualify as a "Replacement Project" per 301 CMR 11.02 (Definitions) and the proposed work likely will not qualify as "Routine Maintenance" exempted from review. The Project exceeds the ENF threshold at 310 CMR 11.03(1)(b)(1) for direct alteration of 25 or more acres of land, 310 CMR 11.03(3)(b)1.d for temporary alteration of >5,000 sf Bordering Vegetated Wetlands (BVW), 310 CMR 11.03(3)(b)1.f for alteration of ½ or more acres of any other wetlands and may exceed the Mandatory EIR threshold at 310 CMR 11.03(3)(a)1.a for temporary wetland impacts over an acre. The Project may potentially exceed the threshold at 310 CMR 11.03(2)(b)(2) for taking of an endangered or threatened species or species of special concern, provided two or more acres of disturbance of designated priority habitat as defined in 321 CMR 10.02. The Project location is also within one mile of an Environmental Justice population, necessitating an EIR.
FEMA floodplain	There are two named perennial streams crossing the Project's ROW: Kings Brook in Palmer, which crosses the ROW approximately 3 miles north of Palmer Substation at Flynt Street; and School Street Brook which crosses the ROW northeast of West

	Ware Street in Palmer. Kings Brook is mapped by FEMA as having a 100-year floodplain.
Estimated Building GHG Emissions	The Project will not result in stationary source GHG emissions.
Anticipated Permits	The Project requires the following State Agency Actions. • State Highway Access Permit (MassDOT) • Section 401 Water Quality Certificate (MassDEP); • Energy Facilities Siting Board/Department of Public Utilities approval under G.L. c. 164, §69J and §72; and • NHESP Conservation and Management Permit – Potential - To be Determined based on ongoing consultation with NHESP.
Environmental Justice Populations	The Project Site is not within a census block group that meets the State's definition of an EJ Population. Within a 1-mile radius of the Project Site, the following Environmental Justice populations are found: • 3 Income-based Communities – at least 25 percent of households have a median household income 65 percent or less than the state median household income. Within the 5-mile radius of the Project Site, 9 Income-based communities are present, along with: • 1 Minority and Income Community – at least 25 percent of households have a median household income 65 percent or less than the state median household income, and also have the attributes of the "Minority" population. Refer to the attached Environmental Justice Map for EJ populations within one and five miles from the Project Site.
Vulnerable Health EJ Criteria	The Massachusetts Department of Public Health (DPH) EJ Tool indicates that the Town of: • Ware meets the Vulnerable Health EJ criteria for low birth weight, elevated blood lead prevalence, and childhood asthma but not for heart attack; • Palmer meets the criteria for elevated blood lead prevalence and heart attack but does not meet the criteria for childhood asthma and low birth weight; and • West Brookfield does not meet the criteria for heart attack. The DPH EJ Tool does not show data for other parameters in the West Brookfield community. The DPH EJ Tool also indicates at the census tract level that: • The census tract in Ware containing a small portion of the Project Site meets the criteria for elevated blood lead levels and low birth weight and • The census tract in Palmer containing a majority of the Project area meets the criteria for elevated blood lead levels but not for low birth weight.

	The tool does not show data for other parameters in census tracts located within the Project Site.
Potential Impacts to EJ Populations	The Project is proposed within the existing ROW, thereby minimizing adverse environmental impacts. Project air quality and noise impacts will be temporary in nature and related to active construction. As these impacts will be intermittent and will not be in front of any single location for an extended period of time, they will not result in severe environmental or public health impacts, nor will they exacerbate any existing health or environmental burdens for the identified EJ populations. No long-term impacts to soil, bedrock, vegetation, surface water, groundwater, wetland resources, or air quality will occur. The Proponent will be implementing measures to avoid, minimize, and mitigate potential environmental impacts throughout the entire Project alignment, including where it crosses through or is within one mile of mapped EJ populations.
Project Benefits	The Project will: • address the need for improved reliability and telecommunications as the Proponent is invested in improving the electrical infrastructure through upgrades of the existing O15N Transmission Line; • improve transmission system infrastructure and comply with comprehensive regional plans for maintaining electric transmission reliability in New England, for EJ and non-EJ Populations alike; • provide improved shielding from lightning and high-speed communication between Palmer and Ware Substations as the Project includes installing an optical ground wire ("OPGW"); and • enable future distributed energy resources ("DER") interconnection and load growth in the area and increase transfers of power over time to support electrification within the Commonwealth since the Rebuilt Line will be designed with additional capacity.
How to Request Additional Information	Community members can request the following: • A meeting to discuss the Project, • Spanish-language oral interpretation services, and/or • Other accommodations, including meetings after business hours and/or at locations near public transportation. Please call the contact listed at the top of this form to make a request.

Appendix F

Historic Resources Supporting Documentation

APPENDIX A
MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD
BOSTON, MASS. 02125
617-727-8470, FAX: 617-727-5128

PROJECT NOTIFICATION FORM

Project Name: National Grid Line O15N Asset Condition Refurbishment

Location / Address: Hampshire, Worcester, and Hampden Counties, Massachusetts

City / Town: Ware, West Brookfield, and Palmer

Project Proponent

Name: New England Power Company d/b/a/ National Grid

Address: 40 Sylvan Road

City/Town/Zip/Telephone: Waltham, MA 02451

Agency license or funding for the project (list all licenses, permits, approvals, grants or other entitlements being sought from state and federal agencies).

Agency Name	Type of License or funding (specify)
USACOE	S404/S10 (PCN)
EPA NPDES Storm Water Program	NOI & SWPPP
MA MEPA	ENF Form
MassDEP	Concom Wetland Protection Act (NOI), 401 Individ. WQC; CH 91 License
MA Energy Facility Siting Board	Petition to construct
NHESP MA ENdangered Species Act	

Project Description (narrative):

The New England Power Company (NEPCo), d/b/a/ National Grid, is proposing upgrades to the 69 kV O15N transmission line in Ware, West Brookfield, and Palmer, Massachusetts as part of the Line O15N Asset Condition Refurbishment (ACR) Project (Project). Line O15N extends approximately 10.35 miles between the Ware 501 Substation in Ware and the Palmer 503 Substation in Palmer. Proposed improvements include replacing wood pole structures with direct embedded light-duty steel single pole structures, reconductoring, installation of new grounding, and installation of one OPGW. Project plans are still being finalized, but access road upgrades or construction may also be required.

Does the project include demolition? If so, specify nature of demolition and describe the building(s) which are proposed for demolition. No

Does the project include rehabilitation of any existing buildings? If so, specify nature of rehabilitation and describe the building(s) which are proposed for rehabilitation. No

Does the project include new construction? If so, describe (attach plans and elevations if necessary).

No new construction; Project represents refurbishment of existing Line O15N.

APPENDIX A (continued)

To the best of your knowledge, are any historic or archaeological properties known to exist within the project's area of potential impact? If so, specify. No -see enclosed intensive (locational) archaeological survey technical proposal

What is the total acreage of the project area? Open Project ROW area is approximately 126 acres

Woodland ______	acres	Productive Resources:	
Wetland ______	acres	Agriculture ______	acres
Floodplain ______	acres	Forestry ______	acres
Open space ______	acres	Mining/Extraction ______	acres
Developed ______	acres	Total Project Acreage ______	acres

What is the acreage of the proposed new construction? ______ acres

What is the present land use of the project area? Electrical transmission line corridor

Please attach a copy of the section of the USGS quadrangle map which clearly marks the project location.

See enclosed intensive (locational) archaeological survey technical proposal

This Project Notification Form has been submitted to the MHC in compliance with 950 CMR 71.00.

Signature of Person submitting this form: [signature] Date: 3/15/2023

Name: Ora Elquist (Gray & Pape, Inc.)

Address: 60 Valley Street, Suite 301

City/Town/Zip: Providence, Rhode Island 02909

Telephone: 401-323-3200

REGULATORY AUTHORITY

950 CMR 71.00: M.G.L. c. 9, §§ 26-27C as amended by St. 1988, c. 254.

The Commonwealth of Massachusetts

William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

PERMIT TO CONDUCT ARCHAEOLOGICAL FIELD INVESTIGATION

Permit Number 4261 Date of Issue March 31, 2023

Expiration Date March 31, 2024

Gray & Pape, Inc.--Providence, R.I. is hereby authorized to conduct an archaeological field investigation pursuant to Section 27C of Chapter 9 of General Laws and according to the regulations outlined in 950 CMR 70.00.

National Grid Line 015N Asset Condition Refurbishment Project,
Ware, West Brookfield, and Palmer

Project Location

Brona Simon

Brona Simon, State Archaeologist
Massachusetts Historical Commission

220 Morrissey Boulevard, Boston, Massachusetts 02125
(617) 727-8470 • Fax: (617) 727-5128
www.state.ma.us/sec/mhc

GRAY & PAPE
HERITAGE MANAGEMENT
Since 1987

60 Valley Street
Suite 103
Providence, RI 02909
401.273.9900

January 10, 2024

Brona Simon
State Historic Preservation Officer
Executive Director
Massachusetts Historical Commission
220 Morrissey Boulevard
Boston, Massachusetts 02125

RE: National Grid Line O15N Asset Condition Refurbishment Project – Ware, West Brookfield, and Palmer, Massachusetts
Permit Amendment Request
Gray & Pape #22-67002.019

Dear Ms. Simon,

As you are aware, National Grid is proposing upgrades as part of the Line O15N Asset Condition Refurbishment Project (Project) located in Ware, West Brookfield, and Palmer, Massachusetts (Figures 1 through 4). National Grid has identified access roads upgrades where new construction or grading may be necessary, and other work area updates. These include those in archaeologically sensitive areas identified and confirmed by walkover survey conducted during 2023 intensive archaeological survey investigations completed for Project (Table 1; see Figures 1 through 4 and enclosed Project plans). The work areas in addition to access roads include pull pads and expanded or reconfigured structure work pads.

Gray & Pape's ongoing intensive survey has been conducted under State Archaeologist's Permit #4261 issued by the MHC March 31, 2023. Project plans are not finalized, but additional revisions are expected to be minor. To accommodate this updated scope of work related to the additional access roads and work areas, and any other minor revisions to Project plans as they occur, Gray & Pape requests that Permit #4261 be amended to include the ongoing intensive (locational) archaeological survey of archaeologically sensitive work areas for the 2024 field season. The results of the ongoing intensive survey completed in 2023 and 2024 for the Project will be provided in one comprehensive report.

Intensive survey along the access roads and pull pads will consist of linear transects with test pits excavated at 10-meter (m) intervals. Testing within the expanded or reconfigured work pads previously tested in 2023 will add test pits as necessary to the existing 10-m interval staggered grid, as necessary. All test pits will be excavated in 10-centimeter (cm) levels to a maximum of 100 cm below surface (cmbs) or to C horizon subsoils, whichever comes first. Gray & Pape estimates that up to 120 to 130 test pits will be necessary to adequately the additional work areas, inclusive of any radial testing placed at 2.5- to 5-m intervals around low density finds or isolated find spots. The intensive survey will be completed as weather and ground conditions permits (e.g., no snow cover, unfrozen soils).

GRAY & PAPE
HERITAGE MANAGEMENT

TABLE 1. ARCHAEOLOGICALLY SENSITIVE ACCESS ROADS AND OTHER WORK AREAS.

Work Area	Location Based on Existing or Proposed Structures	Station Nos.	Plan Page	Estimated Test Pits
Expanded Work Pad	Structures 40 and 41	N/A	5	6
Access Road	Structures 67 to 69	213+50 to 217+00	8	6
Access Road	Structures 84 to 85	262+20 to 264+00	11	5
Access Road	Structures 108 to 109	316+00 to 319+00; 335+00 to 336+00	13	12
Access Road	Structures 112 to 113	348+50 to 349+75	14	5
Expanded Work Pad	Structure 113	N/A	14	3
Pull Pad	Between Structures 113 to 114	N/A	14	8
Access Road	Structures 113 to 114	352+75 to 353+75	14	3
Expanded Work Pad	Structure 114	N/A	14	4
Access Road	Structures 114 to 115	355+00 to 356+50	14	5
Pull Pad	Between Structures 114 and 115	N/A	14	8
Access Road	Structures 116 to 117	366+25 to 368+25	14	6
Access Road	Structures 117 to 118	369+75 to 372+00	14	6
Access Road	Spur to Structure 138	400+00 to 400+80	16	3
Access Road	Spur to Proposed Structure 106	402+50 to 403+00	16	2
Access Road	Spur to Structure 139	409+00 to 410+50	16	4
Access Road	Structures 140 to 141	415+20 to 417+50	16	7
Access Road	Structure 141 to Proposed Structure 108	418+50 to 419+60	16	3
Access Road	Proposed Structure 108 to Structure 142	421+00 to 422+00	16	3
Access Road	Spur to Structure 143	427+50 to 428+00	17	3
			Total Test Pits	102

Thank you for your time and attention to this matter. If you have any questions or require additional information, please feel free to contact Kristen Heitert, Regional Project Manager, or me at your convenience.

Sincerely,

Ora Elquist, MA, RPA
Principal Investigator

Enclosure

cc: Kevin O'Brion, National Grid (via email)
Mike Retter, National Grid (via email)

6/30/2023 Created in ArcPro 3.0 for G&P Project 22-67013.001.

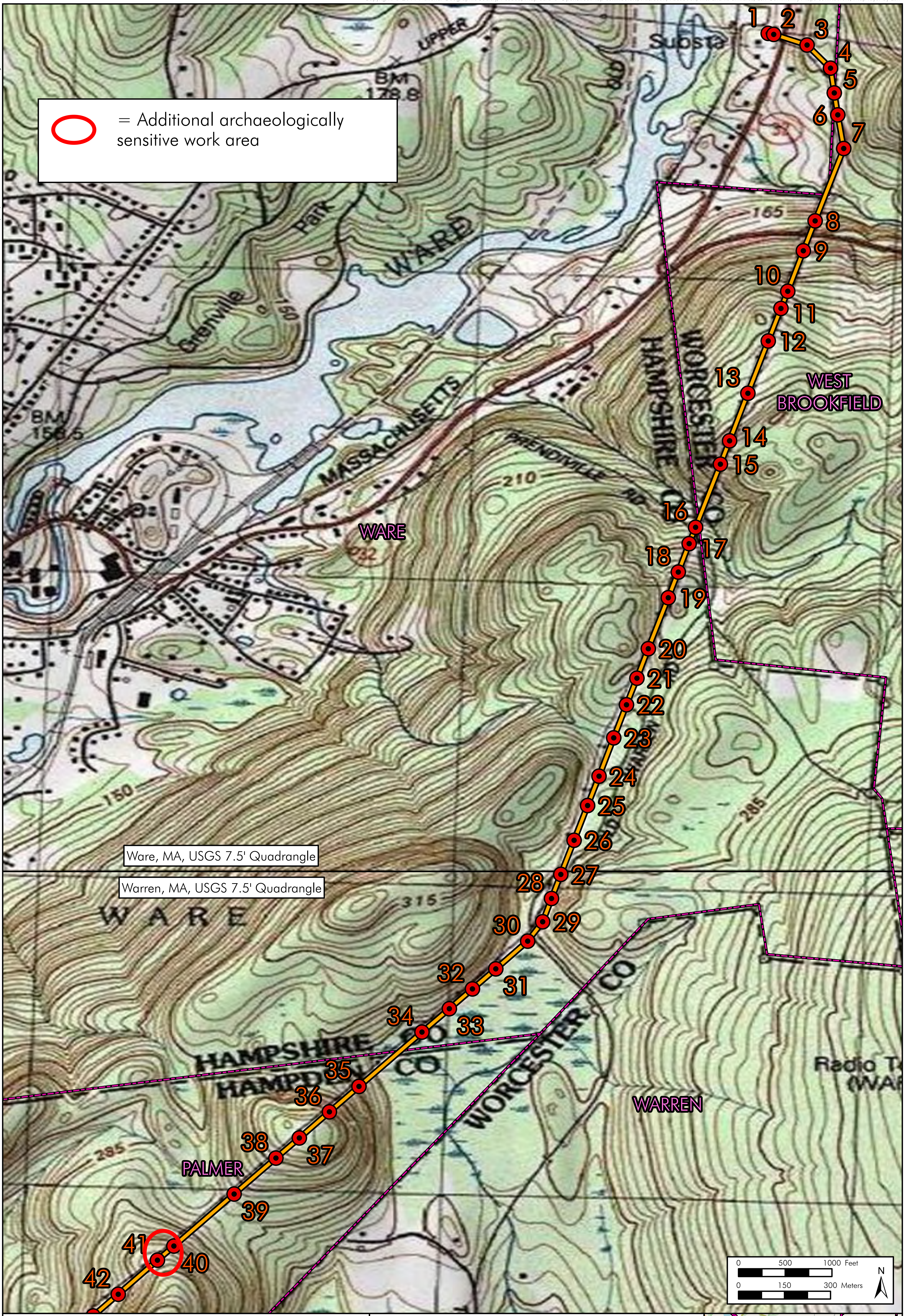


Figure 1
Line O15N Asset Condition Refurbishment Project on the Ware and Warren USGS topographic quadrangles, 7.5-minute series.

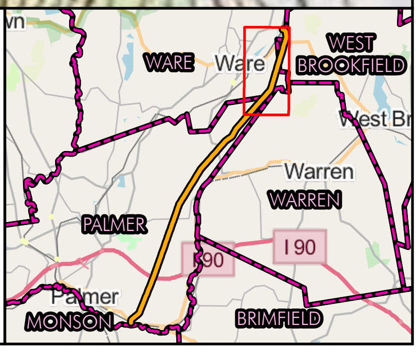
GRAY & PAPE
HERITAGE MANAGEMENT

Existing Structure

Line O15N Project

Town Boundary

USGS Topographic Quadrangle Boundary



6/30/2023 Created in ArcPro 3.0 for G&P Project 22-67013.001.

Figure 2
Line O15N Asset Condition Refurbishment Project on the Palmer and Warren USGS topographic quadrangles, 7.5-minute series.

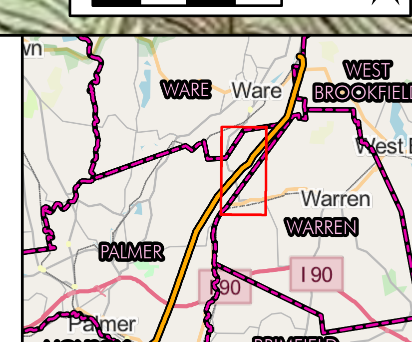
GRAY & PAPE
HERITAGE MANAGEMENT

Existing Structure

Line O15N Project

Town Boundary

USGS Topographic Quadrangle Boundary



6/30/2023 Created in ArcPro 3.0 for G&P Project 22-67013.001.

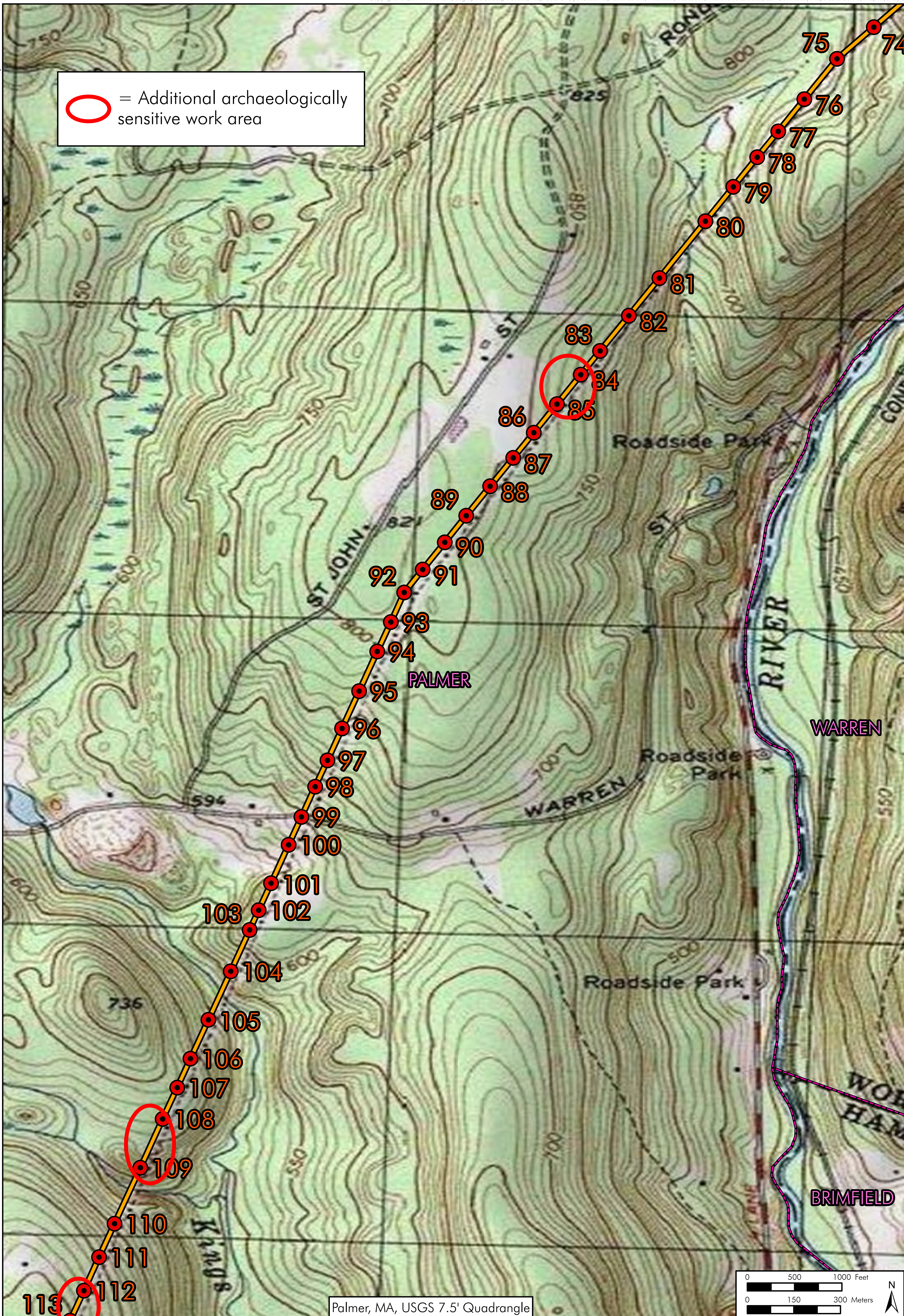


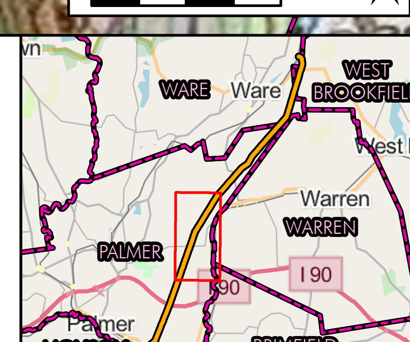
Figure 3
Line O15N Asset Condition Refurbishment Project on the Palmer USGS topographic quadrangle, 7.5-minute series.

GRAY & PAPE
HERITAGE MANAGEMENT

Existing Structure

Line O15N Project

Town Boundary



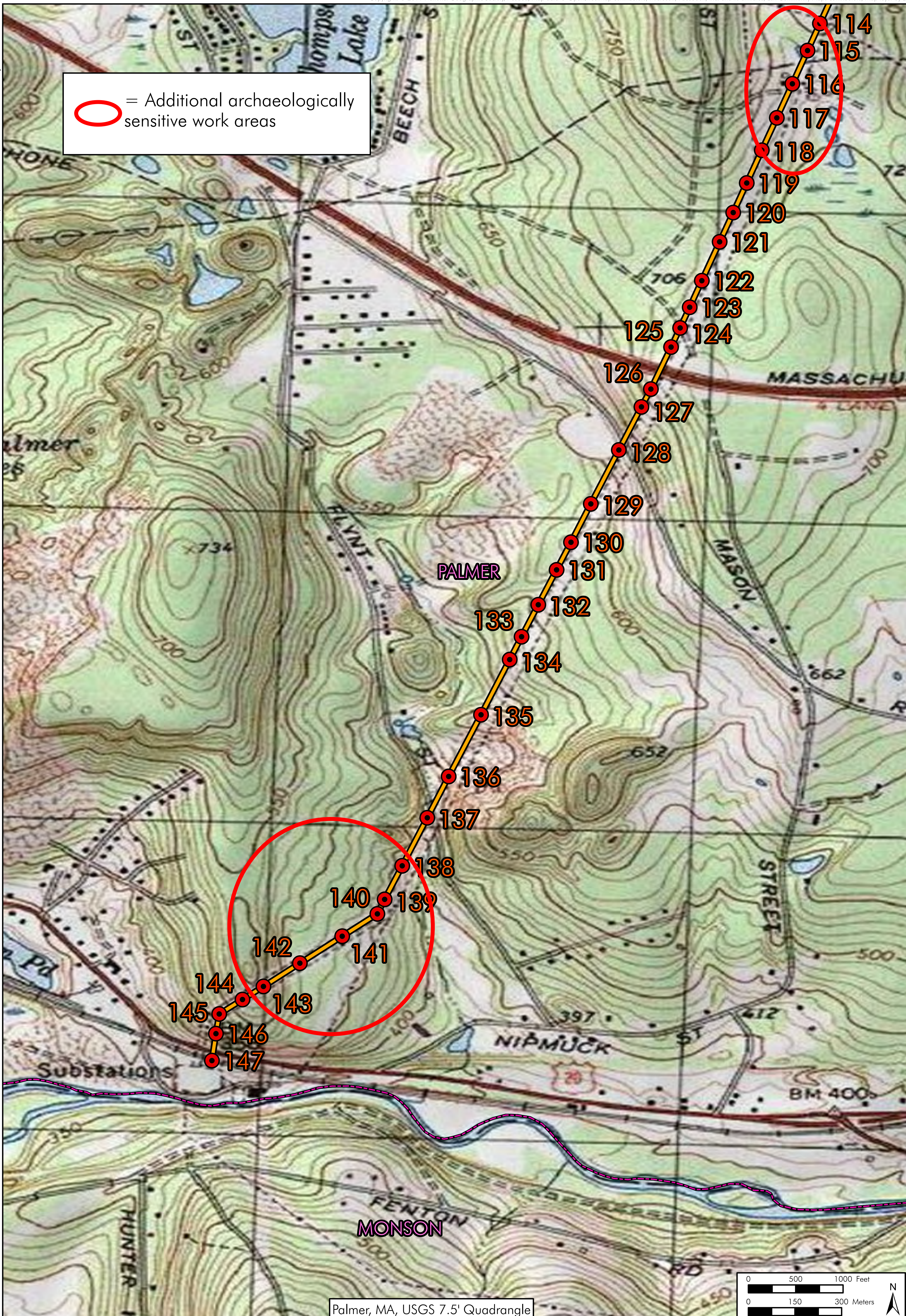


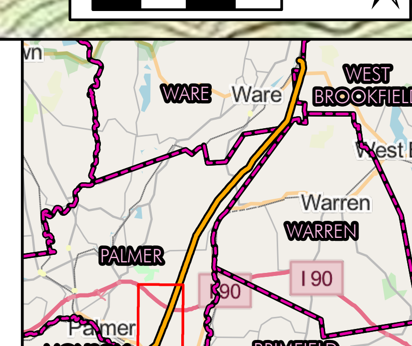
Figure 4
Line O15N Asset Condition Refurbishment Project on the Palmer USGS topographic quadrangle, 7.5-minute series.

GRAY & PAPE
HERITAGE MANAGEMENT

Existing Structure

Line O15N Project

Town Boundary



Appendix 1-2

Secretary's Certificate on the EENF

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Maura T. Healey
GOVERNOR

Kimberley Driscoll
LIEUTENANT GOVERNOR

Rebecca L. Tepper
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1081
http://www.mass.gov/eea

September 30, 2024

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
EXPANDED ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: Palmer to Ware Improvements Project
PROJECT MUNICIPALITY	: Ware, West Brookfield, and Palmer
PROJECT WATERSHED	: Chicopee River
EEA NUMBER	: 16866
PROJECT PROPONENT	: New England Power Company (d/b/a National Grid)
DATE NOTICED IN MONITOR	: August 23, 2024

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G.L. c. 30, ss. 61-62L) and Section 11.06 and 11.11 of the MEPA Regulations (301 CMR 11.00), I have reviewed the Expanded Environmental Notification Form (EENF) and hereby determine that this project **requires** the submission of an Environmental Impact Report (EIR). In accordance with Section 11.06(8) of the MEPA regulations, the Proponent requested that I allow a Single EIR to be submitted in lieu of the usual two-stage Draft and Final EIR process. I hereby grant the request to file a Single EIR, which the Proponent should submit in accordance with the Scope included in this Certificate.

Project Description

As described in the EENF, the project consists of upgrading an existing 10.35-mile-long section of overhead transmission line (O15N Line) from Palmer Substation #503 to Ware Substation #501. Specifically, the project involves replacing the existing line and structures to improve telecommunications between the two substations, address widespread damage to the existing structures, and improve reliability of the transmission line. The transmission line will be moved to the center of the existing right-of-way (ROW), completely replacing the existing structures, conductor, and shield wire. Work will include minor vegetation management, upgrading existing access roads, and creating new access as required to construct and maintain the rebuilt line. New access road construction will consist of grading and laying gravel. Work pads will be constructed/utilized to facilitate the removal of existing structures and new pole installations. As described in the EENF, work pads constructed in wetlands will consist of temporary construction mats. Work pads constructed within Riverfront Area or Rare Species Habitat will be graded and restored after construction is complete. Work pads in the remaining upland areas will be constructed through grading and installation of gravel. All work is proposed within the existing, maintained ROW.

The rebuilt line will generally be constructed with light-duty steel single-pole structures, ranging in height from approximately 75 feet to 110 feet above ground. Where the O15N Line crosses under a different existing transmission line (the 345 kV 301 Line north of Smith Street in Palmer), engineered steel H-frame structures will be utilized instead. The existing steel shield wire will be replaced with optical ground wire (OPGW) and will include 15 OPGW splice boxes. The line will continue to be operated at 69 kilovolts (kV), but designed to allow future operation at 115 kV, if needed. According to the Proponent, New England Power Company (NEP), additional upgrades to the connecting substations (which are not proposed as part of this project) would be required prior to the line operating at 115 kV. The rebuilt line will utilize fewer structures than the existing line, with a total of 147 structures proposed to be removed, and 112 structures proposed to be installed. The EENF indicates that the project will improve the reliability, safety, and resiliency of the transmission line.

Project Corridor

The 150-acre project corridor consists of a 10.35-mile section of the O15N ROW, traversing the Towns of Ware, West Brookfield, and Palmer. This section of the O15N originates at Palmer Substation #503 (located southeast of downtown Palmer), crosses Route 9 and Route 32, and terminates at Ware Substation #501 (located northeast of downtown Ware). The eight-mile stretch of the ROW from the Ware Substation to Structure 118 is approximately 100 feet wide and generally cleared; in the remaining two miles of the project corridor to the Palmer Substation, the ROW is approximately 200 feet wide and similarly cleared to the edge of the Proponent’s easement rights. For its entire length, the existing O15N Line is off-center, with the outermost conductor only approximately 30 feet away from the edge of the ROW. All but eight (8) of the 147 structures supporting this section of the existing 69 kV O15N line are wood, with a majority (six) of the eight steel structures installed in 2021 to replace extensively damaged wooden structures. Adjacent land uses are predominantly forest, with some residential, agricultural, and light industrial uses.

According to the EENF, while all work will be contained within the existing, maintained ROW, there are Article 97 Land[1] within and adjacent to the project corridor (as further described below). The project includes work in *Estimated and Priority Habitat of Rare Species* as delineated by the Natural Heritage and Endangered Species Program (NHESP) in the 15th Edition of the Massachusetts Natural Heritage Atlas. Wetland resource areas within the ROW include Bordering Vegetated Wetland (BVW), Land Under Water (LUW), Bank, and Riverfront Area. There are 16 Certified Vernal Pools within 0.5 miles of the project corridor, but none within the existing ROW. Lower Graves Brook, an Outstanding Resource Water (ORW) is located approximately 0.5 miles from the edge of the existing ROW.

The project corridor does not cross any mapped Environmental Justice (EJ) populations (as defined in M.G.L. c. 30, § 62) but is within one mile of three EJ populations; all of which are characterized by Income criteria. There are seven (7) additional EJ populations located within 5 miles of the project corridor. As described below, the EENF included a review of potential impacts and benefits to EJ populations and described public involvement efforts undertaken to date.

---

[1] Article 97 refers to Article 97 of the amendments to the state constitution, which require a 2/3 vote of the General Court to authorize any change in use or disposition of land or interest in land that was acquired for the purposes set forth in Article 97, such as park and conservation land.

Environmental Impacts and Mitigation

According to the EENF, potential environmental impacts associated with the project include the alteration of ±19 acres of land and the alteration of several wetland resource areas, including approximately 4,811 square feet (sf) of LUW; 2,617 linear feet (lf) of Bank; 200,080 sf (4.59 acres) of BVW; and 98,523 sf (2.26 acres) of Riverfront Area. The project involves the alteration of approximately 20.86 acres of Priority/Estimated Habitat (all located within the maintained ROW) that may result in a "Take" of mapped rare species, as further discussed below.

Measures to avoid, minimize, and mitigate project impacts include containing all proposed work to the existing ROW; use of temporary construction mats where crossing wetlands or water courses is unavoidable; use of erosion and sedimentation controls and other best management practices (BMPs) during construction; restoration of any work pads proposed within Riverfront Area or Priority/Estimated Habitat; complete avoidance of work within the 100-year floodplain; and implementation of measures to protect identified rare species in consultation with NHESP. As discussed below, the Single EIR should provide more detail on avoidance and minimization measures, particularly with regard to the proposed access roads and work pads.

Jurisdiction and Permitting

The project is undergoing MEPA review and is subject to a mandatory EIR pursuant to 301 CMR 11.03(3)(a)(1)(a) of the MEPA regulations because it requires Agency Actions and will result in the alteration of one or more acres of BVW (4.59 acres). The project is also required to prepare an EIR under 301 CMR 11.06(7)(b) of the MEPA regulations because it is located within one mile of one or more EJ populations. Additionally, the project exceeds the Environmental Notification Form (ENF) thresholds at 301 CMR 11.03(3)(b)(1)(d) and 11.03(3)(b)(1)(f) as it will result in the alteration of 5,000 or more sf of BVW, and alteration of one-half acre or more of any other wetlands, respectively. The project may also exceed the ENF threshold at 301 CMR 11.03(2)(b)(2), alteration of greater than two acres of disturbance of designated Priority Habitat, as defined in 321 CMR 10.02, that results in a Take of a state-listed endangered or threatened species or species of special concern.

The project requires a 401 Water Quality Certification (WQC) from the Massachusetts Department of Environmental Protection (MassDEP), an Access Permit from the Massachusetts Department of Transportation (MassDOT), Energy Facilities Siting Board (EFSB) Approval, and potentially a Conservation and Management Permit (CMP) from NHESP.

The project requires Orders of Conditions (OOC) from the Palmer and Ware Conservation Commissions (or in the case of an appeal of either OOC, a Superseding Order of Conditions from MassDEP) and review by the West Brookfield Authority. The project also requires Section 404 Pre-Construction Notification (PCN) from the U.S. Army Corps of Engineers (USACE) and a National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP) from the U.S. Environmental Protection Agency (EPA).

Because the project is not seeking Financial Assistance from an Agency, MEPA jurisdiction extends to those aspects of the project that are within the subject matter of required or potentially required Permits and are likely, directly or indirectly, to cause Damage to the Environment.

Request for Single EIR

The MEPA regulations indicate a Single EIR may be allowed provided I find that the EENF:

a) describes and analyzes all aspects of the project and all feasible alternatives, regardless of any jurisdictional or other limitation that may apply to the Scope;
b. provides a detailed baseline in relation to which potential environmental impacts and mitigation measures can be assessed; and,
c. demonstrates that the planning and design of the project use all feasible means to avoid potential environmental impacts.

For any Project for which an EIR is required in accordance with 301 CMR 11.06(7)(b), I must also find that the EENF:

d. describes and analyzes all aspects of the Project that may affect EJ Populations located in whole or in part within the Designated Geographic Area around the project; describes measures taken to provide meaningful opportunities for public involvement by EJ Populations prior to filing the EENF, including any changes made to the project to address concerns raised by or on behalf of EJ Populations; and provides a detailed baseline in relation to any existing unfair or inequitable Environmental Burden and related public health consequences impacting EJ Populations in accordance with 301 CMR 11.07(6)(n)(1)

Consistent with this request, the EENF was subject to an extended comment period under 301 CMR 11.05(8). For the reasons state below, I hereby grant the request to file a Single EIR.

Review of the EENF

The EENF provided a description of existing and proposed conditions, preliminary project plans, a copy of NEP's construction BMPs ("Maintenance and Construction Best Management Practices for New England" (EG-303NE)), and copies of correspondence with the Massachusetts Historical Commission (MHC). It identified measures to avoid, minimize and mitigate environmental impacts. Consistent with the MEPA Interim Protocol on Climate Change Adaptation and Resiliency, the EENF contained an output report from the MA Climate Resilience Design Standards Tool prepared by the Resilient Massachusetts Action Team (RMAT) (the "MA Resilience Design Tool"),[2] together with information on climate resilience strategies to be undertaken by the project. It also included a description of measures taken to enhance public involvement by EJ populations and a baseline assessment of any existing unfair or inequitable Environmental Burden and related public health consequences impacting EJ Populations in accordance with 301 CMR 11.07(6)(n)(1).

The Proponent provided additional information to the MEPA Office regarding the avoidance of environmental impacts, access road and work pad construction, open space impacts, and transmission upgrades on September 26, 2024. For purposes of clarity, all supplemental materials provided by the Proponent are included in references to the "EENF," unless otherwise indicated.

[2] https://resilientma.org/rmat_home/designstandards/

Alternatives Analysis

As described in the EENF, a review of the 69 kV O15N transmission line's recent operating history, design, and physical condition indicates that it should be rebuilt to ensure reliable service. Specifically, the project is proposed to address the existing line's off-center location within the ROW, resulting in an increased outage risk due to fallen trees; a documented history of outages from lighting, thunderstorms, and fallen trees; poor access for maintenance and outage restoration; and widespread woodpecker damage and structure deterioration. In addition, the EENF states that the project is needed to provide increased shielding to protect the line from lightning and fiber optic capability to improve telecommunications. To address these issues, the EENF evaluated a No-Build Alternative, Partial Rebuild Alternative, Non-Wires Alternative, Rebuild with Spacer Cable Alternative, New Build/New Route Alternative, and Complete Rebuild Alternative (the Preferred Alternative). The EENF included a table comparing each alternatives' feasibility, environmental impacts, and ability to meet project goals (Table 2-2).

The No-Build Alternative was dismissed because, according to the EENF, the transmission structures have a documented history of widespread damage requiring repair and replacement. While this Alternative would avoid environmental impacts associated with construction of a completely rebuilt line (as with the Preferred Alternative), it would result in repeated temporary environmental impacts for access to stage equipment to repair or replace structures on an as-needed basis. It would also not address the poor configuration of the line within the existing ROW, as well as the associated potential for outages due to trees. As such, this Alternative was dismissed.

The Partial Rebuild Alternative would consist of a targeted structure repair program that would address only the structures in the worst condition. As stated in the EENF, replacing individual structures in stages/as necessary would require keeping the existing line in its current configuration in the existing off-center alignment on the ROW. This Alternative would involve similar impacts to the No-Build Alternative and was dismissed for similar reasons; i.e., it would not address the inherent design issues, and would not completely avoid environmental impacts as repeated temporary impacts would still be incurred to obtain access to and safely stage equipment around the existing structures.

The Non-Wires Alternative (NWA) would involve utilizing a combination of energy efficiency and demand response programs, new distributed generation, and new energy storage facilities as alternative means of addressing the need for transmission line improvements. According to the EENF, NWAs are generally appropriate when the underlying need for a project is driven by increasing load levels. Potential environmental impacts of NWAs vary, but would potentially result in fewer impacts to wetlands resources as compared to the Preferred Alternative, while likely resulting in greater tree clearing as new construction would be required (there is no tree clearing proposed as part of the Preferred Alternative). As stated in the EENF, while the project will provide additional, reliable capacity to support anticipated future loads, in this case, the project is not primarily driven by increasing load levels, but by the need to address the deteriorating condition and design of the existing line, as well as the need for increased fiber optic capability. The implementation of an NWA would not address the poor condition of the structures, or the structure constraints/alignment that predispose the existing line to outages from lightning strikes or impacts from trees. As such, the Non-Wires Alternative was dismissed. As noted, the project also intends to increase voltage on the transmission lines to support a future expansion in capacity based on need. The Single EIR should clarify the circumstances under which this future expansion would be implemented, what permitting or approvals would be required at that time, and how the project will demonstrate measures to minimize impacts, including measures to maximize energy efficiency and clean energy generation as part of any future expansion.

A New Build/New Route Alternative would involve reconstructing the transmission line on a new route. Linear corridors located within or adjacent to the O15N transmission corridor were evaluated, included existing electric transmission, railroad, pipeline, and highway and roadway corridors. Based on this review, five potential routes were evaluated to determine if any alternative route would result in fewer impacts than the Preferred Alternative while still meeting project goals. All routes were longer in length compared to the proposed project, and while they may potentially result in fewer wetland impacts as compared to the Preferred Alternative, they would likely involve impacts to Article 97 Land (whereas no impacts are currently proposed), and were more difficult and/or costly to construct. As such, the alternative routes were dismissed.

The EENF indicates that the Preferred Alternative (described herein) was selected as it is the only Alternative that will improve performance of the existing line by addressing all existing deficiencies, while also providing additional thermal capacity and voltage support required to support future load growth. Environmental impacts will be minimized by utilizing the existing ROW to construct the new line, utilizing construction BMPs, and allowing a majority of new access roads and work pads to revegetate following project construction.

The Proponent considered two transmission structure designs for the new line: one that complies with 115 kV design standards, and a second that complies with 69 kV design standards. As stated in the EENF, both the 69 kV and 115 kV designs would be able to support the new conductor and OPGW, and in both cases, the project would still be rebuilt in the center of the ROW. Slightly taller structures would be required to support the 115 kV due to safety requirements; however, 33 fewer structures would be required for the 115 kV line as compared to the 69 kV line, as the taller structures for the 115 kV design allow for greater span lengths. According to the EENF, the 115 kV line will provide both near-term and longer-term transmission system reliability benefits that the 69 kV design would not. It would also allow the line to operate at 115 kV in the future, if necessary, without costly transmission upgrades in the future and associated environmental impacts. The EENF notes that there are no reliability needs observable now that would necessitate the operation of the new transmission line at 115 kV within the 10-year planning horizon. It does not indicate whether this project is part of a master plan developed by NEP for this region or the state, nor does it indicate what additional permitting and approvals would be needed to operate the line at a higher voltage. These issues should be addressed in the Single EIR.

Environmental Justice

As noted above, the project corridor does not cross through any EJ populations, but is located within one mile of three (3) EJ populations, all characterized by Income criteria. There are seven (7) additional EJ populations located within 5 miles of the project corridor (all characterized by Income criteria, with the exception of one census tract characterized by Minority and Income criteria). Within the census tracts containing the above EJ populations within 1 mile of the project site, there are no languages spoken by 5% or more of residents who also identify as not speaking English very well (Limited English Proficiency (LEP) individuals). The EENF indicates that the DGA for the project is 1 mile.

Effective January 1, 2022, all new projects in "Designated Geographic Areas" ("DGA," as defined in 301 CMR 11.02, as amended) around EJ populations are subject to new requirements imposed by Chapter 8 of the Acts of 2021: An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy (the "Climate Roadmap Map") and amended MEPA regulations at 301 CMR 11.00. Two related MEPA protocols—the MEPA Public Involvement Protocol for Environmental

Justice Populations (the "MEPA EJ Public Involvement Protocol") and MEPA Interim Protocol for Analysis of project Impacts on Environmental Justice Populations (the "MEPA Interim Protocol for Analysis of EJ Impacts")—are also in effect for new projects filed on or after January 1, 2022. Under the new regulations and protocols, all projects located in a DGA around one or more EJ populations must take steps to enhance public involvement opportunities for EJ populations, and must submit analysis of impacts to such EJ populations in the form of an EIR.

The EENF describes public involvement activities conducted prior to filing, including advance notification of the project circulated to a list of community-based organizations (CBOs) and tribes/indigenous organizations (the "EJ Reference List") provided by the MEPA Office. Information circulated by the Proponent included the EJ Screening Form which identified ways to request additional information or a community meeting. NEP also created a public website for the project, which provides details of the project and contact information for review.[3] Additionally, NEP hosted two in-person open houses in Ware (May 22, 2024) and Palmer (May 28, 2024); invitations to these meetings were sent to the EJ Reference List and all 300-foot abutters along the route in Ware, Palmer, and West Brookfield, and noticed in three local newspapers.

The EENF contains a baseline assessment of existing unfair or inequitable Environmental Burden and related public health consequences impacting EJ populations in accordance with 301 CMR 11.07(6)(n)1 and the MEPA Interim Protocol for Analysis of EJ Impacts. The EENF indicates that three census tracts within Billerica were identified by the Massachusetts Department of Public Health (DPH) EJ Tool as exhibiting "vulnerable health EJ criteria"; this term is defined in the DPH EJ Tool to include any one of four environmentally related health indicators that are measured to be 110% above statewide rates based on a five-year rolling average.[4] Specifically, Ware exhibits vulnerable health EJ criteria for childhood asthma, while Palmer and West Brookfield exhibit vulnerable health EJ criteria for heart attack. One census tract in Ware exhibits vulnerable health EJ criteria for both childhood blood lead levels and low birth weight, and one census tract in Palmer exhibits vulnerable health EJ criteria for solely childhood blood lead levels. In addition, the EENF indicates that the following sources of potential pollution exist within the identified EJ populations, based on the mapping layers available in the DPH EJ Tool:

- Major air and waste facilities: 3
- M.G.L. c. 21E sites: 1
- "Tier II" Toxics Release Inventory Site: 10
- MassDEP sites with AULs: 1
- Wastewater treatment plants: 1
- Underground storage tanks: 3
- EPA facilities: 1

Although not required by the MEPA Interim Protocol for Analysis of EJ Impacts, the EENF also surveyed environmental indicators tracked through the U.S. EPA's "EJ Screen," which shows the indicators measured at the following percentiles for the identified EJ populations as compared to the MA

[3] Website available here: https://www.palmertowareimprovementproject.com/index.htm

[4] See https://matracking.ehs.state.ma.us/Environmental-Data/ej-vulnerable-health/environmental-justice.html. Four vulnerable health EJ criteria are tracked at the municipal level in the DPH EJ Viewer (heart attack hospitalization, childhood asthma, childhood blood lead, and low birth weight); of these, two (childhood blood lead and low birth weight) are also available at the census tract level.

statewide average. The EENF indicates that the following indicators are elevated at 80th percentile or higher of statewide average within the DGA:

- Particular Matter (PM2.5): 83rd percentile
- Ozone: 88th percentile

While the EENF concludes that there is some indication of an existing "unfair or inequitable" burden in certain EJ populations within the DGA based on the screening indicators above, it asserts that the project will not result in disproportionate adverse effects, or increase the risks of climate change, on the EJ populations by materially exacerbating such existing burdens. As further discussed below, the transmission lines were assessed as having a "High" risk rating for extreme precipitation (urban and riverine flooding) and extreme heat. According to the EENF, the project will improve the overall reliability of the power transmission system which both EJ and non-EJ communities rely on. There is no proposed work within the 100-year floodplain, and the project does not involve any tree clearing. As described in the EENF, there is no new impervious surface proposed and no stormwater impacts are anticipated. The EENF indicates that project impacts will be limited to the construction period, and measures will be employed to mitigate these impacts, including potential noise, traffic, and water quality impacts.

Land Alteration

The EENF indicates that the project will involve the alteration of approximately 19 acres of land, all contained within the existing, actively managed ROW. The EENF does not clarify what portion of land alteration is associated with the construction of access roads or work pads/pull pads. A total of 190 gravel work pads are proposed as part of the project; 65 of these work pads will be permanent and the remaining 125 will be temporary. Work pads will vary in size from 60 ft x 50 ft to 250 ft x 80 ft. Access to the current and proposed structures will be achieved by using a mix of existing access roads and constructing new access roads within the existing ROW. There are currently 18,472 lf (~3.5 miles) of existing gravel access roads. Approximately 16,996 lf (~2.9 mi) of new permanent gravel access roads are proposed. All newly constructed gravel roads will be 16 feet in width. While tree trimming may be required, no tree cutting is proposed. The EENF contains a breakdown of land use types within the project area, which includes residential, commercial, industrial, agricultural, forested land, and ROWs (Table 1-1).

Wetlands

According to the EENF, the project is proposed to result in the temporary alteration of 199,967 sf (4.59 acres) of BVW; 2,617 lf of Bank; 4,811 sf of LUW; and 93,989 sf (2.16 acres) of Riverfront Area The project will permanently impact an additional 113 sf of BVW and 4,534 sf of Riverfront Area. Permanent impacts to BVW are related to the installation of steel structures; these impacts will be mitigated through 1:1 replication of BVW, although the EENF does not clarify where wetlands replication is proposed. The Palmer and Ware Conservation Commissions will review the project for its consistency with the provisions of the Wetlands Protections Act (WPA), the Wetland Regulations (310 CMR 10.00), and associated performance standards. MassDEP will review the project for its consistency with the 401 WQC regulations (314 CMR 9.00). As stated in comments from MassDEP, the project will require a Section 401 WQC for impacts to Vegetated Wetlands greater than 5,000 square feet. I echo comments from MassDEP, which recommend that the Proponent request that the local Conservation Commissions defer a decision on the filing and keep the meeting open until MEPA review is complete, and the 401 WQC is issued, to ensure consistency with any requirements in the final MEPA Certificate or conditions of the WQC.

As described in the EENF, the above-listed temporary impacts to wetland resource areas are primarily associated with the use of construction mats within wetland resource areas. This includes the placement of matting within wetlands and over waterways, resulting in temporary impacts to these resource areas and to wildlife. The construction mats will be installed to allow access for heavier equipment and vehicles to support the road building and line work and are considered a BMP to reduce wetland impacts by avoiding soil compaction. Construction mats will be removed from all resource areas once construction is completed, and disturbed areas will be restored. Permanent impacts to wetland resource areas from the project are associated with the replacement and installation of new caisson supported structures, the construction of access roads within the ROW, and the construction of stone and gravel work pads within the ROW.

Article 97

The EENF identifies four state- and municipal -owned open space lands located within or adjacent to the ROW, consisting of a total of approximately 42 acres of open space within the ROW and 247 acres within 300 feet of the ROW. As described in the EENF, alteration to open space within the ROW will occur in the form of newly constructed gravel access roads and permanent work pads. Impacts to open space owned by the Massachusetts Department of Fish and Game (DFG) will consist of 0.25 acres of permanent impact from work pads and 6 acres of permanent impact from new access roads, and 2.64 acres of temporary impacts from work pads and construction matting. Impacts to open space managed by the Town of Palmer will consist of 0.01 acres of permanent impacts from work pads and 0.37 acres of permanent impact from new access roads, and 0.02 acres of temporary impacts from construction matting. The EENF states that NEP's easements for the existing line predate the establishment of the open space properties in these areas and, further, that the project has been designed to utilize existing access or develop new access within NEP's existing easements. The EENF indicates that no legislative authorization is needed as no disposition or change in use of such land will result from the project. To mitigate temporary construction-phase disturbances to public open spaces and existing trail systems, NEP will coordinate with the affected stakeholders and will develop an outreach plan to include safety signage and temporary detours around active construction zones.

Rare Species

As noted above, portions of the project area are mapped as Priority Habitat for the Orange Sallow Moth (*Pyrrhia aurantiago*), Climbing Fumitory (*Adlumia fungosa*), Jefferson Salamander (*Ambystoma jeffersonianum*), Green Rock-Cress (*Boechera missouriensis*), and Lion's foot (*Nabalus serpentarius*). These species and their habitats are protected pursuant to the Massachusetts Endangered Species Act (M.G.L. c.131A) and its implementing regulations (MESA; 321 CMR 10.00). The EENF indicates that the project will temporarily alter 18.5 acres and permanently alter 2.36 acres of Priority and/or Estimated Habitat. Project-specific BMPs will be designed with NHESP and are likely to include time-of year (TOY) restrictions, pre-construction surveys, and/or use of temporary avoidance fencing during construction.

Comments from NHESP state that, based on the information included in the EENF, it is anticipated that the project will be able to avoid a Take of Orange Sallow Moth and Jefferson Salamander. The Division will coordinate with the proponents to conduct botanical surveys for the Climbing Fumitory, Green Rock-Cress, and Lion's foot to determine the appropriate permitting pathway for state-listed plants and if the project will require a Conservation and Management Permit (CMP; 321 CMR 10.23) for any of the three state-listed plants. As stated in comments from NHESP, projects resulting in a Take may only be permitted if they meet the performance standards for a CMP, which require the Proponent to demonstrate that the project has avoided, minimized, and mitigated impacts to state-listed species.

Climate Change

Adaptation and Resiliency

Effective October 1, 2021, all MEPA projects are required to submit an output report from the MA Resilience Design Tool to assess the climate risks of the project. Based on the output report attached to the EENF, the project has a “High” risk for extreme precipitation (urban flooding), extreme precipitation (riverine flooding), and extreme heat. Based on the 50-year useful life identified and the self-assessed criticality of the project asset, the Tool recommends a planning horizon of 2070 and a return period associated with a 50-year (2% chance) storm event when designing the project (a “utilities” asset) for the extreme precipitation parameter. The Tool recommends planning for the 90th percentile when designing for extreme heat. There is no proposed work within the 100-year floodplain, and the project does not involve any tree clearing. As described in the EENF, there is no new impervious surface proposed and no stormwater impacts are anticipated. The EENF states that the project will result in a more climate-ready and resilient transmission system that can withstand more extreme weather events, address existing system capacity shortages and increasing demand, and support future interconnection of renewable energy projects. The EENF further states that the increased capacity of the new line will allow it to support higher volumes of currently active and forecasted renewable energy resources in this region. As noted, the Single EIR should further describe the process by which the need for increased capacity will be determined in the future, and whether alternatives to maximize opportunities for energy efficiency and clean energy generation will be explored.

Greenhouse Gas Emissions

This project is subject to review under the May 2010 MEPA Greenhouse Gas Emission (GHG) Policy and Protocol (Policy) because it exceeds thresholds for a mandatory EIR. The GHG Policy includes a de minimis exemption for projects that are expected to produce minimal GHG emissions. The EENF indicates that GHG emissions associated with the project will be limited to the construction period and are de minimis. The Proponent therefore was not required to submit a GHG analysis in conjunction with the EENF.

Construction Period

The EENF indicates that project construction is expected to commence in July 2027 and conclude in December 2028. As described in the EENF, the project construction manager will implement a waste management plan to divert project-related construction waste material from landfills through recycling and salvaging where practicable. All construction activities should be managed in accordance with applicable MassDEP’s regulations regarding Air Pollution Control (310 CMR 7.01, 7.09-7.10), and Solid Waste Facilities (310 CMR 16.00 and 310 CMR 19.00, including the waste ban provision at 310 CMR 19.017). The project should include measures to reduce construction period impacts (e.g., noise, dust, odor, solid waste management) and emissions of air pollutants from equipment, including anti-idling measures in accordance with the Air Quality regulations (310 CMR 7.11). I encourage the Proponent to require that its contractors use construction equipment with engines manufactured to Tier 4 federal emission standards, or select project contractors that have installed retrofit emissions control devices or vehicles that use alternative fuels to reduce emissions of volatile organic compounds (VOCs), carbon monoxide (CO) and particulate matter (PM) from diesel-powered equipment. Off-road vehicles are required to use ultra-low sulfur diesel fuel (ULSD). If oil and/or hazardous materials are found during construction, the Proponent should notify MassDEP in accordance with the Massachusetts Contingency Plan (310 CMR 40.00). All construction activities should be undertaken in compliance with the conditions of all State and local permits.

SCOPE

General

The Single EIR should follow Section 11.07 of the MEPA regulations for outline and content and provide the information and analyses required in this Scope. It should clearly demonstrate that the Proponent has sought to avoid, minimize and mitigate Damage to the Environment to the maximum extent practicable.

Project Description and Permitting

The Single EIR should identify any changes to the project since the filing of the EENF. It should identify and describe State, federal, and local permitting and review requirements associated with the project and provide an update on the status of each of these pending actions. The Single EIR should include a description and analysis of applicable statutory and regulatory standards and requirements, and a discussion of the project's consistency with those standards.

The Single EIR should include detailed site plans for existing and post-development conditions at a legible scale. Plans should clearly identify buildings, interior and exterior public areas, impervious areas, transportation improvements, and stormwater and utility infrastructure. The Single EIR should provide detailed plans, sections, and elevations to accurately depict existing and proposed conditions, including proposed above- and below-ground structures, on- and-off-site open space, and resiliency and other mitigation measures. The Single EIR should update quantified temporary and permanent environmental impacts (including to specific resource types) to the extent these impacts have changed since the filing of the EENF.

As noted above, the project will increase the capacity of the O15N transmission line from 69 kV to 115 kV; however, the line will continue to operate at 69 kV until operation at 115 kV is warranted, which would also require upgrades to connecting substations. The Single EIR should clarify what additional work would be required for this section of the O15N Line to operate at 115 kV. It should clarify whether the upgrades to the adjoining substations are currently proposed as part of any long-term planning, and whether the upgrades to the substations are being evaluated as part of EFSB review of this project. The EENF indicates that there are no reliability needs observable now that would necessitate the operation of the new transmission line at 115 kV within the 10-year planning horizon; the Single EIR should clarify when the need for this line to operate at 115 kV is expected to occur, based on any long-term forecasting undertaken by the Proponent. The Single EIR should address whether this ACR project is part of a master plan developed by NEP for this region or the state. It should describe what permitting or approvals would be required to operate at a higher voltage, and how the project will demonstrate measures to minimize impacts, including measures to maximize energy efficiency and clean energy generation as part of any future expansion.

The information and analyses identified in this Scope should be addressed within the main body of the Single EIR and not in appendices. In general, appendices should be used only to provide raw data, such as drainage calculations, traffic counts, capacity analyses and energy modelling, that is otherwise adequately summarized with text, tables and figures within the main body of the Single EIR. Information provided in appendices should be indexed with page numbers and separated by tabs, or, if provided in electronic format, include links to individual sections. Any references in the Single EIR to materials provided in an appendix should include specific page numbers to facilitate review.

Environmental Justice / Public Health

The Single EIR should include a separate section on "Environmental Justice" and contain a full description of measures the Proponent intends to undertake to promote public involvement by such EJ populations during the remainder of the MEPA review process including a discussion of any of the best practices listed in the MEPA EJ Public Involvement Protocol that will be employed. It should describe any outreach that will be conducted as part of local review processes. The Single EIR should include an update on any outreach conducted since the filing of the EENF and a description of any changes made to the project (including mitigation measures) in response to this outreach. The Single EIR, or a summary thereof, should be distributed to the "EJ Reference List," with any updates to the list provided by the MEPA Office upon request.

The Single EIR should provide additional information regarding measures to mitigate any potential impacts to EJ populations during the construction period. Specifically, the Single EIR should provide more detail regarding construction period activities, including the estimated number of construction period truck trips that are anticipated for the project, and the potential for increased emissions within EJ populations near the ROW. The Single EIR should indicate whether any significant vegetation management will occur near EJ populations and/or identified "Hot Spots," as indicated in the Climate Change section below.

Land Alteration and Article 97

The Single EIR should provide an update of total of land alteration, distinguishing between temporary and permanent impacts. It should clarify the land cover types (scrub shrub, grassland, etc.) associated with other types of land alteration. The Single EIR should clarify what the proposed vegetation management will entail. It should identify the total number of work pads and access roads proposed to be constructed as part of the project, and the number that are proposed to be permanent. It should describe any restoration measures following project construction for temporary access roads/work pads. The Single EIR clearly show the area and location of work pads on site plans, as well as the areas to be restored following project construction. The Single EIR should demonstrate that the size of work pads has been minimized to the maximum extent possible, particularly in environmentally sensitive areas (NHESP habitat, Article 97 Land, wetland resource areas, etc.). The Proponent should consult with DFG to confirm that no Article 97 disposition is required. Although work pads, new sections of access road, and widening of access roads will not result in significant forest clearing, shrub/herbaceous vegetation will be permanently converted to gravel. The Single EIR should identify the total existing and proposed gravel areas, including access roads and work pads. It should describe any stormwater management that will be constructed as part of the project.

Wetlands

The Single EIR should provide updated estimates of permanent and temporary impacts to wetland resource areas as appropriate, and clarify the activities with which these impacts are associated. The EENF indicates that the project will result in 4,811 sf of temporary impacts to LUW. The Single EIR should clarify the nature of the temporary impacts (i.e., are the impacts solely from the placement of mats over the waterway or are there impacts from placing material directly into the waterway), as requested in comments from MassDEP. The EENF indicates that 1:1 replication will be provided for permanently impacted BVW. As noted in comments from MassDEP, the design of any replacement area should incorporate the recommendations from the *Massachusetts Inland Wetland Replacement Guidelines*, second edition (dated September 2022). Efforts should be made to identify areas where naturally functioning wetlands can be created, potential areas for wetland replication should be identified in the Single EIR. The Single EIR should describe long-term monitoring of the BVW replication areas to ensure they establish effectively. Work pads, new access roads, and expanded road widths should be considered new degraded areas; the Single EIR should identify the new creation of degraded areas within each resource area. The Single EIR should evaluate offsite mitigation and/or restoration of onsite degraded areas to compensate for conversion of vegetated areas to degraded areas. The Proponent is expected to expand upon the proposed mitigation measures to include mitigation for the large areas of vegetation and soil that will be replaced with gravel throughout the project.

Rare Species

The EENF indicates that NEP will continue to consult with NHESP. The Single EIR should provide an update on this consultation, and identify whether the project is anticipated to result in a Take requiring a CMP, if that determination has been made at the time of filing of the Single EIR. The Single EIR should identify any mitigation measures that have been incorporated into the project. It should update the calculations of impacts to Priority and Estimated Habitat (separately) as necessary and distinguish between temporary and permanent impacts to these resources. It should continue to evaluate measures to reduce impacts to rare species habitat, particularly through the reduction of work pads within these areas.

Climate Change

While the EENF indicates that there is no work proposed within the 100-year floodplain/Bordering Land Subject to Flooding, the EENF does identify the presence of mapped 100-year floodplain (with no Base Flood Elevation (BFE)) within the project corridor. The Single EIR should clarify whether there is any exiting transmission structure within the project corridor that is currently, and will remain, within the 100-year floodplain. The Single EIR should include a narrative explaining whether proposed infrastructure improvements will make the project assets more resilient to risks associated with riverine flooding from a 50-year (2%) storm event estimated as of 2070 specifically. In particular, the Single EIR should discuss whether new foundations are being elevated above any defined BFEs or other similar water/flood elevation measure to ensure that the structures are resilient to future flooding risks. This value can be determined either through use of the Tier 2/3 methodologies provided by the MA Resilience Design Tool.[5] Alternatively, the Single EIR should compare elevations to any BFEs determined at locations in close proximity to the project corridor. The

[5] https://msc.fema.gov/portal/advanceSearch

Single EIR should clarify whether the project corridor is located within or near "Hot Spots" as identified by the RMAT data dashboard.[6]

Construction Period

The Single EIR should confirm that the project will include a spills contingency plan that addresses prevention and management of potential releases of oil and/or hazardous materials from pre- and post-construction activities. It should confirm that this plan will be presented to workers at the site and enforced. The plan should include but not be limited to, refueling of machinery, storage of fuels, and potential releases.

Mitigation and Draft Section 61 Findings

The Single EIR should include a separate chapter summarizing all proposed mitigation measures including construction-period measures. This chapter should also include a comprehensive list of all commitments made by the Proponent to avoid, minimize, and mitigate the environmental and related public health impacts of the project, and should include a separate section outlining mitigation commitments relative to EJ populations. The Single EIR should contain clear commitments to implement these mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation. The list of commitments should be provided in a tabular format organized by subject matter (land alteration, wetlands, rare species, climate change, environmental justice, etc.) and identify the Agency Action or Permit associated with each category of impact. Draft Section 61 Findings should be separately included for each Agency Action to be taken on the project. The filing should clearly indicate which mitigation measures will be constructed or implemented based upon project phasing to ensure that adequate measures are in place to mitigate impacts associated with each development phase.

Responses to Comments

The Single EIR should contain a copy of this Certificate and a copy of each comment letter received. The Single EIR should contain a direct response to the scope items in this Certificate. To ensure that the issues raised by commenters are addressed, the Single EIR should also include direct responses to comments to the extent that they are within MEPA jurisdiction. This directive is not intended, and shall not be construed, to enlarge the scope of the Single EIR beyond what has been expressly identified in this certificate.

Circulation

The Proponent should circulate the Single EIR to each Person or Agency who previously commented on the EENF, each Agency from which the Project will seek Permits, Land Transfers or Financial Assistance, and to any other Agency or Person identified in the Scope. The Proponent may circulate copies of the Single EIR to commenters other than Agencies in a digital format (e.g., CD-ROM, USB drive) or post to an online website. However, the Proponent should make available a

[6] See https://resilientma-mapcenter-mass-eoeea.hub.arcgis.com/#DataViewer. As explained in the dashboard, a statewide Land Surface Temperature (LST) Index was created by combining estimates of surface temperature from days in 2018, 2019, and 2020 where the high air temperature exceeded 70 degrees Fahrenheit. Hot spots are areas with the 5% highest LST Index values within each RPA region.

reasonable number of hard copies to accommodate those without convenient access to a computer to be distributed upon request on a first come, first served basis.

September 30, 2024
Date

Rebecca L. Tepper

Comments received:

09/11/2024	Massachusetts Division of Fisheries and Wildlife (MassWildlife), Natural Heritage and Endangered Species Program (NHESP)
09/23/2024	Massachusetts Department of Environmental Protection (MassDEP), Western Regional Office (WERO)

RLT/ELV/elv

DIVISION OF
FISHERIES & WILDLIFE

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September 11, 2024

Rebecca Tepper, Secretary
Executive Office of Energy and Environmental Affairs
Attention: MEPA Office
Eva Vaughan, EEA No. 16866
100 Cambridge St.
Boston, Massachusetts 02114

Project Name:	*Palmer to Ware Improvement Project*
Proponent:	*New England Power Company d/b/a National Grid*
Location:	*Ware, West Brookfield, & Palmer MA*
Document Reviewed:	*Expanded Environmental Notification Form*
EEA No.:	*16866*
NHESP No.:	*23-8371*

Dear Secretary Tepper:

The Natural Heritage & Endangered Species Program of the Massachusetts Division of Fisheries & Wildlife (the "Division") has reviewed the Expanded Environmental Notification Form (the "EENF") for the proposed Palmer to Ware Improvement (the "Project") and would like to offer the following comments regarding state-listed species and their habitats.

According to the Massachusetts Natural Heritage Atlas, portions of the Project site are mapped as *Priority Habitat* for the Orange Sallow Moth (*Pyrrhia aurantiago*), Climbing Fumitory (*Adlumia fungosa*), Jefferson Salamander (complex) (*Ambystoma jeffersonianum*), Green Rock-Cress (*Boechera missouriensis*) and Lion's foot (*Nabalus serpentarius*). These species and itheir habitats are protected pursuant to the Massachusetts Endangered Species Act (MGL c.131A) and its implementing regulations (MESA; 321 CMR 10.00).

The MESA is administered by the Division and prohibits the Take of state-listed species, which is defined as "in reference to animals…harm…kill…disrupt the nesting, breeding, feeding or migratory activity…and in reference to plants…collect, pick, kill, transplant, cut or process…Disruption of nesting, breeding, feeding, or migratory activity may result from, but is not limited to, the modification, degradation, or destruction of Habitat" of state-listed species (321 CMR 10.02).

The Project, as proposed and described in the EENF, includes the rebuild of an existing utility line to address widespread damage to existing structures and provide improved telecommunications between two substations. Work will include minor vegetation management, upgrading existing access, and creating new access as required to construct and maintain the rebuilt line.

Based on the information in the ENF, the Division anticipates that the Project will be able to avoid a Take of Orange Sallow Moth and Jefferson Salamander. The Division will coordinate with the proponents to conduct botanical surveys for the Climbing Fumitory, Green Rock-Cress, and Lion's foot to determine the appropriate permitting pathway for state-listed plants and if the project will require a Conservation and Management Permit (CMP; 321 CMR 10.23) for any of the three state-listed plants. The Proponent can update the Secretary about the CMP in the next MEPA submission including, if required, how the project will qualify for a CMP by demonstrating that the project has avoided, minimized and mitigated impacts to state-listed species consistent with the following performance standards: (a) adequately assess alternatives to both temporary and permanent impacts to the state-listed species, (b) demonstrate that an insignificant portion of the local population will be impacted, and (c) develop and agree to carry out a conservation and management plan that provides a long-term net benefit to the conservation of the state-listed species.

Further, we note that the utility right-of-way that is the subject of this filing occupies about 0.41 acres of parcel 52-8 (117 acres) and about 0.41 acres of parcel 49-4 (374.4 acres) which are owned by the Palmer Motorsports Project and subject to restrictions. The development of the Palmer Motorsports site was reviewed by MEPA in 2013 (EEA No. 14089). Due to unpermitted work on the project, on August 20, 2015, a Consent Judgement (CJ) was entered by the Suffolk Superior Court on in Commonwealth v. Palmer Motorsports Park, LLC and J. Read Corp (15-2506). Parcel 52-8 and 49-4 are within the "Project Site" as described in the CJ Section I.2(o) and the right-of-way is located in the areas described as Easement 6 and Easement 5, respectively. The proposed utility right-of-way work appears to be entirely independent from the Palmer Motorsports project as reviewed by MEPA and described in the CJ, however, we provide this information for completeness.

The Division will not render a final decision until the MEPA review process and its associated public comment period is complete. As the MESA review process is ongoing, no alteration to the soil, surface, or vegetation associated with the proposed Project shall occur until the Division has made a final decision.

If you have any questions about this letter, please contact Tim McGuire, Endangered Species Review Biologist, at timothy.mcguire2@mass.gov or 508-389-6366. We appreciate the opportunity to comment on the Project.

Sincerely,

Jesse Leddick
Assistant Director

Cc: Joe Rogers, District Supervisor, Connecticut Valley District Office, MassWildlife
Betsy Harper & Turner Smith, Office of the Attorney General

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

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Maura T. Healey
Governor

Kimberley Driscoll
Lieutenant Governor

Rebecca L. Tepper
Secretary

Gary Moran
Acting Commissioner

September 20, 2024

Rebecca L. Tepper, Secretary
Executive Office of Energy & Environmental Affairs
Massachusetts Environmental Policy Act Office
Eva Vaughan, EEA No. 16866
100 Cambridge Street, 9th Floor
Boston, MA 02114-2524

Re: Palmer to Ware Improvement Project
Ware, West Brookfield, and Palmer - EENF

Dear Secretary Tepper,

The Massachusetts Department of Environmental Protection (MassDEP), Western Regional Office (WERO) appreciates the opportunity to comment on the Expanded Environmental Notification Form submitted for the proposed Palmer to Ware Improvement Project in Ware, West Brookfield and Palmer (EEA #16866).

The applicable MassDEP regulatory and permitting considerations regarding wetlands, air pollution, solid waste and waste site cleanup are discussed.

I. Project Description

The Proponent, New England Power Company is proposing to upgrade the existing 10.35-mile-long overhead transmission line that originates at Palmer Substation #503 and terminates at the Ware Substation #501. The Project Site is approximately 150 acres, and passes through Palmer, Ware and West Brookfield. The Proponent intends to move the transmission line to the center of the existing 100-200-foot-wide O15N right-of-way, completely replacing the existing structures, conductor, and shield wire. The Project will remove 147 existing structures and install 112 new structures, predominantly light-duty and engineered steel. This work will require vegetation management, upgrading existing access and creating new access for construction and maintenance. Work is anticipated to be completed by November 2028.

Three Environmental Justice populations are located within a one-mile radius of the Project Site, in the communities of Ware, Warren and Monson. These populations are characterized as Income.

Environmental Impacts associated with this project include:

- Total site acreage – 150 Acres
- New acres of land altered – 19 Acres
- Maximum structure height (feet) – 90 ft Existing, 125 ft Proposed, Difference +35ft
- Square feet (SF) of Bordering Vegetated Wetlands alteration: 199,967 SF – Temporary, 113 SF - Permanent
- Square feet (SF) of other wetland alteration:
    - Land Under Water – 4,811 SF – Temporary, 0 SF Permanent
    - Riverfront Area – 93,989 SF - Temporary, 4,534 SF – Permanent
    - Bank – 2,617 Linear Feet – Temporary, 0 Linear Feet Permanent
    - Total other Wetland Alteration - 70,313 SF

II. Required Mass DEP Permits and/or Applicable Regulations

Wetlands
310 CMR 10.000
Water Quality Certificate
314 CMR 9.00
Water Quality Standards
314 CMR 4.00
Air Pollution
310 CMR 7.00
Solid Waste
310 CMR 16.00
Hazardous Waste
310 CMR 30.00
Bureau of Waste Site Cleanup
310 CMR 40.000

III. Permit Discussion

Bureau of Water Resources

Wetlands Protection Act
As indicated by the project proponent, this project is subject to the Wetlands Protection Act (WPA) and the associated regulations. As noted below, the proponent states that the project will require a 401 Water Quality Certification (WQC). Further, in the event the municipal Order of Conditions is appealed to MassDEP, the subsequently issued Superseding Order of Conditions issued by MassDEP meets the definition of an "Agency Action" contained at 301 CMR 11.02. MassDEP cannot issue its WQC or a Superseding Order of Conditions until after the Project has received a final Certificate from the Secretary. Therefore, to ensure full opportunities for public involvement and to avoid any potential conflict with the final Certificate from the Secretary or the WQC, MassDEP recommends that no such filing occur until after the Project has received a final Certificate from the Secretary. Should the Proponent choose to file a Notice of Intent prior to the

issuance of a final Certificate from the Secretary, MassDEP recommends that Proponent request that the local conservation commissions defer a decision on the filing and keep the meeting open until such time as a final Certificate from the Secretary has been issued, as well as the WQC, to ensure consistency with any requirements in that Certificate or conditions of the WQC.

Limited Project

The project may be eligible for review under the Limited Project provisions contained at 310 CMR 10.53(3)(d). As for all Limited Projects, allowance under these provisions is at the discretion of the local Commission and to the extent practicable, work must comply with the General Performance Standards. As described in the EENF, the project proposes to permanently alter Bordering Vegetated Wetland, and Riverfront Area. The proposed temporary stream-crossings have the potential to alter Inland Bank and Land Under Waterbodies and Waterways. Activities will also be occurring in the buffer zone of resource areas. During the WPA permitting process, the proponent will need to demonstrate how the project will protect the interests of the Act.

Riverfront Area Impact Figures

On the ENF Form, Wetlands, Waterways, Tidelands Section, Part I, subpart B, the Proponent states: *Access roads constructed in Riverfront Areas will be permanent and will result in 4.534 square feet of permanent impact.* 4.534 appears to be a typo, as the Table at Part II subpart C identifies 4,534 square feet of permanent impact. To avoid any potential confusion the typo should be corrected.

Riverfront Area Performance Standards

The Proponent indicates that the proposed project will result in 4,534 square feet of permanent impacts to Riverfront Area from the construction of access roads. As part of the NOI filing the proponent must demonstrate how the project meets the general performance standards at 310 CMR 10.58(4) and/or how the project will protect the interests of the Act.

LUWW Impacts

The Proponent indicates that the project will result in 4,811 square feet of temporary impacts to Land Under Water Bodies or Waterways. The Proponent should clarify the nature of the temporary impacts. i.e. are the impacts solely from the placement of mats over the waterway or are there impacts from placing material directly into the waterway?

Temporary Impacts

Some resource area and waters of the commonwealth impacts are listed as “temporary” in the EENF; the Proponent should be aware that the Wetlands Protection Act and associated regulation do not have a designation of “temporary impacts” to resource areas. The activities proposed in the EENF meet the definition of “Alter” contained in 310 CMR 10.04. The 401 Water Quality Certification regulations, 314 CMR 9.00 specifically include “temporary” activities as being subject to the regulations (310 CMR 9.02). However, temporal impacts to resource areas can be mitigated through “in-situ” replication and/or restoration, as well as via off-site considerations.

Replication

The Proponent indicates that they will provide 1:1 replacement for permanently impacted BVW. The design of any replacement area should incorporate the recommendations from the

Massachusetts Inland Wetland Replacement Guidelines, second edition, September 2022. The Department discourages creating replacement wetlands within areas that will be subsequently subject to vegetation maintenance. Efforts should be made to identify areas where naturally functioning wetlands can be created. Additionally, projects that qualify for Limited Project status can consider alternative mitigation. See Chapter 5 of the *Massachusetts Inland Wetland Replacement Guidelines* for further information.

Resource Areas

Section 1-2 of the ENF Narrative identifies *Land subject to flooding; and vegetated wetlands, and intermittent and perennial streams* as resource areas identified on the site. However elsewhere in the document the Proponent identifies Bordering Land Subject to Flooding, Bordering Vegetated Wetlands, Riverfront Area, Bank (inland), and Land Under Water Bodies or Waterways as resource areas present on the site. To avoid potential confusion, the EENF should consistently identify all Resource Areas. The term Resource Area is defined at 310 CMR 10.04: Resource Area.

401 Water Quality Certification

The Wetlands Program administers the Section 401 Water Quality Certification regulations on behalf of the US Army Corps of Engineers and under the Massachusetts Clean Waters Act, MGL c. 21, §§ 26 through 53, inclusive, and the Regulations promulgated there under at 314 CMR 9.00. The proponent is required to provide sufficient information to adequately describe cumulative impacts to "Waters of the United States within the Commonwealth" and Waters of the Commonwealth. The proponent should clarify which WQC permit application it will be filing. Please note that the project Proponents must request a pre-filing meeting with MassDEP at least 30 days prior to submitting requests for certification. Further information is available at: https://www.mass.gov/how-to/ww-07-08-09-water-quality-certifications-dredging-projects

Avoid, Minimize, Mitigate

The ENF Narrative, Chapter 7.1, Table 7-1 provides a Mitigation Summary Table. Several of the mitigation measures identified are minimization measures. To clarify: Minimization is managing the severity of a projects impacts, typically by incorporating design and risk avoidance measures; Whereas mitigation involves replacing or providing substitute resource areas to address impacts, and is typically accomplished by either restoring, creating, or enhancing, resource areas and the public interests they serve. In accordance with 314 CMR 9.00 impacts to Waters of the United States Within the Commonwealth and Waters of the Commonwealth are to be avoided where possible and if unavoidable, minimized and mitigated. During the 401-water quality certification permitting process the proponent will be required to document site specific efforts to avoid, minimize, and mitigate for each impact. Appropriate minimization and mitigation measures will be determined as part of the WQC application process. MassDEP staff are available for discussion.

Alternatives Analysis

As part of the WQC filing, the Proponent is required to prepare and submit a written alternatives analysis exploring alternatives to the specific proposed discharge of dredged or fill material that would have less adverse impact on the aquatic ecosystem in accordance with 314 CMR 9.06(1).

SWPPP

The Proponent indicates that the project is subject to the requirements of the EPA Administered National Pollutant Discharge Elimination System regulations to prepare a Stormwater Pollution Prevention Plan (SWPPP). MassDEP recommends that the Proponent ensure that the SWPPP includes clear provisions specific to the management and protection of the wetland resource areas within the project.

Priority Habitat

The Proponent indicates that the project site contains habitat for state listed species. The Proponent further states that there will be temporary and permanent impacts to such habitat. The Proponent indicates that they will work with NHESP to avoid and minimize impacts to habitat for the state listed species to the extent possible, and, if required, develop and meet the performance standards for a Conservation Management Permit issued by NHESP. The WPA regulations and WQC regulation both contain provisions prohibiting projects which will have an adverse effect on specified habitat for rare species. In order to document compliance with the provisions of those regulations, the Proponent should undergo NHESP review prior to filing the NOI and WQC application.

Bureau of Air and Waste

Air

Construction and Demolition Activities

The construction and demolition activity must conform to current Air Pollution Control Regulations. The proponent should implement measures to alleviate dust, noise, and odor nuisance conditions that may occur during the construction and demolition activities. Such measures must comply with the MassDEP's Bureau of Air and Waste (BAW) Regulations 310 CMR 7.01, 7.09, and 7.10.

Construction Equipment

MassDEP believes it is necessary to mitigate the construction-period impacts of diesel emissions to the maximum extent feasible and recommends that the project proponent to require the contractors and subcontractors to use diesel equipment/machinery that are fitted with pollution control devises as well as to minimize excessive idling. As of June 1, 2010, all non-road engines shall be operated using only ultra-low sulfur diesel (ULSD) with a sulfur content of no greater than 15 ppm pursuant to 40 CFR 80.510.

Dust

Proponent shall control dust related to the construction operation including the use of the existing roads and the creation of the new roads within the project zone.

Open Burning

Proponent shall not burn vegetative or any other waste unless it is performed in accordance with 310 CMR 7.00, has received prior written approved from by MassDEP **AND** has been approved by municipal fire department officials.

Asbestos

It is common for antiquated electrical components to be insulated with or made from asbestos material. The owner/operator shall ensure that all material be handled in accordance with all applicable state and federal regulations regarding asbestos handling, including testing prior to handling.

Solid Waste

The proponent shall properly manage and dispose of all solid waste generated or discovered by this proposed project, pursuant to this work, will need to be transported to permitted disposal or processing facilities. Unpainted/uncoated asphalt, brick and concrete (ABC) can typically be crushed and recycled as aggregate or hardpack and used as fill material. Non-recyclable solid wastes will need to be shipped to an appropriate disposal facility. Vegetative matter not retained on-site for ecological restoration or mitigation purposes could be composted or processed into mulch.

It is not unusual to encounter illegally dumped solid waste found in abandoned or vacant properties. The proponent shall be required to properly dispose of such waste in accordance with all applicable disposal and handling regulations, including but not limited to asbestos, hazardous waste and solid waste disposal and handling regulations: 310 CMR 16.00 and 310 CMR 19.000, including the regulations at 310 CMR 19.017 (waste ban).

Solid and Hazardous Waste Management (Soil Excavation)

If MassDEP determines that either because of the nature of the proposed activity, the amount of the excavated material, and/or the characteristics of the excavated material that the material requires management as a hazardous or solid waste, then the disposition of the material must comply with any applicable requirements pursuant to 310 CMR 30.0000, 310 CMR 16.00 or 310 CMR 19.000. In addition, compliance with COMM-97-001 *"Reuse and Disposal of Contaminated Soil at Massachusetts Landfills"* and the *"Revised Guidelines for Determining Closure Activities at Inactive Unlined Landfill Sites"*, may be applicable.

Hazardous Waste

1. Any illegally dumped hazardous wastes discovered at any part of the ROWs shall be properly managed in accordance with 310 CMR 30.0000 including reporting to MassDEP

2. If any hazardous waste, including waste oil, is generated at the site, the proponent must ensure that such generation is properly registered with the Department and managed in accordance with 310 CMR 30.0000.

Bureau of Waste Site Cleanup

There are disposal sites within a 0.5-mile radius from the project area with Response Action Outcomes (RAOs) and/or Permanent Solutions with or without conditions (PS/PSC). If soil and/or groundwater contamination is encountered during construction activities, the proponent should retain a Licensed Site Professional (LSP); the MCP details procedures to follow for the parties conducting work. MassDEP staff are available for guidance.

A spills contingency plan addressing prevention and management of potential releases of oil and/or hazardous materials from construction activities should be presented to workers at the site and enforced. The plan should include but not be limited to, refueling of machinery, storage of fuels, and potential releases.

IV. <u>Other Comments/Guidance</u>

MassDEP staff are available for discussions as the project progresses. If you have any questions regarding this comment letter, please do not hesitate to contact Sean Gonsalves at 781-400-4272.

Sincerely,

Sean Gonsalves, R.S. for
Michael Gorski
Regional Director

cc: MEPA File

Appendix 2-1

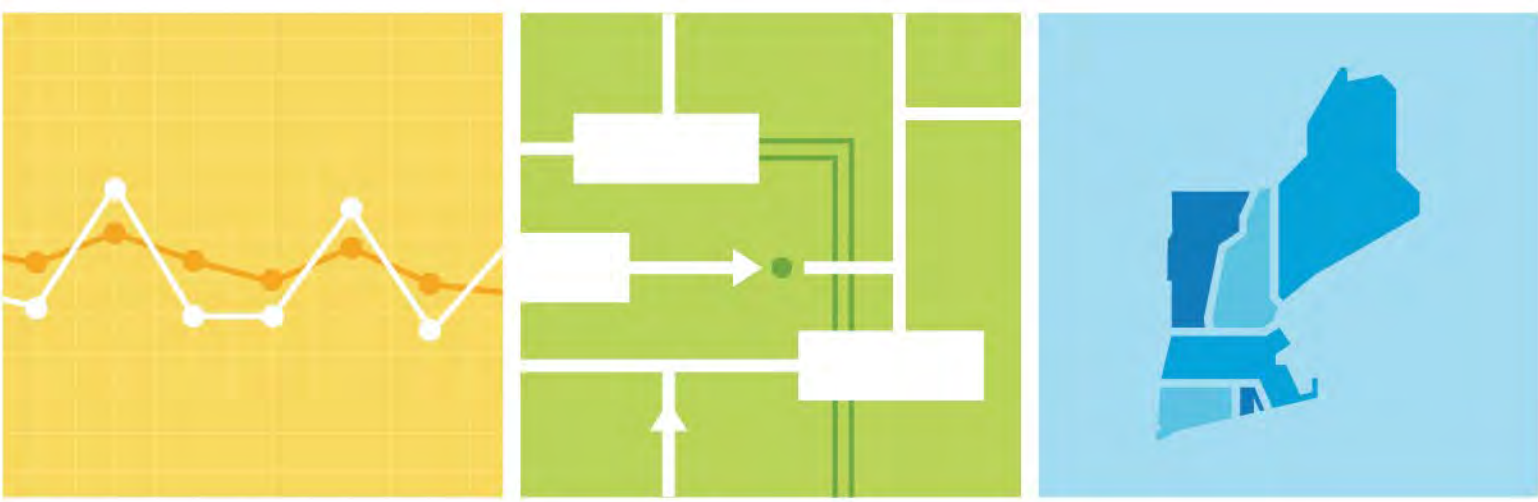
ISO-NE 2050 Transmission Study

2050 Transmission Study

Transmission Planning

FEBRUARY 12, 2024

ISO-NE PUBLIC



Project Team

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Supporting Departments:

Corporate Communications

External Affairs

Economic Studies & Environmental Outlook

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Figures

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Section 1: Study Overview

The New England power system is in the midst of an unprecedented shift in the ways in which electricity is produced and consumed. Five of the six New England states have committed to reducing their carbon dioxide emissions by at least 80% by 2050, prompting ongoing changes in the grid's resource mix and the increased electrification of the heating and transportation sectors.[1] Driven largely by these statewide commitments, the grid continues its shift toward renewable resources like wind and solar photovoltaic (PV) generation. Over the next several decades, these renewable resources are expected to substantially displace natural gas-fired generation as the region's primary resource type. At the same time, increased electrification is expected to significantly increase overall consumer demand for electricity and drive changes in usage patterns that include seasonal and daily shifts in peak demand.

Among ISO New England's responsibilities as a Federal Energy Regulatory Commission (FERC)-authorized Regional Transmission Organization is ensuring the regional power system continues to operate reliably as system conditions change. Transmission planning helps to maintain system reliability and enhance the region's ability to support a robust, competitive wholesale power market by moving power from various internal and external sources to the region's load centers. This 2050 Transmission Study is a pioneering look at the ways in which the transmission system in New England may be affected by changes to the power grid, and includes roadmaps designed to assist stakeholders in their efforts to facilitate a smooth, reliable clean energy transition.

1.1 Study Background and Objectives

In October 2020, the New England States Committee on Electricity (NESCOE) released the New England States' Vision for a Clean, Affordable, and Reliable 21st Century Regional Electric Grid. This vision statement recommended that the ISO work with stakeholders to conduct a comprehensive long-term regional transmission study. This study, eventually titled the 2050 Transmission Study, would help inform stakeholders of the amount and type of transmission infrastructure necessary to provide reliable, cost-effective energy to the region throughout the clean energy transition.

> ***Who is NESCOE?*** *NESCOE is a not-for-profit entity that represents the collective perspective of the six New England Governors in regional electricity matters and advances the New England states' common interest in the provision of electricity to consumers at the lowest possible prices over the long-term, consistent with maintaining reliable service and environmental quality.*

In response to NESCOE's vision statement, the ISO revised Attachment K to the ISO New England Open Access Transmission Tariff to incorporate a new transmission planning process designed to look beyond the current 10-year planning horizon. The first phase of the effort established the rules that will allow New England states, through NESCOE, to request that the ISO perform longer-term scenario-based transmission planning studies, such as this one, on a routine basis. Changes to the ISO Tariff were approved by FERC in early 2022. The 2050 Transmission Study is the first example of its kind within New England.

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[1] The six New England states are Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. The five states with the emissions reduction goals described here are Connecticut, Maine, Massachusetts, Rhode Island, and Vermont.

The longer-term transmission study process is currently informational. The process does not include a formal mechanism for triggering the construction of a new transmission project. However, the ISO is currently discussing the second phase of the longer-term transmission study Tariff changes that will establish a process to enable the states, through NESCOE, to move policy-related transmission projects forward, with an associated cost allocation. This effort began at stakeholder meetings in October 2023, and will continue through early 2024.

1.1.1 Development of Study Objectives and Study-Specific Terms

In 2021, the ISO began coordination with NESCOE to develop objectives and assumptions for this study.

The 2050 Transmission Study has two main objectives:

- Determine the region's transmission needs in order to serve load while satisfying North American Electric Reliability Corporation (NERC), Northeast Power Coordinating Council (NPCC), and ISO reliability criteria.[2]
- Develop *roadmaps* for transmission upgrades designed to satisfy those needs while considering both the feasibility of construction and cost.

In this study, the term *roadmap* is intended as a high-level plan designed to show generally how transmission-related objectives can be accomplished. The roadmaps provided in this study are not intended as comprehensive or detailed plans for construction. They include:

- Conceptual projects specific to the input assumptions of the study.
- Concerns defined as *high-likelihood*; projects that address these concerns are considered useful to the region because they are less dependent on the specific locations of generation and supply to load.
- Lessons learned that can be applied to future long-term transmission studies.

1.1.2 Source of Study Inputs for the Future Scenarios Examined

The future scenarios envisioned by NESCOE included load forecasts and potential resource mixes for the years 2035, 2040, and 2050 that were based on the All Options Pathway in Massachusetts' Deep Decarbonization Roadmap report, published in December 2020. This Pathway was also used in the ISO's recent Future Grid Reliability Study Phase 1 (FGRS), referred to in FGRS as Scenario 3. This future scenario will be referred to in this report as the All Options Pathway.

The All Options Pathway provided two types of data input for the 2050 Transmission Study: 1) New England's expected hourly loads for all hours in a year for 2035, 2040, and 2050 and 2) renewable and conventional energy capacity for the same years. This data was combined with hourly wind and solar production data developed by an advisory firm, DNV, for various locations in New England to create year-round hourly profiles of renewable generation output.[3] Using this data, the ISO developed "snapshots" for the years studied, which combined load and resource profiles for contingency analysis. Contingencies are unexpected events that affect the flow of power on the transmission system, such as the loss of a transmission line, a transformer, or certain types of

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[2] Load is defined as the demand for electricity measured in megawatts; electricity consumption; the amount of electric power delivered to any specified point on a system, accounting for the requirements of the customer's electrical equipment.

[3] For further details on the data set created by DNV, please see the "Variable Energy Resource (VER) Data" page on the ISO-NE website.

substation equipment. This contingency analysis was designed to test peak load boundary conditions, which represent the most extreme or severe cases of combined load and renewable resource output that could realistically be expected to occur. An example of a boundary condition would be a particularly cold winter peak hour, corresponding with high loads, in which weather conditions resulted in low renewable resource production. Essentially, boundary conditions in this study were designed to represent the realistic "worst case scenario" for future transmission planning needs related to serving peak loads.

It is important to note that all conceptual projects in this 2050 Transmission Study are formulated from one particular pathway among the eight mentioned in the MA Deep Decarbonization Roadmap. Changing inputs to the No Thermal Pathway, or the 100% Renewable Pathway, for example, would impact the conceptual projects list.[4] It is likely that the future power system will differ from the assumptions found in the All Options Pathway. As an example, the expected nameplate capacity of battery energy storage for 2030 has already exceeded the All Options Pathway's assumptions for 2035. As the system evolves, the quantity and location of generating resources and load will likely lead to differences between reality and this study's results. However, this study's key takeaways and high-likelihood concerns still represent crucial high-level directional results that can be used by stakeholders to plan for a smooth clean energy transition.

1.1.3 Summary of Input Assumptions for the Future Scenarios Examined

The first input taken from the All Options Pathway was the hourly load for each snapshot year, which was then recast from a 2012 weather year to a 2019 weather year.[5] The next inputs were the highest-load hours from the winter and summer periods. For winter periods, each state in New England was at or near its own peak load while New England as a whole was at its overall peak load, so a single snapshot in time captured worst-case or near-worst-case conditions in all six states. For summer periods, three varieties of peak loads were chosen in order to ensure the study captured the most severe conditions for each part of New England. The first was a summer daytime peak condition, intended to represent a period when total power consumption is highest. This condition is likely to be most pronounced in areas with little behind-the-meter solar penetration, such that solar power production cannot offset the hottest mid-day temperatures. The two remaining conditions used as summer period inputs were evening peak conditions, where the total load served by the transmission system (end-user load less any reductions for behind-the-meter solar) was greatest. During summer evenings, load decreases due to slightly lower consumption, but behind-the-meter solar production is low or zero. Hence, net load is greatest during this time. The All Options Pathway data showed that the three northern New England states (Maine, New Hampshire, and Vermont) tended not to peak at the same time as the region as a whole. To ensure that the worst-case conditions for the northern states were captured, a second summer evening peak snapshot was created, reflecting the hour in which load served from the transmission system was highest in the three northern states.

The resulting loads in each snapshot were significantly higher than any loads seen to-date in New England, and rose significantly from 2035 to 2040 and from 2040 to 2050. The highest load modeled was the 2050 winter evening peak snapshot, at approximately 57 gigawatts (GW). For

[4] The No Thermal Pathway assumed all thermal capacity retired by 2050; the 100% Renewable Pathway assumed no fossil fuels allowed, with zero-carbon combustion fuels allowed for electricity generation by thermal power plants.

[5] For further details on the reasons for this recasting and the process used, please see slide 11 of the following presentation: https://www.iso-ne.com/static-assets/documents/2021/04/a8_2021_economic_study_request_assumptions_part_1_rev2_clean.pdf

comparison, the highest load observed to date on the New England system was the 2006 summer peak of just over 28 GW, and the highest winter load observed to date was the January 2004 peak of just below 23 GW. The loads analyzed in each year studied are shown in Figure 1-1.

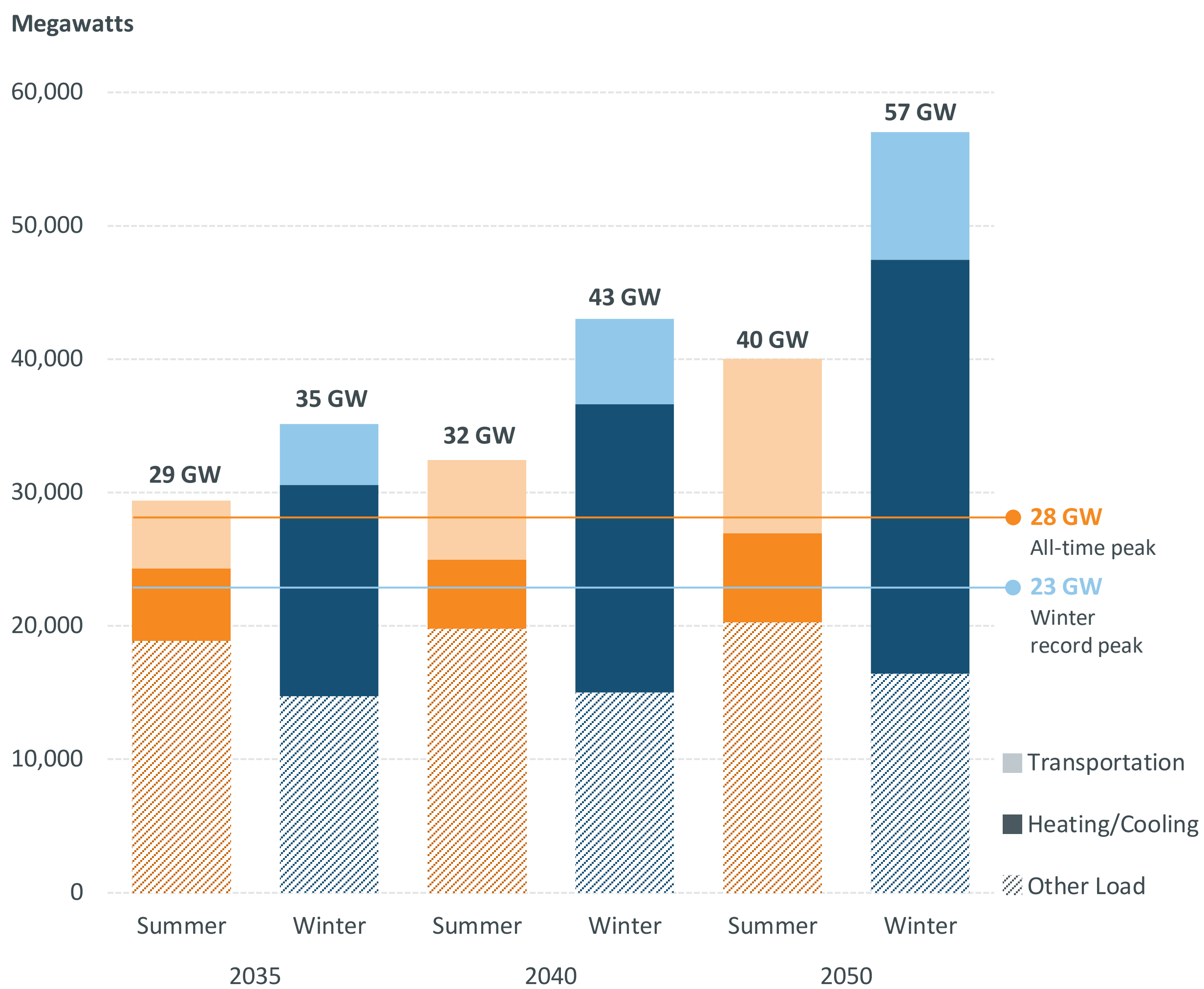

Figure 1-1: Load Levels Analyzed by Study Year

These loads were assumed to be served by a generation fleet that differs significantly from today's resource mix. All coal, oil, diesel, and municipal solid waste-fueled generation, as well as a portion of today's natural-gas-fueled generation, was assumed retired by 2035, the earliest year studied. The remainder of today's natural-gas-fueled generation, as well as biomass, nuclear, hydroelectric, and renewable generators, were assumed to remain operational through 2050. The retired generation, as well as the increases in load, were assumed to be offset by a significant increase in wind and solar generation, as well as battery energy storage and increased imports from neighboring power systems in New York and Québec. Much of this increased wind capacity is located offshore, either off the coast of southeastern Massachusetts and Rhode Island, or in the Gulf of Maine. Figure 1-2 shows the growth in renewable generation and energy storage assumed as inputs for this study.

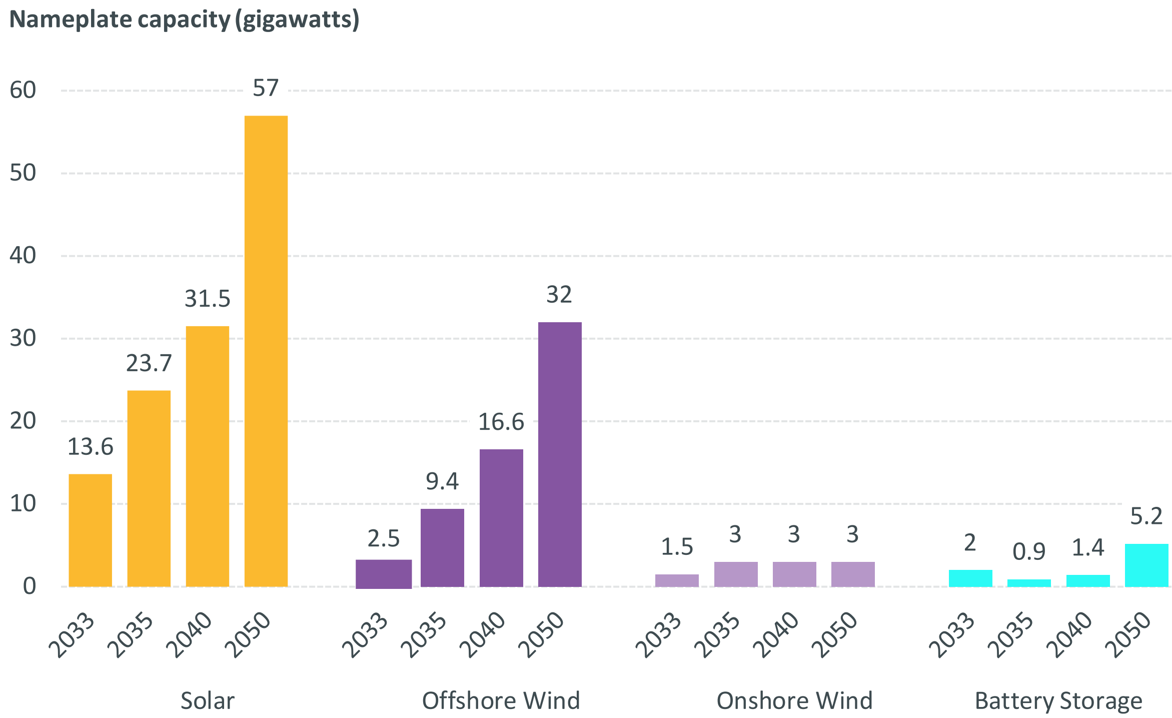

Figure 1-2: Renewable Generation and Energy Storage Input Assumptions

While the All Options Pathway specified a total amount of each generation type by state, transmission planning studies like the 2050 Transmission Study require location data on a more granular level. Exact generator location is needed to develop useful results. In this study, new offshore wind generation was initially assumed to interconnect at major 345 kilovolt (kV) substations near the coast of New England, in order to minimize the length of cables between the interconnection points and offshore wind locations. As the study progressed, some of these interconnection points were relocated in order to eliminate transmission system concerns to the extent possible without changing the total amount of generation in each state (see section 2.4 for further details on generator relocation decisions). Similarly, energy storage facilities were initially assumed to interconnect at major 345 kV stations, but were later relocated within the same state to reduce transmission concerns where possible. Many of these relocations were from 345 kV stations to 115 kV stations. Finally, solar generation was distributed evenly across each 115 kV substation in each state, with certain substations in densely populated areas excluded due to the lack of available land.

In addition to generation located within New England, the All Options Pathway assumed that New England would import power to serve some of its peak load needs from neighboring areas. The following inter-area imports were part of the All Options Pathway and were used in all snapshots examined in this study:

- 1,000 MW imported from New Brunswick over existing 345 kV AC ties.
- 1,850 MW imported from New York over the existing 345 kV, 230 kV, 115 kV, and 69 kV AC ties.

- 1,400 MW imported from Quebec over the existing Phase II HVDC tie (interconnected at Sandy Pond substation in Ayer, Massachusetts).
- 225 MW imported from Quebec over the existing Highgate HVDC back-to-back converter (interconnected in Highgate, Vermont).
- 1,200 MW imported from Quebec over the under-construction New England Clean Energy Connect HVDC tie (interconnecting at Larrabee Road substation in Lewiston, Maine).
- 1,000 MW imported from Quebec over a hypothetical new HVDC tie between Quebec and Vermont (assumed to interconnect at the Coolidge substation in Cavendish, Vermont).

1.1.4 Practical Considerations and Limitations

Three major practical considerations were applied to this study and are important to note when interpreting study results. First, analysis is restricted to thermal steady-state analysis, which identifies thermal overloads that could only be solved by major transmission additions or upgrades. Thermal overloads occur when transmission lines, transformers, or certain substation equipment carries more than its rated amount of current or power flow. This condition can lead to overheating, equipment disconnection, or, in some cases, permanent damage. Analysis of voltage, short circuit or transient stability performance was omitted, and will need to be explored in future studies. This simplification allowed the study team to quickly identify major transmission line and transformer additions, which are usually more expensive and harder to site than the substation upgrades typically required for voltage, short circuit, or transient stability needs.

Second, analysis in this study is limited to transmission needs and conceptual transmission projects. Significant upgrades to the distribution systems will be necessary to accommodate a 2050 peak load that will be roughly double what New England has historically experienced. This anticipated expansion of the distribution system or the sub-transmission infrastructure is beyond the scope of this study, and will likely add significant costs to the evolution of the power system. This consideration required a simplification by modeling all loads at substations operated at 69 kV and above rather than at the lower voltage substations at which they actually connect.

The third and final practical consideration involves resource adequacy. This study found that the resource quantities assumed by the All Options Pathway, when combined with the resource availability assumptions made by the ISO, were insufficient to meet the snapshot loads for the Summer Evening and Winter Evening Peaks of 2035, 2040 and 2050. The largest observed shortfall was roughly 12,000 MW in the 2050 57 GW Winter Peak snapshot. In order to conduct analysis of the transmission system during these snapshots and ensure the model could run, shortfall MWs were added as needed in order to meet load.[6] These shortfall MWs were added at offshore wind points of interconnection (POIs). Future work will be needed to determine more specifically how shortfalls will be resolved. For the purposes of this study, the added shortfall MWs can be thought of as more offshore wind (either higher output or higher installed capacity), battery storage that charges from excess wind during times of high production and discharges when wind production is lower, or additional imports from regions outside of New England through a hypothetical inter-area offshore grid.

[6] For further details, please see the November 2021 presentation on the 2050 Transmission Study scope of work.

1.2 Overview of the New England Transmission System

This section is designed as a primer for those unfamiliar with the New England transmission system. Those readers who are more familiar with transmission planning are invited to skip ahead to Section 2.

1.2.1 General Configuration of the New England Transmission System

ISO New England is responsible for the long-term planning of the networked portions of the high-voltage transmission system (known in New England as the Pool Transmission Facilities, or PTF), and this study was performed in support of this objective.[7] The role of the electric transmission system is to efficiently deliver electricity over long distances, from generation within New England or imports from adjacent areas, to connections to local distribution systems. The transmission system is a networked grid of high-voltage transmission lines and transformers, with electric power naturally distributing itself among many parallel paths according to the locations of supply (generation/imports), demand (load), and electrical characteristics of the high-voltage transmission lines and transformers. Substations, found at the intersection of transmission lines, handle switching, protection, and transformation from one voltage level to another. At many of these substations, transformers step power down from higher transmission voltages, typically 69 kV and above, to distribution voltages below 69 kV. Local transmission owners and distribution companies, rather than the ISO, are responsible for the planning of any radial portions of the transmission system (which have only a single connection to the rest of the transmission system), the transmission-distribution interface, and the distribution systems.

The future evolution of the power system toward renewable and variable or intermittent resources increases the importance of a robust transmission system. Many of the best locations for renewable resources like large-scale wind and solar farms are not near major load centers (i.e., the urban areas of New England) and the transmission system will be relied on to deliver the power from these renewable resources to electricity consumers. While distributed resources, such as rooftop solar, can be located in more populated areas, the transmission system still helps bring power into these areas during nighttime periods or other times when intermittent renewable resources' output is not sufficient to meet the local load. Transmission can also help to provide geographic diversity in renewable resources, smoothing out variations in wind and solar production in different parts of the power system. Finally, with the expected future increase in the electrification of the heating and transportation sectors, summer and winter peak loads are expected to increase dramatically. Additionally, New England's current summer peaking system is forecasted to become winter peaking by the mid 2030s. A robust transmission system will ensure that loads under these future conditions can be served reliably.

New England's power system provides electricity to diverse geographic areas, ranging from rural communities to densely populated cities. The majority of consumer demand, roughly 77%, is located in the southern states of Massachusetts, Connecticut, and Rhode Island.[8] Although the land area in the northern states is larger, the greater urban development in southern New England creates greater demand and corresponding transmission density. However, it is the larger areas of land in northern New England that offer greater potential for renewable power generation. Today,

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[7] An exact definition of the New England PTF may be found in section II.49 of the ISO New England Open Access Transmission Tariff.

[8] The distribution of loads between the New England states can vary from month to month, day to day, and hour to hour. Values cited are seasonal approximations.

flows on the transmission system are primarily from west to east and from north to south. However, flows change throughout each day, and the predominant flows will change significantly by 2050 due to additional new renewable generation and significant load growth. Because the demands on the New England transmission system can vary widely, the system must at all times be able to reliably move power from various internal and external sources to the region's load centers under a wide-ranging set of conditions. Included in these conditions are contingencies. The exact lists of contingencies that must be analyzed are set by reliability standards created by the North American Electric Reliability Corporation (NERC), the Northeast Power Coordinating Council (NPCC), and the ISO. In accordance with these standards, the 2050 Transmission Study examines "N-0" conditions (all facilities in-service), "N-1" conditions (single contingency), and "N-1-1" conditions (two consecutive contingencies, with time for manual system readjustments between contingencies).

1.2.2 Geographic Location and Types of Transmission Lines in New England

The New England transmission system consists of mostly 115, 230, and 345 kilovolt (kV) transmission lines, which are generally longer and fewer in number in northern New England than in the southern states.[9] The region has 13 interconnections with neighboring power systems in the United States and eastern Canada. Nine interconnections are with New York (NYISO)—two 345 kV ties; one 230 kV tie; one 138 kV tie; three 115 kV ties; one 69 kV tie; and one 330-megawatt (MW), ±150 kV high-voltage direct-current (HVDC) tie, the Cross-Sound Cable interconnection. New England and the Maritimes (New Brunswick Power Corporation) are connected through two 345 kV alternating current (AC) ties.[10] New England also has two HVDC interconnections with Québec (Hydro-Québec, or HQ). One is a 120 kV AC interconnection with a 225 MW back-to-back converter station (Highgate in northern Vermont), which converts AC to direct current (DC) and then back to AC. The second is a ±450 kV HVDC line with terminal configurations allowing up to 2,000 MW to be delivered at Sandy Pond in Massachusetts (Phase II).

[9] Detailed maps and diagrams of the New England transmission system may be found on ISO-NE's website, at https://www.iso-ne.com/about/key-stats/maps-and-diagrams.

[10] One exception is that Aroostook County and part of Washington County in Maine receive electricity from New Brunswick, and are administered by the Northern Maine Independent System Administrator (NMISA) rather than ISO New England.

Section 2: Key Takeaways

The 2050 Transmission Study resulted in several high-level observations related to transmission-related challenges the future grid may face as a result of the clean energy transition. These key takeaways are detailed in the following subsections. They are:

1. Reducing peak load significantly reduces transmission cost.
2. Targeting and prioritizing high likelihood concerns is highly effective.
3. Incremental upgrades can be made as opportunities arise.
4. Generator locations matter.
5. Transformer capacity is crucial.

2.1 Reducing Peak Load Significantly Reduces Transmission Cost

Increases in load become significantly more expensive (with regard to transmission costs) as peak load levels increase. This is especially true at levels above ~51 GW of load.[11] Increases in load at peak load levels below 51 GW do increase costs (roughly $0.75 billion per GW of load added from 28 GW to 51 GW), but these increases are small when compared to the increase in costs above 51 GW of load (roughly $1.5 billion per GW of load added from 51 GW to 57 GW). Figure 2-1 shows the approximate cost required for transmission expansion to serve load reliably in each year studied.

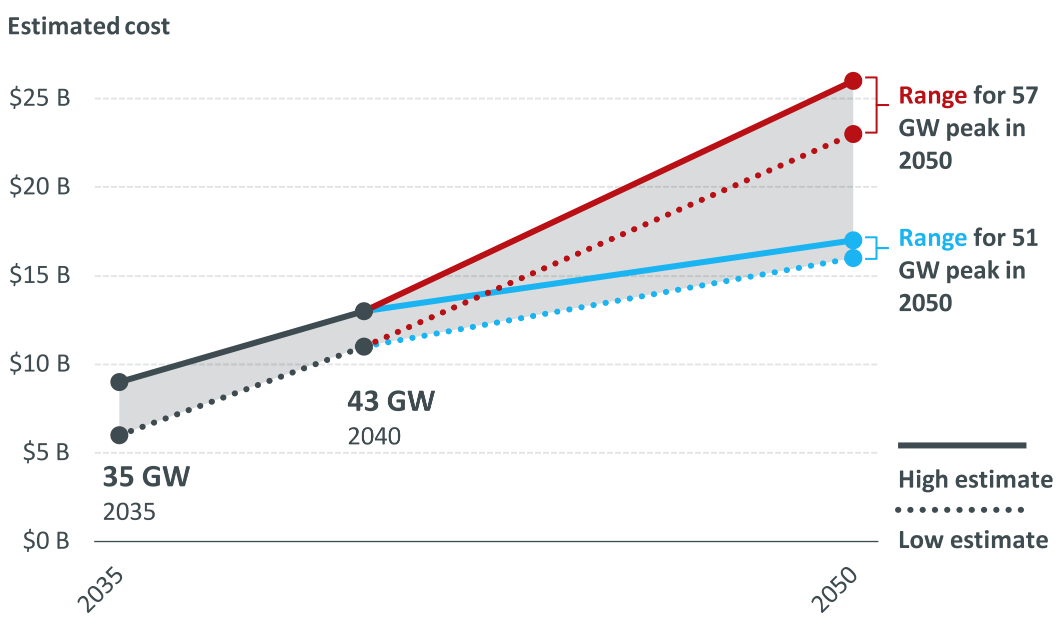

Figure 2-1: Costs by Year Studied

Limiting load growth to no more than a 51 GW peak load level could be achieved in several different ways. A 2050 New England grid with 100% heating and transportation electrification is expected to result in a ~57 GW peak load. However, a 51 GW peak could be achieved under a scenario in which

[11] This subsection concentrates on winter peak loads, which are the highest loads in the 2050 Transmission Study. These winter peak loads occur after sunset, so there is no difference between "gross load," or the actual amount of power consumed by end users before reductions due to rooftop solar, and "net load," or the load served by the transmission system after these reductions.

New England retains some stored fuels like natural gas, oil, propane, hydrogen, etc. for heating and transportation. Since loads above 51 GW would only occur during extremely cold winter days, peak load could be limited to 51 GW in a scenario in which the grid is 100% electrified for most of the year, with only the coldest days using some stored fuels for heating. If the full 6 GW of load reduction came out of heating, this could still represent approximately 80% heating electrification while still maintaining 100% transportation electrification.

Alternately, more aggressive demand response (when customers reduce their electrical consumption for compensation) and peak shaving programs (e.g., smart thermostats that reduce the set temperature during a winter peak time) that could shift load to times of lower demand may also help maintain a 51 GW peak load level, thereby reducing transmission costs. The extent of these forms of load reduction would need to be in addition to those already assumed by the "All Options" pathway, which considered that 50% of electric vehicle charging load, 15% of space heating/cooling load, and 25% of water heating load could be shifted. Work from other studies, however, including Economic Planning for the Clean Energy Transition (EPCET), have shown a potential overall energy deficit in the winter months whether these strategies are deployed or not. Since shifting MWs to other hours of the day would still lead to an overall energy shortfall, the total MWhs consumed in the winter months may still need to be reduced. Reducing load by shifting energy from peak hours to off-peak hours on the same day would help address transmission costs but would not address energy adequacy concerns over longer periods of days or weeks. More aggressive energy efficiency programs (such as incentivizing customers to install better insulation in their homes/businesses, and/or upgrade appliances and heat pumps, etc.) are among the options that could be considered in order to maintain a 51 GW peak load while still achieving electrification goals.

Public education and involvement may be an important factor in modifying consumer behavior to reduce electricity demand at key times. Consumer awareness of the nature and timing of peak load may help consumers participate in the reduction of peak loads to more manageable levels, which could save billions of dollars in transmission system upgrade costs.

2.2 Targeting and Prioritizing High Likelihood Concerns is Highly Effective

One major outcome of the 2050 Transmission Study was the identification of system concerns that could be resolved through transmission system expansion and could appear under a wide variety of possible future conditions. This wide variety of conditions, detailed in Section 3, include different load levels, different generator locations, and differing rates of load growth at particular substations. This report describes a number of *high-likelihood concerns* that appear to meet these conditions. While this study examined just one of many possible futures for the New England power system, and of that possible future examined only certain hours of the year when electricity consumption is expected to be at its highest, these results can still be used to infer which areas of the transmission system are likely to be most limiting as the system evolves.

Projects that address these high-likelihood concerns are likely to bring the greatest benefit for a wide range of possible future conditions as the clean energy transition accelerates. The assumptions used for future load and generation patterns include a fair amount of uncertainty, but these high-likelihood concerns are likely to appear even under somewhat different future conditions. Targeting these concerns should be considered higher-priority than other potential challenges identified in the 2050 Transmission Study, which would likely occur only if generators interconnect at specific locations or if load grows in specific patterns.

In an effort to identify high-likelihood concerns and other transmission overloads, the locations of new generator interconnections were optimized, within reason. By locating these interconnections so as to minimize transmission overloads observed under peak load conditions, any remaining overloads would likely only be solved through transmission expansion. Concerns that could be alleviated by new generation interconnections (within the bounds of the total amounts of generation in each New England state assumed for this study) are therefore not included in the results because they were resolved by the change of generation interconnection location.

2.3 Incremental Upgrades Can Be Made as Opportunities Arise

Many of the transmission system concerns identified in the 2050 Transmission Study could be addressed by rebuilding existing transmission lines with larger conductors, rather than expanding the transmission system into new locations. In many cases, replacing transmission lines with larger conductors and increasing their power transfer capability would allow the system to serve significantly higher peak loads. This type of conductor replacement, or reconductoring, may also require replacing some or all of a transmission line's structures in order to accommodate heavier, larger conductors. Advanced conductor technologies that may be able to make use of existing structures while still delivering higher ratings and lower losses could also be considered. Additionally, other incremental upgrades could be beneficial; examples include bundling multiple conductors per phase on 115 kV lines (already a common practice on 345 kV lines in New England) or rebuilding transmission lines to allow for a higher operating voltage.

Limiting brand new line construction by taking advantage of line rebuilds could minimize costs, especially in densely populated areas in southern New England. In many areas, expanding existing rights-of-way or constructing new rights-of-way could be difficult, expensive, and environmentally disruptive, and thus maximizing the use of existing rights-of-way is critical to the success of the region's transmission system reliability through the clean energy transition.

While these incremental upgrades should be considered crucial to the improvement of New England's transmission system, it is not necessarily prudent for the region to pursue large numbers of line rebuilds immediately. Many of these line rebuilds are highly dependent on the locations of generator interconnections, the geographic distribution of end-user load, and the locations of new load-serving substations. Since these incremental upgrades can generally be built in a shorter timeframe than new transmission on new rights-of-way, it may be more practical to address these incremental needs via the traditional ten-year reliability planning process rather than the longer-term planning process that prompted this study. This strategy would allow the region to hold off on committing to further transmission system investment until new information is available, and also provide opportunities for more cost-effective "right-sizing" transmission projects.

"Right-sizing" is a term used to describe combining line rebuilds necessitated by increased loads with replacements designed to meet asset condition needs. In New England, asset condition projects are identified by transmission owners when equipment exceeds its useful life. Since a significant portion of New England's transmission system was developed in the mid-20th century, many transmission lines are beginning to reach the end of their life and must be replaced. During such an asset condition replacement project, the incremental cost of upgrading a transmission line to a larger conductor size and stronger structures is relatively low. Many expenses inherent in transmission line rebuilds are unrelated to the line's capacity; costs related to building access roads along a right-of-way, labor for building structures, and financing an ongoing project are not significantly affected by the size of the conductor chosen. Therefore, upgrading the capacity of lines as the opportunity arises, or "right-sizing" asset condition projects when they occur, could be a financially prudent way for New England to reliably serve increased peak loads. Further discussions between the ISO, the Transmission Owners, and NESCOE on “right-sizing” asset condition projects will continue at the Planning Advisory Committee in 2024 in order to inform the region of the possible economic advantages of these opportunities more fully.

2.4 Generator Locations Matter

The 2050 Transmission Study also found that the specific location of generators can have a significant impact on the transmission upgrades required for reliability. The study attempted to optimize, within reason, new generator locations for offshore wind, solar photovoltaics (PV), and batteries in import-constrained regions to reduce the number and severity of overloads experienced while serving peak loads. As a result, the overloads observed were those that persisted in spite of these optimized generation locations. Locating generators in suboptimal areas would likely significantly worsen the overloads, particularly in import-constrained regions like Boston. Optimizing generation locations is also crucial for determining which lines must be upgraded, since a generator could either push back on heavy flows toward load centers or contribute to even higher loading on transmission lines, depending on the location of its interconnection. Essentially, locating generators closer to large population hubs will help reduce the strain on the transmission system, since the cumulative distance power must flow to reach electricity consumers will be greatly reduced.

Generator location is less important for some of the larger-scale upgrades like new major lines leading from northern New England to southern New England. Whether a generator is placed at one substation in Maine or at a different station 10 miles away matters very little, since the majority of the power from that generator will ultimately flow from Maine into southern New England regardless of the generator’s exact location. As long as generators in northern New England are located in the general vicinity of the terminal of a large-scale upgrade, the exact substation where they interconnect is not as critical.

2.5 Transformer Capacity Is Crucial

Increasing electrification results in load growth, which then requires more renewable resources to be added to the New England power system. This increase in load and generation can strain the existing transformer capacity within New England, particularly the 345/115 kV transformers. Transformers must reliably “step down” power from higher to lower transmission voltages, and the 2050 Transmission Study revealed that existing transformers across the system were frequently unable to do so without thermal overloads. Between 2035 and 2050, the assumed load increased significantly across the region, in tandem with the increase in generation located farther from load centers. This trend increases the importance of higher voltage lines such as the 345 kV system to transfer power over long distances. Throughout all snapshot years, transformers created choke points, since the system’s existing transformers were not originally designed to handle the large loads assumed in this study.

As described in the previous key takeaway, generator locations matter. When generation location was optimized in order to locate more generation on the 115 kV system closer to the load, rather than on the 345 kV system, transformer overloads were reduced.

Results from the 2050 Transmission Study reveal that the power system is only as reliable as its ability to deliver power through transformers without experiencing overloads. One benefit of higher voltage transmission (in New England, primarily 345 kV) is its increased capacity to transfer more power across long distances while minimizing losses of power along the way. However, this additional power transferred along higher voltage lines must eventually "step down" to 115 kV via transformers on its way to distribution substations fed by 115 kV lines, and these transformers must be able to support the increase in load and power injection. Results from the studied snapshots show that the existing transformer fleet will not be able to adequately support future power flows from the 345 kV to the 115 kV system. This is not an issue with the transformers themselves, but rather is a predictable consequence of increases in load and the fact that this increased load is originating predominantly from locations far away from the generation.

One of the simplifying assumptions of this study was to model load on the 115 kV system, rather than on the distribution system. As a result, this takeaway applies to transformers with windings at or above 115 kV. Presumably, a large number of additional distribution transformers will be required to step down from 115 kV to individual customers. This distribution infrastructure is beyond the scope of this study, and the related planning responsibility lies with the distribution utilities and their state regulators rather than with the ISO. However, this infrastructure will be necessary to support increasing electrification of transportation and heating.

These results indicate that transformers are a key component in the reliable delivery of bulk power as loads increase. Major challenges in addressing these concerns include the time and expense required to build new, large transformers. Lead times for new transformers are often one to two years, and adding a large number in a short period of time will be difficult. Nonetheless, adding transformers throughout the system could likely relieve thermal overloads and support reliability. Ideally, New England transmission owners would wait to order new transformers until it is determined that they are definitely needed, and the location where they are needed is known; however, due to the long lead times and the large number of transformers needed, it may be prudent to start ordering transformers ahead of time and determining their exact locations later on.

Section 3: High-Likelihood Concerns

In response to stakeholder interest and feedback, the 2050 Transmission Study identified what the ISO has termed high-likelihood concerns, as discussed in Section 2.2. It is helpful to identify the transmission concerns that have a high likelihood of occurring even if the assumptions used in the study do not unfold exactly as predicted. This allows the New England region to prioritize concerns based on their likelihood. The ISO has defined a "high-likelihood concern" as one that satisfies the following three criteria:

1. **The thermal concern must appear at two or more load levels.** This could mean that the concern occurs in the same year, but during both summer and winter peaks, or it could mean that it only appears during the winter peak in two separate years, e.g., 2040 and 2050. Requiring the concern to appear at two or more load levels in study simulations significantly increases the probability that the concern will be realized. For example, if a concern appears at the 2040 43 GW winter peak and also at the 2050 51 GW winter peak, there is a much higher likelihood that the concern will occur whether loads reach the highest studied levels (57 GW) or not. As a counterexample, if a concern only occurs once, at 57 GW of load in the winter, then the likelihood of this concern existing in reality will be much lower. If load growth falls slightly short of the study's highest prediction, then the concern is highly unlikely to occur.
2. **The thermal concern must not rely heavily on specific substation-level generator locations.** Many of the generator locations in this study are hypothetical— particularly for offshore wind, solar PV, and batteries, since many of these generators do not yet exist. In reality, these generators will likely be located in somewhat different locations. It is therefore important to prioritize concerns that are not directly triggered by specific generator locations. If observed overloads are caused by a generator interconnected at a certain substation, and this overload would not be observed if the generator was connected to a substation several miles away, this is not considered a high-likelihood concern. However, if a generator could be located anywhere within a range of substations and still cause a thermal overload, this would be considered a high-likelihood concern, provided that it also meets the other two criteria described in this section.
3. **The thermal concern must not rely heavily on load growth at a particular substation.** The study assumed that load will grow proportionally across all of New England; in reality, load will likely grow faster at some substations than it will at others. It is therefore important to prioritize thermal concerns that are not heavily dependent on the exact location of load. For example, if a substation is fed from a single transmission line, the flow on that line is entirely dependent on the load located at that particular substation, and future loads that fall slightly short of forecasts used in this study would not precipitate a thermal concern. This type of concern is not considered high-likelihood. However, thermal concerns observed on transmission lines that transfer power between New England's subregions are much less dependent on specific load locations, and are therefore considered high-likelihood provided they meet the other two criteria described in this section. If load grows slightly more at one station than another in the same area, or if a new

station is added to that area, roughly the same amount of power will still flow over the major transmission line between areas.

Roadmaps that could address each of these high-likelihood concerns are included in Section 4, along with graphic representations of each roadmap.

3.1 High-Likelihood Concerns: North-South

The Maine-New Hampshire and North-South transmission interfaces connect Maine and New Hampshire to northeastern Massachusetts.[12] The 2050 Transmission Study found that these interfaces are high-likelihood concerns due to a variety of thermal overloads that met the criteria described in the previous section. These concerns were observed primarily during winter peak snapshots and were precipitated by the large volume of offshore wind production flowing from relatively generation-heavy and light-load areas in Maine and New Hampshire into the dense, high-load areas in southern New England. Although less severe than the winter observations, concerns were also observed during the summer daytime peak snapshots, precipitated by large excesses in solar production in northern New England. Transporting this excess power between subregions overloaded a significant number of 345 kV and 115 kV transmission lines connecting northern and southern New England. These overloads increased in severity between the 51 GW and 57 GW load levels during the 2050 winter peak snapshot.

The overloads experienced on the Maine-New Hampshire and North-South interfaces were observed in a number of studied years. Some overloads began in 2035 and extended all the way through 2050. Some overloads were observed in both the winter peak and the summer daytime peak snapshots. Additionally, these observed overloads were not highly dependent on generator location. While the total generation in northern New England is a factor in these overloads, the precise locations of particular generator interconnections in Maine do not affect the probability that the overloads will occur; most of the power generated in this subregion still ultimately flows down through the major lines leading into Massachusetts. The exact load distribution within a subregion also does not heavily influence these major transmission lines since they transfer power between subregions rather than serving one particular substation. Even if the precise load location varies within those subregions, the resulting flow on the major lines would remain relatively similar.

Other ISO studies such as FGRS and EPCET's Market Efficiency Needs Scenario (MENS) have also identified bottlenecks on the interfaces between Maine and southern New England. These studies examined the hourly dispatch of the transmission system on a year-round basis, rather than the peak load snapshots used in this study. While the methodology of these studies differs from a full transmission system study (e.g., FGRS used a "pipe-and-bubble" approach to transmission limits and the EPCET MENS used a nodal model with N-1 contingencies rather than N-1-1 contingency analysis), their results support this study's findings, and transfers across the Maine-New Hampshire and North-South interfaces will increase beyond today's limits over a wide range of future conditions.

Analyzing different state-by-state totals of renewable generation, other than those in the All Options Pathway, was beyond the scope of this transmission study. However, it is possible that offshore wind that the study assumed would interconnect in Maine or New Hampshire could be routed south into Massachusetts instead, alleviating some of the stress on the North-South

[12] An interface is a boundary on the power system across which power flow is measured. For example, the Maine-New Hampshire interface is the sum of the flows on all six transmission lines connecting Maine to New Hampshire.

interface. The precise interconnection locations for offshore wind in the Gulf of Maine will depend on many factors, including the exact location of wind lease areas that have not yet been finalized.

3.2 High-Likelihood Concerns: Boston Import

Since most of the load increases examined in the 2050 Transmission Study were the result of increased electrification in the same locations where load is observed today, this heavily impacted already load-dense areas of the New England region, and the Boston subregion in particular. The Boston subregion is the area bound by the Boston Import interface, and it extends from downtown Boston south to Hyde Park, west to Framingham, and north to Amesbury. The 2050 Transmission Study determined that the Boston Import interface is a high-likelihood concern. There were a variety of thermal overloads observed along this interface that met all three criteria. Across most snapshots studied, current import paths into the Boston area are unable to support increasing load due to high load density and low assumed availability of wind generation in the area under summer peak load conditions. The balance of load and generation within the Boston Import interface affects the degree of overloads in this area, and additional generation within the Boston Import subregion could help to reduce overloads on the import paths.

It should also be noted that a significant number of overloads occurred on underground cables that would be expensive to fix through upgrades. In most situations, increasing the rating of underground cables requires a complete replacement of all underground equipment, resulting in costs that are six to eight times higher than rebuilding existing overhead transmission lines. Table 3-1 displays the overloaded mileage on all lines in the Boston area. There are two categories for each set of results: All Lines (Overhead and Underground Lines) and Underground Lines. The results labeled “pre-optimization” show study results from July 2022, before any work to optimize generator interconnection locations (see Section 2.4). Results marked “post-optimization” show the effects of generator interconnection location optimization on reducing transmission overloads. All results are presented without any representative transmission upgrades included; potential upgrades for this area are described in Section 4, and eliminate all of the transmission overloads shown here.

Table 3-1: Miles of Transmission Lines Overloaded in the Boston Subregion by Snapshot Year/Load

Year Studied	Miles of Transmission Lines Overloaded in the Boston Subregion[13]			
	Pre-Optimization: All Lines	Post-Optimization: All Lines	Pre-Optimization: Underground Lines	Post-Optimization: Underground Lines
2035	77.6	98.3	54.8	62.0
2040	169.4	184.5	103.2	97.1
2050 (51 GW winter peak)	398.8	313.5	202.0	165.4
2050 (57 GW winter peak)	477.3	344.6	205.5	169.6

Results indicated that underground cables were the source of a significant percentage of observed overloads in Boston (see Figure 3-1). These results also illustrate that generation location matters, as described in the key takeaway Section 2.4. When generator relocations were optimized to best suit the 2050 snapshots, the number of miles overloaded were reduced. However, optimizing the generation relocation for 2050 produced more overloaded miles in the 2035 and 2040 snapshots than in the original pre-optimization results. Although the best optimization for 2050 was not optimal for 2035 and 2040 results, the results from all later snapshots showed a decrease in overloaded miles between pre- and post-optimization. This example illustrates potential trade-offs between optimization of the transmission system for the long-term and addressing near-term problems that must be considered as the region tackles the clean energy transition. Boston likely requires more import capability and transmission system improvements to address these high-likelihood concerns, and the roadmaps detailed in Section 4 solve for all concerns observed in all years studied while considering generator point-of-interconnection optimization for 2050.

[13] Numbers in this table are based on N-1-1 results when accounting for single-element second contingencies (loss of line, transformer, etc.) but not multiple-element second contingencies (breaker failures, double-circuit tower contingencies, etc.). Mileage includes both lines fully within the Boston subregion and lines crossing the Boston Import interface, which connect the Boston subregion to the remainder of New England.

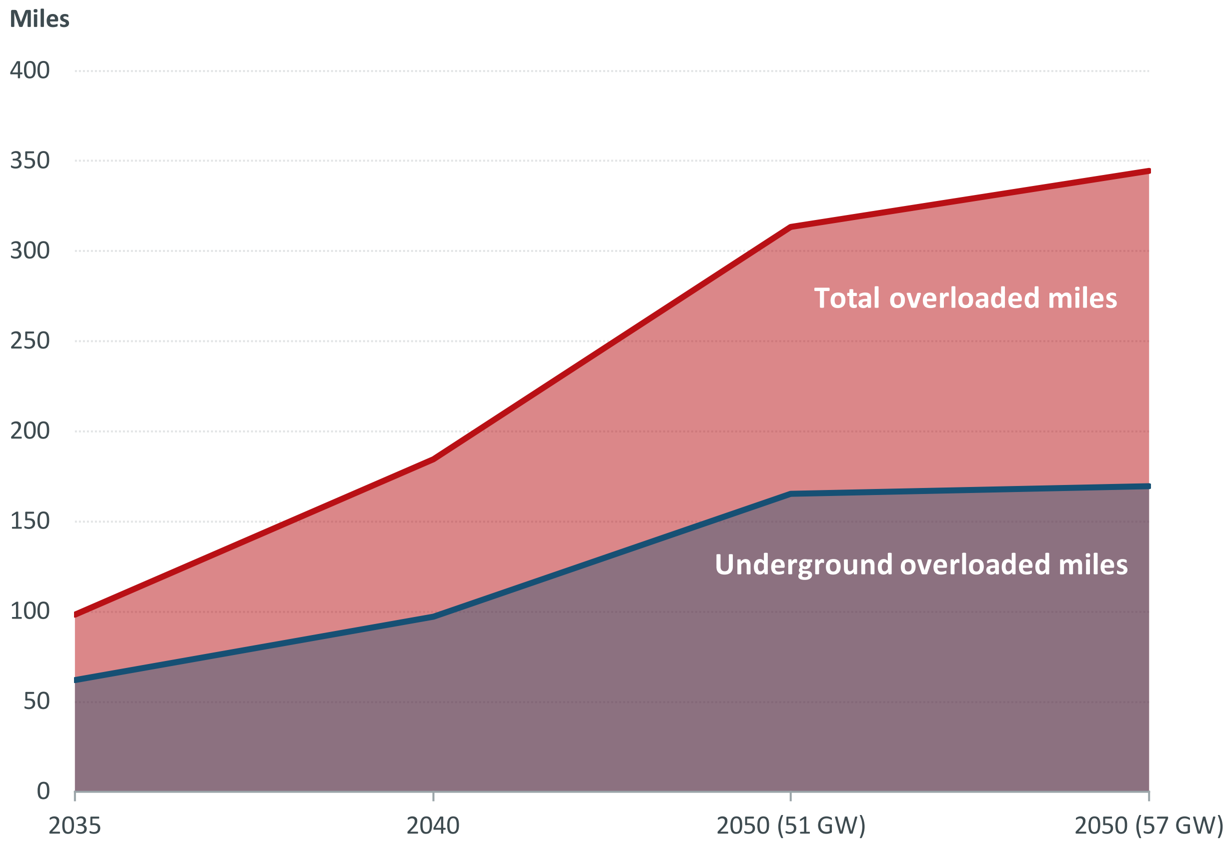

Figure 3-1: Line Mileage Overloaded in Boston with Generator Interconnection Locations Optimized

Alternative approaches that might address these issues yield trade-offs between cost and effectiveness. Moving generator interconnection locations will address some of the identified concerns during peak load conditions, but may be less optimal under off-peak or high-wind-output conditions. Optimizing generator interconnection locations may be more cost-effective than building new transmission, since some interconnection equipment will be needed regardless of the substation where a generator interconnects. However, relocating generator interconnections is not completely cost-free, especially when moving offshore wind interconnections farther from shore, since extra costs associated with cables between offshore and onshore locations may arise. The costs of generator interconnection equipment are also allocated differently than transmission upgrades, potentially complicating the optimization of generator interconnection locations. If there were more generation in load-dense areas, the need to import power into Boston would be less. Bulk power must travel through multiple stations to satisfy load in Boston, and lines may overload along the way due to the large volume of power flow. Locating more generation within the Boston subregion would therefore reduce overloads along this interface under heavy load conditions.

3.3 High-Likelihood Concerns: Northwestern Vermont Import

The 2050 Transmission Study found that importing power into northwestern Vermont is a high-likelihood concern, specifically with regard to the area around Burlington. The study's observed overloads stemmed from the significant amount of forecasted load in the general area without a corresponding amount of local generation, combined with the lack of significant 345 kV transmission lines transferring power into the area. These overloads were observed exclusively in the winter, when load is expected to be highest, as heating in the region becomes significantly more electrified. Overloads were observed primarily on 115 kV lines around the Burlington area, along with a 115 kV inter-area tie line between Plattsburgh, New York and the Sandbar substation in Milton, Vermont.

While the overloads did not appear in both summer and winter, many of them did appear in 2035, 2040, and 2050, indicating a high probability that they will occur even if load in 2050 is lower than assumed. These overloads were not heavily dependent on generation location, as there is no significant generation located in northwestern Vermont. Some new solar was assumed; however, since the overloads occurred after sunset during the winter peak, solar units were unable to provide power. This region is also not ideal for connecting with larger generators or with significant imports like the HVDC connection with Canada assumed in southern Vermont, because northwestern Vermont does not have a strong connection to the 345 kV transmission system. While more generation could help mitigate some of the concerns in the region, it would not be well-connected to other subregions and thus not particularly useful for exporting to those subregions when load is low in Vermont. With few transmission paths in this part of the state, any new, large generation or HVDC import into the area could require significant transmission upgrades.

The high-likelihood concerns observed in northwestern Vermont are dependent on the overall load growth in the area; however, they are not highly dependent on where that load growth is located station-by-station. As long as the load growth occurs somewhere in the general region, many of these overloads are expected to persist.

3.4 High-Likelihood Concerns: Southwest Connecticut Import

Southwest Connecticut arose as a high-likelihood concern due to its positioning in the power system combined with high load density. Since the area is located in a corner of the New England power system, increases in assumed load there surpassed line ratings and precipitated thermal overloads. There are only two 345 kV paths connecting Southwest Connecticut to the rest of the New England system, which limits the amount of power that can flow over the higher voltage transmission lines. The loss of one or both of these 345 kV paths can lead to high flows on the underlying 115 kV system, and transformers in this area suffered thermal overloads as the load increased on the system across all snapshots studied.

Thermal concerns appeared across all studied load levels due to the total load increase across the substations, but were most severe in the 57 GW snapshot. The location of generator interconnections was optimized to address as many overloads as possible, but this had only a limited effect due to the relatively small amount of generation in the area as compared to peak load. The overall subregion was not very sensitive to changes in load since these concerns persisted across 2035, 2040, and 2050. As long as the load was located within Southwest Connecticut, it generally did not matter on a substation-to-substation level exactly where the load was located.

Section 4: Roadmaps and Representative Transmission Solutions

The term *roadmap* is intended in this study as a high-level plan designed to show generally how transmission-related objectives can be accomplished. The roadmaps provided in this study are not intended as comprehensive or detailed plans for construction. They include conceptual projects specific to the study's input assumptions—projects that could be useful in addressing high-likelihood concerns, including line rebuilds, and lessons learned that could be applied to future long-term transmission studies. Roadmaps were developed for groupings of high-likelihood concerns for North-South, Boston Import, and Northwestern Vermont Import. Roadmaps were not developed for Southwest Connecticut or other high-likelihood concerns, since these concerns had a relatively clear single solution, and any alternatives were much costlier. The North-South and Boston Import roadmaps were combined, since these areas were heavily dependent on each other. The cost assumptions for the representative transmission solutions are described in Section 5.

To develop each roadmap, the ISO first focused on designing solutions to meet the 2050 Summer Peak snapshots along with the 2050 51 GW Winter Peak snapshot. Once those solutions were developed, a subset of those solutions were determined to meet the 2035 and 2040 snapshots such that a smooth path could be developed to move from 2035 to 2040 to 2050 without having to build a solution and then rebuild it in the future. Finally, the study identified additional upgrades on top of the 2050 51 GW Winter Peak snapshot that were required to reach the 2050 57 GW Winter Peak snapshot.

4.1 North-South/Boston Import Roadmaps

Four main roadmaps were developed for solving the high-likelihood concerns observed on the North-South and Boston Import interfaces. These roadmaps were developed to provide the region's stakeholders a variety of examples of how these concerns might be mitigated. The ISO does not recommend any particular roadmap over another; each includes advantages and disadvantages. Collaboration between stakeholders and the region as a whole will help determine the best path forward.

4.1.1 North-South/Boston Import Roadmap #1: AC Roadmap

The first roadmap centers around an AC 345 kV framework. This roadmap consists of a 345 kV line from the Surowiec substation in Pownal, Maine to the Timber Swamp substation in Hampton, New Hampshire, and another 345 kV line from Timber Swamp to the Ward Hill substation in Haverhill, Massachusetts. These two 345 kV lines would primarily be constructed overhead, with short underground sections as needed to address segments where overhead construction is difficult or impossible. An additional 345 kV partially overhead/partially underground line would also be required from Ward Hill to the Wakefield Junction substation in Wakefield, Massachusetts, continuing to the Mystic substation in Everett, Massachusetts. Finally, a third AC cable (in addition to two existing AC cables) from the Stoughton 345 kV substation in Stoughton, Massachusetts to the K Street substation in Boston, Massachusetts would be required to help resolve import issues in the southern and western portions of the Boston sub-region. These upgrades, along with ancillary rebuilds of existing transmission lines, would be sufficient to meet the 51 GW winter peak load. A 57 GW winter peak would require a second 345 kV Timber Swamp-Ward Hill line in addition to the above-mentioned new lines. In addition to the major upgrades described above, this roadmap would require approximately 666 miles of overhead line rebuilds to reliably serve a 51 GW load and 1,058 miles of overhead line rebuilds to reliably serve a 57 GW load.

This option is somewhat limited in its flexibility due to constrained rights-of-way along much of the path, since lines connecting Maine to Massachusetts should be overhead in order to have enough capacity. While it may be possible to add new 345 kV transmission to existing rights-of-way, there will be expenses associated with reconfiguring existing lines. Additionally, the risk that all lines in a right-of-way may be lost (e.g., due to brush fires) would need to be evaluated further outside of this study. Figure 4-1 represents the general direction of power flow and location of major new transmission lines in this roadmap.

Figure 4-1: North-South/Boston Import AC Roadmap

4.1.2 North-South/Boston Import Roadmap #2: Minimization of New Lines Roadmap

The second roadmap attempts to minimize the number of newly constructed lines, and instead prioritizes rebuilding existing lines with larger conductors. This roadmap would still require the new 345 kV partially overhead/partially underground Ward Hill-Wakefield Junction-Mystic line and the third Stoughton to K St AC cable mentioned in roadmap #1, but it would not require any of the new lines in Maine or New Hampshire. The omission of new ME-NH lines would, however, necessitate approximately 252 miles of additional rebuilds, for a total of 918 miles of rebuilt overhead lines to support a 51 GW winter peak load.

It is important to note that this roadmap is not sufficient to support a 57 GW winter peak load. Additional new lines will be required to support a 57 GW winter peak, and line rebuilds alone cannot address the concerns observed in this study. The study did not determine exactly which new lines would be necessary to serve a 57 GW peak reliably, since this roadmap began to converge on the same solutions as other roadmaps as more lines were added. If this roadmap is followed, the region could potentially use demand response, energy efficiency, and other measures to achieve 6 GW of load reduction and avoid a 57 GW winter peak. However, these solutions also have associated costs. This roadmap would be easier to site than roadmaps #1 and #3, although building fewer new lines would likely come with disadvantages related to stability and voltage performance that cannot be accurately quantified in this study. The concerns regarding loss of right-of-way described at the end of section 4.1.1 with regard to roadmap #1 would apply to this roadmap as well. Figure 4-2 represents the approximate locations of rebuilds described in this roadmap.

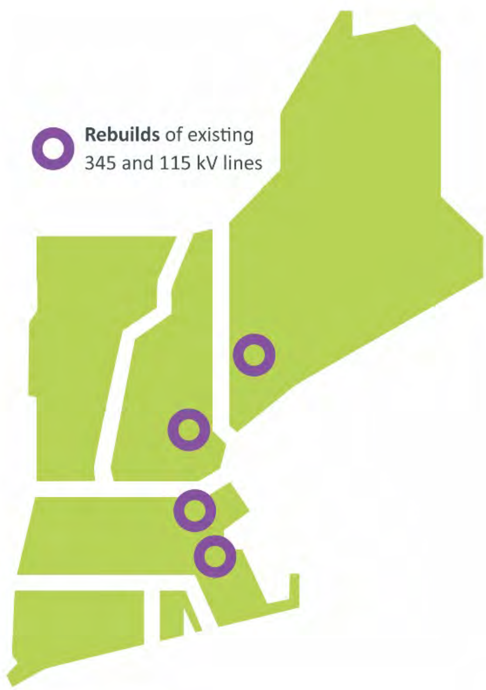

Figure 4-2: North-South/Boston Import Minimization of New Lines Roadmap

4.1.3 North-South/Boston Import Roadmap #3: Point-to-point HVDC Roadmap

The third roadmap centers around a potential point-to-point HVDC framework. It consists of a single 1,200 MW HVDC line from the Surowiec substation in Pownal, Maine to the Mystic substation in Everett, Massachusetts. Additionally, the new AC cable from Stoughton to K Street described in Roadmap #1 would be required to help resolve import issues in the southern and western portions of the Boston sub-region. This roadmap is useful for addressing high-likelihood concerns for all snapshots through 51 GW of load. In order to reliably serve the 57 GW load level in the 2050 winter peak snapshot, an additional 1,200 MW HVDC line would need to be constructed between 2040 and 2050 from the South Gorham substation in Gorham, Maine to the Tewksbury substation in Tewksbury, Massachusetts. The HVDC lines in this roadmap could be constructed overhead, underground, or underwater, offering flexibility for siting. The DC/AC converters at each terminal of the HVDC lines may also have short-circuit and stability benefits that were not quantified by this study. The main disadvantage to this roadmap will likely be related to land availability in Boston for siting the large DC/AC converter stations needed to terminate these new HVDC lines; although the Tewksbury area likely has enough land availability for this converter station, and Mystic may have enough availability once the existing generation at that location has been retired. In addition to the major upgrades described above, this roadmap would require approximately 624 miles of overhead line rebuilds to reliably serve a 51 GW load and 1,027 miles of overhead line rebuilds to reliably serve a 57 GW load. Figure 4-3 represents the general direction of power flow and location of major new transmission lines in this roadmap.

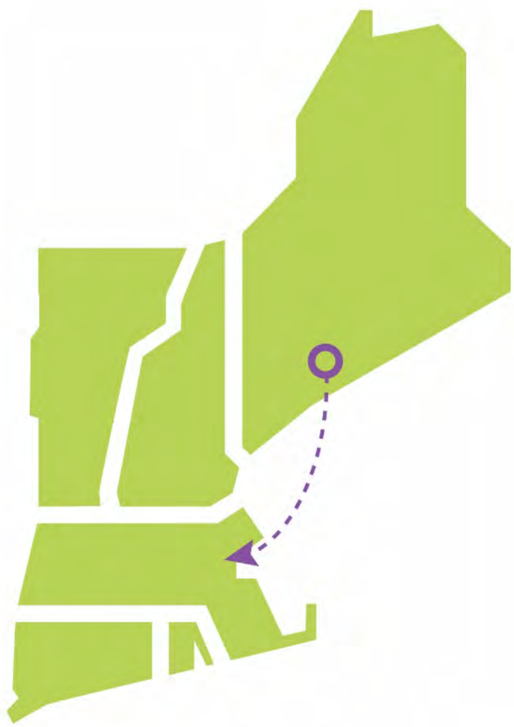

Figure 4-3: North-South/Boston Import Point-to-Point HVDC Roadmap

4.1.4 North-South/Boston Import Roadmap #4: Offshore Grid Roadmap

The final roadmap would make use of an offshore grid framework by connecting up to three offshore wind plants. These would be connected with offshore HVDC cables to form new paths between wind farms. In combination with the cables already built to connect these wind farms to on-shore substations, these offshore connections will enable the transfer of power between various sub-regions in New England. Several different configurations were examined. Initially, the study investigated a grid connecting offshore wind that interconnected in Maine, New Hampshire, and Boston. This solution was not efficient, since offshore grids are most effective when there is excess capacity on the offshore cables, i.e., when wind output is relatively low and more spare capacity is available to transfer power through the cables. The North-South interface was most highly overloaded during the winter peak snapshots, when wind output was at its highest, meaning that each 1,200 MW offshore connection had just ~200 MW of excess capacity available. This made only a minor difference in resolving overloads. Overloads on lines crossing the North-South interface were so high that roughly 10 connections between northern New England and Boston would be required (under the offshore grid framework) to solve the concerns, and there were not enough offshore wind interconnection points to make this feasible. Additionally, such a high number of offshore connections would lead to significantly higher costs than other roadmaps for North-South transfers.

The offshore grid was much more effective in the summer peak snapshots, when the wind production was low and there was more spare capacity available on the cables. Many of the Boston Import overloads were worse in the summer, when wind injections into Boston dropped. When overloads were observed in winter, they were relatively small. The offshore grid is therefore a good candidate for solving these particular concerns.

Various configurations were examined before this roadmap was finalized. To address concerns related to high Boston Import flows, the roadmap centers on a three-terminal offshore grid between Brayton Point in Somerset, Massachusetts; K Street in Boston, Massachusetts; and Mystic in Everett, Massachusetts by building offshore connections between Brayton Point Wind, K Street Wind, and Mystic Wind.[14] This framework was sufficient for the 2035 and 2040 snapshots. For the 2050 snapshots, two separate connections between pairs of offshore wind farms were required in addition to the three-terminal grid; one between West Farnum Wind (interconnecting in North Smithfield, Rhode Island) and Brighton Wind (interconnecting in Boston, Massachusetts), and another between Montville Wind (interconnecting in Uncasville, Connecticut) and Woburn Wind (interconnecting in Woburn, Massachusetts). These offshore upgrades were sufficient to solve the Boston Import concerns. The study assumed that all interconnected wind plants would be located in the wind lease area off of the southern coast of New England, and thus would be connected together with relatively short underwater cables.

The incremental cost of this offshore grid roadmap is simply the total cost of these offshore-offshore connections, since the study inherently assumed offshore wind generation and thus associated cables to the shore were covered by generation interconnections which were beyond the scope of the 2050 Transmission Study. These offshore – onshore cables would be required to bring wind energy onshore whether the individual wind plants are each connected directly to the shore or as part of a networked offshore system. Any interconnected offshore wind plants would need to be built such that they are compatible with other offshore wind plants in the area, facilitating their connection to a network. For example, any HVDC technology used on the cables would need to be inter-operable between any other wind farms that would eventually be connected together. Solving the remaining North-South interface concerns under this roadmap would require the AC roadmap's North-South upgrades: a new 345 kV line from Surowiec, Maine to Timber Swamp, New Hampshire, and a new 345 kV line from Timber Swamp to Ward Hill in Massachusetts, with this line doubled for the 57 GW winter peak snapshot. The continuation of this line to Wakefield Junction and Mystic would not be necessary, since the Boston Import issues addressed by this continuation in the second roadmap were resolved by the offshore grid in this roadmap. The offshore grid also removes the need for a third 345 kV Stoughton – K Street underground cable. In addition to the major upgrades described above, this roadmap would require approximately 606 miles of overhead line rebuilds to reliably serve a 51 GW load and 1,023 miles of overhead line rebuilds to reliably serve a 57 GW load. Figure 4-4 represents the general location of conceptual wind projects and interconnections in this roadmap.

[14] Capitalized wind project names in this section and in Figure 4-4 are purely hypothetical, and are merely provided as placeholders in order to reduce confusion. These names refer to the onshore substations to which each wind farm connects.

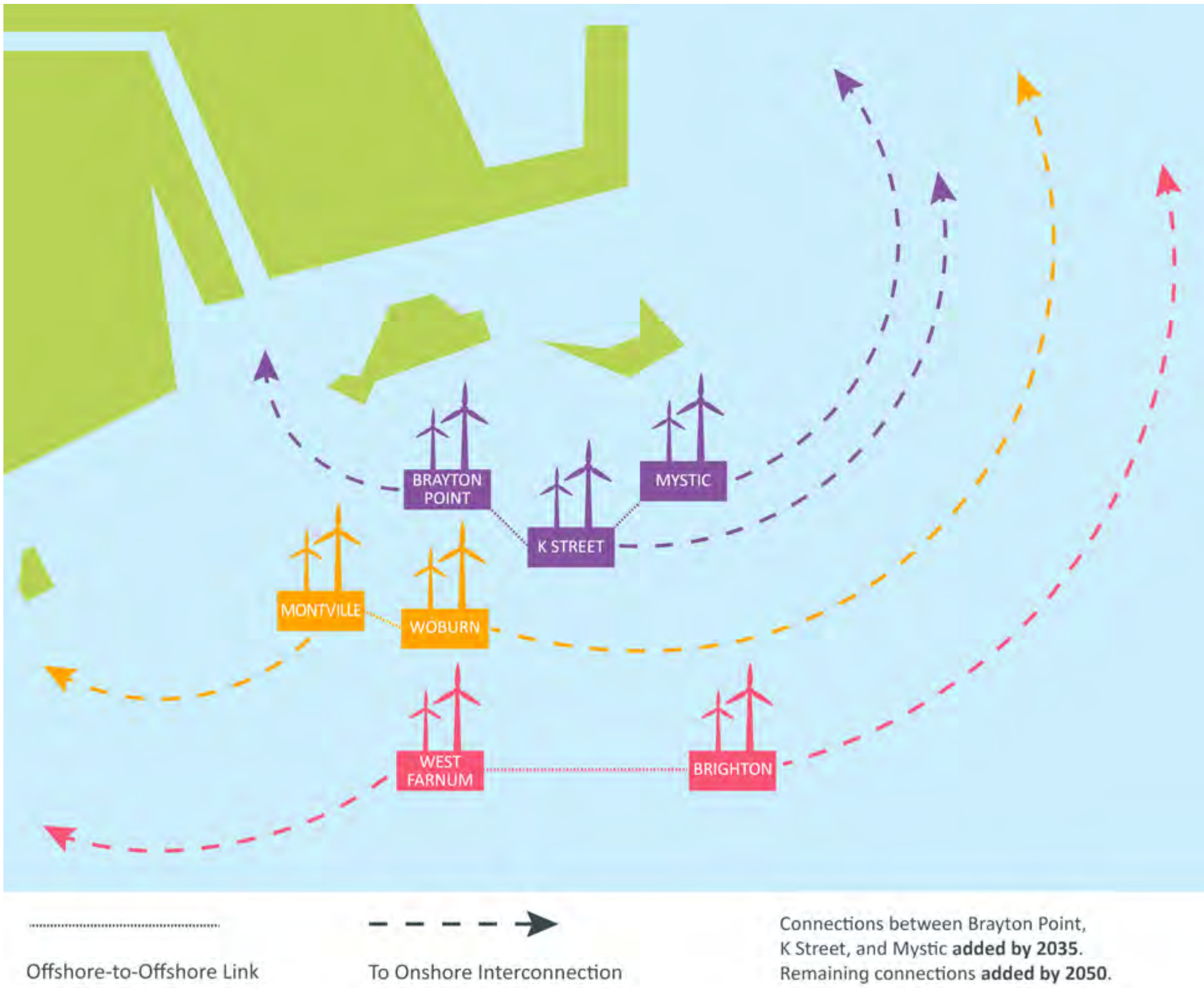

Figure 4-4: Boston Import Offshore Grid Roadmap

4.1.5 Other Projects to Resolve Concerns in Boston

The roadmaps described in previous sections resolve many concerns related to bringing power into the Boston sub-region from elsewhere in New England. However, these roadmaps do not resolve a number of concerns related to moving power around the Boston sub-region. These concerns were caused primarily by the need to bring power from the major 345 kV hubs in Boston to each individual 115 kV substation where power is delivered to the local distribution network. As described previously, relocation of offshore wind interconnections addresses some of these concerns. The remaining concerns, shown in Figure 3-1, are addressed with a combination of the Boston-related portions of the other roadmaps and the following projects.[15]

[15] Replacement of existing pipe-type underground cables in the Boston area for asset condition reasons, as mentioned on slide 13 of a July 2023 presentation regarding upcoming asset condition projects, is not included in this analysis, and the cost is not included in the total costs discussed in Section 5 of this report. When analysis for the 2050 Transmission Study was conducted, sufficient information to model these projects was not available.

The first project includes the conversion of three existing 230 kV lines in the western portion of the greater Boston region to 345 kV standards. These lines would bring power from the West Medway substation, in Medway, Massachusetts, to the Waltham, Sudbury, and Framingham substations, and help bring power to other 115 kV substations nearby. Upgrading these lines to 345 kV would allow them to bring more power into these areas from the southwest, reducing the stress on underground cables west of Boston. The mileage of these rebuilt lines is included in the total overhead line mileage listed for each roadmap above.

The second project includes a new substation in Cambridge, Massachusetts designed to tie together lines serving the Kendall Square area of Cambridge with lines leading towards Brighton and other neighborhoods in the western portion of Boston. This new substation is included in all Boston Import roadmaps in this study in order to eliminate overloads on the cables connecting the 345 kV network at the North Cambridge substation to the Brighton substation.

4.2 Northwestern Vermont Import Roadmaps

Four roadmaps were developed for solving the high-likelihood concerns observed in northwestern Vermont around the city of Burlington. These roadmaps were developed to provide the region's stakeholders with a variety of examples of how these concerns might be mitigated. As with the previous roadmaps, the ISO does not recommend any particular roadmap over another; each includes advantages and disadvantages. Collaboration between stakeholders and the region as a whole will help determine the best path forward.

4.2.1 Northwestern Vermont Import Roadmap #1: PV-20 Upgrade and Doubling of K-43 Roadmap

The first roadmap centers on upgrading the PV-20 line from New York into Vermont from 115 kV to 230 kV, and constructing a new 115 kV overhead line in parallel to the existing K-43 line that runs from the New Haven substation in New Haven, Vermont to the Williston substation just south of the city of Burlington in northern Vermont. The 230 kV conversion of the existing PV-20 line would only require work on the overhead portion of the line, since the underwater portion that runs under Lake Champlain is already capable of operating at 230 kV. The portion of the line that would need to be upgraded to 230 kV is approximately 9.3 miles long. An additional 7.55 miles of overhead line would need to be converted to 230 kV between Vermont and New York, but the cost estimates in this study only cover the portion of the line that is within New England, ending at the overhead-to-submarine transition structure on the eastern shore of Lake Champlain. A new 230/115 kV transformer would also be required at the Sandbar substation north of the city of Burlington. The build of the new 115 kV line in parallel to the existing K-43 line will be similar to the existing 20.8-mile-long line, with the assumption that the existing K-43 line is also rebuilt with larger conductors. This roadmap would also require approximately 120 miles of 115 kV overhead line rebuilds to reliably serve a 51 GW load and 151 miles of 115 kV overhead line rebuilds to reliably serve a 57 GW load. Both of these numbers include the 20.8 mile rebuild of the existing K-43 line mentioned above. In addition to transmission line additions and upgrades, three new 345/115 kV transformers need to be added at existing 345 kV stations in Vermont to reach a 51 GW load, and an additional two new 345/115 kV transformers need to be added at existing 345 kV stations in Vermont to reach a 57 GW load. Figure 4-5 represents the general direction of power flows and location of the new transmission line and the 115-to-230-kV conversion in this roadmap.

Figure 4-5: Northwestern Vermont Import PV-20 Upgrade and Doubling of K-43 Roadmap

4.2.2 Northwestern Vermont Import Roadmap #2: Coolidge-Essex Roadmap

The second roadmap would require the construction of a new 345 kV line from the Coolidge substation north of Ludlow, Vermont, to the Essex substation just outside of the city of Burlington, Vermont. This line would be approximately 90 miles long and would likely require the expansion of existing transmission rights-of-way for the majority of its length. New 345 kV substation equipment, including a 345/115 kV transformer, would be required at the Essex substation, as this station is currently only capable of 115 kV operation. This option would require approximately 105 miles of 115 kV overhead line rebuilds to reliably serve a 51 GW load and approximately 189 miles of 115 kV overhead line rebuilds to reliably serve a 57 GW load. In addition to the new transformer at Essex, one new 345/115 kV transformer would need to be installed at an existing 345 kV substation to reach 51 GW and an additional one 345/115 kV transformer would be needed at an existing 345 kV substation to reach 57 GW. Figure 4-6 represents the general direction of power flow and location of new transmission lines in this roadmap.

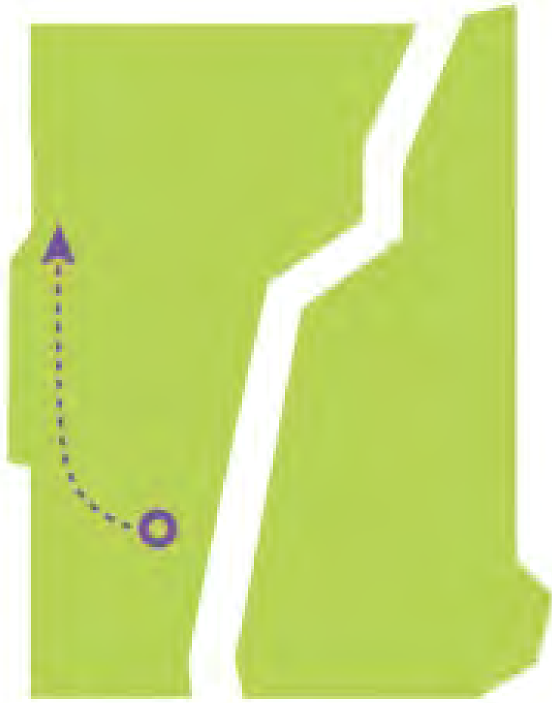

Figure 4-6: Northwestern Vermont Import Coolidge-Essex Roadmap

4.2.3 Northwestern Vermont Import Roadmap #3: New Haven-Essex and Granite-Essex Roadmap

The third roadmap would require construction of a new 345 kV line from the New Haven substation in New Haven, Vermont, to the Essex substation just outside of the city of Burlington, in addition to a new 230 kV overhead line from the Granite substation east of Williamstown, Vermont, to the Essex substation.[16] Both of these new lines would require their own new substation equipment at the Essex substation to operate at 345 kV and 230 kV, since the Essex substation is currently only capable of 115 kV operation. This new equipment would include a new 345/115 kV transformer and a new 230/115 kV transformer. The length of the line from New Haven to Essex would be approximately 25 miles and the length of the line from Granite to Essex would be approximately 45 miles. This option would require approximately 79 miles of 115 kV overhead line rebuilds to reliably serve a 51 GW load and approximately 121 miles of 115 kV overhead line rebuilds to reliably serve a 57 GW load. In addition to new transformers at Essex, two new 345/115 kV transformers would need to be installed at existing 345 kV substations to reach a 51 GW load and an additional one 345/115 kV transformer would be needed at an existing 345 kV substation to reach 57 GW. Figure 4-7 represents the general direction of power flows and location of new transmission lines in this roadmap.

[16] It may be prudent to build this line to 345 kV standards in advance, to allow for an eventual conversion of the Vermont and New Hampshire 230 kV systems to 345 kV if necessary.

Figure 4-7: Northwestern Vermont Import New Haven-Essex and Granite-Essex Roadmap

4.2.4 Northwestern Vermont Import Roadmap #4: Minimization of New Lines Roadmap

A variation on the first roadmap was also examined to determine if the Vermont high-likelihood concerns could be resolved without constructing entirely new overhead lines. Results showed that the new line in parallel to the K-43 line could be eliminated if the 0.4 mile underground section of the K-65 line between the North Ferrisburg substation and Charlotte substation, along with the 1.7 mile underground section of the K-65 line between the Shelburne substation and the Queen City substation in southern Burlington, had an additional parallel cable added to each section. The PV-20 upgrade from 115 kV to 230 kV (in both New York and in Vermont), along with the new 230/115 kV transformer, would still be required. This option would require approximately 142 miles of 115 kV overhead line rebuilds to reliably serve a 51 GW load and approximately 192 miles of overhead line rebuilds to reliably serve a 57 GW load. Three new 345/115 kV transformers would need to be installed to reach 51 GW of load, and an additional two 345/115 kV transformers would be needed to reach 57 GW. The choice between the first roadmap and this variation is therefore a choice between building a 20.8 mile overhead line versus doubling up 2.1 miles of underground cables plus rebuilding approximately 41 miles of overhead lines to reliably serve a 57 GW load. However, this approach of minimizing new overhead construction is generally less robust than roadmaps involving additional overhead transmission lines. In addition to the voltage and stability benefits of new transmission lines, new overhead lines also provide more margin for loads higher than those assumed in this study, different load distributions among the substations in Vermont, and other unexpected developments. Rebuilds alone leave very little headroom to operate the system reliably, with many lines loaded very close to their ratings under post-contingency conditions. Figure 4-8 represents the general direction of power flow and location of new transmission lines and the 115-to-230-kV conversion in this roadmap.

Figure 4-8: Northwestern Vermont Import Minimization of New Lines Roadmap

4.3 Southwest Connecticut Import

Like Boston, the Southwest Connecticut area is a densely populated urban area with high demand for power and little space for overhead transmission line corridors. As heating and transportation are electrified between now and 2050, load in this area is anticipated to grow, and additional transmission capacity will be necessary to serve this load reliably. While it may be possible to serve this load by interconnecting generating and storage resources locally, the Energy Pathways study specified relatively low amounts of offshore wind and storage for the state of Connecticut, and there is little land available for utility-scale solar in this area. The 2050 Transmission Study assumed that a new offshore wind farm would connect to the Norwalk substation, and that battery storage facilities would interconnect at Cos Cob (in Greenwich, CT) and Glenbrook (in Stamford, CT). Even with the assumption that these facilities will inject power into the subregion, additional transmission is needed to serve load reliably.

This study found that one set of solutions could address reliability concerns in Southwest Connecticut at a relatively lower cost and impact than other solution alternatives—hence the lack of multiple roadmaps for this subregion. The representative solutions suggested for this area include three new 115 kV underground cables in the Norwalk-Stamford area: one from Norwalk to Glenbrook (in Stamford, CT); one from Ely Avenue to Norwalk Harbor (both in Norwalk, CT); and a third extending an existing cable from its current endpoint at South End (in Stamford, CT) to Cos Cob. The Norwalk-Glenbrook cable would take advantage of a spare 115 kV duct bank in parallel with two existing Norwalk-Glenbrook cables, which would reduce its cost somewhat compared to an underground cable on a brand-new route. In addition to these upgrades, 96 miles of overhead

115 kV lines and 6 miles of underground 345 kV lines must be rebuilt, and two 345/115 kV transformers must be added in order to reliably serve a 51 GW winter peak load.

Additional 345 kV capacity into Southwest Connecticut would be required to serve a 57 GW winter peak load. Today, the region is fed by only two 345 kV paths: one from Long Mountain (in New Milford, CT), and the other from Beseck (in Wallingford, CT). Portions of the path from Long Mountain to Norwalk are underground, leading to lower ratings than a typical 345 kV overhead line. While additional 345 kV overhead lines would provide the capacity needed, these lines would be lengthy and would be difficult to route and site through the densely populated areas of Southwest Connecticut. Instead, this study suggests re-using an unused underground segment of the Long Mountain-Norwalk path, which would allow for more power flow. This cable was originally de-energized due to temporary over-voltage concerns.[17] Additional study would be required to ensure that the cable could be re-energized safely without risking equipment damage; additional substation equipment may be necessary to manage voltage if this cable is placed into service. The costs of this study work and substation equipment would likely be far less than developing a third 345 kV path into Southwest Connecticut. Along with re-energizing this cable, an additional two 345/115 kV transformers, 125 miles of rebuilt overhead 115 kV lines, and 21 miles of rebuilt overhead 345 kV lines would be necessary to reliably serve Southwest Connecticut at the 57 GW winter peak load level. Figure 4-9 represents the general direction of power flows and location of major new transmission lines in this roadmap.

Figure 4-9: Southwest Connecticut Import Transmission Additions

4.4 Transformer Additions

As described in section 2.5, transformer capacity has the potential to create bottlenecks in the power system between today and 2050. A large number of existing PTF transformers, primarily 345/115 kV transformers, were identified as overloaded before representative transmission upgrades were added to the system models. Table 4-1 lists the number of transformer overloads across different snapshots, and illustrates the correlation between transformer overloads and increasing load. The results marked “pre-optimization” show results from July 2022, before the study was redesigned to optimize generator interconnection locations. As described in section 2.4, generator locations have a major impact on power flows and overloads on transformers. Results

[17] Temporary over-voltage is a phenomenon caused by short-circuit conditions and by switching of transmission elements. This phenomena is particularly severe in areas with significant development of underground transmission, including Southwest Connecticut.

marked “post-optimization” show the effects of optimization on reducing transmission overloads. All results in this table are exclusive of any representative transmission upgrades.

Table 4-1: Transformer Overloads by Snapshot Year, Pre- and Post-Optimization

Year Studied	Number of PTF Transformers Overloaded[18]	
	Pre-Optimization Results	Post-Optimization Results
2035 (35 GW Winter Peak)	14	16
2040 (43 GW Winter Peak)	56	43
2050 (51 GW Winter Peak)	86	57
2050 (57 GW Winter Peak)	99	81

While a large number of PTF transformers were overloaded in the initial study results, a smaller number of transformers would be required to address these concerns. In many cases, multiple existing transformers at a single substation are overloaded, and the addition of a single new transformer is sufficient to return the loading on all existing transformers to applicable limits. While the exact number of required transformers varies based on the roadmap chosen for North-South/Boston Import and Northwest Vermont, all combinations of roadmaps require approximately 40 new transformers to address all reliability concerns. Of these 40 transformers, approximately 20 would address high-likelihood concerns. The remaining 20 would be needed to address non-high-likelihood concerns, and in many instances, are only needed to serve load in the 57 GW winter peak snapshot.

Given the long lead times (18-24 months), limited manufacturing capability, and transportation challenges for large power transformers, transformer capacity has the potential to be a significant limiting factor on the evolution of the power system and the electrification of end-user energy consumption.

4.5 Other High-Likelihood Concerns

In addition to the concerns described above, the study revealed a number of other isolated high-likelihood concerns that were not related to consistent trends like those associated with North-South transfers or other named high-likelihood concerns. The following upgrades were considered in order to address these other high-likelihood concerns:

- Upgrade and convert 298 miles of 69 kV lines to 115 kV.
- Rebuild 225 miles of overhead 115 kV lines.
- Rebuild 37 miles of overhead 345 kV lines.
- Build 13 miles of new overhead 115 kV lines.

[18] Numbers in this table are based on N-1-1 results when accounting for single-element second contingencies (loss of line, transformer, etc.) but not multiple-element second contingencies (breaker failures, double-circuit tower contingencies, etc.).

- Build two new overhead 345 kV lines between Brayton Point and Grand Army (both in Somerset, MA), for a total of 3 miles of new construction.
- Increase the rating of the series capacitor on line 3023 in Orrington, ME.

These upgrades are scattered around New England, rather than concentrated in a particular area. Full details on these additional upgrades can be found in the Technical Appendix to this report.

4.6 Non-High-Likelihood Concerns

Finally, many concerns found in this study were not considered high-likelihood concerns, and are mainly related to serving load for the 57 GW winter peak load level. Since they only appear at this load level, they are particularly sensitive to the distribution of load among individual substations. If the evolution of the region's distribution system differs significantly from the assumptions studied, it is possible that new distribution substations will be located in a way that changes the severity and location of these reliability concerns. Therefore, these concerns are not considered high-likelihood.

The upgrades associated with these non-high-likelihood concerns are as follows. While the exact upgrades may vary depending on the location of distribution load-serving substations, this list of upgrades is a reasonable approximation of upgrades that will be required if the region's load grows to a 57 GW winter peak.

- Rebuild 393 miles of overhead 115 kV transmission lines.
- Rebuild 287 miles of overhead 345 kV transmission lines.
- Build 105 miles of new overhead 115 kV transmission lines.
- Build 57 miles of new underground 115 kV cables.
- Replace 10 miles of existing underground 115 kV cables with higher-rated cross-linked polyethylene (XLPE) cables.
- Install 4 new series reactors at various locations throughout New England.
- Install approximately 300 new circuit breakers at various substations throughout New England.
- Separate transmission lines on 10 sections of double-circuit towers.[19]

[19] Double-circuit towers are structures supporting two overhead transmission lines on the same structure. NERC, NPCC, and ISO-NE reliability criteria require the consideration of the loss of both lines on double-circuit towers simultaneously, which is often caused by lightning strikes. Separation of circuits on double-circuit towers involves building new structures for at least one of the two circuits, and depending on the right-of-way layout, may or may not require additional right-of-way width.

4.7 Maps of All Transmission Upgrades and Additions

The maps in this section show the full set of transmission upgrades identified as conceptual roadmaps in this study. Rebuilds of existing transmission lines are shown in purple and new transmission lines are shown in red.

The maps below should not be considered authoritative lists of all line rebuilds; due to the scale of the maps and approximations of substation locations, some lines are difficult or impossible to distinguish from each other. All transmission lines are represented as straight lines between endpoints, and thus do not reflect actual line routes or locations of rights-of-way. This study examined four different northwestern Vermont roadmaps and four different North – South/Boston Import roadmaps. The northwestern Vermont roadmaps were far enough away from the North – South/Boston Import roadmaps that they can be considered to be independent from each other. The maps below show one northwestern Vermont roadmap paired with one North – South/Boston Import roadmap each, but these could be paired in any combination, rather than being limited to the ones shown below. A full list of rebuilt transmission lines for each roadmap may be found in the Technical Appendix to this report.

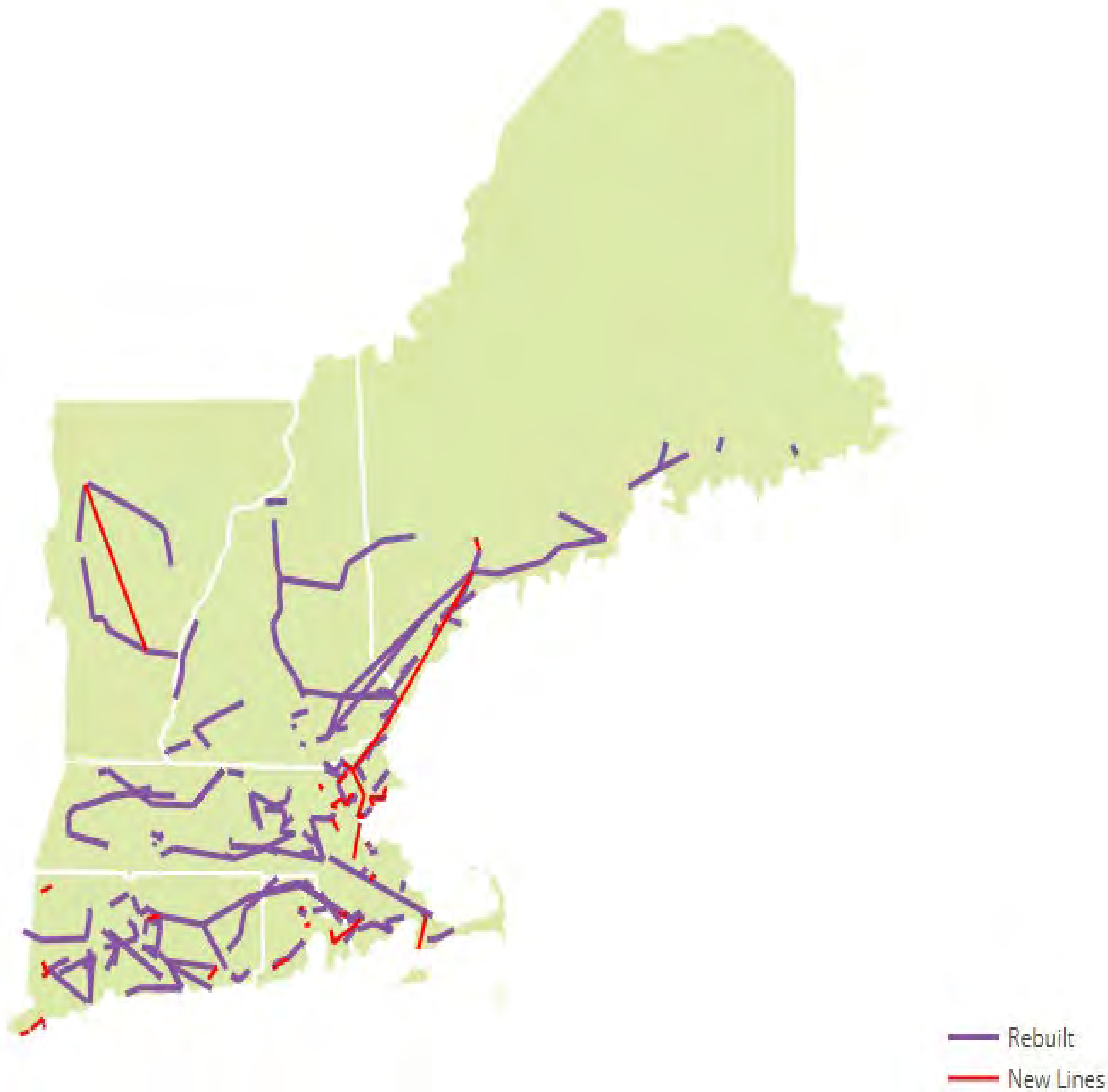

Figure 4-10: Transmission Upgrades and Additions for the Coolidge -Essex Roadmap and the AC Roadmap

Figure 4-11: Transmission Upgrades and Additions for the Minimization of New Lines Roadmaps

Figure 4-12: Transmission Upgrades and Additions for the PV-20 Roadmap and the DC Roadmap

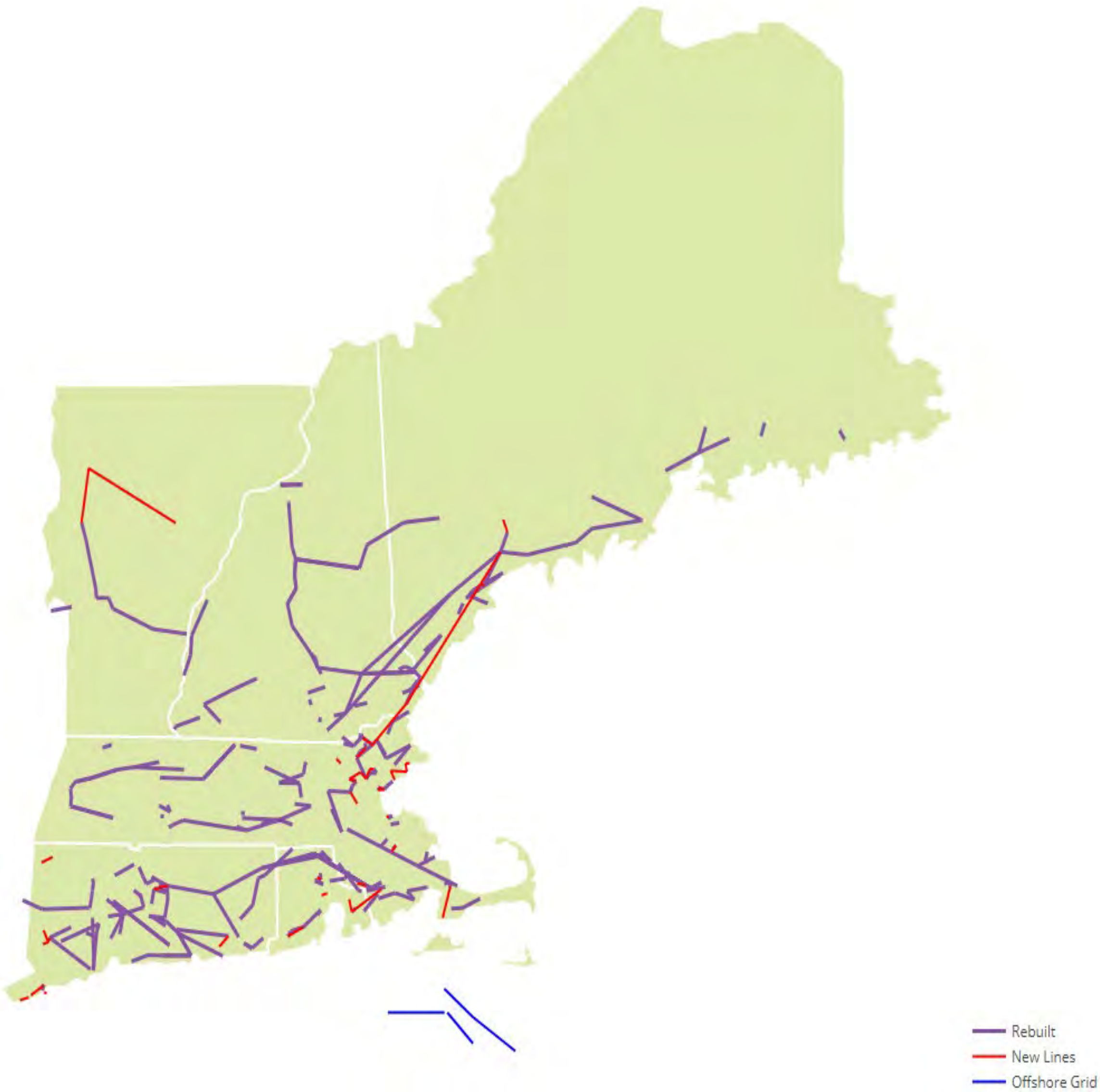

Figure 4-13: Transmission Upgrades and Additions for the New Haven - Essex Roadmap and the Offshore Grid Roadmap

Section 5: Cost of Transmission System Upgrades

One of the major goals of the 2050 Transmission Study was to provide a rough estimate of the costs required to develop the transmission system of 2050. The projects proposed as conceptual roadmaps in this study are not intended to constitute a transmission plan, and the region's transmission system will likely develop differently from the system envisioned in this study. However, the identified upgrades are still useful for providing an order-of-magnitude estimate of future transmission system costs. These estimated costs are intended to inform consumers, industry stakeholders, and policy makers of the costs inherent in maintaining reliable transmission service through the clean energy transition.

The ISO's estimates of costs for these representative transmission projects were developed from two sources. The first, used for more complex projects, was Electrical Consultants, Inc. (ECI), a consultant with extensive experience in project management and transmission system construction. ECI's cost estimates were primarily made up of materials, labor, and right-of-way costs. These cost estimates did not include some aspects of transmission costs, such as financing costs (allowance for funds used during construction, or AFUDC), contingency costs for unexpected difficulties during construction, and engineering, permitting, and indirect costs. ECI did include permitting fees and filing costs, but these costs did not reflect the extensive labor typical of permitting large projects in New England. To account for these and to ensure ECI's calculated costs were easily comparable to actual project costs in New England, a 95% adder was applied. This adder was calculated as follows:

- 10% adder for financing costs: Recent transmission projects in New England have incurred financing costs in the range of 5-14% of the total labor, materials, and right-of-way costs. A 10% adder approximates the midpoint of this range.
- 20% adder for engineering, permitting, and indirect costs: These costs have varied widely on recent transmission projects, from 2% to 32% of the total labor, materials, and right-of-way costs. Larger projects, especially those involving underground transmission, tend to be near the higher end of this range. A 20% adder is slightly higher than the midpoint of this range.
- 50% adder for contingency: ISO-NE Planning Procedure 4 (PP4), Attachment D specifies a contingency adder of 30-50% for projects with cost estimates in the "Proposed" stage of project development.[20] ECI's estimates were "desktop" estimates made without field visits or detailed analysis of local site conditions. Consequently, the high end of this 30-50% range is appropriate to reflect the possibility of significant extra costs as projects proceed.
- The 50% contingency is applied to the material/labor/right-of-way cost, financing, and engineering/permitting/indirect costs; this leads to a final cost of 130% (the financing and engineering/permitting/indirect adder) times 150% (the contingency adder), or a total of 195% (95% above the original materials/labor/right-of-way cost).

The second source of cost data was a set of assumptions based on recently-observed project costs in New England. The ISO analyzed cost data from reliability projects in both the Regional System Plan (RSP) Project List and asset condition projects from the Asset Condition List (ACL). These projects were used to develop per-mile assumptions for new or substantially rebuilt transmission lines, and for additions to existing substations such as new transformers and circuit breakers.

[20] PP4 Attachment D is available on ISO-NE's website at https://www.iso-ne.com/static-assets/documents/rules_proceds/isone_plan/pp04_0/pp4_0_attachment_d.pdf.

These cost assumptions were used for rebuilds of existing lines and other less complex projects. Because of the sheer number of transmission projects included in this study, this approach provided a more cost-effective method for estimating costs. Conducting detailed cost analysis for these transmission line rebuilds and other simpler projects would be expensive, time-consuming, and unlikely to add significant precision. Some projects will likely exceed the costs calculated using these assumptions, and other projects will be less expensive than the assumptions, but the ISO's expectation is that the aggregated cost of the full list of these projects will be within an order-of-magnitude range of accuracy. The cost assumptions developed are shown in Table 5-1.

Table 5-1: Cost Assumptions for 2050 Transmission Study Upgrades

Project Type	Assumed Cost
69/115 kV – rebuild of existing overhead lines	$5M per mile
69/115 kV – new overhead line construction	$7M per mile
230/345 kV – rebuild of existing overhead lines	$6M per mile
230/345 kV – new overhead line construction	$8M per mile
New 115/69 kV transformer	$10M per transformer
New 345/115 kV transformer	$10M per transformer
New 69/115 kV circuit breaker	$2M per breaker
New 230/345 kV circuit breaker	$2M per breaker
New/replaced underground line construction (any voltage level)	$35M per mile

In addition to the costs listed above, this study uses representative cost assumptions for components of offshore grids. These costs were developed as part of the National Renewable Energy Laboratory (NREL)'s Atlantic Offshore Wind Transmission Study, and presented as part of a progress update on that study on July 27, 2023. These costs are illustrated in Table 5-2.

Table 5-2: Cost Assumptions for Offshore Grid Components

Component	Assumed Cost
HVDC Circuit Breaker	$37.5M per breaker
"End" platform (wind farm connection to one other wind farm)	$112.5M per platform
"Middle" platform (wind farm connection to two other wind farms)	$142.5M per platform
HVDC Cable	$10.5M per mile

The costs provided by the NREL team include engineering, permitting, indirect, and financing costs; however, they do not include any allowance for contingency. As a result, a 50% adder above the materials and labor costs were applied to these estimates. This 50% adder is included in the costs.

A number of caveats must be applied to the cost estimates included in this report. First, they include only a subset of the total costs of transitioning the electric delivery system to a low-emissions future. The costs of upgrades related to voltage performance, transient stability performance, short-circuit performance, and other aspects of transmission planning that are beyond the scope of this study are not included here. Other transmission upgrades, such as new load-serving substations and required generator interconnection upgrades, are also not included. Second, significant upgrades to distribution systems will be needed in order to accommodate a 2050 peak load that is roughly double what New England has historically experienced. These distribution system upgrades will form a substantial portion of the cost of the clean energy transition. However, this is beyond the scope of the 2050 Transmission Study, and beyond the ISO's jurisdiction and expertise.

It should also be noted that all costs quoted in this report are expressed in present-day (2023) dollars. No adjustments to account for inflation, increases in equipment prices, or other long-term trends were applied. As New England and other regions of the United States and the world are undergoing energy transitions simultaneously, it is difficult to predict long-term trends in electrical equipment costs, and these long-term trends could significantly affect the costs quoted in this report.

5.1 Estimated Costs by Roadmap and Year

The following section lays out the total costs estimated by the 2050 Transmission Study, and categorizes those costs by type of rebuild. All costs are subject to the caveats noted previously. Costs are provided for each roadmap and are broken down by the year studied (2035, 2040, and 2050) to illustrate the degree to which costs might possibly be deferred to later dates in the energy transition. Two sets of costs are included for 2050: one to accommodate a winter peak of 51 GW (a reduced peak load, as described in Section 2.1), and one to accommodate the 57 GW peak load assumed in the Energy Pathways to Deep Decarbonization report.

Costs illustrated in Table 5-3 and Figure 5-1 are associated with the North-South/Boston Import roadmaps. These costs will be affected by the choice of four roadmaps detailed in Section 4.1. Figure 5-2 and Figure 5-3 categorize the costs by rebuild type for both the 51 GW and 57 GW winter peak load snapshots.

Table 5-3: Estimated Cumulative Costs for North-South/Boston Import Roadmaps

Year/Load Level	AC Roadmap	Minimization of New Lines Roadmap	Point-to-Point HVDC Roadmap	Offshore Grid Roadmap
2035	$4.4 Billion	$2.8 Billion	$5.0 Billion	$4.0 Billion
2040	$6.2 Billion	$5.0 Billion	$6.5 Billion	$5.8 Billion
2050 (51 GW winter peak)	$7.6 Billion	$7.5 Billion	$7.9 Billion	$7.9 Billion
2050 (57 GW winter peak)	$10.2 Billion	Not Achievable*	$12.8 Billion	$10.7 Billion

*As described previously, the Minimization of New Lines roadmap is not capable of reliably serving a 57 GW peak load.

Figure 5-1: Estimated Cumulative Costs for North-South/Boston Import Roadmaps

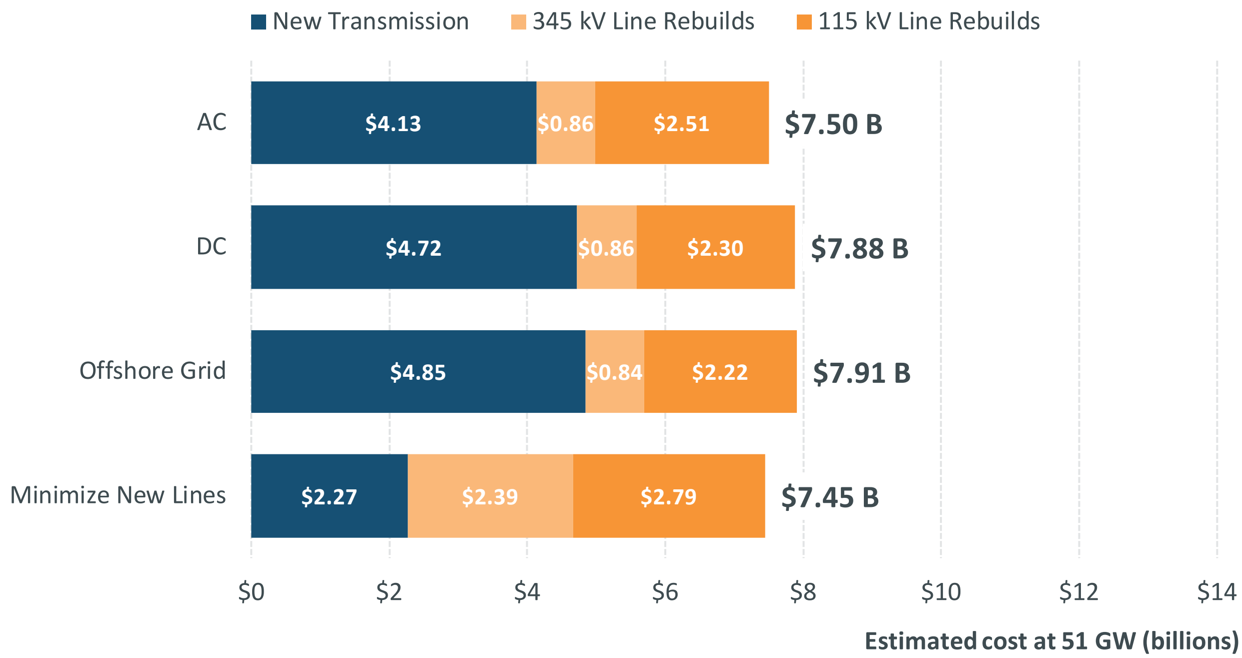

Figure 5-2: Cost Categories for North-South/Boston Import Roadmaps: 51 GW Winter Peak

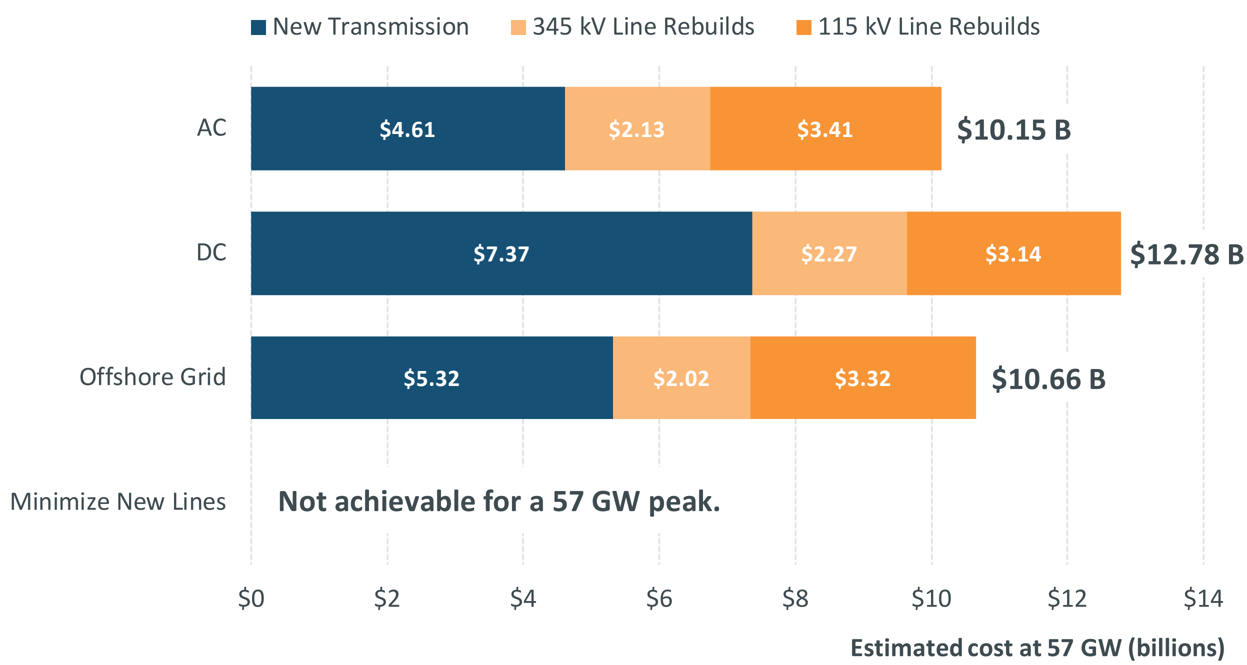

Figure 5-3: Cost Categories for North-South/Boston Import Roadmaps: 57 GW Winter Peak

Costs illustrated in Table 5-4 and Figure 5-4 are associated with the Northwest Vermont roadmaps. As with North-South/Boston Import costs above, multiple roadmaps were developed for this high-likelihood concern and detailed in Section 4.2. Figure 5-5 and Figure 5-6 categorize the costs by rebuild type for both the 51 GW and 57 GW winter peak load snapshots.

Table 5-4: Estimated Cumulative Costs for Northwestern Vermont Import Roadmaps

Year/Load Level	PV-20 Upgrade and Doubling of K-43 Roadmap	Coolidge – Essex Roadmap	New Haven – Essex and Granite – Essex Roadmap	Minimization of New Lines Roadmap
2035	$0.7 Billion	$1.1 Billion	$1.1 Billion	$0.6 Billion
2040	$0.8 Billion	$1.3 Billion	$1.1 Billion	$0.8 Billion
2050 (51 GW winter peak)	$0.9 Billion	$1.5 Billion	$1.2 Billion	$0.9 Billion
2050 (57 GW winter peak)	$1.2 Billion	$2.0 Billion	$1.4 Billion	$1.2 Billion

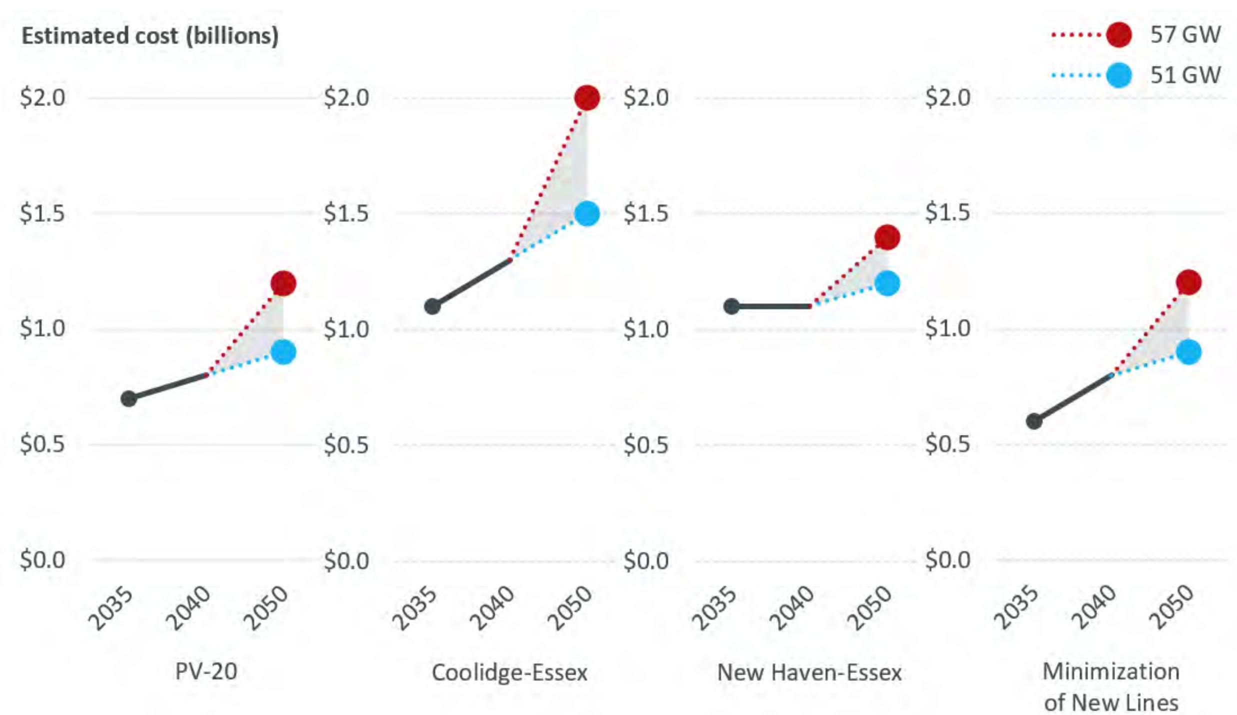

Figure 5-4: Estimated Cumulative Costs for Northwestern Vermont Import Roadmaps

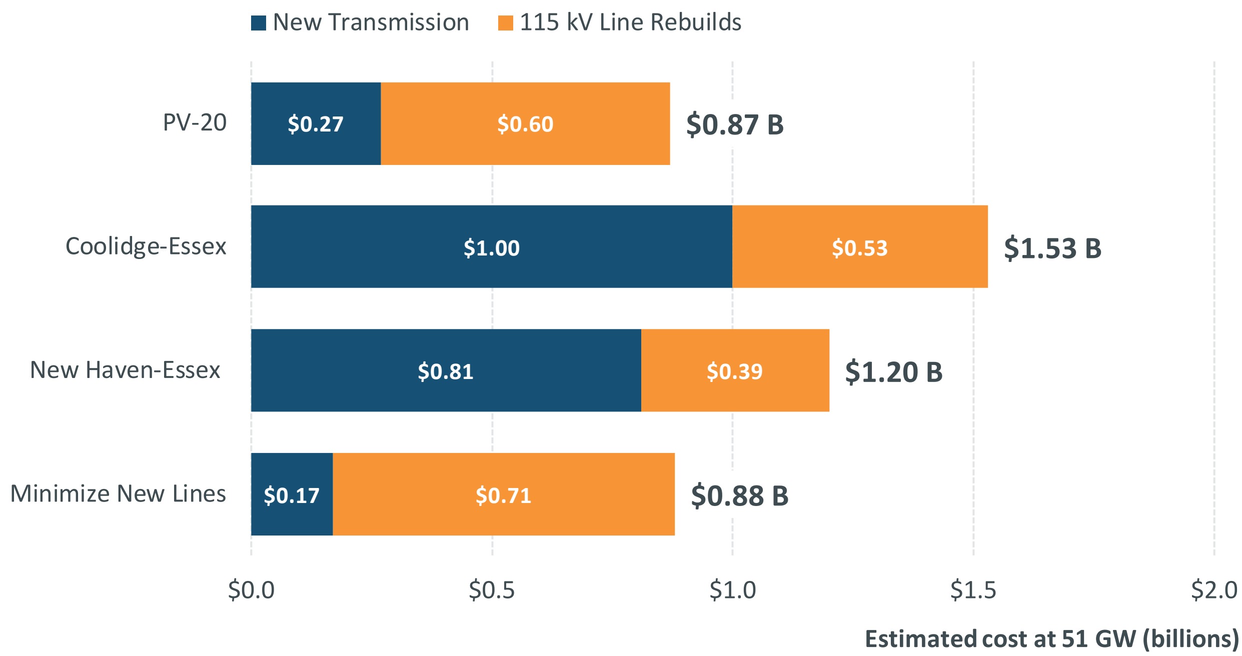

Figure 5-5: Cost Categories for NWVT Import Roadmaps: 51 GW Winter Peak

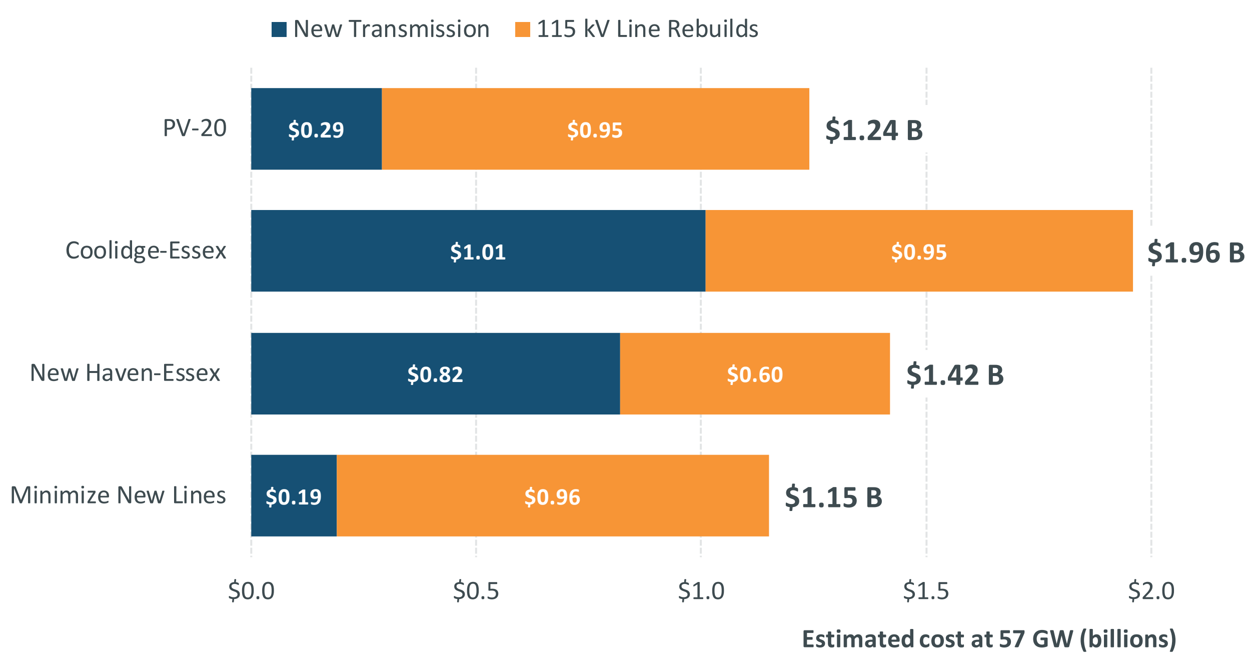

Figure 5-6: Cost Categories for NWVT Import Roadmaps: 57 GW Winter Peak

Costs illustrated in Table 5-5 are associated with the Southwest Connecticut Import high-likelihood concern.

Table 5-5: Estimated Cumulative Costs for Southwest Connecticut Import

Year/Load Level	Southwest Connecticut Import
2035	$0.5 Billion
2040	$0.7 Billion
2050 (51 GW winter peak)	$0.8 Billion
2050 (57 GW winter peak)	$1.6 Billion

Costs illustrated in Table 5-6 are associated with miscellaneous high-likelihood concerns.

Table 5-6: Estimated Cumulative Costs for Miscellaneous High-Likelihood Concerns

Year/Load Level	Miscellaneous High-Likelihood Concerns
2035	$1.7 Billion
2040	$2.8 Billion
2050 (51 GW winter peak)	$3.1 Billion
2050 (57 GW winter peak)	$3.1 Billion

Table 5-7 shows the costs associated with addressing non-high-likelihood concerns:

Table 5-7: Estimated Cumulative Costs for Non-High-Likelihood Concerns

Year/Load Level	Non-High-Likelihood Concerns
2035	$0.4 Billion
2040	$1.4 Billion
2050 (51 GW winter peak)	$3.2 Billion
2050 (57 GW winter peak)	$6.6 Billion

Table 5-8 totals the costs associated with each year in the tables above and provides a range of costs for each year studied, while Figure 5-7 illustrates how those costs change by year studied and maximum load served.

Table 5-8: Estimated Cumulative Costs by Year Studied

Year/Load Level	Maximum Load Served (MW)	Total Cost Range	Cost Breakdown	
2035	35,000	**$6-9 Billion**	$2.8-5.0 Billion	N-S/Boston
			$0.6-1.1 Billion	NWVT
			$0.5 Billion	SWCT
			$1.7 Billion	Misc. HLC
			$0.4 Billion	Non-HLC
2040	43,000	**$11-13 Billion**	$5.0-6.5 Billion	N-S/Boston
			$0.8-1.3 Billion	NWVT
			$0.7 Billion	SWCT
			$2.8 Billion	Misc. HLC
			$1.4 Billion	Non-HLC
2050 (51 GW winter peak)	51,000	**$16-17 Billion**	$7.5-7.9 Billion	N-S/Boston
			$0.9-1.5 Billion	NWVT
			$0.8 Billion	SWCT
			$3.1 Billion	Misc. HLC
			$3.2 Billion	Non-HLC
2050 (57 GW winter peak)	57,000	**$23-26 Billion**	$10.2-12.8 Billion	N-S/Boston
			$1.2-2.0 Billion	NWVT
			$1.6 Billion	SWCT
			$3.1 Billion	Misc. HLC
			$6.6 Billion	Non-HLC

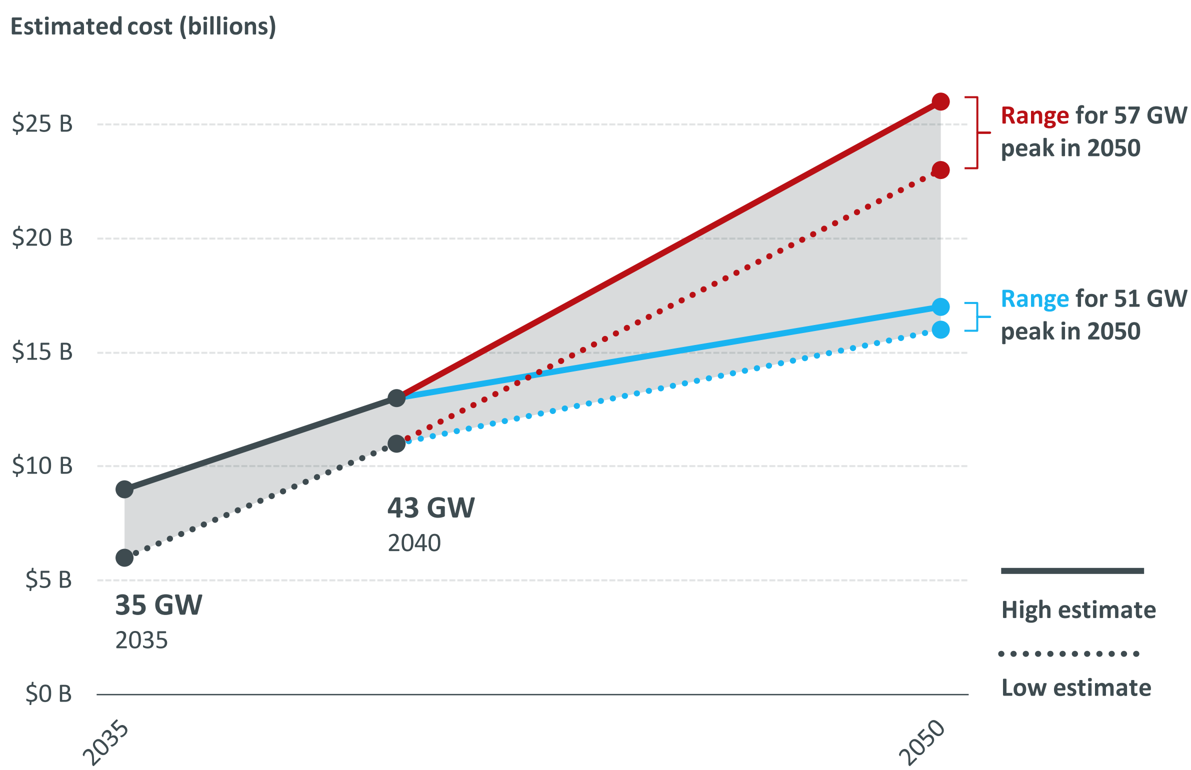

Figure 5-7: Total Costs by Year Studied

Note that these costs are only part of the required total investment in the transmission system. Other costs include asset condition projects unrelated to this study, and costs required to meet voltage, stability, and short-circuit needs. While these costs appear to be quite large, they should be viewed in the context of typical transmission system expenditures in New England on a yearly basis. The spending on these projects will be spread out over a 26-year period between now and 2050, so the total cost of $16-$17 billion to serve a 51 GW winter peak load is approximately $0.62-$0.65 billion per year. Similarly, the total cost of $23-$26 billion to serve a 57 GW winter peak load results in average spending of approximately $0.88-$1.00 billion per year. By way of comparison, total transmission project spending between 2002 and 2023 on both reliability-based projects and asset condition projects totaled $15.3 billion, or an average of approximately $0.73 billion per year. Similarly, the forecasted combined spending on reliability and asset condition projects in the upcoming five-year period, from December 2023 through December 2028, is a total of approximately $3.85 billion, or an average of $0.77 billion per year.[21] Many of the line rebuilds proposed in this study will also overlap with asset condition needs, and any one project could address both system expansion and aging equipment.

[21] Source: RSP Project List and Asset Condition List June 2023 Update, https://www.iso-ne.com/static-assets/documents/2023/06/final_project_list_presentation_june_2023.pdf

Section 6: Future Work

The 2050 Transmission Study is the first longer-term transmission study conducted for New England. Results revealed many important lessons about the future development of New England's transmission system, and many opportunities for similar studies in the future. As time passes, the assumptions regarding generator types, sizes, and locations used in this study will be replaced with real-life data, providing more precision around the transmission system upgrades that will be required in the future.

One potential area of focus for future longer-term transmission studies is the addition of analysis beyond steady-state thermal analysis. As mentioned in Section 1.1.4, the scope of this study was limited to steady-state thermal analysis, due in part to uncertainties about the detailed characteristics of future generators. More detailed models of future generation projects will allow future studies to include analysis of transmission system voltage, which will shed light on certain substation upgrades that may be required to maintain acceptable voltage and avoid equipment damage. In addition, these models may permit the ISO to analyze transient stability and electromagnetic transient (EMT) performance. These types of analyses examine the performance of the system in the milliseconds to seconds following an unexpected event like a lightning strike or tree contact on a transmission line, ensuring that generators can continue supplying power through the event and that the system can recover to a new operating condition. Finally, future longer-term transmission studies may leverage the findings of the ISO's economic studies to examine conditions other than summer and winter peak loads. Analysis from economic studies will predict likely system conditions for off-peak periods (including load levels, renewable energy output, and the types of generators likely to be operating in a given hour), and can highlight periods of particular stress on the transmission system. This data can then be used in a future longer-term transmission study to examine the transmission system's performance during these periods of interest.

At the time of this report's publication, the longer-term transmission study process is purely informational. However, the ISO began stakeholder discussions on Phase II of the longer-term transmission study process in October 2023. This second phase is designed to create a process in the ISO New England Open Access Transmission Tariff by which NESCOE can choose transmission system concerns to address, conduct a Request for Proposals to solicit transmission project proposals, and then advance those proposals towards construction and operation. Depending on the timing of these changes to the Tariff, the results of this study or other future longer-term transmission studies may inform this solution development process.

Another key topic related to the future of the New England power system is the expansion of the distribution system. Plans for the distribution system are outside the ISO's jurisdiction and area of expertise but could be a key input for further transmission studies. With more granular data on plans to meet customer load, future longer-term transmission studies can include better data on the location and sizes of substations that transfer electricity from the transmission system to local distribution systems, and eventually to individual customers. This will allow for more precise modeling of the future transmission system and a more accurate view of the region's future power system.

Section 7: Conclusion

As the clean energy transition accelerates, power flows across New England's transmission system will eclipse all previous highs. The "best case" 51 GW winter peak load snapshot analyzed in this study is more than double the highest winter peak ever recorded in New England, January 2004's 23GW level, and the "worst case" 57 GW winter peak load snapshot is almost 150% higher. Assuming increased build-outs of renewables continue, and electrification of heating and transportation proceeds as expected, the region's aging transmission system has the potential to become a significant bottleneck to progress if it does not keep pace with changes to other elements of the power system.

In 2021, NESCOE and the ISO recognized that the traditional 10-year planning horizon was no longer sufficient to adequately analyze a transmission system undergoing such immense change. The 2050 Transmission Study is an unprecedented look at the future of New England's transmission system, and the results produced by this study will assist stakeholders and the ISO in making important decisions about improvements and pathways forward. Processes developed and lessons learned in this study also pave the way for future studies, as the ISO continues to meet its commitment to overseeing a reliable and cost-effective regional transmission system. With the addition of the Longer-Term Transmission Planning process to the ISO New England Open Access Transmission Tariff, studies like this one will be conducted periodically to re-assess the long-term evolution of the transmission system and associated costs.

Although the roadmaps provided in this study are not intended as comprehensive plans, and overloads and issues associated with the high-likelihood concerns may not occur in exactly the way this study has outlined, these big-picture observations represent a large step towards meeting the challenges that lie ahead for New England's transmission system. Ensuring the reliable, economic delivery of electricity that customers have come to expect will require innovative solutions, and most importantly, collaboration and communication between stakeholders, the states, transmission owners, and the ISO.

Targeted approaches to problem-solving, like optimizing generator locations or right-sizing asset condition projects, could become particularly crucial as the region moves towards upgrading an aging system in the most cost-effective manner. Such targeted problem-solving requires cooperation and collaboration. The ISO will continue to provide the forward-looking analysis presented in this study in future studies, and will continue to focus on longer-term transmission planning studies in collaboration with stakeholders to help identify the best paths forward.

Appendix 5-1

Project Route Maps

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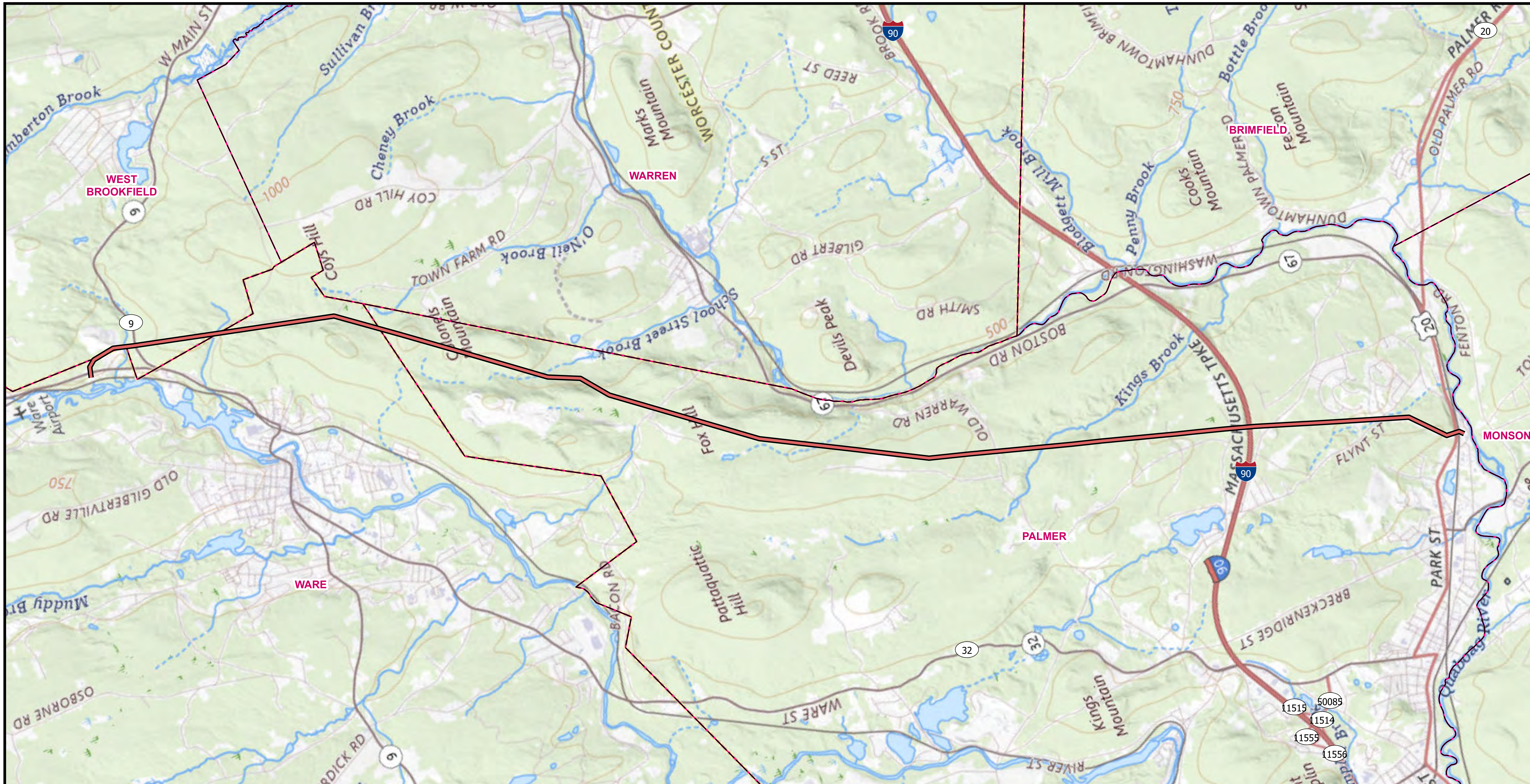

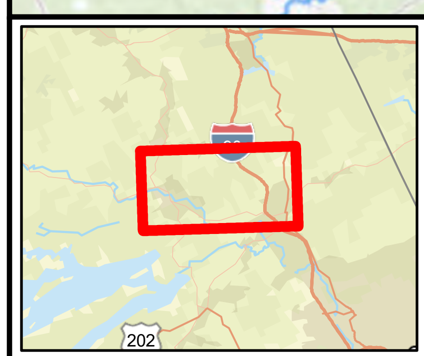

Existing O15N Transmission Line

Town Boundary

1:60,000

0 2,500 5,000 10,000

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-1: Project Route

Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

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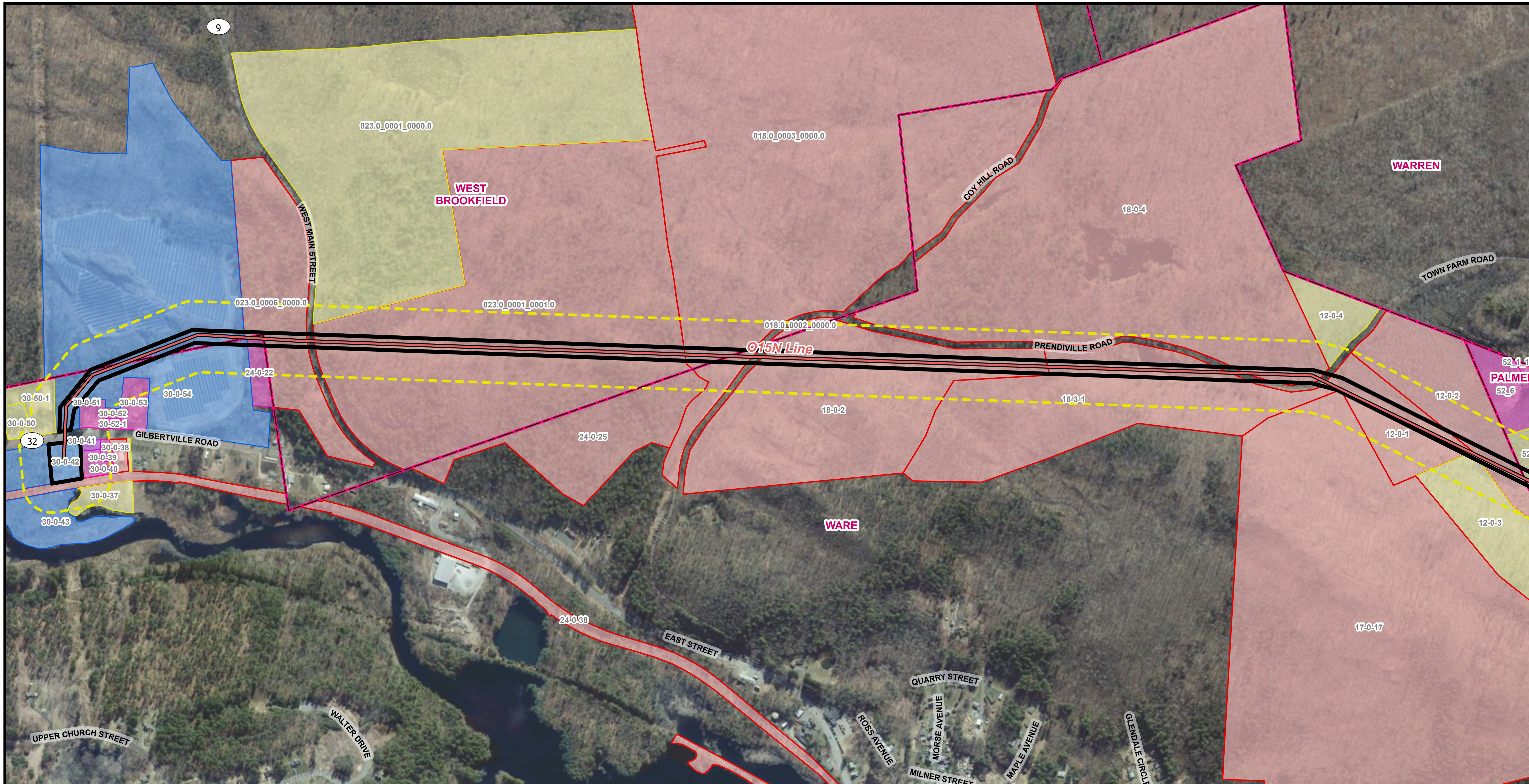

Existing O15N Transmission Line
300-ft Buffer from ROW
Approximate ROW

Parcel Land Use

- Agricultural/Horticultural
- Commercial
- Municipal/Federal Land
- Forest Land
- Industrial
- Residential
- Vacant

Note: No Sensitive Receptors within 300 feet of Right-of-Way

1:12,000

0 500 1,000 2,000

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-2: Land Use

Page 1 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

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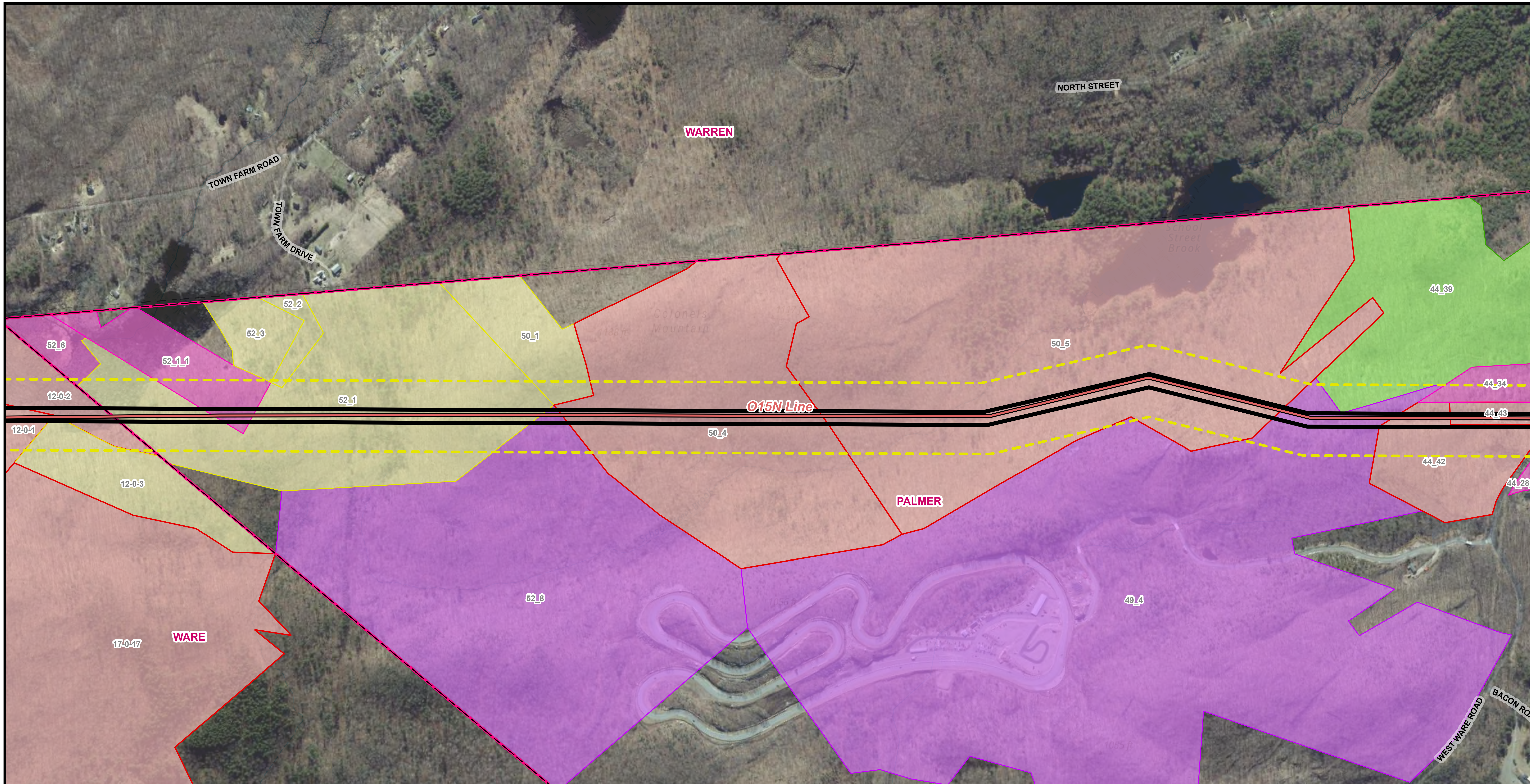

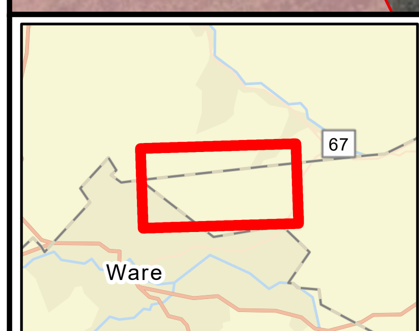

Existing O15N Transmission Line
300-ft Buffer from ROW
Approximate ROW

Parcel Land Use
- Agricultural/Horticultural
- Commercial
- Exempt
- Forest Land
- Industrial
- Residential
- Vacant

Note: No Sensitive Receptors within 300 feet of Right-of-Way

1:12,000

0 500 1,000 2,000 Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-2: Land Use

Page 2 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

nationalgrid

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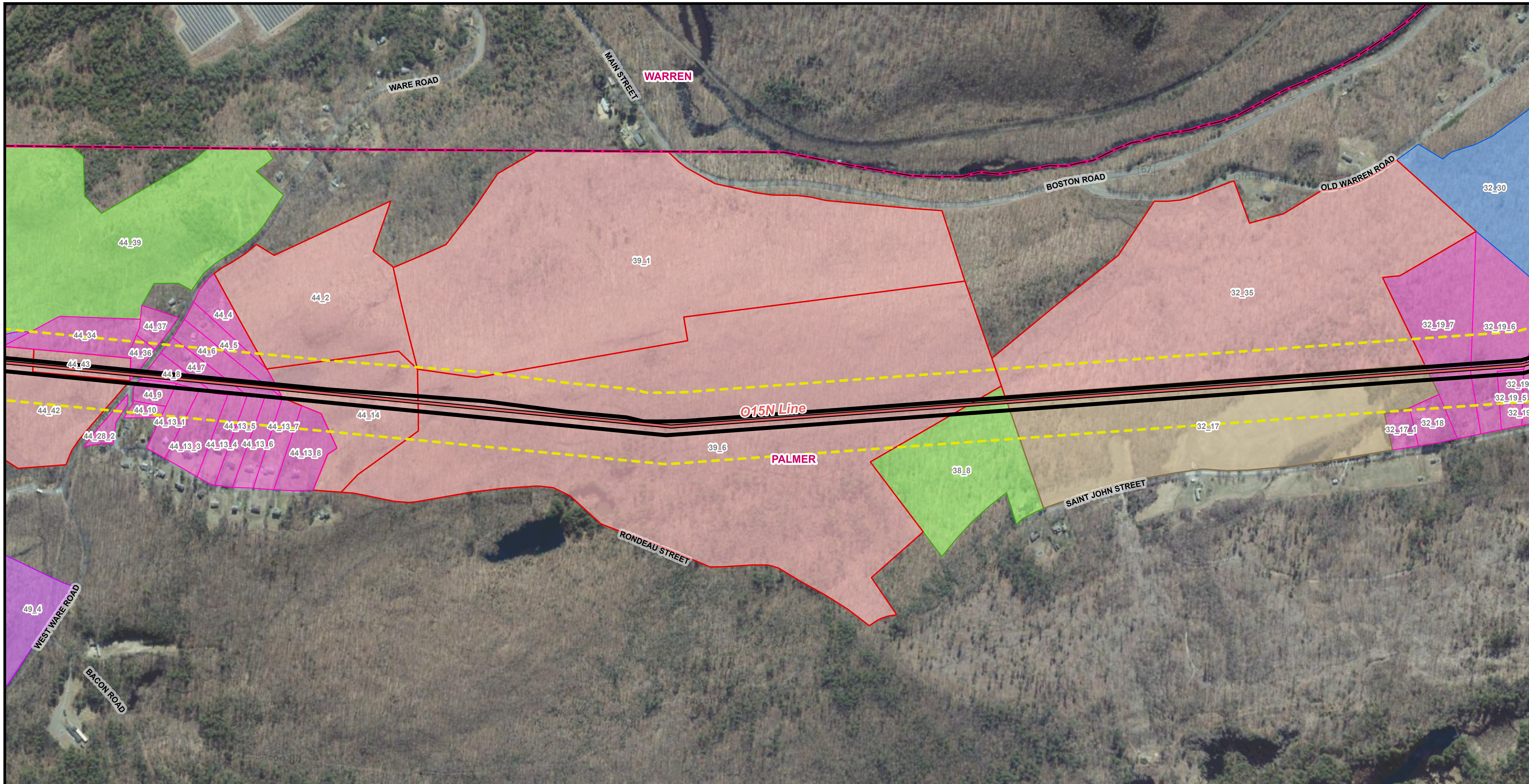

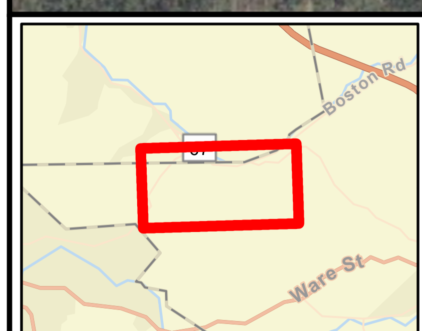

- Existing O15N Transmission Line
- 300-ft Buffer from ROW
- Approximate ROW

Parcel Land Use
- Agricultural/Horticultural
- Commercial
- Exempt
- Forest Land
- Industrial
- Residential
- Vacant

Note: No Sensitive Receptors within 300 feet of Right-of-Way

1:12,000

0 500 1,000 2,000 Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-2: Land Use

Page 3 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

nationalgrid

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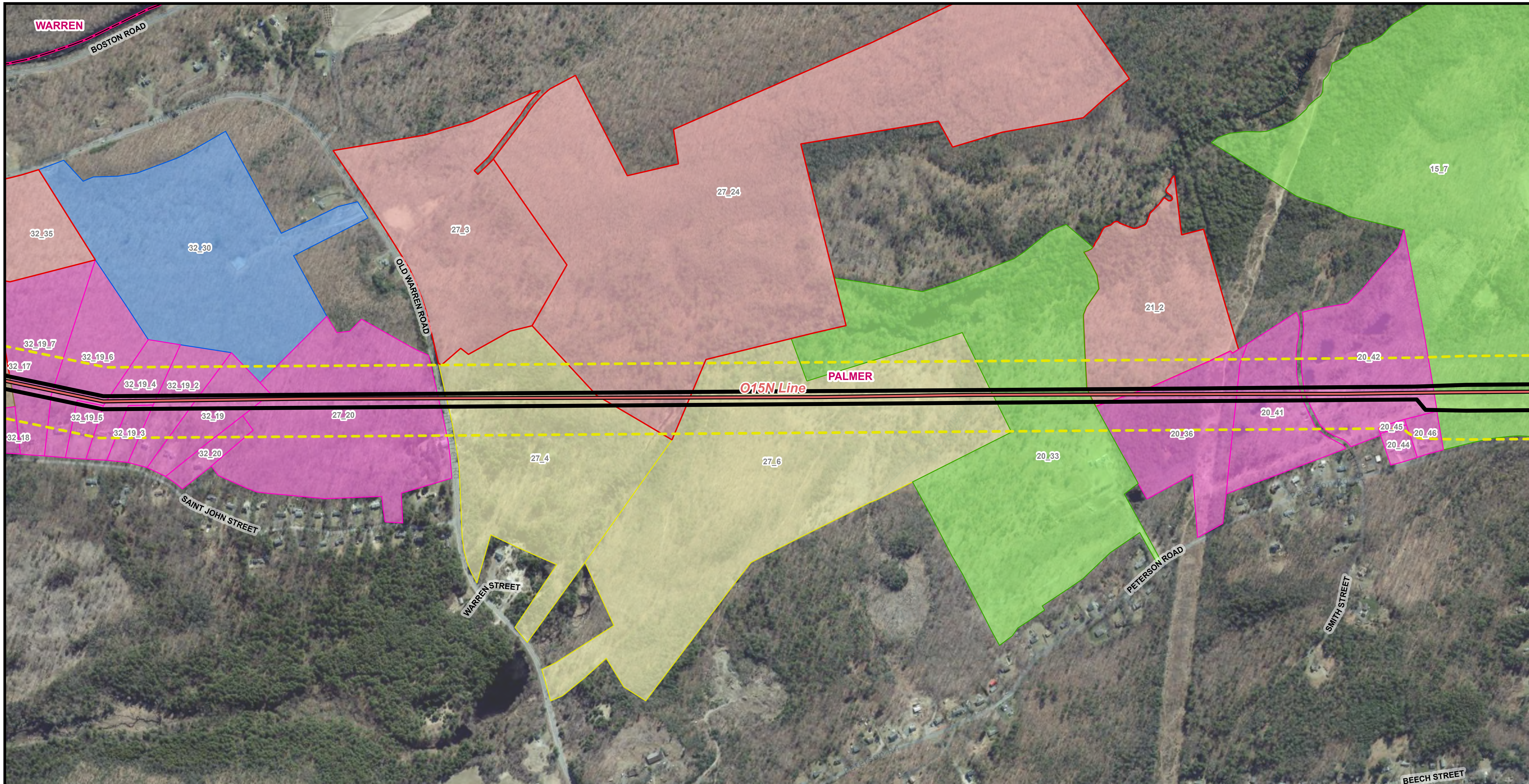

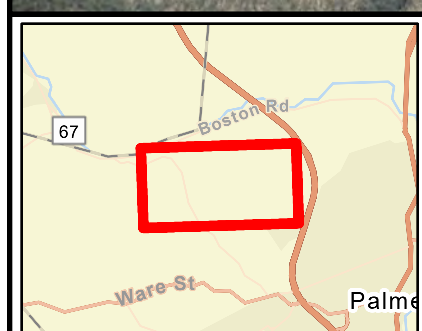

Existing O15N Transmission Line
300-ft Buffer from ROW
Approximate ROW

Parcel Land Use
- Agricultural/Horticultural
- Commercial
- Exempt
- Forest Land
- Industrial
- Residential
- Vacant

Note: No Sensitive Receptors within 300 feet of Right-of-Way

1:12,000

0 500 1,000 2,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA Figure 5-2: Land Use

Page 4 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

nationalgrid

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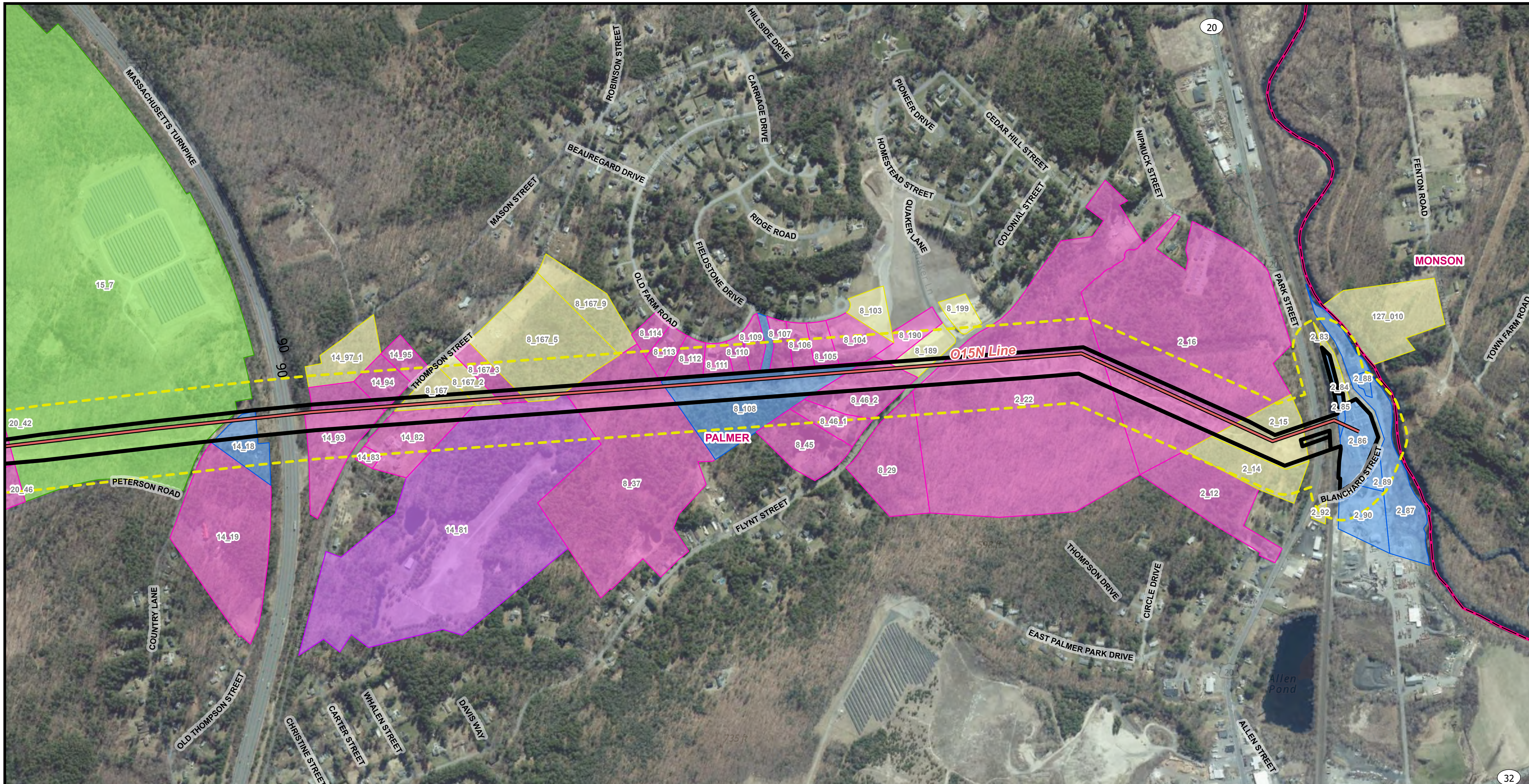

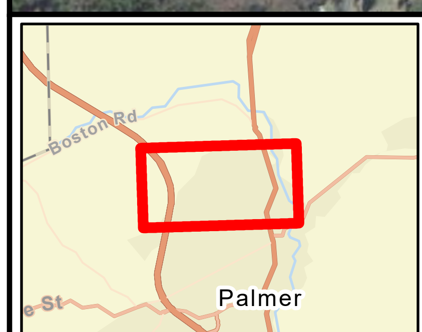

- Existing O15N Transmission Line
- 300-ft Buffer from ROW
- Approximate ROW

Parcel Land Use

- Agricultural/Horticultural
- Commercial
- Exempt
- Forest Land
- Industrial
- Residential
- Vacant

Note: No Sensitive Receptors within 300 feet of Right-of-Way

1:12,000

0 500 1,000 2,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA Figure 5-2: Land Use

Page 5 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

nationalgrid

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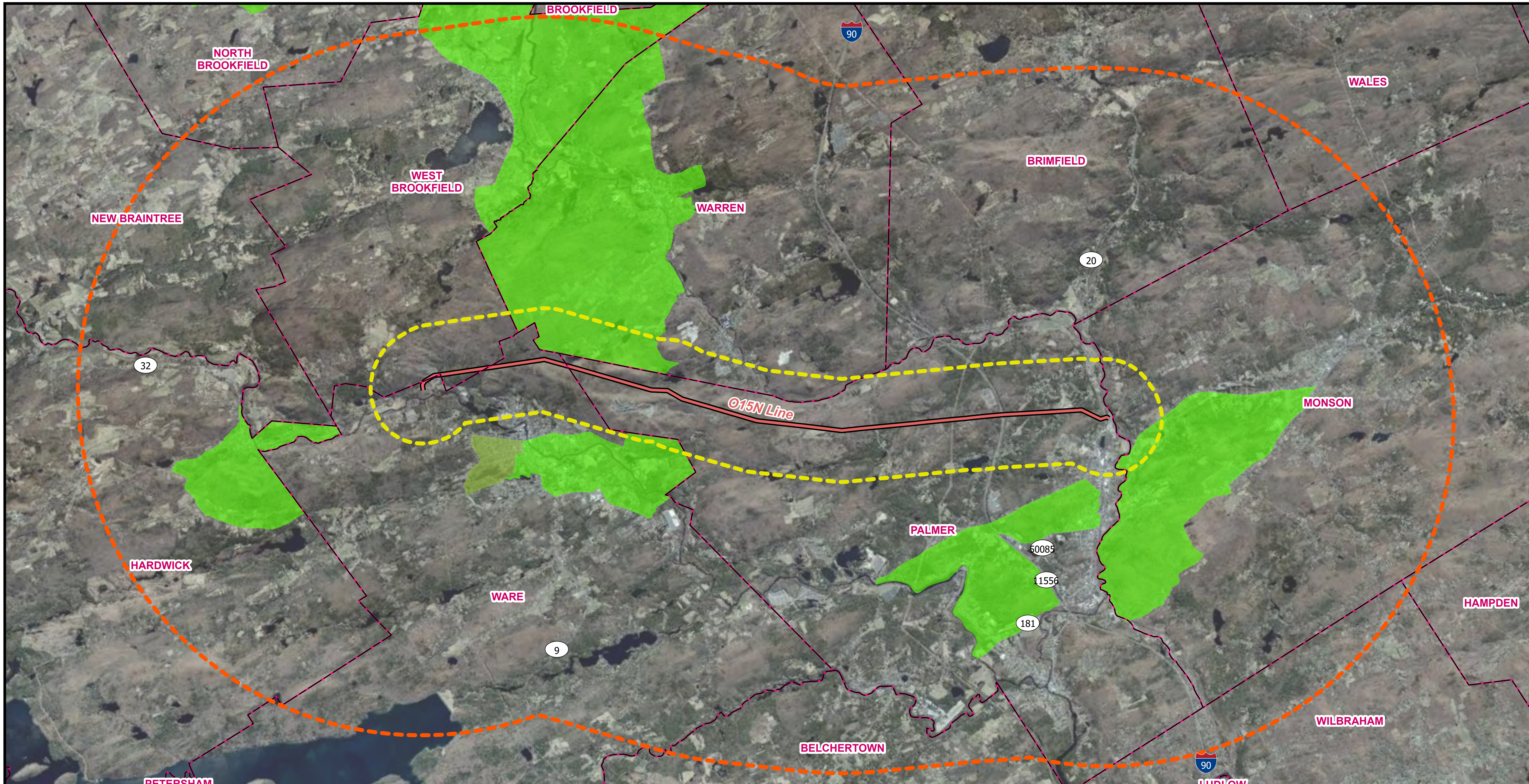

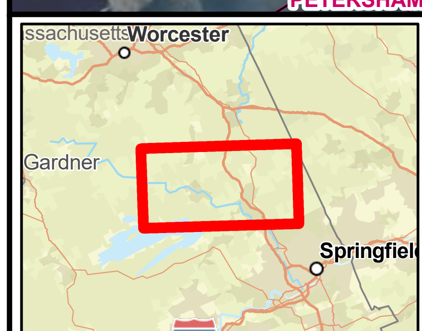

Existing O15N Transmission Line

1-mi Buffer from ROW

5-mi Buffer from ROW

Town Boundary

EJ Block Groups

Income: at least 25% of households have a median household income 65% or less than the state median household income

Minority and Income

1:120,000

0 5,000 10,000 20,000

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-3: Environmental Justice

Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

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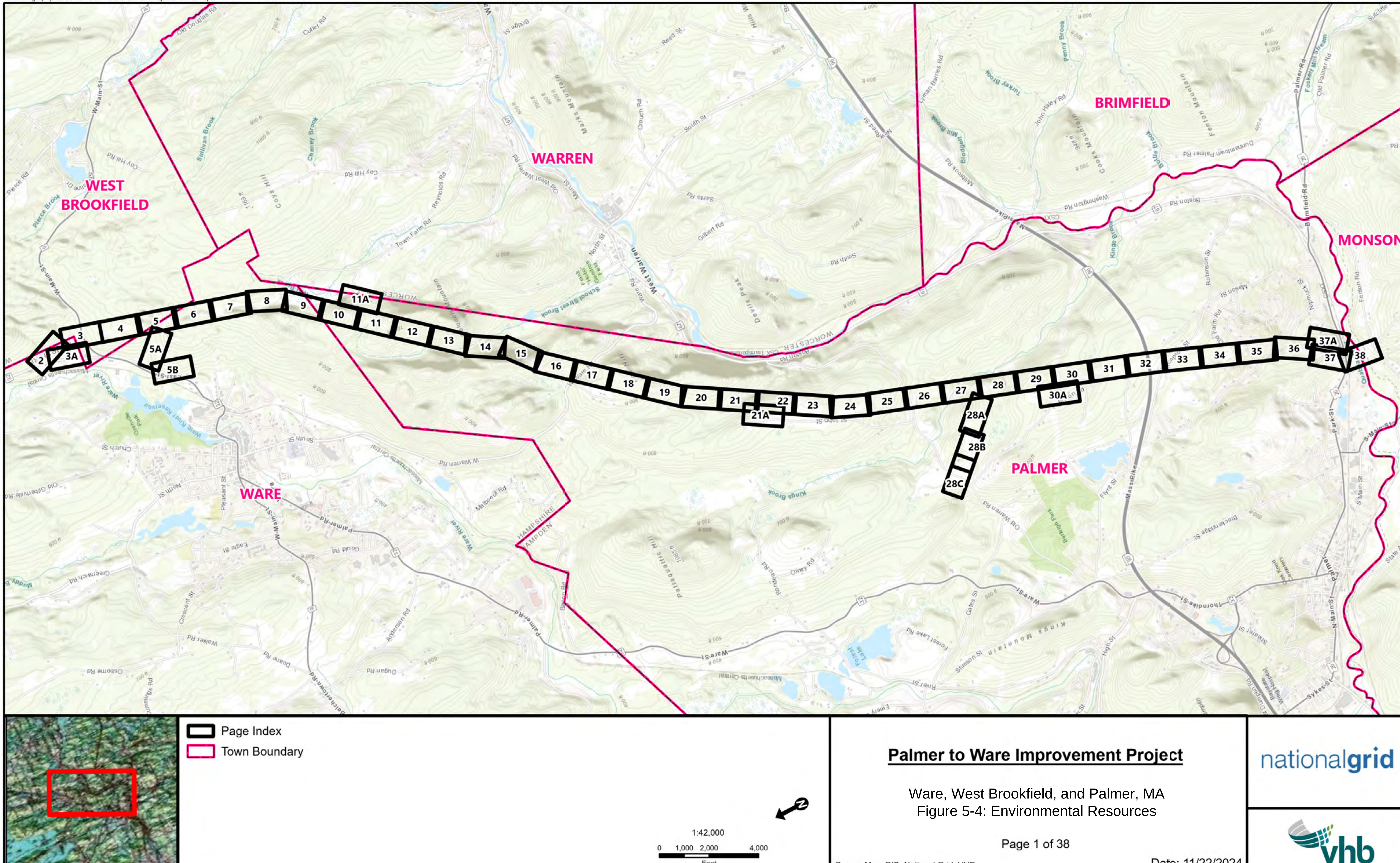

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

Page 1 of 38

Source:MassGIS, National Grid, VHB

Date: 11/22/2024

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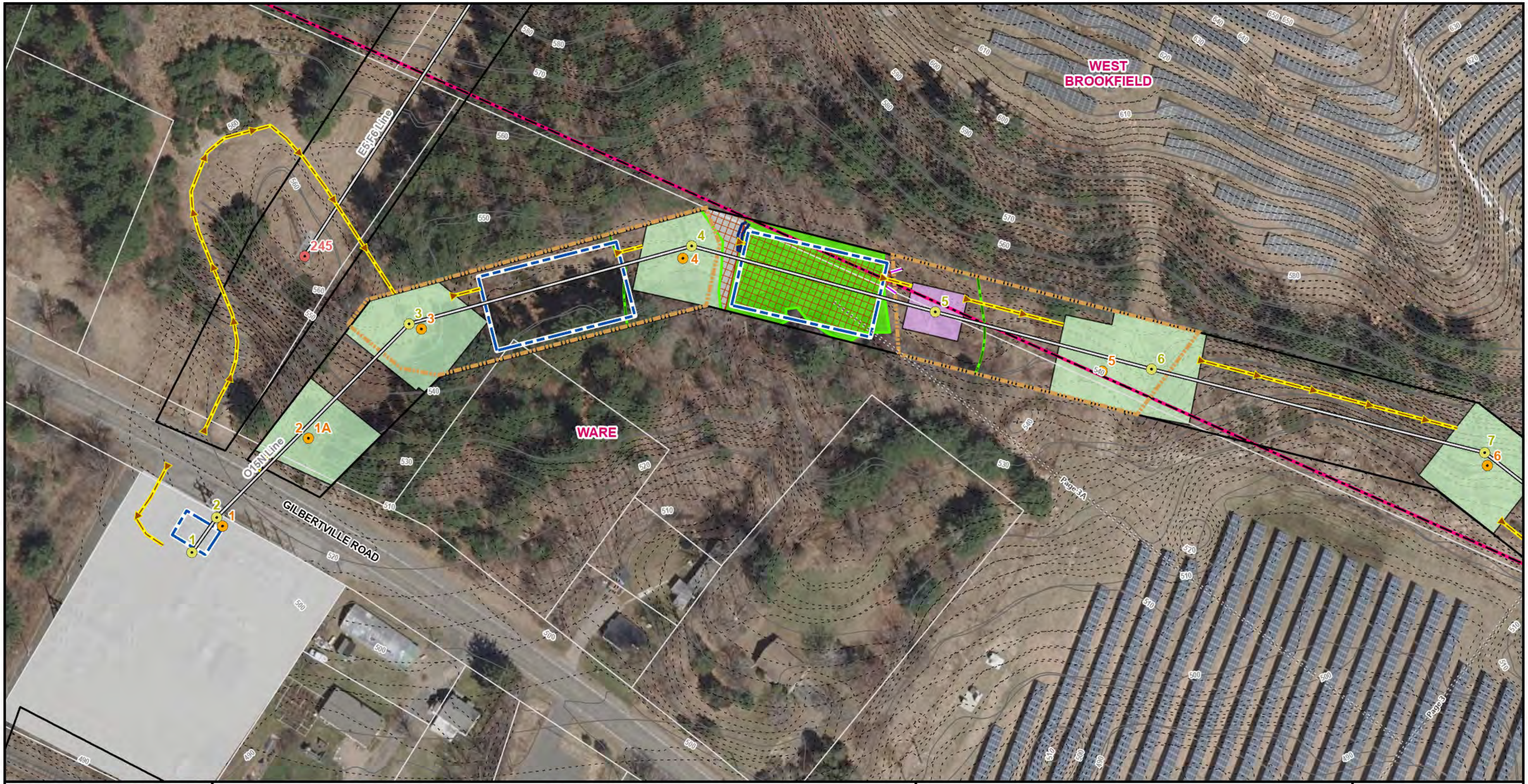

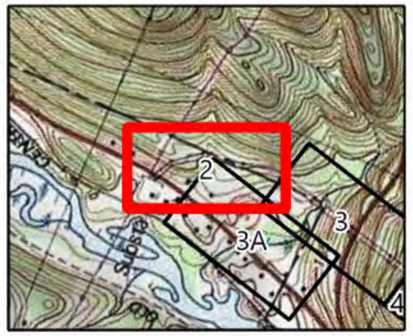

Proposed Structure
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Temporary Work Pad
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100-ft Buffer Zone
200-ft Riverfront Area
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Ditch
Stonewall
Limit of Disturbance
Erosion and Sediment Control Barrier
Match Line
2' Contour
10' Index Contour
Parcel Boundary
Town Boundary

1:1,200

0 25 50 100
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

Page 2 of 38

Source: MassGIS, National Grid, VHB

Date: 12/8/2024

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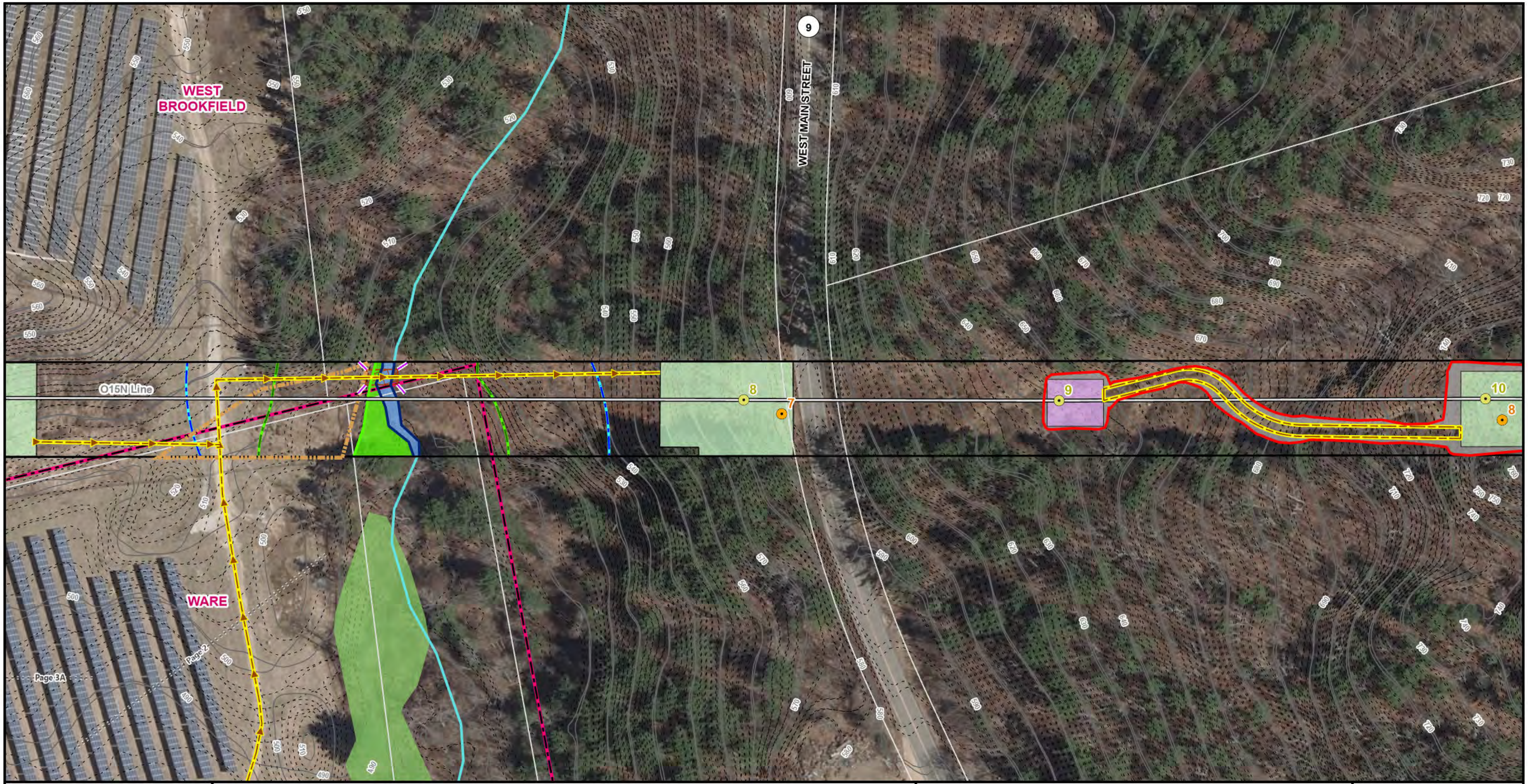

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1:1,200

0 25 50 100
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

Page 3 of 38

Source: MassGIS, National Grid, VHB

Date: 12/8/2024

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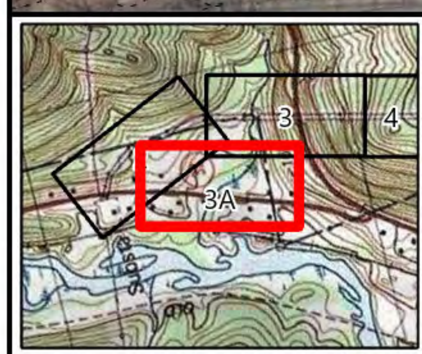

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1:1,200

0 25 50 100
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

Page 3A of 38

Source: MassGIS, National Grid, VHB

Date: 12/8/2024

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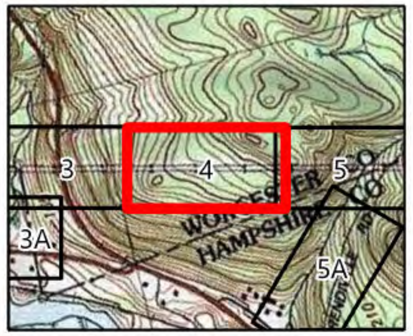

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1:1,200

0 25 50 100

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

Date: 12/8/2024

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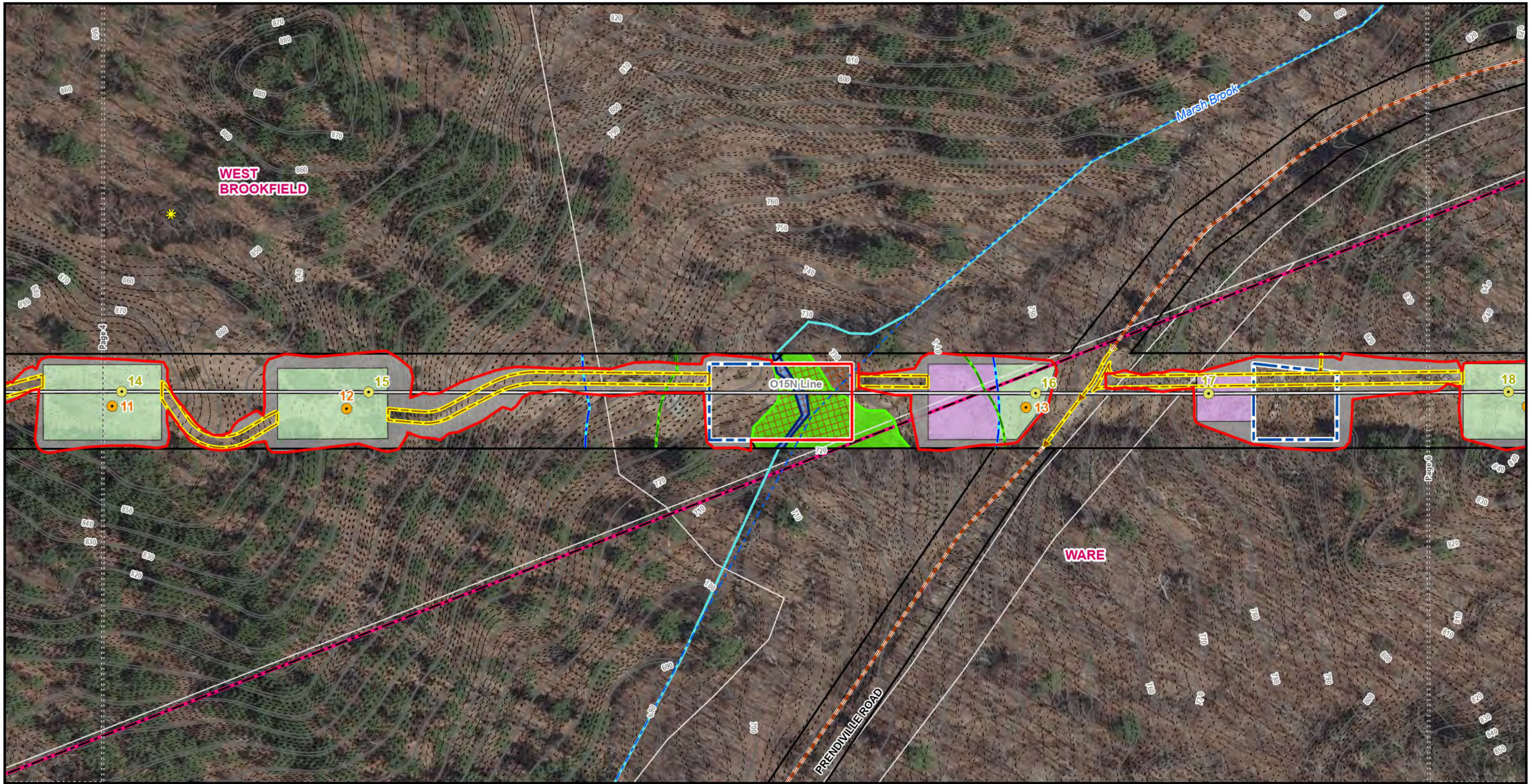

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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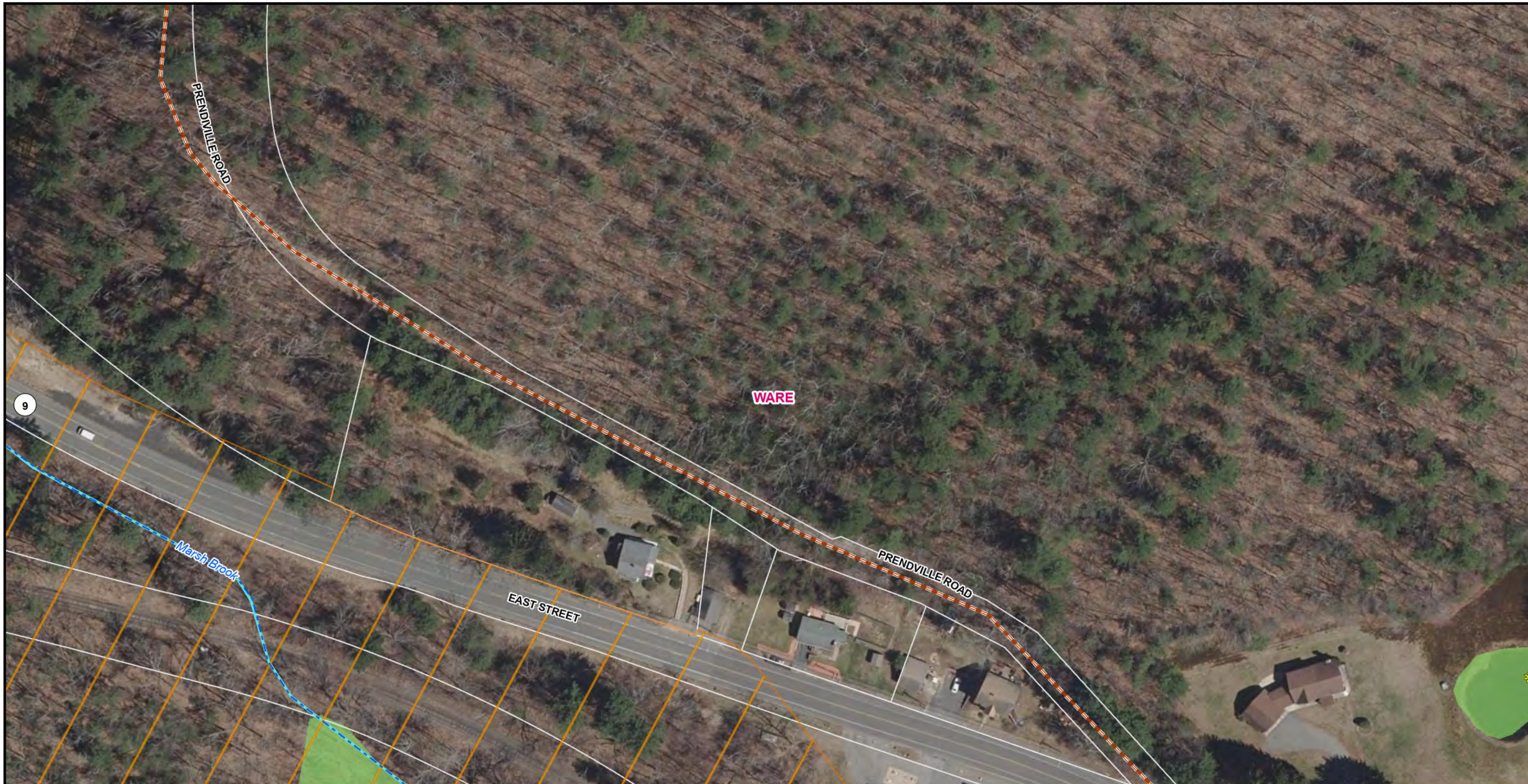

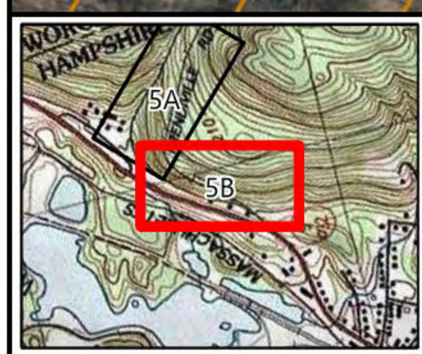

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

Page 5B of 38

Source: MassGIS, National Grid, VHB

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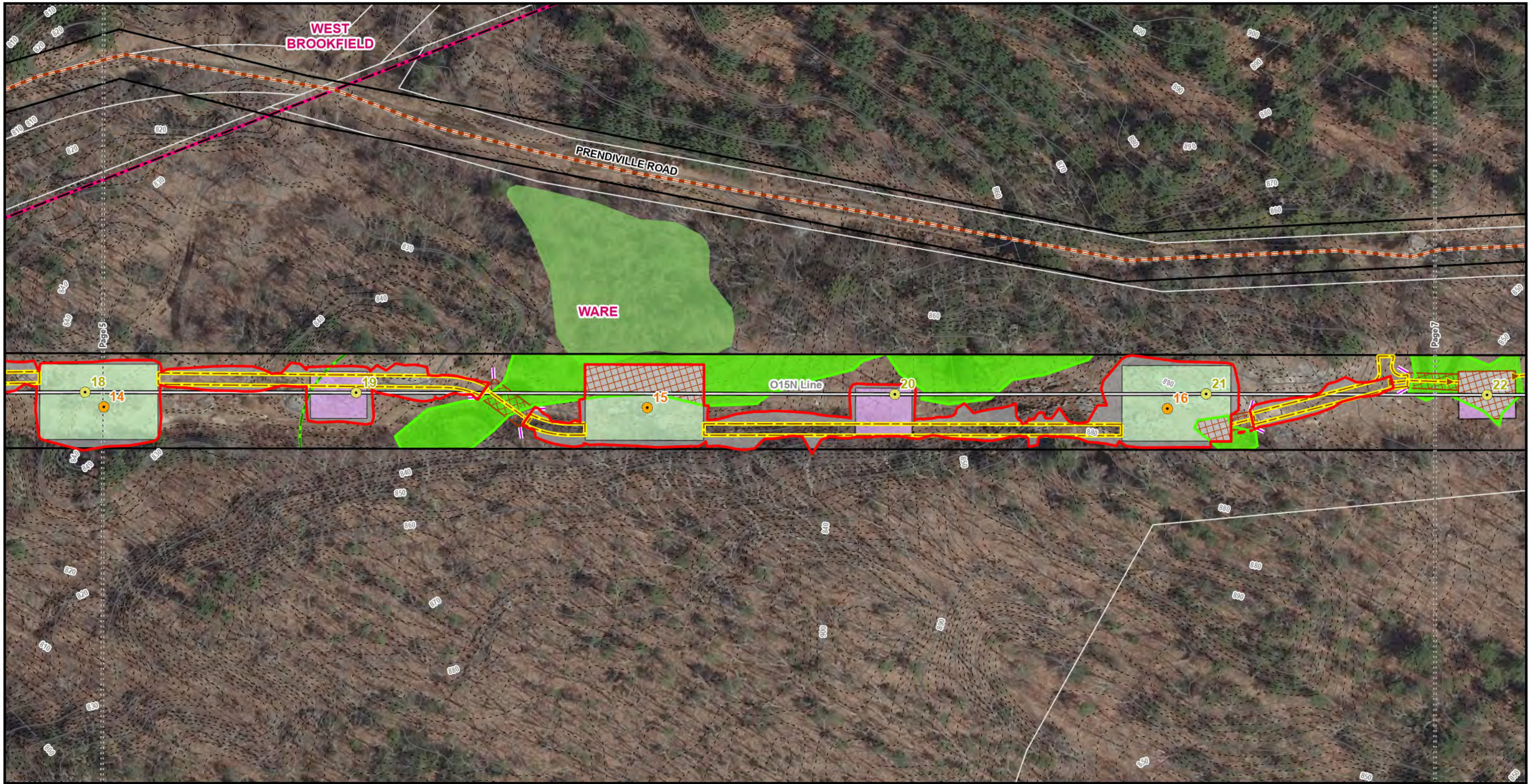

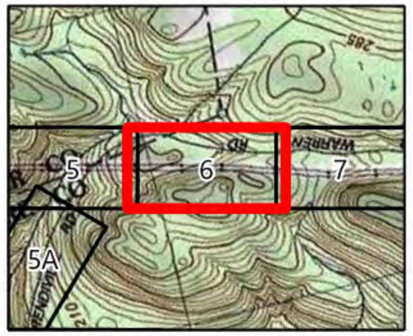

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1:1,200

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-4: Environmental Resources

Page 6 of 38

Source: MassGIS, National Grid, VHB

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

Page 7 of 38

Source: MassGIS, National Grid, VHB

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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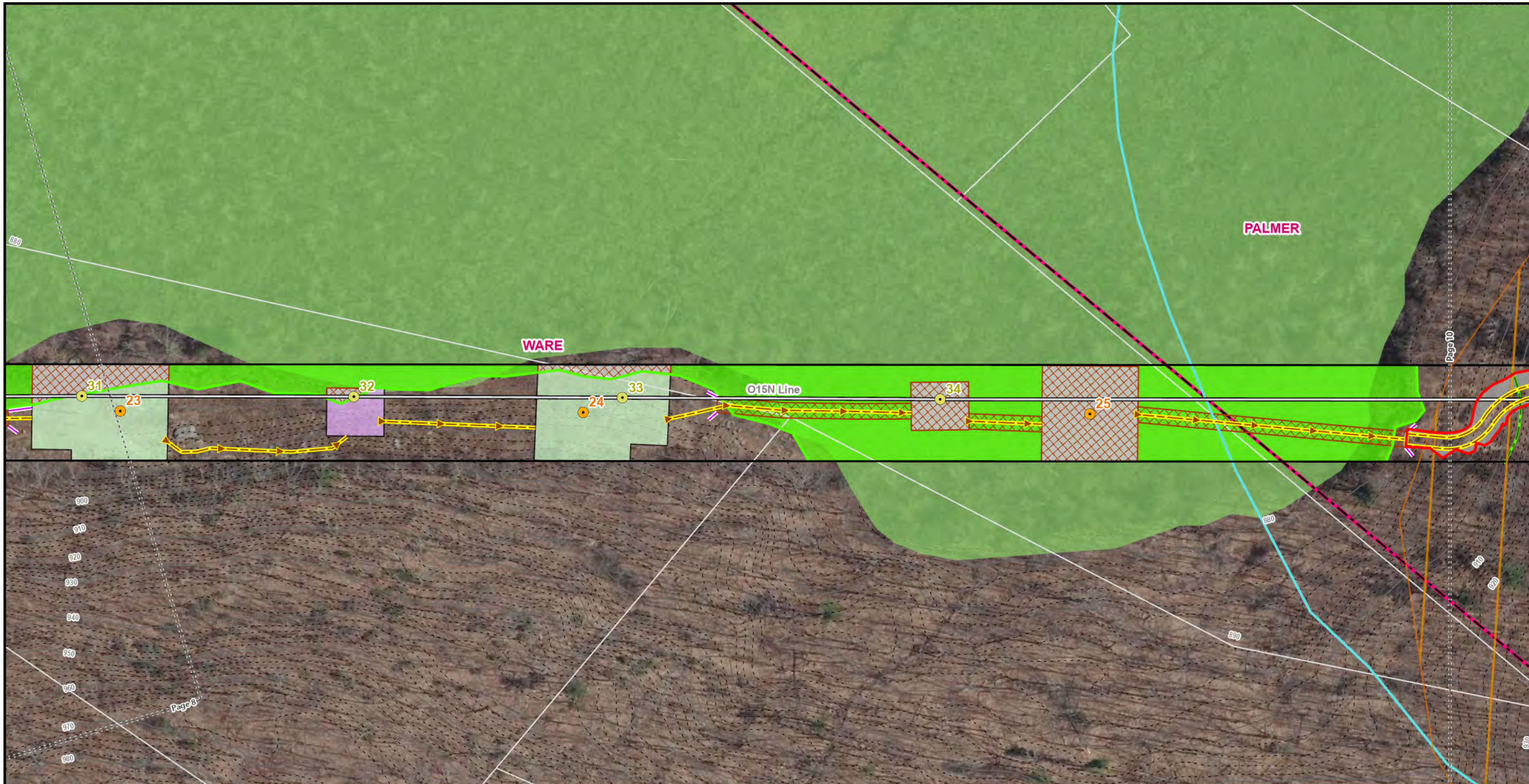

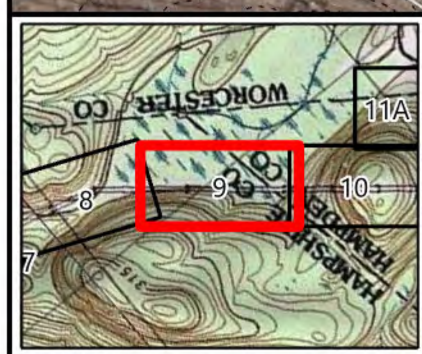

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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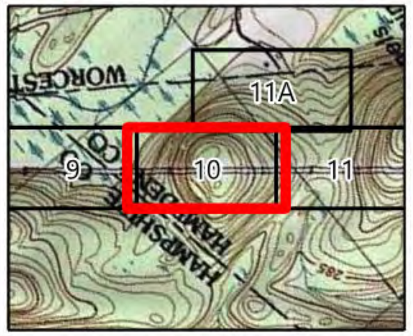

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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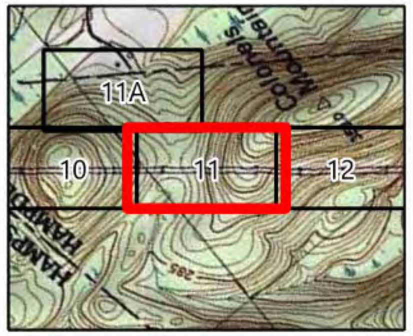

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1:1,200

0 25 50 100

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

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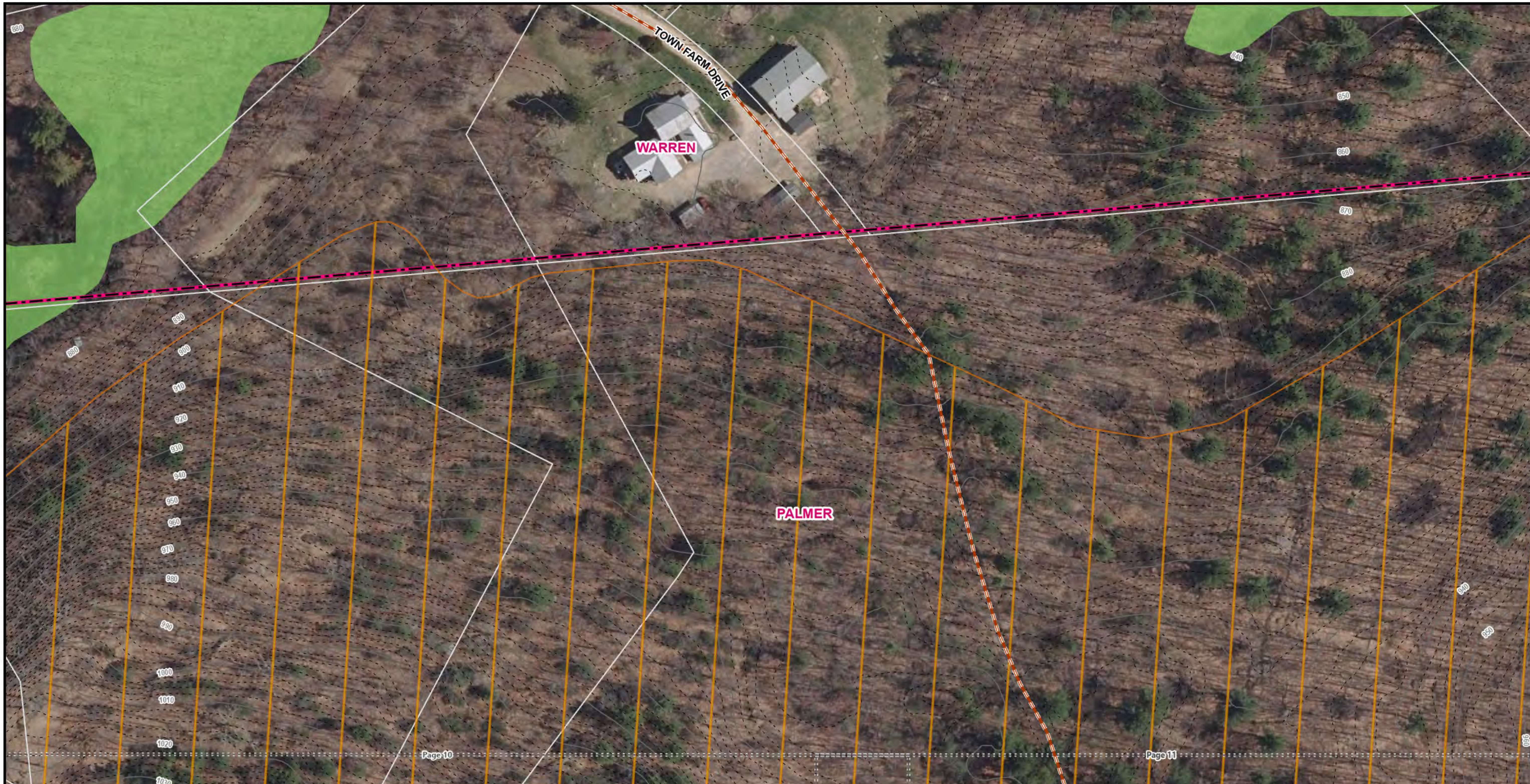

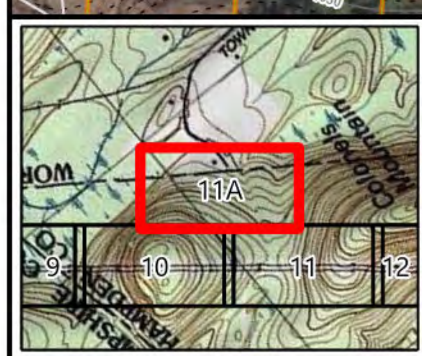

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Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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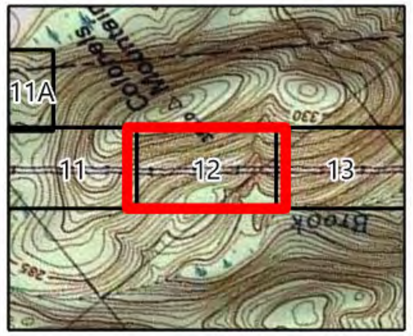

- Proposed Structure
- Structure to be Removed
- Overhead Transmission Line
- Proposed Access
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- Off-ROW Access
- Permanent Work Pad
- Temporary Work Pad
- MA DFW Coldwater Fisheries Resources
- 100-ft Buffer Zone
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- Stonewall
- Limit of Disturbance
- Erosion and Sediment Control Barrier
- Match Line
- 2' Contour
- 10' Index Contour
- Parcel Boundary
- Town Boundary

1:1,200

0 25 50 100

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

Date: 12/8/2024

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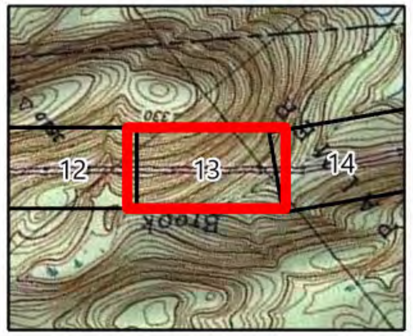

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1:1,200

0 25 50 100
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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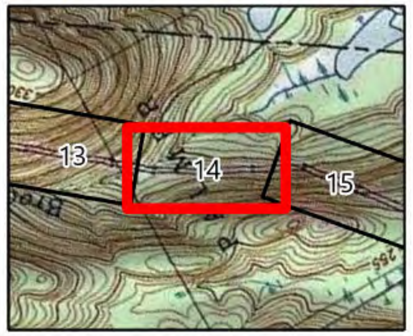

Proposed Structure	NHESP Potential Vernal Pools
Structure to be Removed	NHESP Certified Vernal Pools
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Proposed Access	NHESP Estimated Habitats of Rare Wildlife
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Permanent Work Pad	Temporary Pull Pad
Temporary Work Pad	Grading Area
MA DFW Coldwater Fisheries Resources	Culvert
100-ft Buffer Zone	Ditch
200-ft Riverfront Area	Stonewall
Watercourse (Non-delineated)	Limit of Disturbance
Delineated Top of Bank	Erosion and Sediment Control Barrier
Delineated Wetland Edge	Match Line
DEP Wetlands	2' Contour
Archaeological Sensitive Areas	10' Index Contour
	Parcel Boundary
	Town Boundary

1:1,200

0 25 50 100

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-4: Environmental Resources

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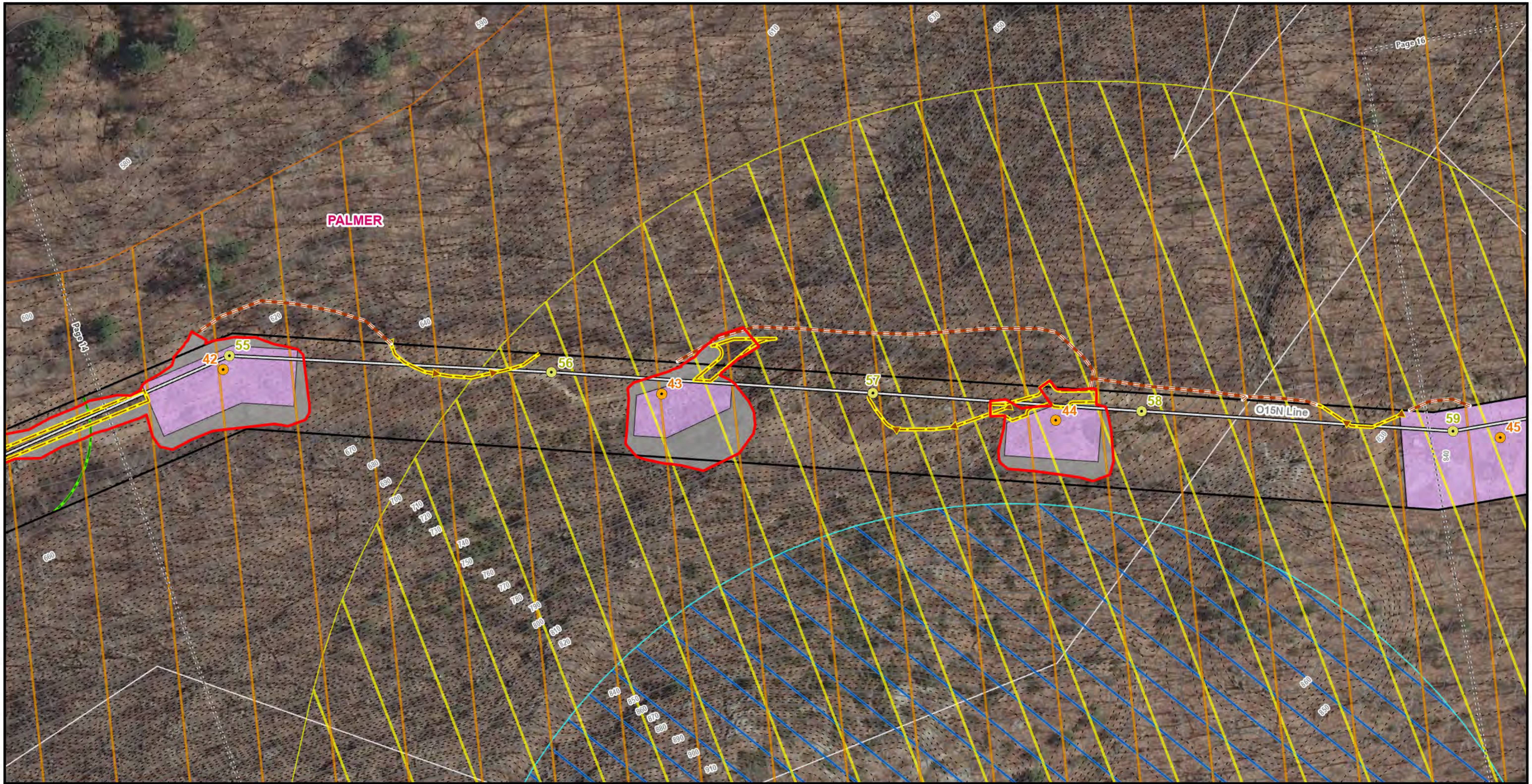

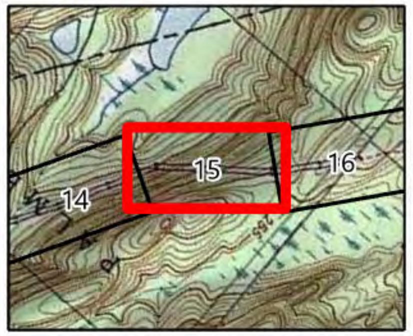

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Ware, West Brookfield, and Palmer, MA

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0 25 50 100
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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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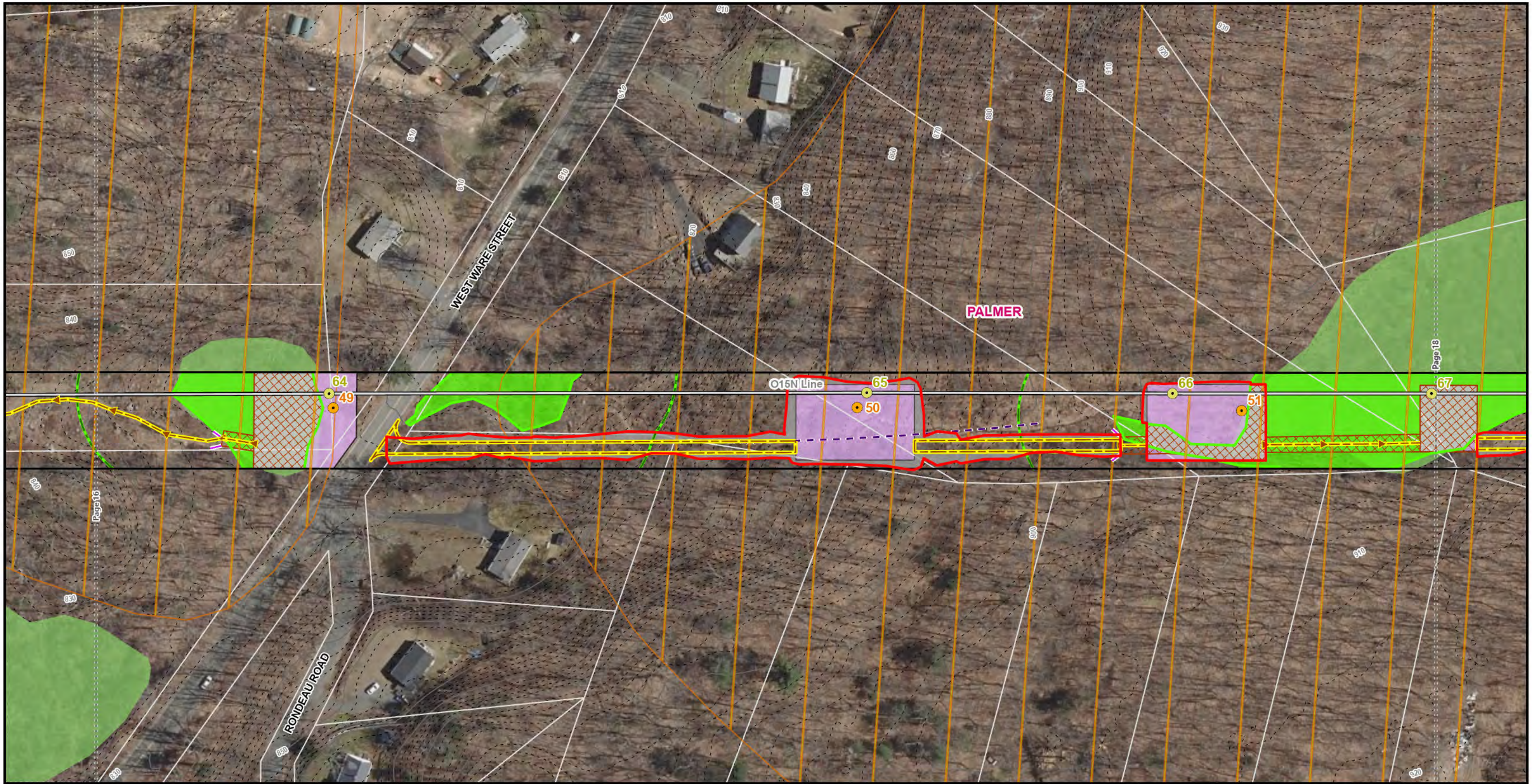

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-4: Environmental Resources

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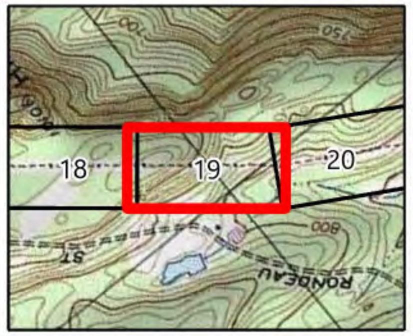

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-4: Environmental Resources

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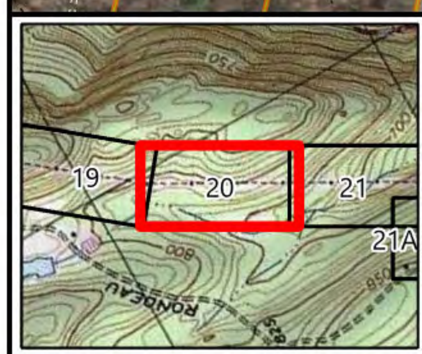

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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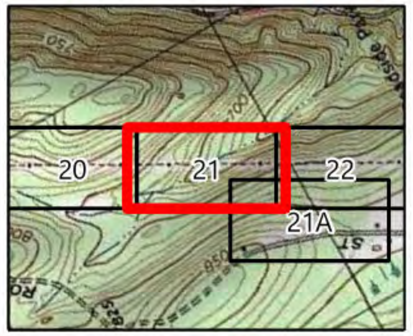

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

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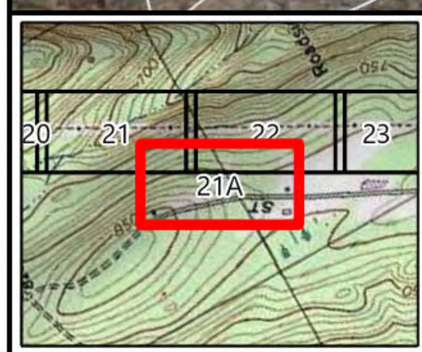

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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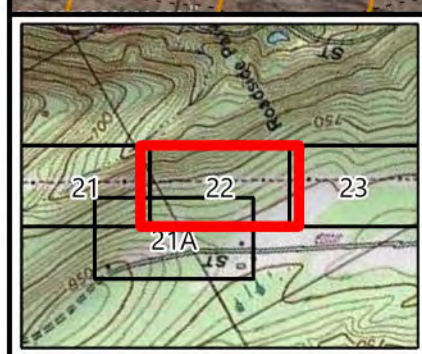

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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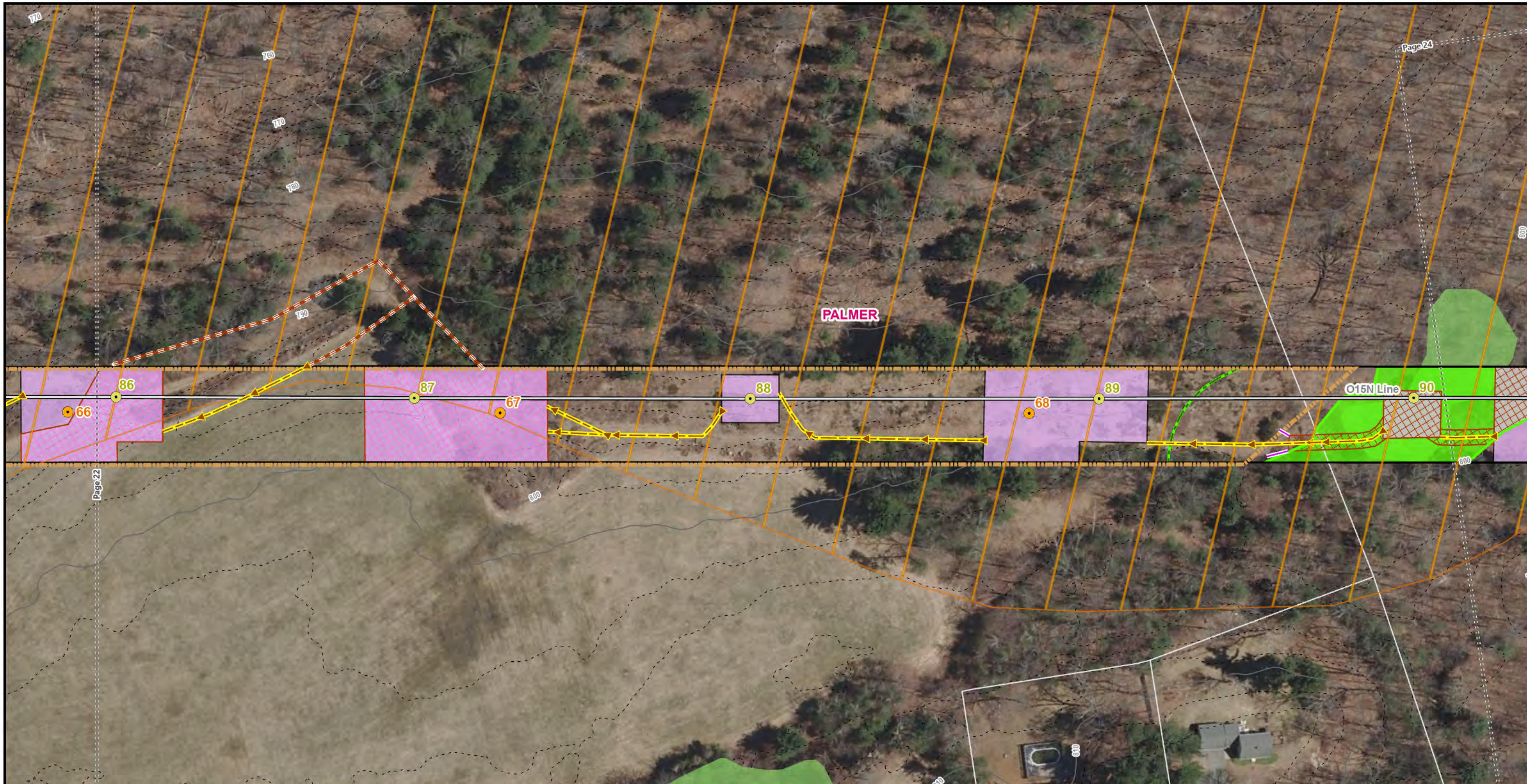

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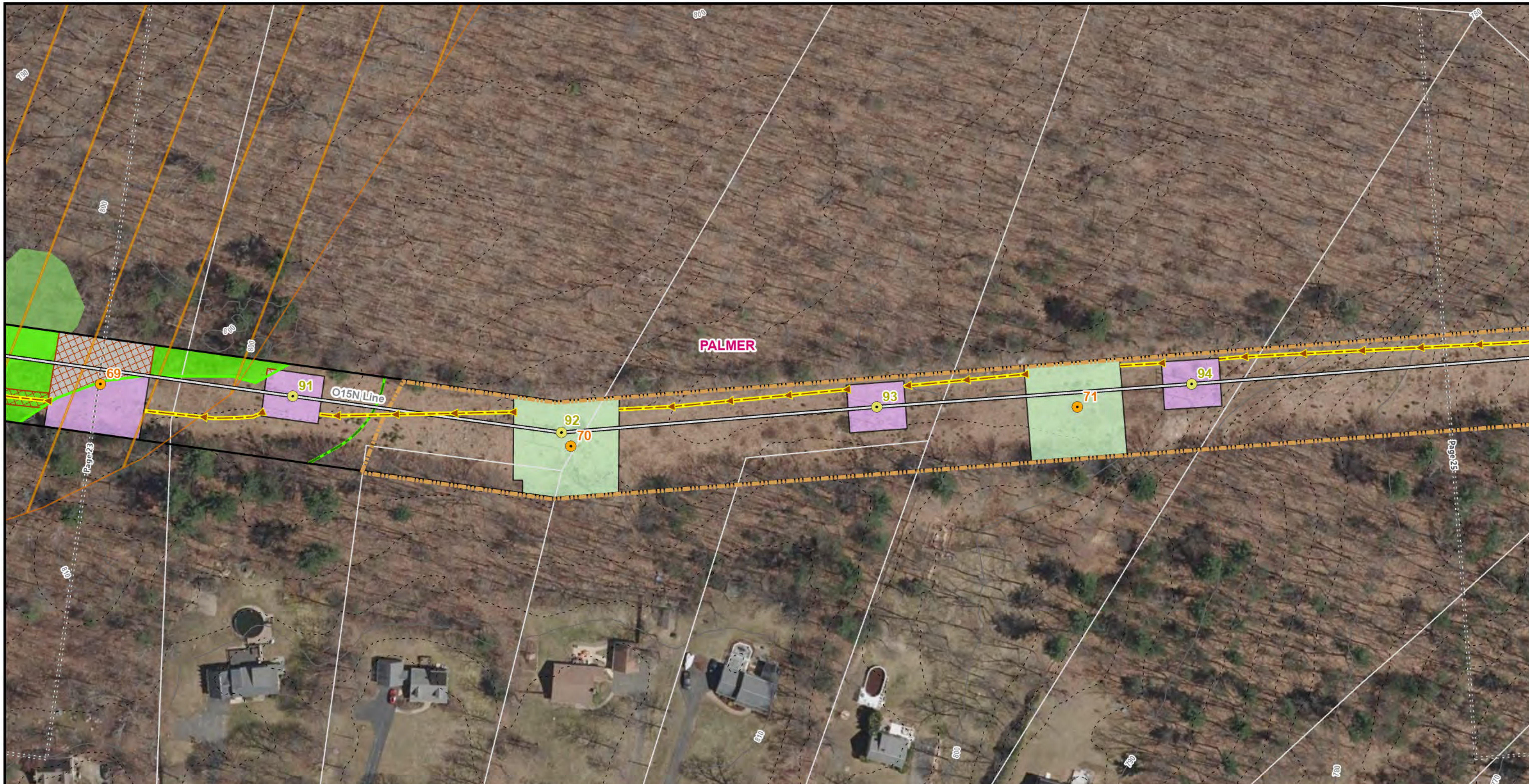

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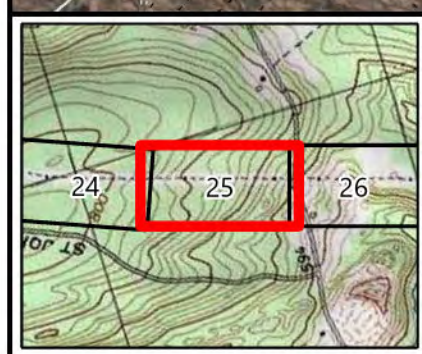

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Figure 5-4: Environmental Resources

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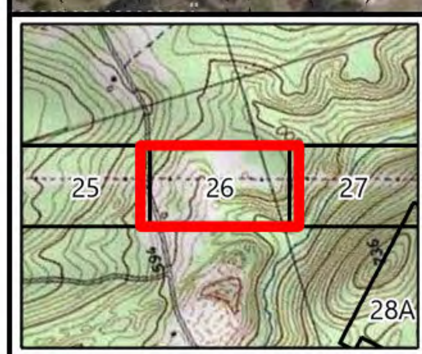

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Figure 5-4: Environmental Resources

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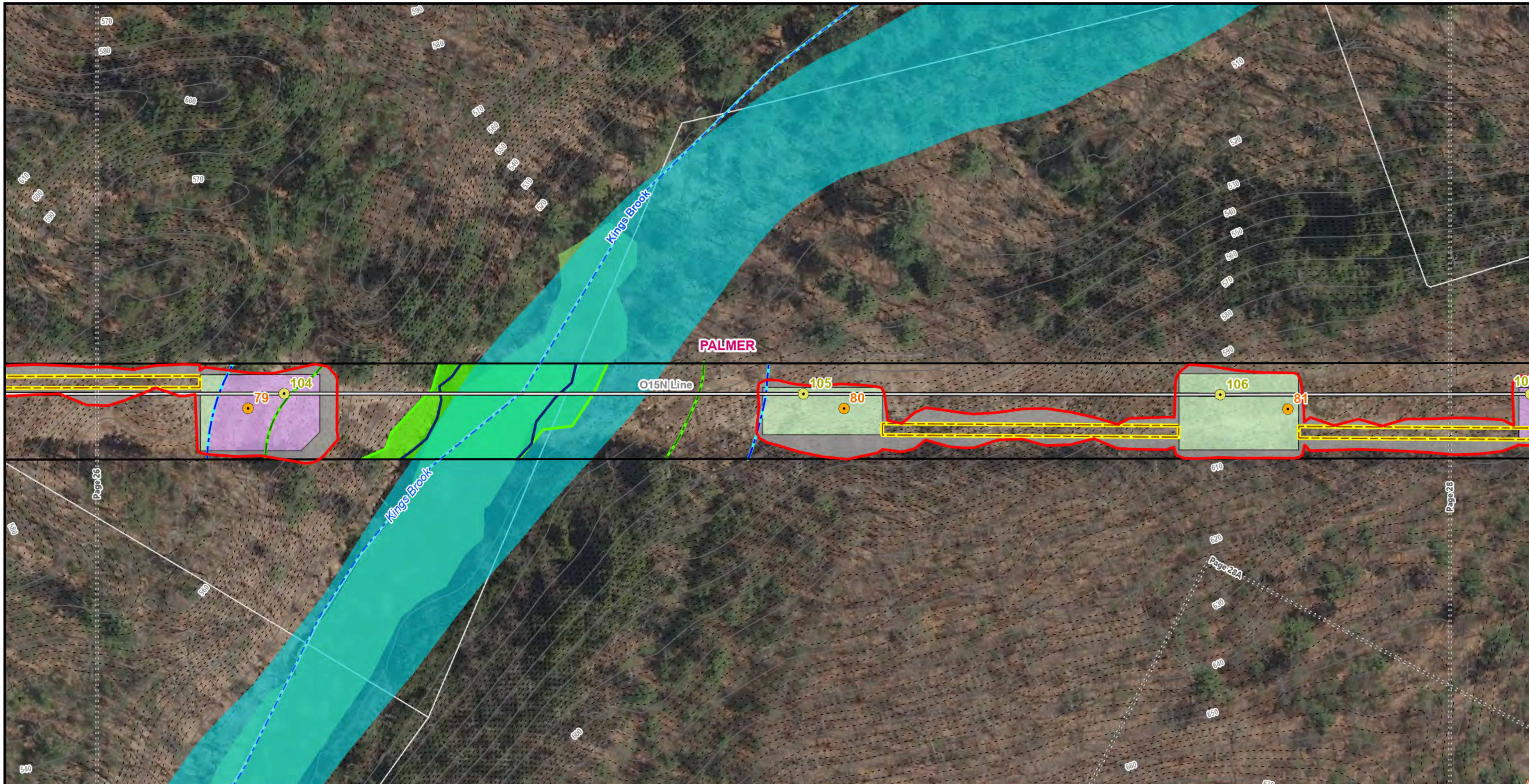

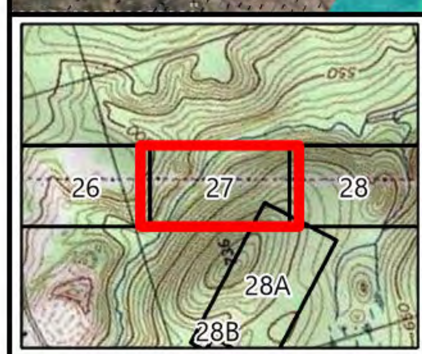

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- Stonewall
- Limit of Disturbance
- Erosion and Sediment Control Barrier
- Match Line
- 2' Contour
- 10' Index Contour
- Parcel Boundary
- Town Boundary

1:1,200

0 25 50 100
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

Source: MassGIS, National Grid, VHB

Date: 12/8/2024

nationalgrid

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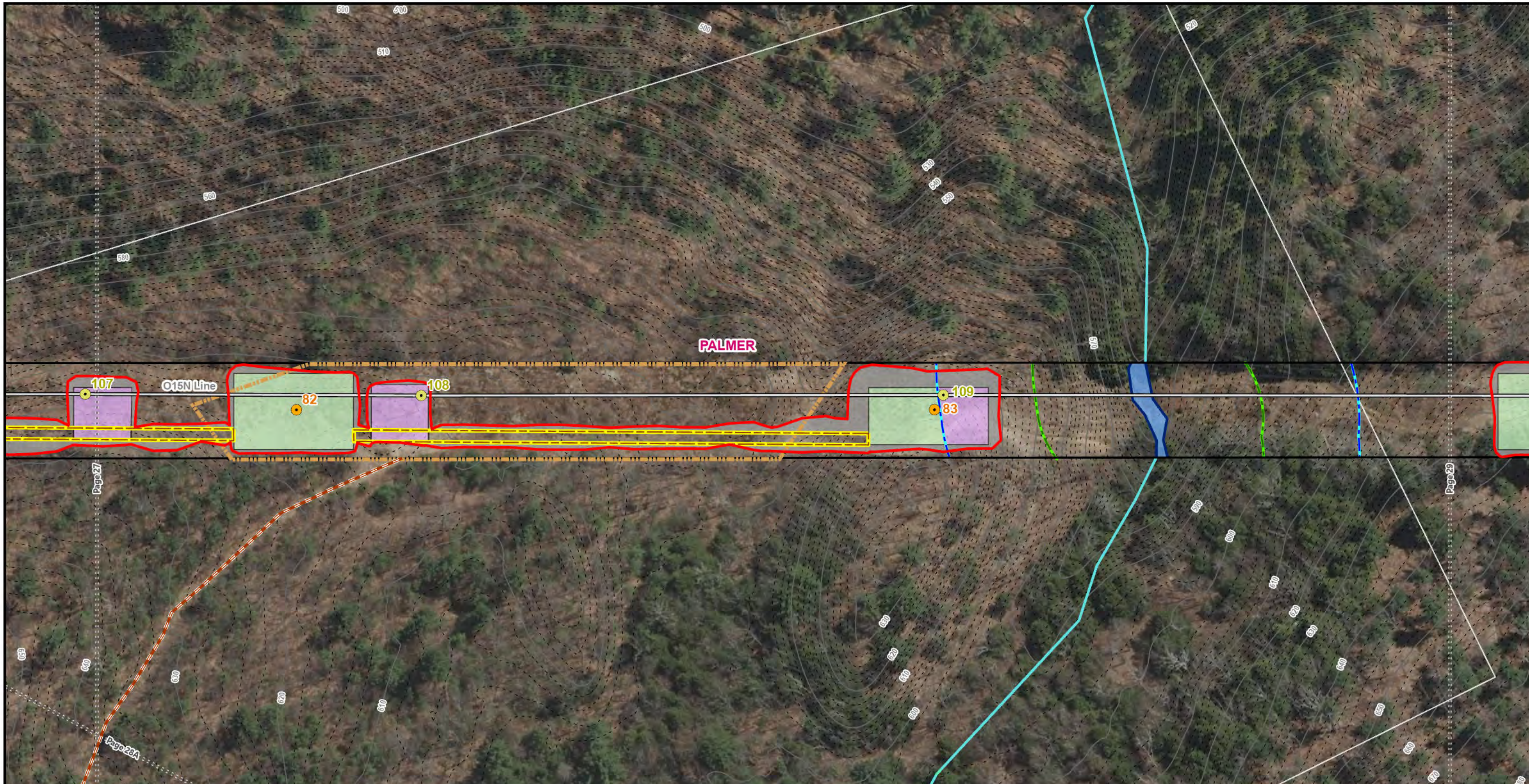

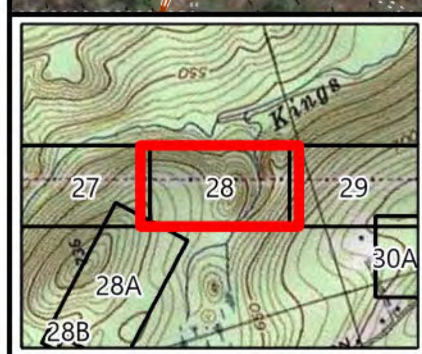

Proposed Structure
Structure to be Removed
Overhead Transmission Line
Proposed Access
Existing Access
Off-ROW Access
Permanent Work Pad
Temporary Work Pad
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100-ft Buffer Zone
200-ft Riverfront Area
Watercourse (Non-delineated)
Delineated Top of Bank
Delineated Wetland Edge
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1:1,200

0 25 50 100
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

Date: 12/8/2024

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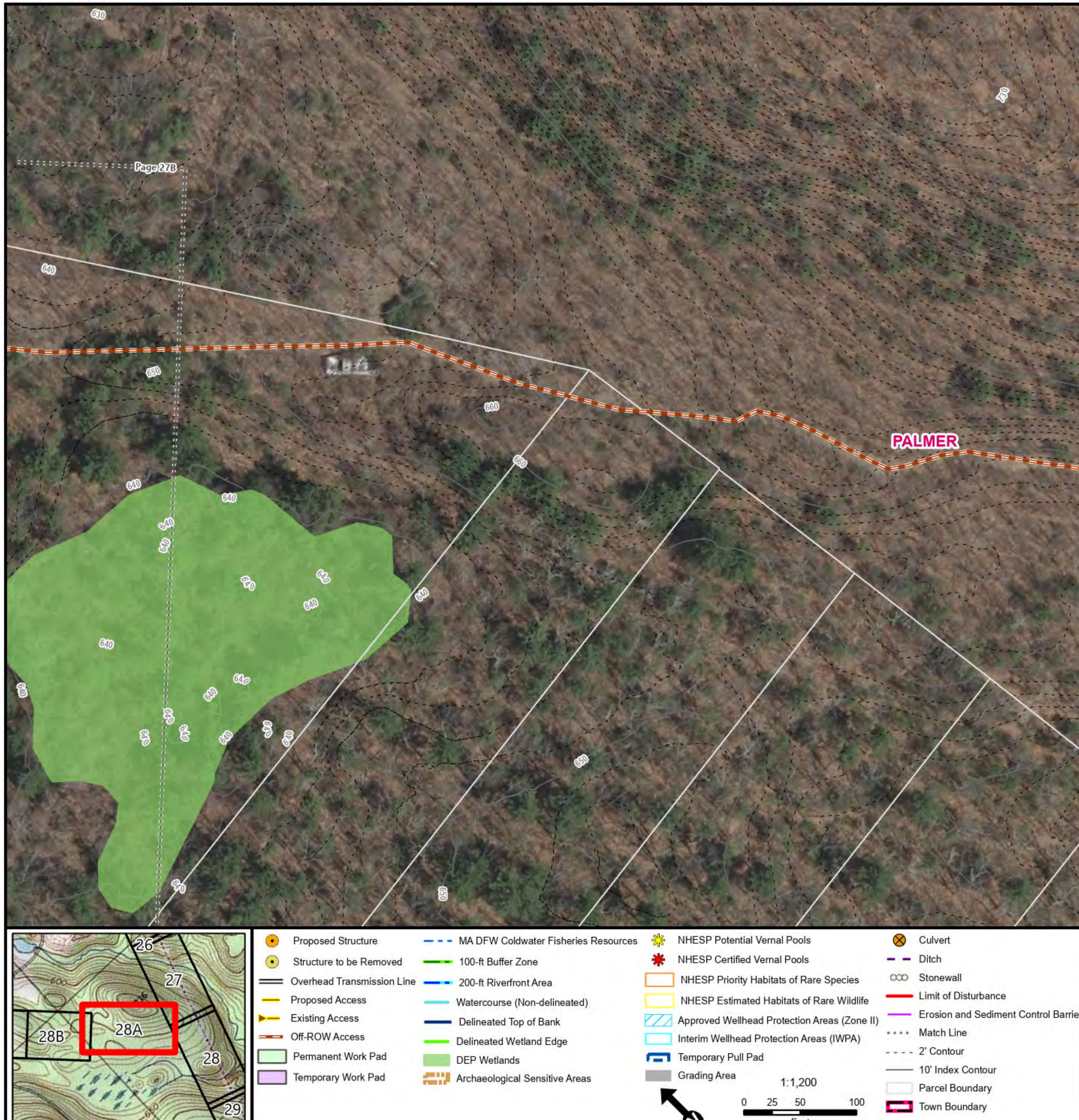

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

Date: 12/8/2024

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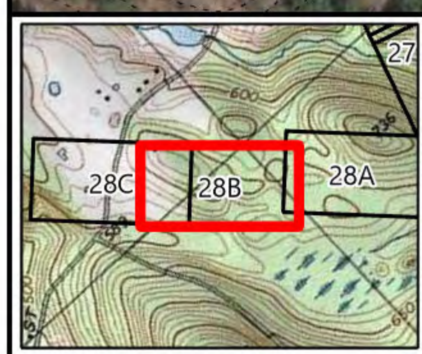

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

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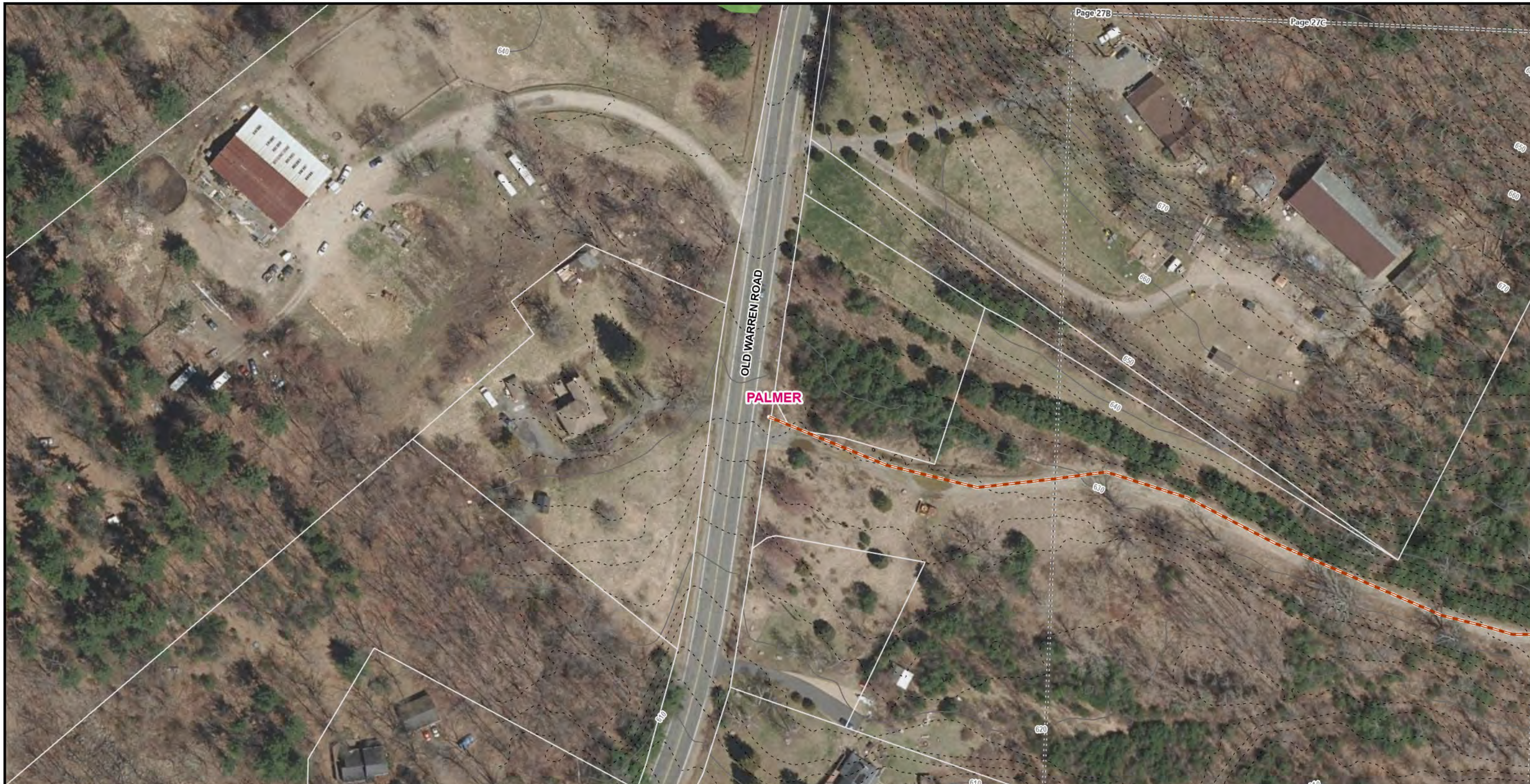

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

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Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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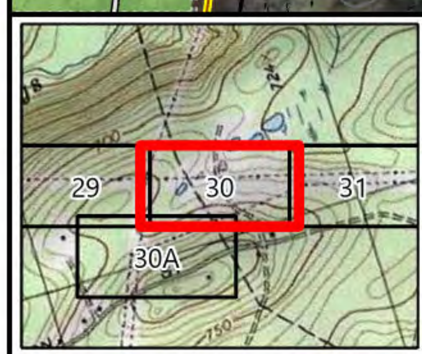

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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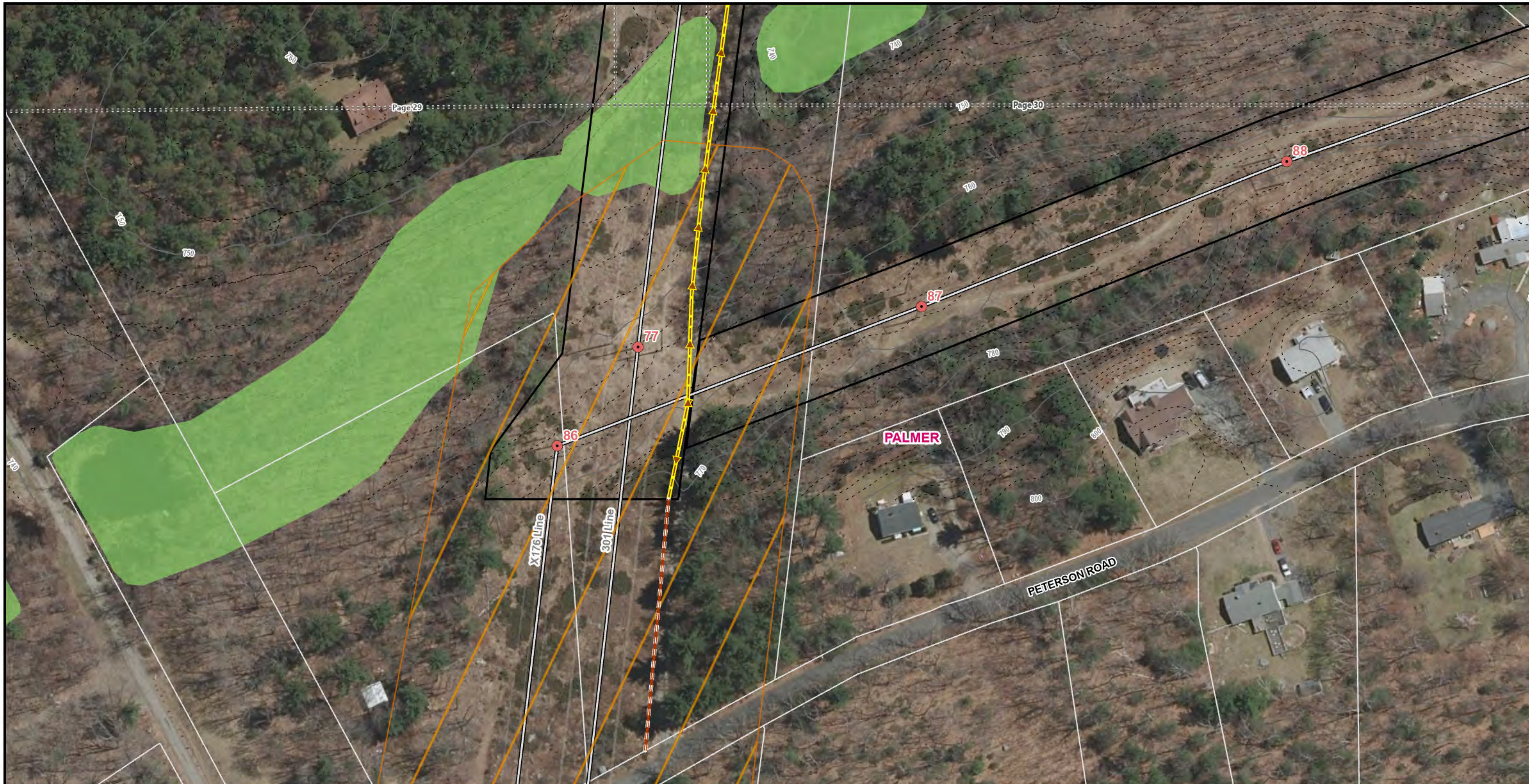

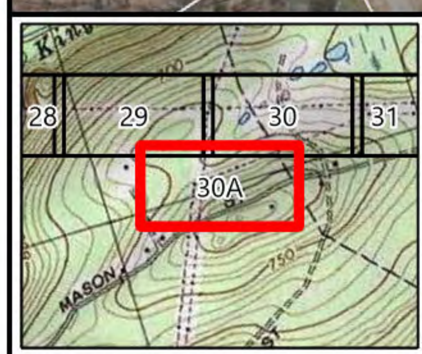

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

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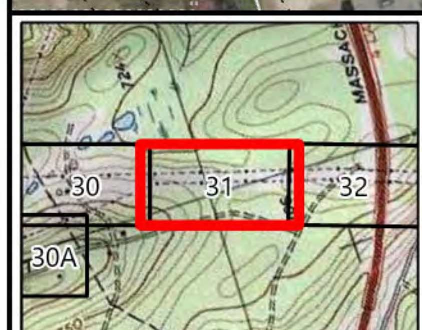

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1:1,200

0 25 50 100

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

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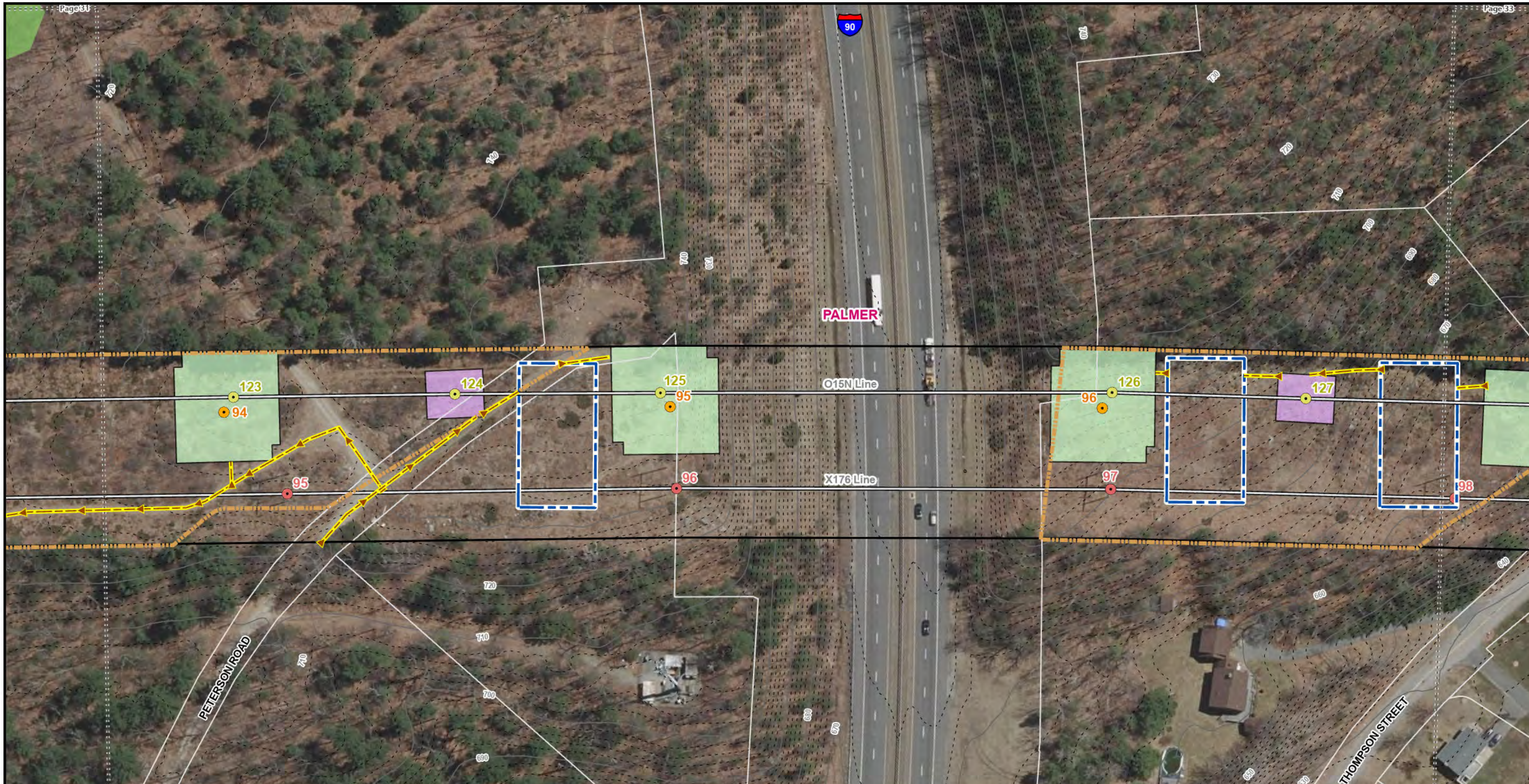

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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

Source: MassGIS, National Grid, VHB
Date: 12/8/2024

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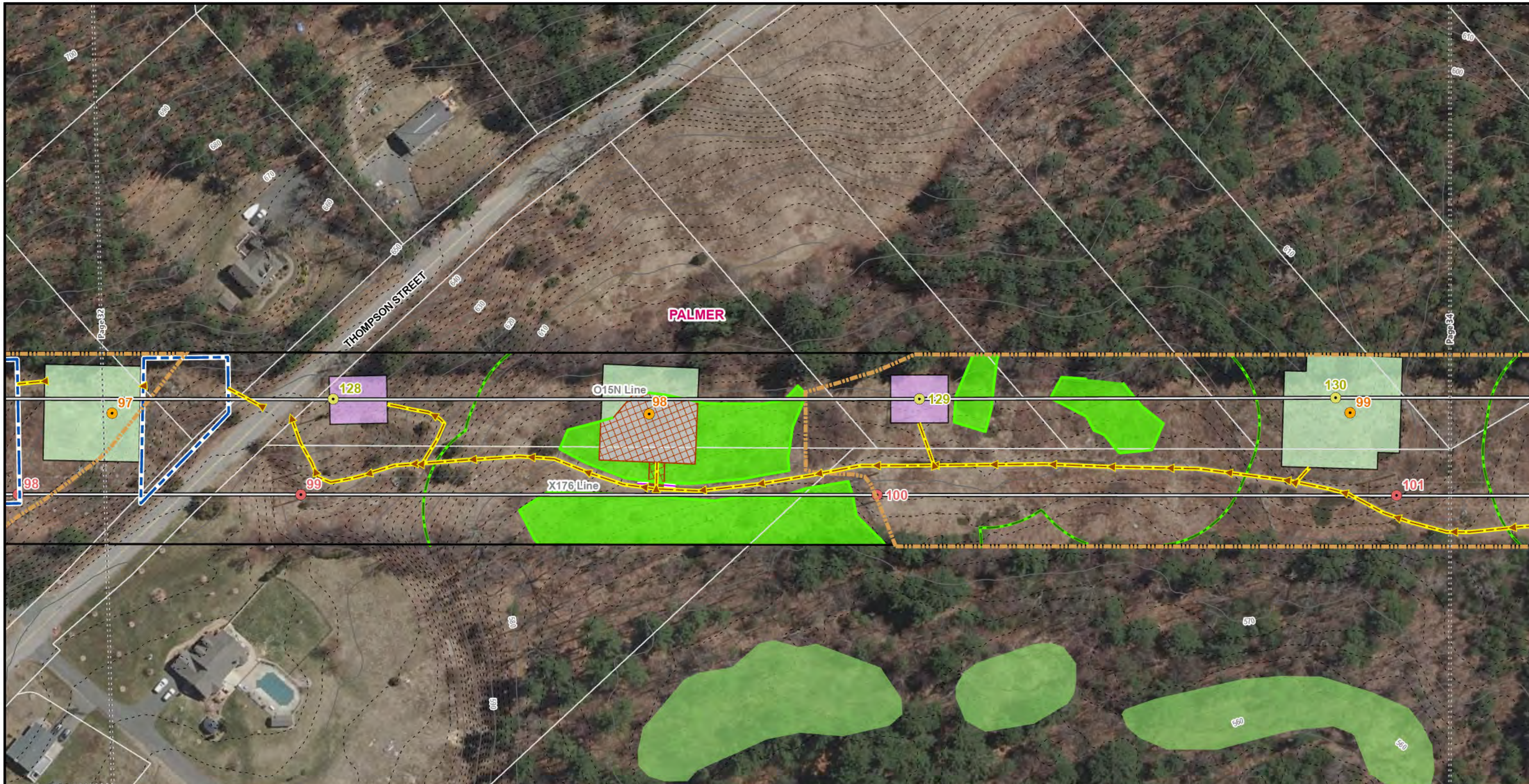

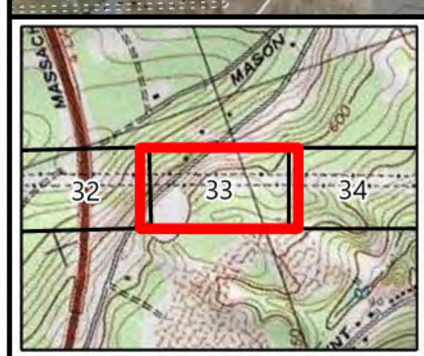

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Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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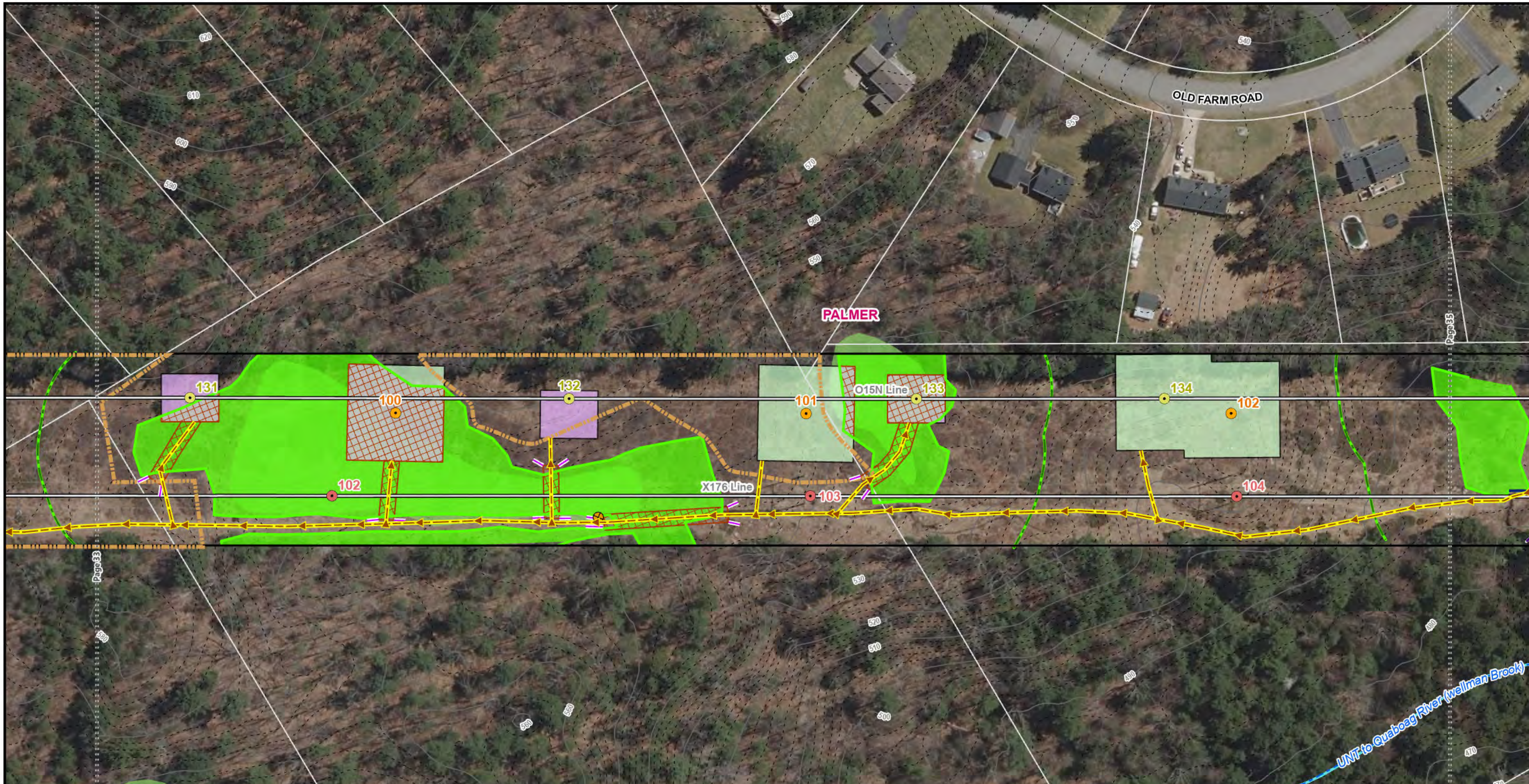

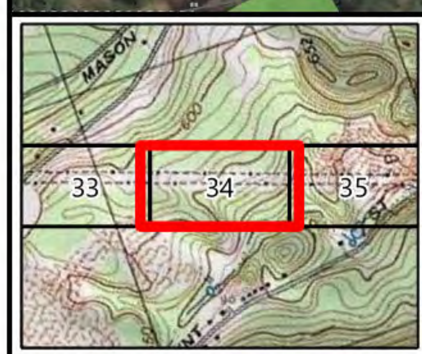

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1:1,200

0 25 50 100
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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

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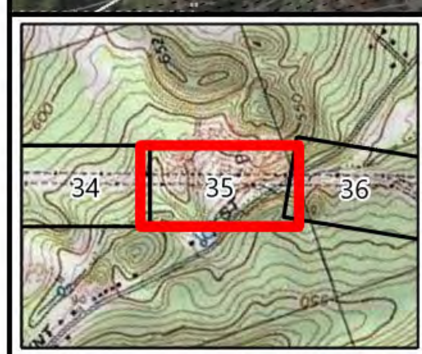

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1:1,200

0 25 50 100
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Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-4: Environmental Resources

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Source: MassGIS, National Grid, VHB

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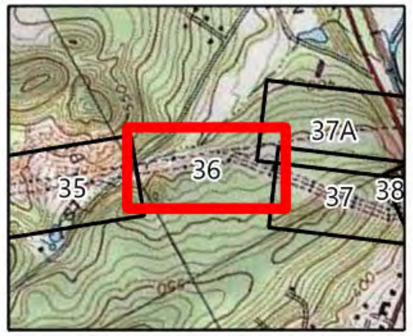

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Figure 5-4: Environmental Resources

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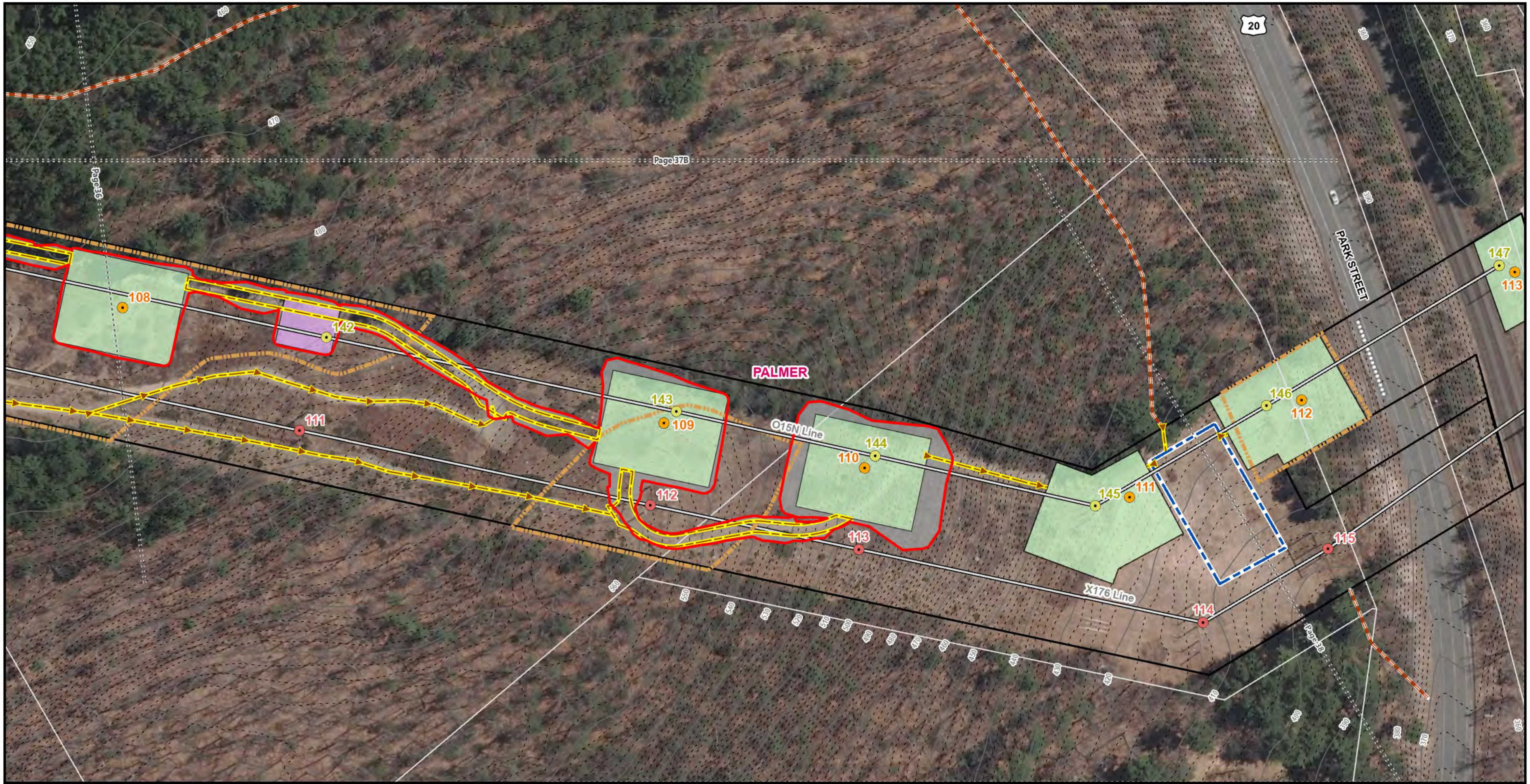

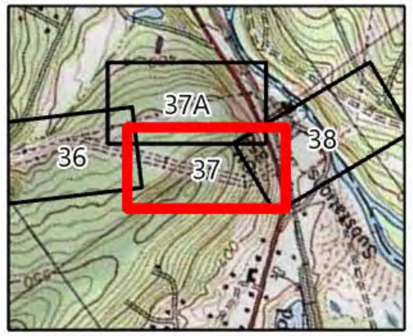

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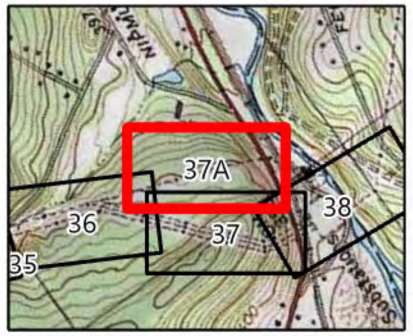

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Figure 5-4: Environmental Resources

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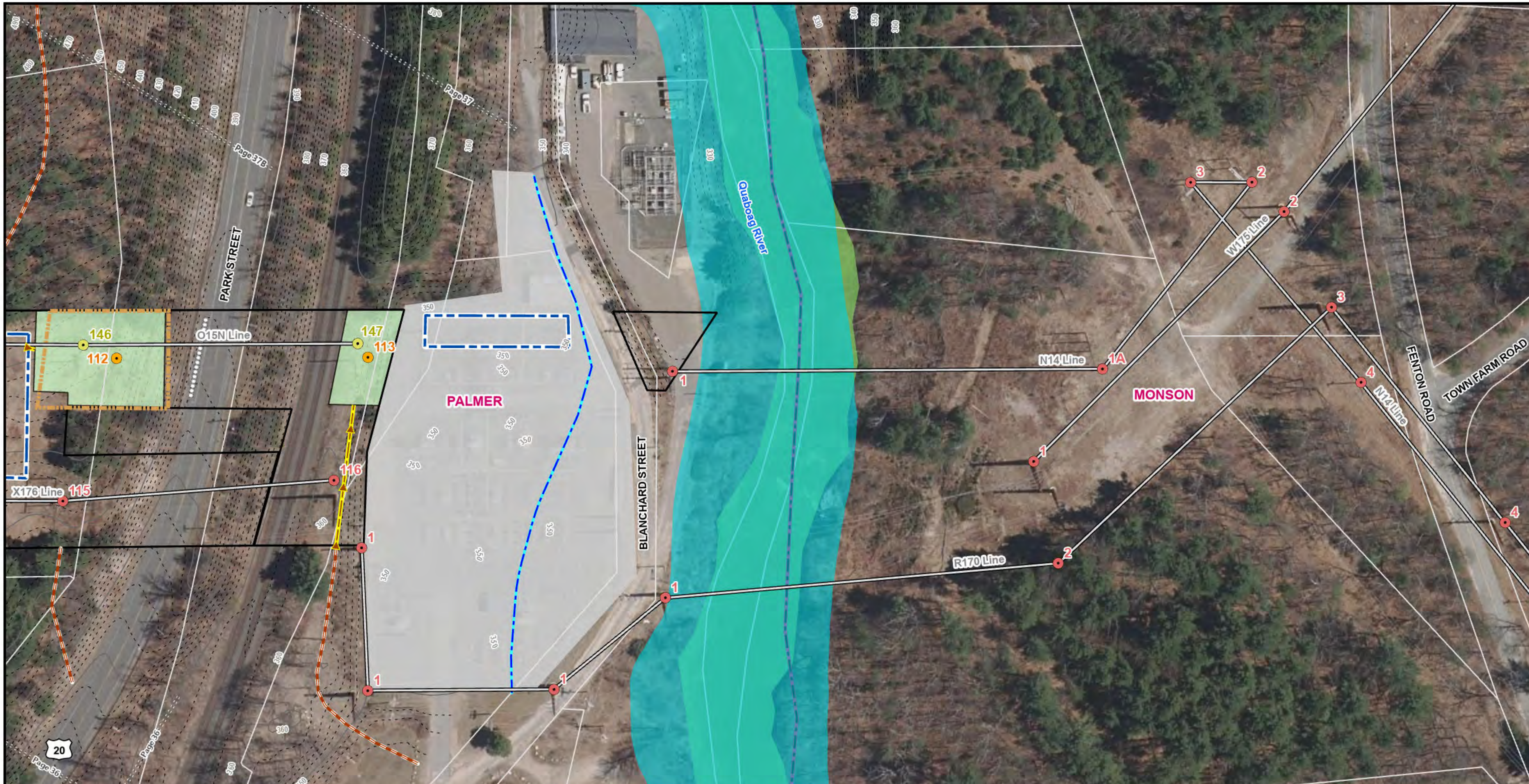

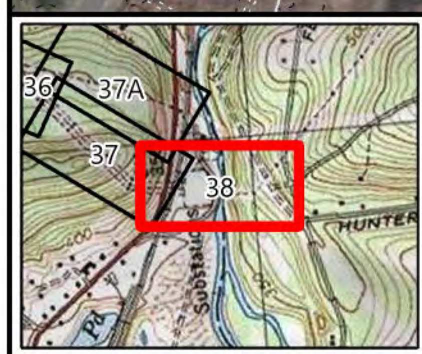

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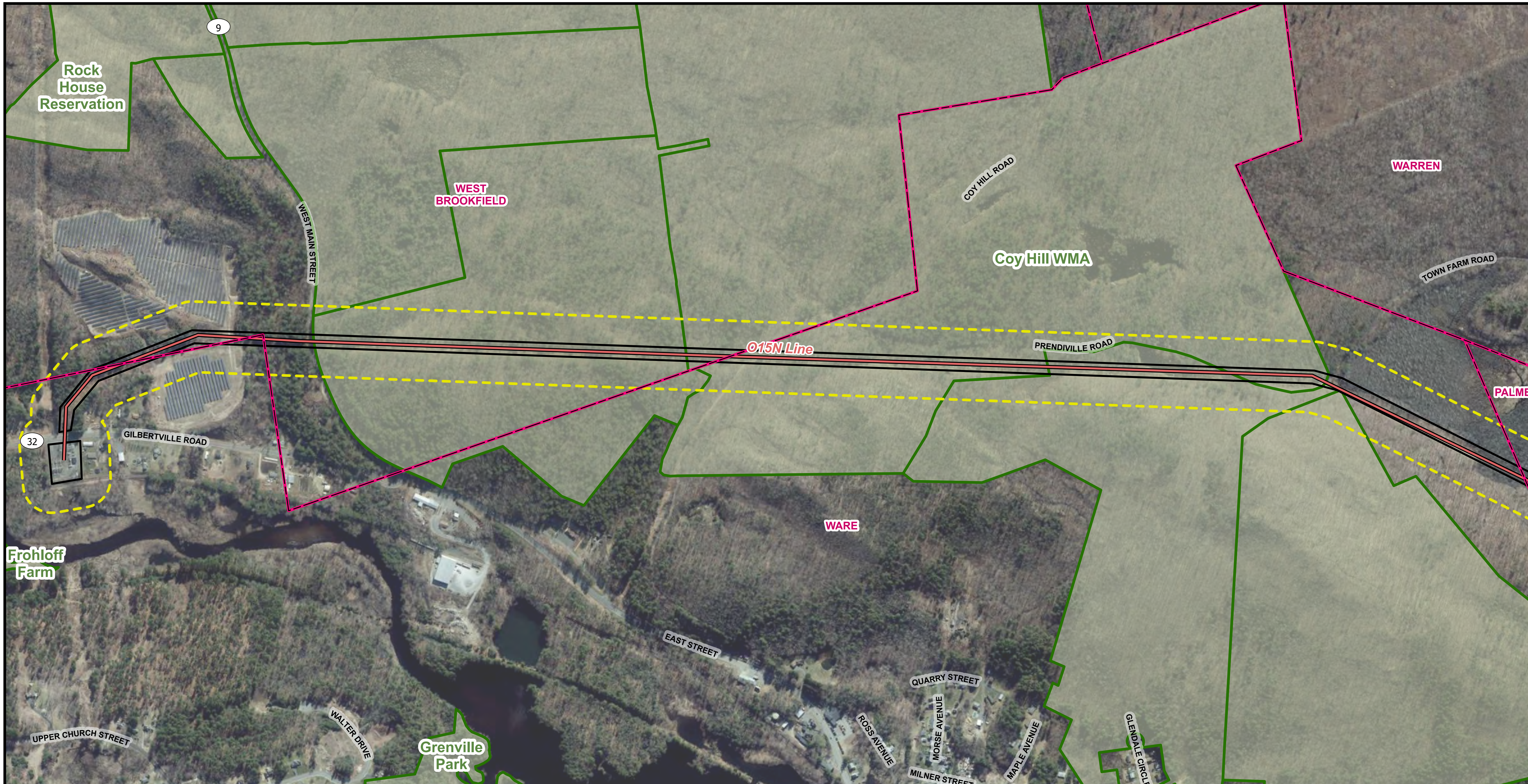

Existing O15N Transmission Line

300-ft Buffer from ROW

Open Space

Approximate ROW

Town Boundary

1:12,000

0 500 1,000 2,000

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA Figure 5-5: Open Space

Page 1 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

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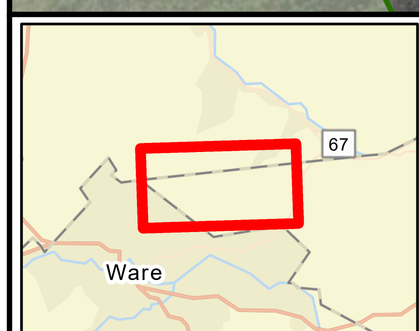

Existing O15N Transmission Line
300-ft Buffer from ROW
Open Space
Approximate ROW
Town Boundary

1:12,000
0 500 1,000 2,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-5: Open Space

Page 2 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

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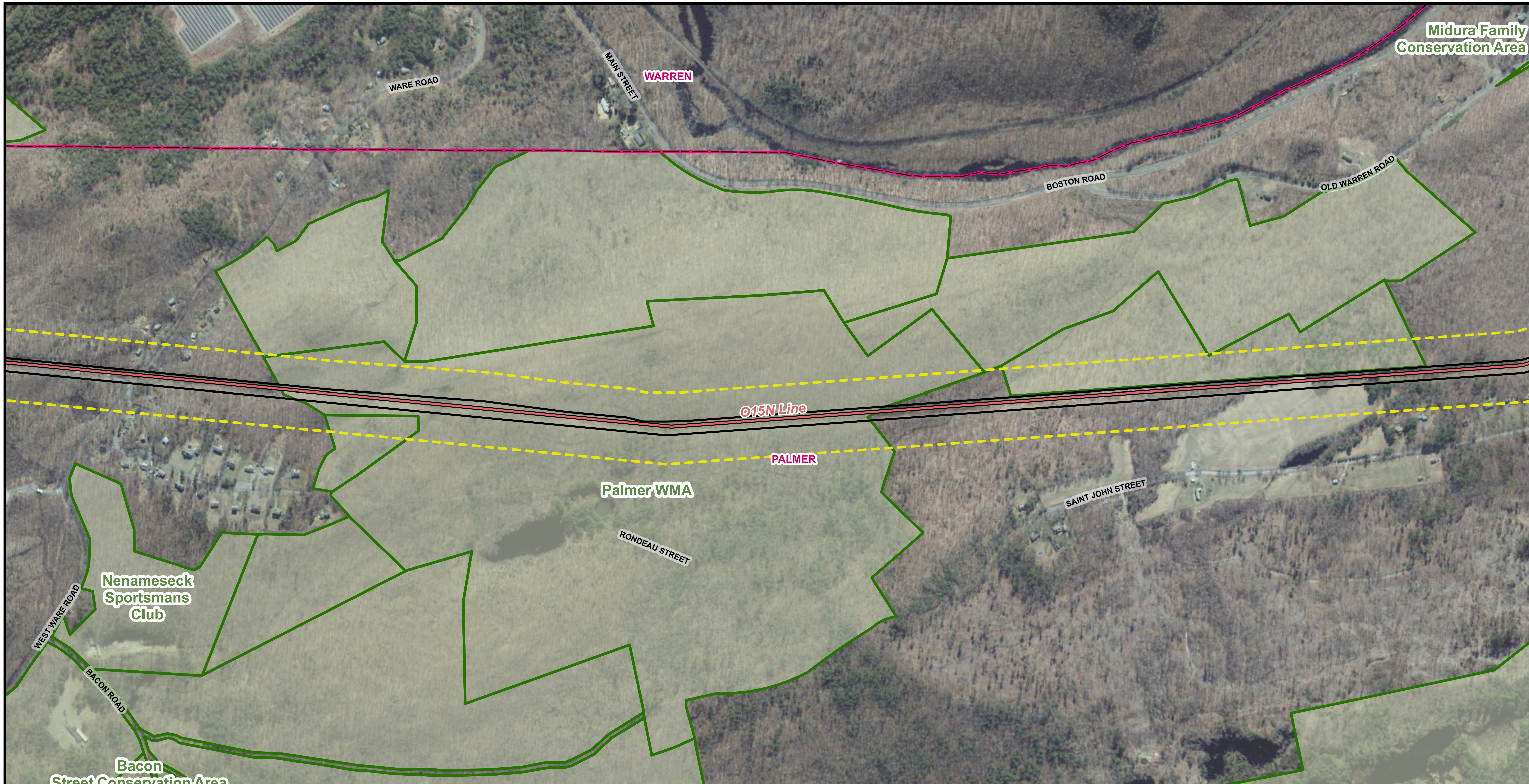

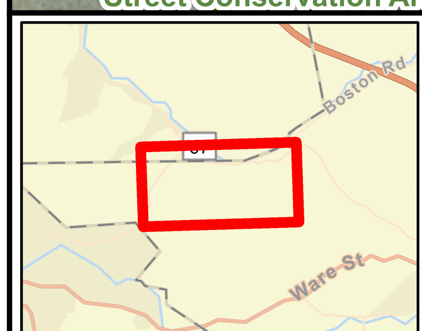

Existing O15N Transmission Line
300-ft Buffer from ROW
Open Space
Approximate ROW
Town Boundary

1:12,000
0 500 1,000 2,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-5: Open Space

Page 3 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

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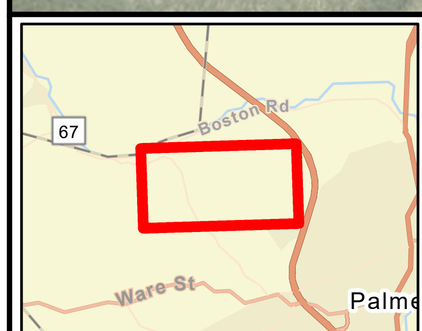

- Existing O15N Transmission Line
- 300-ft Buffer from ROW
- Open Space
- Approximate ROW
- Town Boundary

1:12,000

0 500 1,000 2,000 Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-5: Open Space

Page 4 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

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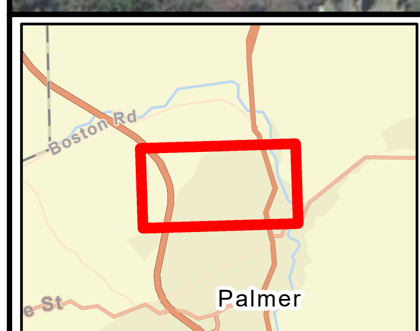

- Existing O15N Transmission Line
- 300-ft Buffer from ROW
- Open Space
- Approximate ROW
- Town Boundary

N

1:12,000

0 500 1,000 2,000

Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA

Figure 5-5: Open Space

Page 5 of 5

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

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Existing O15N Transmission Line
Town Boundary
Aquifer - Medium yield
Interim Wellhead Protection Areas (IWPA)
Approved Wellhead Protection Areas (Zone II)
Outstanding Resource Waters - Public Water Supply Contributor

1:60,000
0 2,500 5,000 10,000
Feet

Palmer to Ware Improvement Project
Ware, West Brookfield, and Palmer, MA
Figure 5-6: Water Resources
Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 10/9/2024

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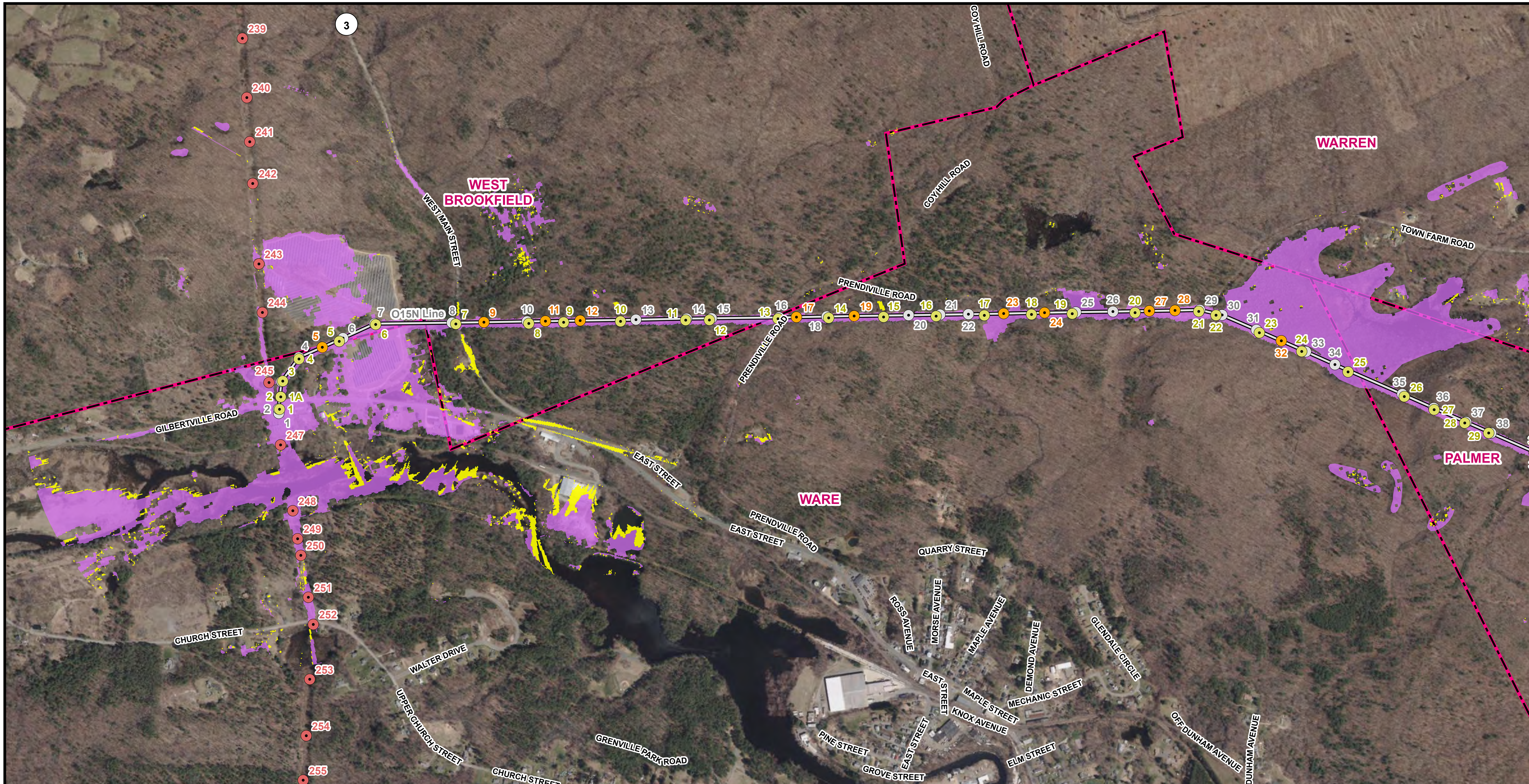

- Existing Structure
- Proposed Structure
- Structure to be Replaced
- Structure to be Removed
- Overhead Transmission Line
- 1/2 mile APE
- O15N Line Existing Visibility
- Additional Proposed Structure Visibility Area
- MHC Historic Inventory
- MHC Historic Inventory
- Town Boundary

1:12,000

0 500 1,000 2,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-7: Viewshed

Page 1 of 4

Source: MassGIS, National Grid, VHB

Date: 11/22/2024

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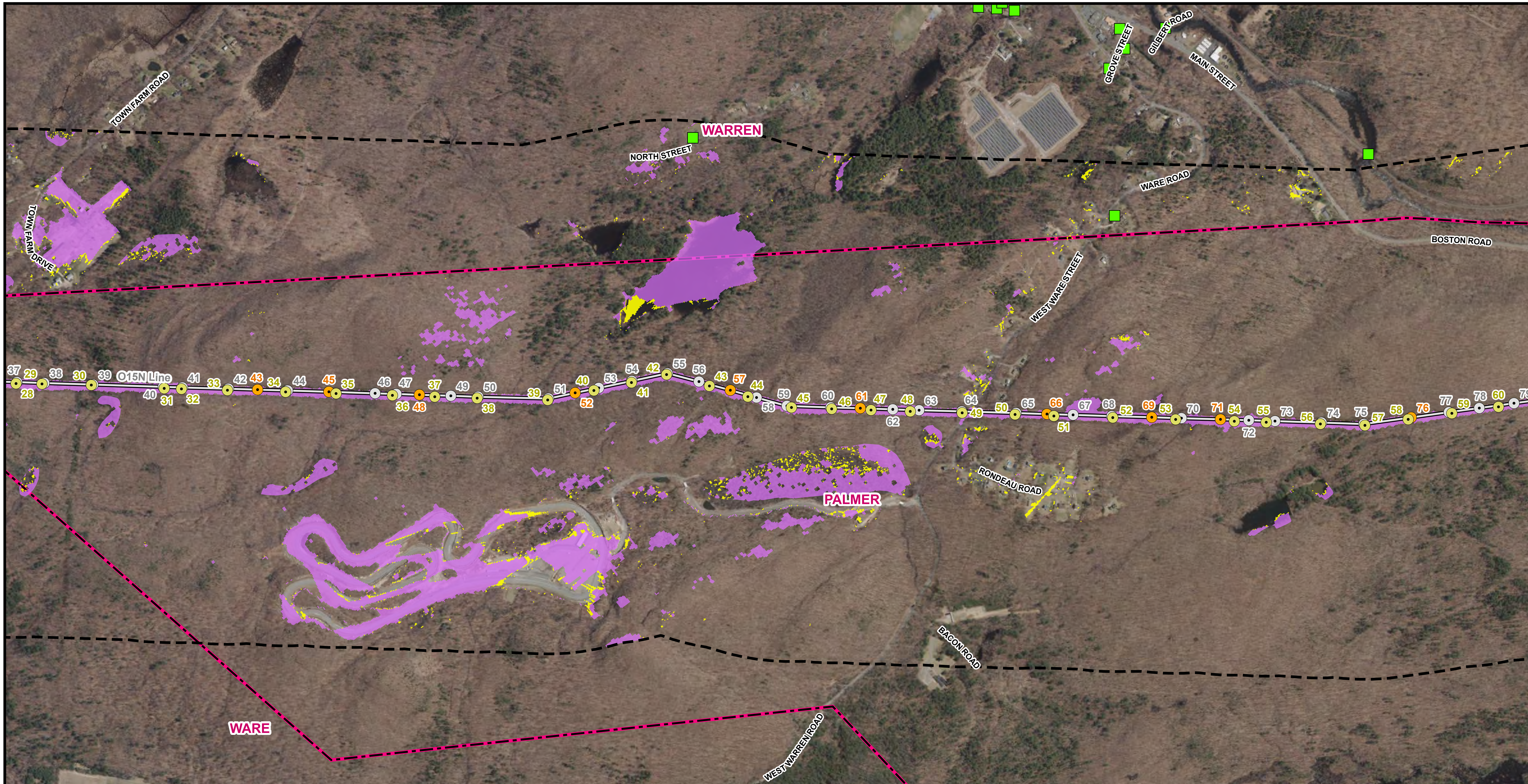

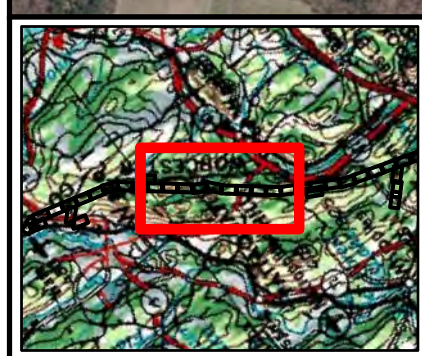

- Existing Structure
- Proposed Structure
- Structure to be Replaced
- Structure to be Removed
- Overhead Transmission Line
- 1/2 mile APE
- O15N Line Existing Visibility
- Additional Proposed Structure Visibility Area
- MHC Historic Inventory
- MHC Historic Inventory
- Town Boundary

1:12,000

0 500 1,000 2,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-7: Viewshed

Page 2 of 4

Source: MassGIS, National Grid, VHB

Date: 11/22/2024

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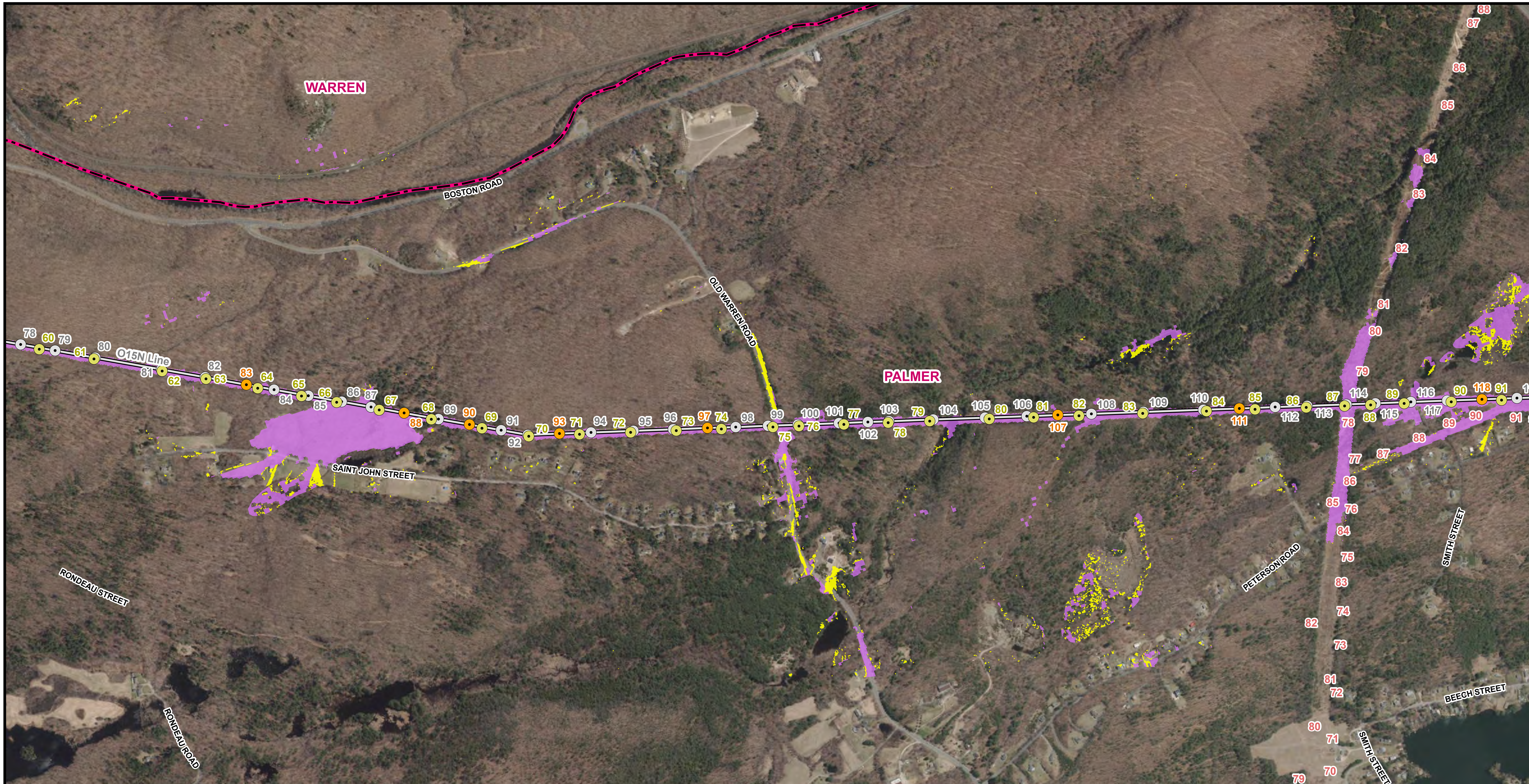

Existing Structure
Proposed Structure
Structure to be Replaced
Structure to be Removed
Overhead Transmission Line
1/2 mile APE
O15N Line Existing Visibility
Additional Proposed Structure Visibility Area
MHC Historic Inventory
MHC Historic Inventory
Town Boundary

1:12,000

0 500 1,000 2,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-7: Viewshed

Page 3 of 4

Source: MassGIS, National Grid, VHB

Date: 11/22/2024

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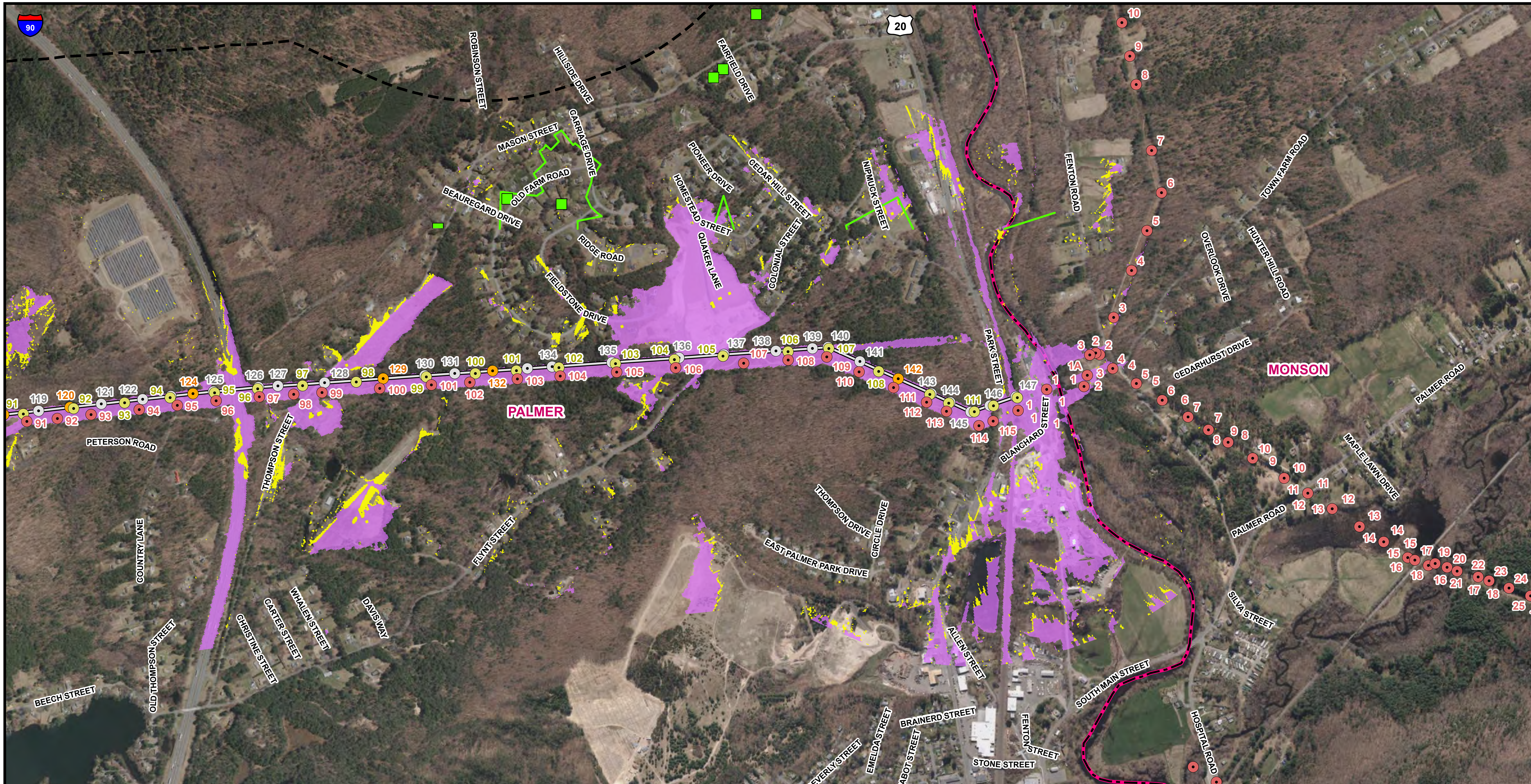
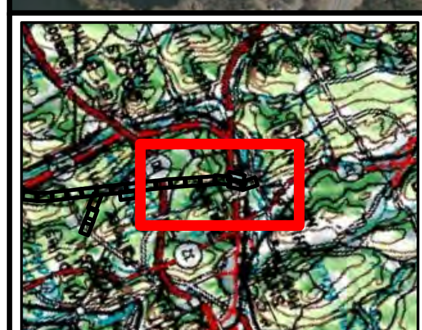




Existing Structure
Proposed Structure
Structure to be Replaced
Structure to be Removed
Overhead Transmission Line
1/2 mile APE
O15N Line Existing Visibility
Additional Proposed Structure Visibility Area
MHC Historic Inventory
MHC Historic Inventory
Town Boundary

1:12,000

0 500 1,000 2,000
Feet

Palmer to Ware Improvement Project

Ware, West Brookfield, and Palmer, MA
Figure 5-7: Viewshed

Page 4 of 4

Source: MassGIS, National Grid, VHB

Date: 11/22/2024

Appendix 5-2

National Grid's ROW Access, Maintenance and Construction Best Management Practices Environmental Guidance Document - EG-303NE

PURPOSE/OBJECTIVE:
This document provides National Grid personnel, consultants and contractors with Best Management Practices (BMPs) for conducting work on electric and natural gas transmission and distribution rights-of-ways (ROWs) and substations in New England.

WHO:
These BMPs are to be followed by all personnel conducting work on Company electric and gas ROWs and substations in New England. These BMPs do not apply to Company employees and contractors performing routine vegetation management activities that are not a part of construction or re-construction projects. Employees and contractors maintaining vegetation on Company ROWs and substations must follow the National Grid ROW Vegetation and Substation Vegetation Management Plans.

DEFINITIONS:

Refer to **Glossary** in **Appendix 1** and **Acronyms** in **Appendix 2**.

WHAT TO DO:

1.0 Project Planning

Prior to the start of any project (proposed new facilities or maintenance of existing facilities), the Project Engineer or other project planner shall determine whether any environmental permits or approvals are required, per the state-specific EG-301 environmental checklists. Any questions regarding which activities may be conducted in regulated areas or within environmentally sensitive areas shall be referred to the National Grid Environmental Scientist or Project Environmental Consultant.

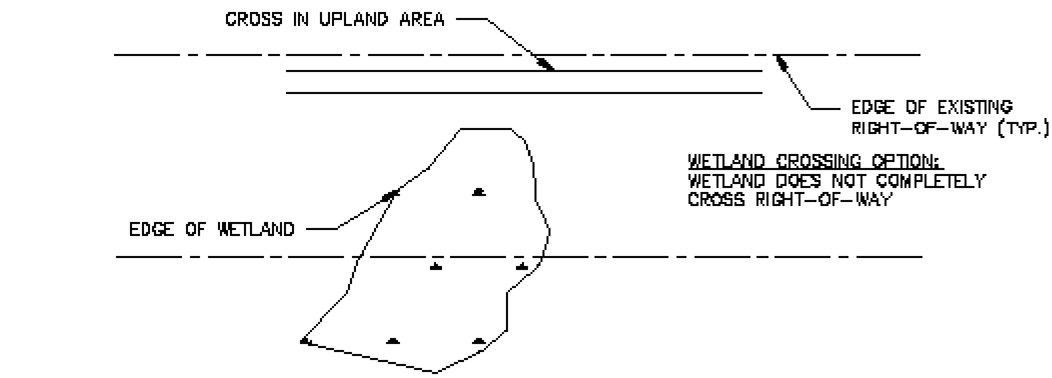
All new construction and maintenance projects shall follow clear and enforceable environmental performance standards, which is the purpose for which these BMPs have been compiled.

1.1 Avoidance and Minimization

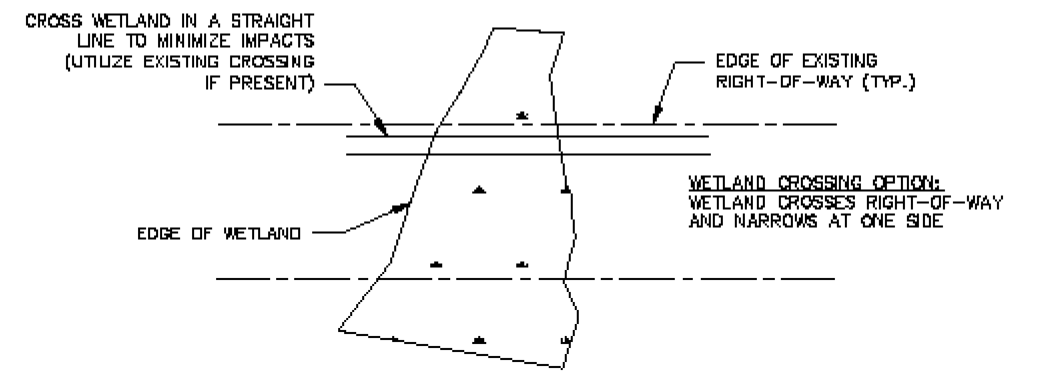
Measures shall always be taken to avoid impacts to wetlands, waterways, rare species habitats, known below and above ground historical/archeological resources and other environmentally sensitive areas. If avoidance is not possible, then measures shall be taken to minimize the extent of impacts. Alternate access routes or staging areas shall always be considered. Below is a list of methods that shall be considered where impacts are unavoidable:

- Use existing ROW access where available. Keep to approved routes and roads without deviating from them or making them wider.
- Off-ROW access shall never be assumed and shall be coordinated through National Grid Real Estate before being implemented.
- Where no existing ROW access is present, avoid wetlands and if a wetland crossing is necessary, cross wetlands at the most narrow point possible or at the location of a previously used crossing (if evident). Figure 1 below illustrates this minimization technique.

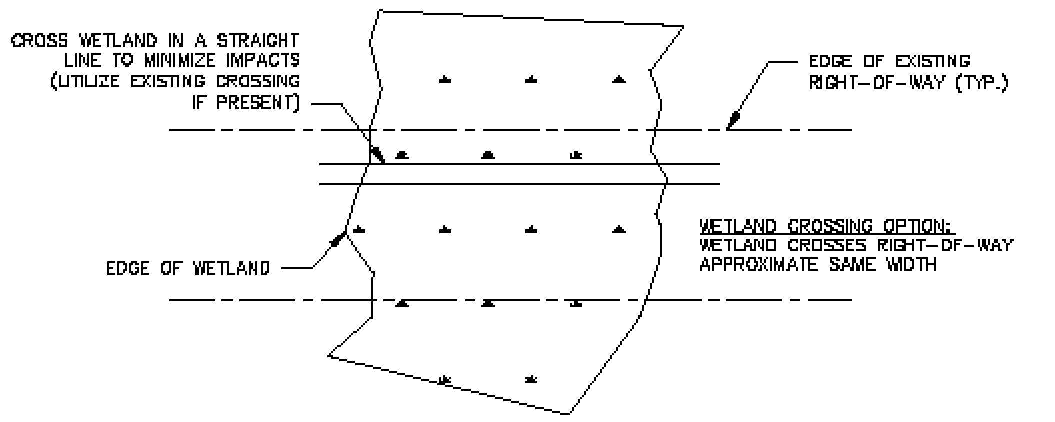
- Avoid and minimize stream crossings.
- Minimize the width of typical access roads through wetlands to a maximum width of 16 feet.
- Conduct work manually (without using motorized equipment) in wetlands, wherever possible.
- Use construction mats in wetlands to minimize soil disturbance and rutting when crossing or working within wetlands. When not using mats for access, standard vehicles shall not be allowed to drive across wetlands without the prior approval of the National Grid Environmental Scientist. Use of a low ground pressure (LGP) vehicle may be a feasible alternative to mats provided that such LGP vehicle use has been reviewed and approved by the National Grid Environmental Scientist. See Section 7.0.
- Coordinate the timing of work to cause the least impacts during the regulatory low-flow period under normal conditions, when water/ground is frozen, after the spring songbird nesting season, and, outside of the anticipated amphibian migration window (mid-February to mid-June). Refer to the United States Army Corps of Engineers (USACE) state-specific General Permit for the definition of the low-flow period in each state at: http://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/. A summary table is provided in Section 7.0.
- Seek alternative routes or work methods to minimize impact.



WETLAND AVOIDANCE
FIGURE 1a – AVOIDANCE



WETLAND AVOIDANCE
FIGURE 1b – MINIMIZATION
(CROSSING AT NARROWEST LOCATION)



WETLAND AVOIDANCE
FIGURE 1c – MINIMIZATION
(CROSSING UNIFORM WIDTH IN A STRAIGHT LINE)

1.2 Historically Significant Areas

Areas that have been identified as historically and/or culturally significant shall be avoided in accordance with site-specific avoidance plans, as applicable. Refer to the project-specific Environmental Field Issue (EFI) for any applicable avoidance plans or consult with the National Grid Environmental Scientist. Demarcation of these areas to be avoided shall use staked orange snow fencing or an equivalent physical barrier (not just ribbon flagging) and signage. Refer to Section 14.0 for signage guidance.

1.3 Rare Species Habitat

Work within areas that have been identified as mapped rare species habitat shall follow site-specific requirements, as applicable. In Massachusetts, maintenance activities within mapped habitat (known as Priority Habitat of Rare Species) shall follow the BMPs outlined in the Natural Heritage Endangered Species Program (NHESP)-approved National Grid Operation and Maintenance Plan. Work in mapped rare species habitat may require, at a minimum, turtle training for crews and sweeps of work areas for turtles, botanist identification of rare plant locations and avoidance of these locations, and protection of vernal pools, all prior to the start of work. Demarcation of these areas to be avoided (e.g., rare plant populations, overwintering turtles, nests) shall use staked orange snow fencing or an equivalent physical barrier (not just ribbon flagging) and signage. Refer to Section 14.0 for signage guidance.

Where new substations are being constructed or existing substations are undergoing a rebuild or expansion, and the substations are located in mapped rare turtle habitat, project team members should consider fenceline improvements or measures needed to prevent/eliminate turtle entrance into the substation or allow multiple points for easy egress such that turtles are not trapped within the substation fenceline.

Other requirements may apply in NH, VT and RI. Refer to the project-specific EFI for any applicable measures or consult with the National Grid Environmental Scientist.

1.4 Meetings

Pre-permitting meetings shall take place early in the project development process to determine what permits are triggered by the proposed work and the timeline required for permitting. During these meetings, the team shall develop access plans and BMPs to be used during construction of the project.

Field / Constructability review meetings shall take place on-site to evaluate construction site access and job site set-up, to ensure that the project can proceed as permitted. It is at this point in time where work areas, pulling locations, laydown areas, parking areas, and equipment storage areas are evaluated and located. Off-ROW areas under consideration should be included in this discussion.

Prior to submitting permit plans to regulatory authorities, the construction group (contractor or National Grid) shall review the plans for final sign off.

Pre-construction meetings are typically held prior to the commencement of all work to appoint responsible parties, discuss timing of work, and further consider options to avoid and/or minimize impacts to sensitive areas. These meetings can occur on- or off-site and shall include all the willing and available stakeholders (i.e., utility employees, contractors, consultants, inspectors, and/or monitors, and regulatory personnel). Training of crews and supervisors of the EFI, Stormwater Pollution Prevention Plan (SWPPP), rare species, and other permit requirements shall be conducted at a pre-construction meeting.

Pre-job briefings shall be conducted daily or otherwise routinely scheduled meetings shall be conducted on-site with the work crew throughout the duration of the work. These meetings are a way of keeping everyone up to date, confirming there is consensus on work methods and responsibilities, and ensuring that tasks are being fulfilled with as little impact to the environment as possible.

The Project Environmental Scientist/Monitor and Construction Project Manager shall communicate regularly (e.g. weekly or bi-weekly meetings or phone conversations) to discuss the work completed since last communication (i.e. work locations, wetland impacts, equipment used, and unexpected delays or work conditions). These meetings or calls shall include the expected schedule of construction for the upcoming week, the long term construction plans, and planned methods for working near/in wetlands. Both the Project Environmental Scientist/Monitor and Construction Project Manager shall work together so the Project complies with all environmental permits and regulations. When changes to the Project scope or agreed work plan are proposed they shall be done so with the final approval of the National Grid Environmental Scientist.

1.5 Communication of Project Specific Environmental Requirements

Project specific environmental concerns, to include sensitive resources, permits, approved access and time-of-year or other restrictions, shall be communicated to the project team and be included as part of the Pre-Bid and Pre-Construction Meetings. Project specific requirements shall be communicated to the project manager/construction manager/engineering group using the following guidelines:

<u>Environmental Field Issue</u> – The EFI will be a full document consisting of narrative, project permits, access and matting plans. A table summarizing pertinent (but not all) permit conditions and the responsible party for those conditions shall be included in the EFI. Copies of all permits should be included as attachments. This will be prepared for most projects with multiple permits or large, complex projects (siting board, Section 404, 401 WQC, SWPPP). There shall be EFI training at the pre-construction meeting. The National Grid EFI template is located in **EI-303NE**.

<u>Simplified Environmental Field Issue</u> – The Simplified EFI is a memorandum containing environmental resources present, project permit(s), access and matting plans and a table summarizing relevant permit conditions and responsible party for those conditions. Copies of all permits should be included as attachments. The Simplified EFI will be prepared for most projects with 1 or 2 permits (Order of Conditions, S404 Cat 1). The Simplified EFI should also be provided for projects that have environmental resources present, but the scope of the project does not trigger environmental permitting (e.g., the scope of work qualifies for maintenance exemption(s)). The resources present

shall be discussed at the Pre-Bid and Pre-Construction meetings and any changes in scope will require additional review by the National Grid project team.

E-mail delivery of Permit and any Sediment/Erosion control or BMP plan – For those projects with only one permit (eg., MA Order of Conditions, RI DEM permit, RI CRMC permit, NH Utility Notification) or projects with a sediment & erosion control plan (local town requirement or for exempt maintenance work), a copy of the permit and any applicable plan will be emailed to the Project Manager (and the project team where deemed necessary) to be incorporated into the Construction Field Issue.

STORMS work management system input – For STORMS work, no EFI is prepared unless multiple permits are required for the project (see guidance above). If only a MA Order of Conditions, MA Determination of Applicability, RI DEM permit, RI CRMC permit, RI SESC Approval, or NH Utility Notification is required, then the permit is attached in the Documents tab and conditions noted in Remarks/Comments section. Standard STORMS boilerplate language is located in **EI-303NE**.

1.6 Timing of Work

Regulatory authorities may place seasonal or time-of-year restrictions on project construction elements. These time-of-year restrictions may be state or permit-specific, and shall be adhered to.

Work during frozen conditions. Activities conducted once wetland areas are frozen sufficient to minimize rutting and other impacts to the surrounding environment may be authorized by the National Grid Environmental Scientist. Work during this time also generally reduces disturbance of aquatic and terrestrial wildlife movement by avoiding sensitive breeding and nesting seasons. When not using mats for access, vehicles shall not be allowed to drive across wetlands without the prior approval of the National Grid Environmental Scientist.

Work during the regulatory low-flow period. Conducting work during the low-flow period can reduce impacts to surface water and generally avoids spawning and breeding seasons of aquatic organisms. If the water is above normal seasonal levels, adjustments to work activities and methods are required.

1.7 Alternate Access

1.7.1 Manual Access

In some cases such as for smaller projects, work areas can be accessed manually. This includes access on foot through upland and shallow wetland areas, access by boat through open water or ponded areas, and climbing of structures where possible. Smaller projects, such as repair of individual structures, or parts of structures, that do not categorically require the use of heavy machinery, shall be accessed manually to the greatest extent practicable.

1.7.2 Use of Overhead/Aerial Access

Using helicopters can be expensive and is not always feasible, but it may be appropriate in some situations in order to get workers and equipment to a site that otherwise may be very difficult to access. The use of overhead and/or aerial equipment may be beneficial for work in areas where larger water bodies, deep crevices, or mountainous areas hinder ground access. The landing area for helicopters shall be reviewed for environmentally sensitive resources. Use of helicopters requires Project Manager and Senior Management approval.

2.0 Inspection, Monitoring and Maintenance

All construction practices and controls shall be inspected on a regular basis and in accordance with all applicable permits and local, state, and federal regulations to avoid and correct ANY damage to sensitive areas.

The construction crews shall be responsible for completing daily inspections, and IMMEDIATELY bring any **damage or observed erosion, or failed erosion controls** to the attention of the Person-In-Charge and the National Grid Environmental Scientist. Where applicable and/or as directed by environmental permits issued for the project, the Project Environmental Consultant shall conduct weekly (at a minimum) inspections of the project work areas and shall document their inspection using the Stormwater, Wetlands & Priority Habitat Environmental Compliance Site Inspection / Monitoring Report form found in **Appendix 3** and issue the report within 24 hours. The Person-in-Charge shall work with the National Grid Environmental Scientist and the Project Environmental Consultant to determine when and how the repairs shall be made.

Project-specific Action Logs and Long-Term Restoration Logs are prepared as needed by the National Grid Environmental Scientist or the Project Environmental Consultant to track issues and/or repairs and assign responsible parties.

3.0 Best Management Practices

The BMP sections presented in this EG address access, construction, snow and ice management, structures in wetlands, access road maintenance and repair, clean-up and restoration standards, ROW gates, field refueling and maintenance operations, management of spills/releases, and a summary of key construction BMPs.

Note that BMPs shown on any permit drawings for a specific project may need to be revised and or supplemented during the execution of a project based on unforeseen or unexpected factors such as extreme weather or unknown subsurface conditions. It is the responsibility of the Contractor to work with the National Grid Environmental Scientist and/or the Project Environmental Consultant to identify necessary changes and to ensure that construction-related impacts to wetlands, water bodies and other environmentally sensitive areas are avoided.

Any deviation from the approved BMPs shown in the EFI and/or SWPPP plans shall be communicated immediately to the National Grid Environmental Scientist as it may require additional permitting or could result in a permit violation.

3.1 Wetland Boundary Demarcation

Prior to the start of any activity conducted under an environmental permit, wetland boundaries shall be reviewed. Flagging for wetland boundaries, stream banks and other resource areas shall be refreshed as needed. This may become particularly important when the original flagging was placed in previous seasons and now may have become obscured.

3.2 Sedimentation and Erosion Controls

Appropriate sedimentation and erosion control devices shall be installed at work sites, in accordance with permit conditions and/or regulatory approvals, and as needed to prevent adverse impacts to water resources and adjacent properties.

The overall purpose of such controls is to prevent and control the movement of disturbed soil and sediment from work sites to adjacent, undisturbed areas, and particularly to water resources, public roads and adjacent properties. All proprietary controls shall be installed per manufacturer's recommendations and specifications.

Appropriate sedimentation and erosion control devices include but are not limited to: silt fencing, straw bales, wood chip bags, straw wattles, compost socks, erosion control blankets, mulch, slope interruption practices, flocculent powder/blocks and storm drain/catch basin inlet protection. Such controls shall be installed between the work area and environmentally sensitive areas such as wetlands, streams, drainage courses, roads and adjacent property when work activities shall disturb soils and result in a potential for causing sedimentation and erosion.

In Massachusetts, use of monofilament-encased wattles shall be avoided in mapped Priority Habitat for snakes and amphibians. For projects with work within mapped Priority Habitat for snakes and amphibians, wattles that are encased in a sock, hemp, fiber, or movable jute netting are required to prevent entrapment. Also, "wildlife gaps" should occur every 50 feet, if possible, given wetland permit conditions. This spacing of the wattles allows snakes and amphibians to move across the ROW. Refer to the Amphibian and Reptile BMPs in **Appendix 4**.

Staked straw bales often serve as the demarcation of the limits of work and/or sensitive areas to be avoided. Work shall never be conducted outside the limit of erosion controls without prior approval from the National Grid Environmental Scientist.

Project plans depict proposed erosion controls, however field conditions may warrant additional practices be implemented (e.g., wet conditions, frozen conditions, poorly drained soils, steep slopes, materials used for work pads, transition areas to construction mats, number of trips across work areas, etc.).

Any deviation from the approved erosion controls shown in the EFI and/or SWPPP plans needs to be communicated immediately to the National Grid Environmental Scientist as it may require additional permitting or result in a permit violation.

Appendix 4 provides typical sketches of common sedimentation and erosion controls. If a SWPPP is required for the project, maintenance and inspection of erosion controls shall follow the SWPPP requirements. Sedimentation and erosion controls shall be properly maintained and inspected on a periodic basis, until work sites are properly stabilized and restored. Inspections shall be documented using the Inspection Form "Storm Water, Wetlands & Priority Habitat Environmental Compliance Site Inspection/Monitoring Report" (**Appendix 3**).

The sequence and timing of the installation of sedimentation and erosion control measures is critical to their success. Sedimentation and erosion controls shall be installed prior to commencing construction activities that may result in any soil disturbance or cause otherwise polluted site runoff. Inspection of these devices may be required by the National Grid Environmental Scientist or by regulators prior to the start of work. The installation of water bars and other erosion control measures shall be installed shortly thereafter.

3.3 Concrete Wash Outs

Concrete wash outs shall be used for management of concrete waste. Concrete and concrete washout water shall not be deposited or discharged directly on the ground, in wetlands or waterbodies, or in catch basins or other drainage structures. Where possible, concrete washouts shall be located away from wetlands or other sensitive areas. Consult the National Grid Environmental Scientist on proposed concrete wash out locations prior to their use. Following the completion of concrete pouring operations, the wash outs shall be disposed of off-site with other construction debris. Refer to BMPs in **Appendix 4**.

3.4 Construction Activities in Standing Water

The use of silt curtains or turbidity barriers may be required when working in or adjacent to standing water such as ponds, reservoirs, low flowing rivers/streams, or coastal areas. Silt curtains and turbidity barriers prevent sediment from migrating beyond the immediate work area into the resource areas.

Coffer dams constructed using sheet piling or large sandbags (Trade names such as "the Big Bag" or "DamItDams") may be used to temporarily isolate and contain a work area in standing water.

When working in standing water, an oil absorbent boom, in addition to a silt curtain or other temporary barrier, shall be placed around the work area for spill prevention.

Work in drinking water reservoirs or other waters may require extensive regulatory agency review, even for maintenance work, which could result in additional time required for permitting, review and material procurement prior to the start of work.

3.5 Dewatering

Where excavations require the need for dewatering of groundwater or accumulated stormwater, the water shall be treated before discharge. Appropriate controls include dewatering basins, flocculent blocks, filter bags, filter socks, or weir tanks. Schematics of these BMPs are included in **Appendix 4**. Water trucks or fractionation tanks may be utilized if watertight containers are desired for controlled on-site discharge or for off-site discharge into an approved dewatering area when site restrictions make it difficult to utilize other dewatering methods on-site. Dewatering discharge water shall never be directed into wetlands, streams/rivers, other sensitive resource areas, catch basins, other stormwater devices, or substation Trenwa trenches. Dewatering flow shall be controlled so that it does not cause scouring or erosion through the use of a dewatering basin, filter sock, or equivalent. If it is determined that the chosen controls are not appropriately filtering the fine sediment from the dewatering pumpate then the National Grid Environmental Scientist shall be notified immediately and the controls shall be revised or supplemented.

When establishing a dewatering basin, consideration should be given to the anticipated volume of water and rate of pumping in determining the size of the dewatering basin. Dewatering basins shall be constructed on level ground. Once pumping commences, the basin shall be monitored frequently to assure that the rate of water delivery to the structure is low enough to prevent water from flowing, unfiltered, over the top of the basin walls. The basin shall be monitored throughout the dewatering process because the rate of filtration shall decrease as sediment clogs the filter fabric. If the basin is not appropriately filtering the fine sediment from the dewatering pumpate then the basin may need to be supplemented with a flocculent block. Field conditions shall dictate how often the basin should be inspected.

Distance to sensitive areas, direction of flow (toward or away from protected, or sensitive areas, such as wetlands, ponds, or streams), amount of vegetative ground cover between the basin and nearby sensitive areas, ground conditions (ledge, frozen, etc.), volume of water being pumped, and pump-rate, are some of the factors to be considered when determining an inspection frequency. Clogged filter fabric shall be replaced and accumulated sediment shall be removed as necessary from the basins to maintain efficacy.

Any new dewatering location (not previously reviewed and approved by the National Grid Environmental Scientist during project planning or permitting) shall be reviewed and the discharge location approved by the National Grid Environmental Scientist before use.

Complex projects that require large scale dewatering shall require individual review by the National Grid Environmental Scientist and may trigger additional permitting.

Dewatering in areas of known chemical contamination may require a separate NPDES permit, or other approval, and treatment or containment system. Consult with the National Grid Environmental Scientist.

3.5.1 Overnight Dewatering

Some projects may necessitate 24-hour dewatering for on-site construction activities. Overnight dewatering will be evaluated on a case-by-case basis by the National Grid Environmental Department.

If it is necessary to conduct overnight dewatering on a project, a dewatering plan must be submitted to the Environmental Department for review and approval **5 business days prior to beginning dewatering activities**. Sufficient knowledge of flow, discharge, and re-infiltration rate of water must be obtained and submitted for review. The Environmental Department

may require monitored dewatering for a period of time in order to provide this data in support of a request for 24-hour dewatering. The dewatering plan must include at a minimum:
1. Location of dewatering system, system components (basin, frac tank, etc), and materials.
2. Location of discharge and distance from closest wetland.
3. Location of erosion controls. A secondary perimeter of erosion controls will be required around the dewatering system for overnight dewatering.
4. Peak flow, discharge rate and re-infiltration rates.
5. Visual monitoring plan for discharge. Expected duration of dewatering.
6. Emergency provisions if overnight, unattended dewatering is proposed.

3.5.2 Dewatering Clean Up/Restoration

Basins shall be cleaned and removed as soon as dewatering is complete. Sediment removed from the dewatering basin shall be allowed to dry before being disposed of by evenly spreading it over unvegetated upland areas where erosion is not a concern if clean or removing it from the site for proper disposal. Off-site trucking of wet soils is prohibited. The sediment disposal area shall be approved by the National Grid Environmental Scientist or the Project Environmental Consultant prior to use. Stabilization measures shall also need to implemented and approved by the National Grid Environmental Scientist or the Project Environmental Consultant. Soils/sediments shall be dewatered and dried to the point practicable for either on-Site reuse or off-Site transport.

3.6 Check Dams

Check dams are a porous physical barrier installed perpendicular to concentrated storm water flow. They are used to reduce erosion in a swale by reducing runoff energy (velocity), while filtering storm water, thereby aiding in the removal of suspended solids.

Check dams should only be used in small drainage swales that shall not be overtopped by flow once the dams are constructed. These dams should not be placed in streams. Check dams are typically installed in ROWs or on other construction sites prior to the start of soil disturbing work. Per the Rhode Island Soil Erosion and Sediment Control Handbook, no formal design is required for a check dam if the contributing drainage area is 2 acres or less and its intended use is shorter than 6 months; however, the following criteria should be adhered to when specifying check dams.

- The drainage area of the ditch or swale being protected should not exceed 10 acres.
- The maximum height of the check dam should be 2 feet.
- The center of the check dam must be at least 6 inches lower than the outer edges.
- The maximum spacing between the dams should be such that the toe at the upstream dam is at the same elevation as the top of the downstream dam.

Per the NHDES stormwater manual, the use of check dams should be limited to swales with longitudinal slopes that range between 2 to 5 percent that convey drainage from an area less than 1 acre. Existing conditions that exceed these limitations should be assessed in the field and discussed with the National Grid Environmental Scientist to determine the viability of this BMP for the specific application. Check dams are often comprised of stone, straw bales, sand bags, or compost/silt socks. Use of check dams should be coordinated with the National Grid Environmental Scientist to ensure that the material selection, spacing and construction method are appropriate for the site. Check dams composed of biodegradable materials (e.g. straw bales or wattles, wood chip bags) may require periodic replacement for continued proper functioning[1]. Refer to BMPs in **Appendix 4**.

3.7 Water Bars

Water bars should be used on sloping ROWs to divert storm water runoff from unstabilized or active access roads when needed to prevent erosion. Surface disturbance and tire compaction promote gully formation by increasing the concentration and velocity of runoff. Water bars are constructed by forming a ridge or ridge and channel diagonally across the sloping ROW. Each outlet should be stable. The height and side slopes of the ridge and channel are designed to divert water and to allow vehicles to cross. When siting water bars, consideration shall be given to the sensitivity of the area receiving the diverted runoff. For example, runoff should not be directed into a wetland, waterbody, other environmentally sensitive areas, or to private property or public roadways. Refer to BMPs in **Appendix 4**.

3.8 Retaining Walls

In some situations, retaining walls comprised of concrete blocks, gabions, boulders or other comparable materials may be required to stabilize the shoulder of existing access roads and/or supplement required erosion controls. Installation of such measures shall not be allowed as a maintenance activity. Should these controls be considered for a project, it shall be reviewed by the National Grid Environmental Scientist, as design and additional permitting may be required.

3.9 Slope Stabilization

Temporary slope stabilization practices help to keep exposed, erodible soils stabilized while vegetation is becoming established. Acceptable temporary slope stabilization practices may include the use of erosion control blankets, or hydraulic erosion control. Erosion control blankets, often comprised of natural fibers (e.g., jute, straw, coconut, or other degradable materials) are a useful slope stabilization, erosion control and vegetation establishment practice for ditches or steep slopes. Blankets are typically installed after final grading and seeding for temporary or permanent seeding applications. Hydraulic erosion control practices, including Bonded Fiber Matrix or hydroseed with a soil stabilizer (e.g., tackifier and/or mulch) may be an acceptable or desirable alternative form of temporary slope stabilization. For all practices, manufacturer's specifications should be followed for installation depending on slope and other field conditions. Consult the National Grid Environmental Scientist prior to selecting and installing any slope stabilization practices. Refer to BMPs in **Appendix 4**.

[1] Grass growth on a biodegradable type check dam is evidence that the material is decomposing. While this doesn't mean it is no longer functioning, it means it may be in a weakened condition and could potentially fail under high flow velocity. It is acceptable for grass to be growing on a stone check dam.

3.10 Maintenance of Sedimentation and Erosion Controls

Sedimentation and erosion controls shall be maintained in good operational condition during the course of the work. This includes, but is not limited to, replacing straw bales that are no longer in good condition, re-staking straw bales, replacing or re-staking silt fence, and removing accumulated sediment. Remove sediment before it has accumulated to one half the height of any exposed silt fence fabric, straw bales, other filter berm, check dams or water bars. Accumulated sediment shall be removed from sedimentation basins to maintain their efficacy. Manage the removed sediment by evenly spreading it over unvegetated upland areas where erosion is not a concern, by stockpiling and stabilizing, or by disposing of off-site. Stabilization measures shall also need to be implemented and approved by the National Grid Environmental Scientist or the Project Environmental Consultant. Where a SWPPP has been prepared for a specific site, the guidelines documented therein shall govern the management of sediment.

4.0 Right-of-Way (ROW) Access

Whenever possible, access shall be gained along existing access routes or roads within the ROW. However, in some cases there is no existing access. In many cases, temporary access can be utilized. The following practices provide general guidance on accessing a ROW. Check with a National Grid Environmental Scientist to determine if any environmental permitting is required before utilizing a temporary access.

Note that the building of new roads or enlargement of existing roads is **prohibited** unless this activity is allowed by a project-specific permit, and the new roads appear on the Site Plans that were authorized in the regulatory approvals.

4.1 Off-ROW Access

Off-ROW access shall be evaluated for wetlands, rare species, cultural resources and other potential sensitive receptors, as applicable. National Grid Real Estate and Stakeholder Relations shall also be contacted as soon as possible once off-ROW access is determined to be needed.

4.2 Stabilized Construction Entrance/Exit for Access to ROWs from Public or Private Roads

A suitable (minimum 15-foot wide by 50-foot long) construction entrance/exit shall be installed at the intersection of the ROW access road/route with public/private paved roads, or other such locations where equipment could track mud or soil onto paved roads. The construction entrance/exit should be comprised of clean stone installed over a geotextile fabric. Geotextile fabric may be omitted for permanent construction entrances/exits on a case-by-case basis with the approval of the National Grid Environmental Scientist. Refer to BMPs in **Appendix 4**.

Construction entrance areas shall be monitored and maintained to ensure that stone or other material is not deposited onto the roadway, causing a safety concern. Where track-out of sediment has occurred onto a roadway, it shall be swept off the road by the end of that same work day.

If a construction entrance/exit is clogged with sediment and no longer functions, the sediment and stone may require removal and replacement with additional clean stone (clean stone refreshment) to ensure this tracking pad is performing its intended function adequately. Heavier traffic use may require this clean stone refreshment multiple times throughout a project. Reinforcement of these stabilized construction entrance/exits with asphalt binder or asphalt millings is not likely to be considered "maintenance" and may trigger additional permitting requirements[2]. In some cases, heavily used construction entrances/exits may benefit from the installation of a 5-15 foot strip of asphalt binder or asphalt millings closest to the paved roadway to capture any stone that is tracked from the stone apron. Such cases shall be evaluated on an individual basis with the National Grid Environmental Scientist.

Once work is complete, the construction entrance/exit shall either be removed or retained, depending upon future maintenance-related access needs, property ownership, and/or project-specific approvals. If removed, the area shall be graded, seeded (if adequate root and seed stock are absent) and mulched. Proper approvals for leaving access roads in place shall be obtained; contact the National Grid Environmental Scientist and Property Legal.

4.3 Maintenance of Existing Access Roads

In many cases, the existing access road may need to be maintained to allow passage of the heavy equipment required for scheduled maintenance work. Access roads cannot deviate from the approved and permitted access plans. Maintenance of these roads may include adding clean gravel or clean crushed stone to fill depressions and eroded areas. This activity shall be conducted only within the width of the existing access road footprint and does not include widening existing access roads

If gravel begins to migrate onto the existing vegetated road shoulder, this gravel shall be removed during the project and/or after the completion of use of the road to ensure the road fill is not spreading into adjacent resource areas, or resulting in the road becoming much wider than its pre-existing or permitted condition. In some areas of mapped rare species habitat or other sensitive areas where project-specific permit conditions require the prevention of the migration of sediments into adjacent resources, an engineered stabilization system (e.g., GeoWeb or similar) may be suitable to prevent sedimentation while allowing for unrestricted wildlife migration.

In Massachusetts, any proposed widening of access roads in turtle Priority Habitat would require individual consultation with NHESP and, depending on the level of impact proposed, may require a Project Review filing. The limited filling of ruts or potholes is compatible with the National Grid Operation and Maintenance Plan approved by NHESP under the Massachusetts Endangered Species Act, however, severely rutted access roads in turtle Priority Habitat that require extensive linear feet of stone for safe passage will require individual consultation with NHESP.

[2] Depending on the road, use of an asphalt binder or asphalt millings as a construction entrance/exit may trigger state or local permit requirements.

Major reconstruction projects may require multiple permits. In all cases, the fill to be used for existing access roads shall be clean and free of construction debris, trash or woody debris. Use of processed gravel may be approved by the Person-In-Charge and the National Grid Environmental Scientist, on a case-by-case basis. If clean stone is used then addition of more erosion controls may not be necessary.

4.5 Maintenance of Existing Culverts

Damaged culverts may not be repaired or replaced without consulting with the National Grid Environmental Scientist to determine if a permit is required. For functioning culverts, care shall be taken to protect adjacent wetlands and watercourses by installing appropriate sedimentation and erosion controls around the downstream end of the culvert. Culverts shall be repaired/replaced in kind and shall not be changed in size unless approval has been obtained from the National Grid Environmental Scientist. In-kind replacement is replacement using the same material, functional inverts, diameter and length as the existing culvert. Changes to any of these characteristics shall require permitting. Installation of any **new** culvert is not allowed without obtaining all necessary permits first. Refer to BMPs in **Appendix 4**.

If, at the time of anticipated replacement, there is heavy flow through the culvert, the Person-In-Charge shall consult with the National Grid Environmental Scientist, to verify whether the culvert shall be replaced at that time. Water may need to be temporarily diverted during culvert repair/replacement. There typically are seasonal restrictions limiting both the replacement of existing culverts as well as installation of new culverts to the low-flow period. The low-flow period can vary from state to state. If any unexpected conditions are encountered during culvert replacement, the National Grid Environmental Scientist shall be contacted immediately prior to the work being completed for additional consultation.

4.6 Temporary Construction Access over Drainage Ditch or Swale

In some situations, construction access from paved roads onto ROWs may require the crossing of drainage ditches or swales along the road shoulder. In these situations, the installation of construction mats, mat bridges or temporary culverts may facilitate construction access over the ditches or swales. These culverts shall be temporary only, sized for peak flow, and shall be removed after construction is complete. Consult with the National Grid Environmental Scientist prior to installation. In addition, if access over existing culverts may require extending the culvert, consult with the National Grid Environmental Scientist. Refer to BMPs in **Appendix 4**.

4.7 Construction Material along ROW

After preparing a site by clearing and/or installing any necessary erosion and sediment controls and prior to the start of construction, material such as poles, cross-arms, cable, insulators, stone and other engineered backfill materials may be placed along the ROW, as part of the project. The stockpiling of stone and other unconsolidated material on construction mats shall be avoided, if determined necessary due to access and work pad constraints, the material must be placed on a geotextile fabric and be properly contained with a sedimentation barrier such as straw wattle. No construction material shall be placed in wetlands or other sensitive resource areas unless authorized by the National Grid Environmental Scientist or Project Environmental Consultant.

5.0 Winter Conditions

5.1 Snow Management

Refer to **Appendix 6** for the current Snow Disposal Guidelines.

5.2 De-Icing

Where allowed, calcium chloride is preferred as a de-icing agent when applied according to manufacturer's guidelines in upland areas. Sand shall be used on construction mats through wetland areas.

Consult with the National Grid Environmental Scientist on de-icing agents when working in a facility or substation close to resource areas. Many municipalities have specific requirements for de-icing agents allowed within 100 feet of wetland resources and other sensitive areas.

5.3 Snow and Ice Management on Construction Mats

Proper snow removal on construction mats shall avoid the formation of ice. To avoid the formation of ice, snow shall be removed from construction mats before applying sand. Prior to their removal from wetlands, sand shall be collected from the construction mats and disposed of in an upland area. A round street sweeping brush mounted on the front of a truck may be an effective way to remove snow from construction mats. Propane heaters may also be suitable solutions for snow removal and/or de-icing of construction mats.

Once construction mats are removed, wetlands shall be inspected for build up of sand that may have fallen through construction mats. Care shall be taken to inspect wetland crossings as each mat is removed to ensure sand is properly removed and disposed of off-site.

6.0 Construction Mats

The use of construction mats allows for heavy equipment access within wetland areas. The use of construction mats minimizes the need to remove vegetation beneath the access way and helps to reduce the degree of soil disturbance and rutting in soft wetland soils. Construction mats most often used by National Grid are wooden timbers bolted together typically into 4-ft by 16-ft sections, wooden lattice mats, or composite mats. In some cases, construction mats or other mats are used for staging or access in upland areas based on site conditions (e.g., agricultural field access). Refer to BMPs in **Appendix 4**.

Typically construction mats may be installed on top of the existing vegetation, however in some instances cutting large woody vegetation may be required. Check with National Grid Environmental Scientist prior to cutting or clearing vegetation for construction mat placement.

Where an extended period of time has lapsed since wetland delineation and start of construction, and new vegetative growth has concealed wetland flagging or flagging is simply no longer obviously visible, wetland boundaries should be re-flagged where necessary prior to the installation of matting.

Follow the approved plans in the EFI for construction mat installation and do not deviate from the plans. **Any deviation from the approved plans needs to be communicated immediately to the National Grid Environmental Scientist as it may require additional permitting, require stopping the project or result in a permit violation or revocation.**

6.1 Construction Mats and Mowing

Close coordination with the mowing contractor shall be required to ensure that access plans are followed, and construction mats are utilized when necessary. Sometimes mowing contractors may have to work off the leading edge of a construction mat to mow in order to lay the next construction mat and continue further into the wetland. Under no circumstances shall trees or shrubs be allowed to be pulled out of the wetland by the root ball. The root ball of trees and shrubs shall remain intact. Chipping debris and excessive amounts of slash shall not be placed in wetlands or other resource areas. In some instances, it may be beneficial to pile a reasonable amount of slash within a nearby upland area to create habitat for wildlife. This activity shall be approved by the National Grid Environmental Scientist.

6.2 Stream Crossings and Stream Bank Stabilization

Stream crossings shall be bridged with construction mats or other temporary minimally-intrusive measures unless fording is acceptable for the site and is authorized by the National Grid Environmental Scientist. Care shall be taken when installing a construction mat bridge to insure that the stream bed and banks are not damaged during installation and removal and that stream flow is not unduly restricted. Where stream width allows, construction mats shall be installed to span the watercourse in its entirety without stringer placement in the water or any restriction of stream flow. Environmental permits may be required to cross or disturb protected waters, depending upon state-specific regulatory requirements. Refer to BMPs in **Appendix 4**. Immediately following construction mat removal, all stream banks shall be stabilized and restored to prevent sedimentation and erosion.

6.3 Cleaning of Construction Mats

Mats shall be certified clean by the vendor prior to installation. The vendor shall use the certification form provided as **Appendix 5** to document compliance. Clean is defined as being free of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials prior to being brought to the project site. Any equipment or timber mats that have been placed or used within areas containing invasive species within the project site shall be cleaned of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials at the site of the invasive species prior to being moved to other areas on the project site to prevent the spread of invasive species from one area to another[3]. **Mats shall be cleaned prior to being removed at the completion of the project: exceptions to this requirement**

[3] On ROW projects where multiple wetlands may be dominated by the same invasive species, cleaning may not be required for movement along the ROW. Check with the National Grid Environmental scientist for guidance.

may be made on a case-by-case basis. Consult with the National Grid Environmental Scientist prior to discharging or disposing of any waste water or waste material from the cleaning of construction mats.

6.4 Stone Removal for Construction Mat Placement

For situations where the matting contractor determines that stones or boulders must be removed or relocated within wetland areas in order to install safe and level structure work pads or access roads the boulders shall be moved in a manner which does not result in significant soil disturbance (i.e., pushing with a bull dozer is not allowed). The boulders shall not be placed on any existing vegetated areas within wetlands or within vernal pools. When numerous boulders shall be removed from a wetland area, they shall be deposited in an upland area outside of the flagged wetland limits, outside of any cultural resource areas and outside of any RTE species populations. Any boulders that shall be placed within buffers (In MA, the 100-foot buffer zone, and in RI, the 50-foot Perimeter Wetland, 100-foot or 200-foot Riverbank Wetlands) shall be placed to avoid causing soil disturbance and they shall be within an approved limit of work. When there is a significant number of boulders that need to be removed, the National Grid Environmental Scientist shall be consulted for guidance.

6.5 Transition onto Mats

Erosion controls and stone or wood chip ramps shall be installed to promote a smooth transition to and minimize sediment tracking onto construction mats. Geotextile may be added beneath stone or wood chip transitions to facilitate removal, as necessitated by site or permit conditions. Mat transitions shall be removed once construction mats have been removed and during restoration. Refer to BMPs in **Appendix 4**.

6.6 Construction Material on Mats

The stockpiling of stone, drill spoils and other unconsolidated material on construction mats shall be avoided unless determined necessary due to access and work pad constraints. Additional controls, such as watertight mud boxes and geotextile/filter fabric over or between construction mats shall be considered for stockpile management. If material is placed on construction mats and falls through into wetlands, the material must be removed by hand. Saturated soils shall be allowed to dewater prior to off-site transport for sufficient time to ensure that water/sediment is not deposited onto construction mats or public roads during transport. Heavy machinery shall not be left overnight on mats located within floodplain unless approved by the National Grid Environmental Scientist, the machinery is still in use, and removal of the equipment requires the use of additional equipment to move it and would increase vehicle trips in/ou of wetlands. In these situations and when approved by the National Grid Environmental Scientist, the equipment shall be secured against vandalism and secondary containment measures shall be employed where feasible. Mat anchoring shall be evaluated, see below.

6.7 Mat Anchoring

The National Grid Environmental Scientist and Project environmental consultant shall indicate to the project team when mat anchoring may or shall be necessary. The matting contractor will propose the method of mat anchoring, which will be approved by the National Grid Environmental Scientist and the

National Grid Construction Supervisor. The need for anchoring should be noted in the project EFI, on the project access and matting plans, and in the scope of the bid document (if externally sourced).

Anchoring of construction mats should be considered when any of the following conditions are presented at a project work location:

Location	Considerations
Stream crossings Shorelines of Ponds/Lakes Wetlands Floodplains	When located in a mapped flood area (A). When mapped 100-year flood elevations (AE) are greater than 2 ft above existing grades. Where past flash flood events have occurred. Where steep terrain is present or surrounds the project location. When mats will be in place during hurricane season for greater than 2 weeks.
Tidal areas	When located in a Velocity (V or VE) Zone. When mats will be in place during a moon tide cycle. When mats will be in place during hurricane season for greater than 2 weeks.

Examples of mat anchoring are provided below, but the implementation methods for anchoring mats are not limited to these examples. Where anchoring is determined to be necessary, the matting contractor should propose a method suitable based on field conditions and that takes crew safety, slip/trip/fall hazards, size of matting footprint, and other project and site-specific factors into consideration. Refer to BMPs in **Appendix 4**.

Limited sets of mats

- Cable or rope in chain pockets and run linearly, or
- Linear ropes anchored using helical screws, manta ray anchors, or posts.

Larger sets of mats or those without chain pockets

- Chain link fence posts or other posts driven in along mat edge every 3-4 feet and ropes then laced across mats between opposing posts before storm event, or
- Anchor bolts added to mats, then cable is laced between bolts and tied to helical or manta ray anchor.

6.8 Corduroy Roads

Corduroy roads are a wetland crossing method where logs are cut from the immediate area and used as a road bed to prevent rutting from equipment crossing. This technique is designed to be used in areas of wetland crossings where there is no defined channel or stream flow and should never be used in streams. Corduroy logs shall be placed in the narrowest area practicable for crossing with the logs placed perpendicular to the direction of travel across wet area. The use of corduroy logs shall only be in emergencies when approved by the National Grid Environmental Scientist or when they have been specifically permitted as part of a project. Refer to BMPs in **Appendix 4**.

6.9 Construction Mat Removal

Once construction mats are removed, wetlands shall be inspected for build up of sand or other materials that may have fallen through construction mats. Care shall be taken to inspect wetland crossings as each mat is removed to ensure any materials are properly removed and disposed of off-site.

6.10 Utility Air Bridging

In ROWs where other utility facilities (including but not limited to gas, oil, fiber optic, electric, water, and sewer) are co-located within the transmission ROW, bridging may be required to cross those facilities. The project team shall coordinate with the respective utility company prior to determining if bridging or permanent crossings are required.

7.0 LGP Equipment Use

Only when approved by the National Grid Environmental Scientist on a case-by-case basis shall equipment with a LGP **psi that meets the state-specific USACE General Permit requirement when loaded** be allowed to access through wetlands. Refer to the state-specific General Permit for the definition of LGP in each state at: http://www.nae.usace.army.mil/Missions/Regulatory/State-General-Permits/, or to the summary table provided below. The National Grid Environmental Scientist's approval of the use of LGP equipment through wetlands depends on several criteria including:

- Time of year. LGP equipment use may be allowed if weather and field conditions at the time of construction are suitable to eliminate/minimize the concern of rutting or other impacts. Frozen, frozen snow pack, low flow, drought conditions, or unsaturated surface soil conditions are typically acceptable conditions. Spring and fall construction, due to the typical higher precipitation, are not suitable times of year for LGP equipment use.
- Number of trips. Multiple trips through a wetland have shown to increase the potential for damage and require matting. LGP equipment use shall likely only be approved if trips are limited to one trip in and one trip out.
- Type of wetland system. Some wetlands have harder soils/substrate, and may be passable without causing significant damage. Some of the wetlands along National Grid ROWs have existing hard bottom roads that have been vegetated over time and may be traversed with LGP equipment without construction mats.
- Emergencies. LGP equipment use may be allowed during emergency or storm conditions for outage restoration.
- State-specific USACE General Permit Performance Standards. The standard is for no impact to the wetland, which may be obtained by using LGP equipment **when loaded**). "*Where construction requires heavy equipment operation in wetlands, the equipment shall either have low ground*

pressure (as specified in the USACE GP), or shall not be located directly on wetland soils and vegetation; it shall be placed on construction mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation."

- Local bylaws. Municipal wetland bylaws, where applicable, shall be reviewed for prohibitive conditions or applicable performance standards.

LGP equipment is prohibited in the following resources areas:

- Stream crossings
- State listed-species habitat
- Outstanding Resource Waters (ORWs)
- Vernal pools
- Archaeological sensitive areas

Where LGP equipment use is desired in lieu of construction mats, the construction supervisor should identify these areas on marked-up access plans. A site visit with the Project Environmental Monitor should be scheduled to assess if the proposed locations are potential candidates. The Project Environmental Monitor will document potentially suitable locations and dismiss others as unsuitable.

ACOE New England District General Permit Requirements

State	Restrictions	Maximum PSI (when loaded) for Use without Mats	Reference
MA	*One of the following must apply:* Equipment operated within wetlands shall: a) Have low ground pressure; b) Be placed on timber mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation; or c) Equipment must be operated on adequately dry or frozen conditions such that shear pressure does not cause subsidence of the wetlands immediately beneath equipment and upheaval of adjacent wetlands.	3 psi	MA General Permit, General Condition 13
NH	*One of the following must apply:* Equipment operated within wetlands shall: a) Have low ground pressure; b) Be placed on timber mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation; or c) Be operated on frozen wetlands.	4 psi	NH General Permit, General Condition 17
VT	*One of the following must apply:* Equipment operated within wetlands shall: a) Have low ground pressure; b) Be placed on timber mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation; or c) Be operated on frozen wetlands such that shear pressure does not cause subsidence of the wetlands immediately beneath equipment and upheaval of adjacent wetlands. Note: Written authorization from the Corps required to waive the use of mats during frozen or dry conditions.	3 psi	Vermont General Permit, General Condition 14
RI	*One of the following must apply:* Equipment operated within wetlands shall: a) Have low ground pressure; b) Be placed on timber mats that are adequate to support the equipment in such a way as to minimize disturbance of wetland soil and vegetation; or c) Be operated on frozen wetlands such that shear pressure does not cause subsidence of the wetlands immediately beneath equipment and upheaval of adjacent wetlands.	6 psi	Rhode Island General Permit, General Condition 15

State	Restrictions	Maximum PSI (when loaded) for Use without Mats	Reference
	Note: Written authorization from the Corps required to waive the use of mats during frozen or dry conditions.		

Due to the fact that ground conditions may change between the time of the evaluation and construction, LGP equipment approval is required **at the time of construction for each wetland crossing** and shall be dependent upon the above conditions. In addition, LGP equipment use and approval shall be assessed by the National Grid Environmental Scientist or Project Environmental Monitor during construction on a continuing basis

Once a location is approved for the use of LGP equipment:

- The Construction Supervisor must check-in with the Project Environmental Monitor at least two weeks before construction begins to ensure conditions remain suitable for LGP equipment use, and weather conditions are favorable.
- The Project Environmental Monitor must observe the equipment when in use.
- LGP equipment use shall cease immediately if field conditions are found to be unsuitable (i.e. soil rutting greater than six inches or the destruction of vegetation root systems beyond the capacity of natural revegetation).
- **If wetlands damage occurs, the use of the LGP equipment shall be suspended, and the wetlands be restored.**
- Any LGP equipment used within areas containing invasive species within the project site shall be cleaned of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials at the site of the invasive species prior to being moved to other areas on the project site to prevent the spread of invasive species from one area to another.

8.0 Soil Disturbing Activities

8.1 Dust Control

Cutting activities shall be conducted to minimize the impacts of dust on the surrounding areas. Dust suppression is an important consideration. Water or other National Grid approved equivalent in accordance with the manufacturer’s guidelines may be used for dust control along ROWs in upland areas. During application of water for dust control, care shall be taken to ensure that water does not create run-off or erosion issues. Refer to BMPs in **Appendix 4.**

8.2 Clearing

Clearing is not allowed without specific permission as it constitutes soil disturbance under several regulatory programs and may trigger permitting by increasing the project’s footprint of disturbance. If clearing is required for a project, the limit of clearing shall be established with flagging or construction fencing and/or erosion controls. Clearing shall be done in accordance with project specific permits. Following the completion of clearing, the limits of work shall be re-established. Refer to BMPs in **Appendix 4**.

8.3 Grubbing

Grubbing is not allowed without specific permission as it constitutes soil disturbance under several regulatory programs and likely triggers permitting by increasing the project's footprint of disturbance. If grubbing is required for a project, the limit of grubbing shall be re-established after clearing has been completed. The area of grubbing shall be identified with flagging or construction fencing and/or erosion controls. Grubbing shall be conducted in accordance with project-specific permits.

8.4 Blasting, Noise and Vibration Control

If blasting is anticipated, the project team, including the National Grid Environmental Scientist, shall be consulted. If possible, plan work in residential areas to avoid noisy activities at night, weekends or during evenings. Emergency work in residential areas should be carried out in such a way as to keep noise to a minimum at night and weekends. Equipment should be maintained as per the manufacturer's guidance to minimize noise and vibration.

Work plans must consider local noise ordinances and provide specific controls to ensure noise levels are maintained within specified limitations.

8.5 Site Grading

The work site shall not be graded other than in accordance with project permits. Any proposed grading shall be reviewed by the National Grid Environmental Scientist for wetlands, rare species habitat, areas of cultural and historical significance, and other environmentally sensitive areas prior to start of work. In some cases, additional testing for cultural or historical resources may be triggered by proposed grading; alternatives to grading may be sought due to protracted time frame of obtaining the permit associated with testing and performing the testing. Grading outside of a regulated area shall be kept to the minimum extent necessary for safe and efficient operations and shall comply with the project permit plans.

Grading shall be performed in a manner which does not increase the erosion potential at the Site (e.g., terraces or slope interruptions shall be utilized). Graded sites shall be promptly stabilized by applying a National Grid approved seed mix (if adequate root and seed stock are absent), and mulching with hay, straw or cellulose (use straw or cellulose hydromulch where the potential introduction of invasive plant species is of concern) to reduce erosion and visual impact, as soon as possible following completion of work at the site. Grading within a regulated area shall be subject to the review and approval of the National Grid Environmental Scientist.

In some municipalities, site grading activities require the prior approval of the Town Engineer, Building and Zoning Official, or Public Works Director. Local ordinances or bylaws should be reviewed for applicable restrictions and permitting thresholds

8.6 Grounding Wells

The installation of grounding wells shall require erosion controls and proper soil management. Due to the typical depth required for grounding wells (typically 50 to 200 feet or more), erosion controls shall be installed around the proposed well location when working in buffer zone, in proximity to sensitive resources or near slopes. Also, dewatering basins may be required for the proper management of groundwater. The National Grid Environmental Scientist shall be consulted for the disposal of any excess soil.

8.7 Counterpoise and Cathodic Protection

The installation of counterpoise or cathodic protection shall require erosion controls and proper soil management. The National Grid Environmental Scientist shall be consulted for the disposal of any excess soil.

8.8 Work Pads

When work pads are being constructed, only clean material shall be used in their construction. Work pads shall only be constructed in areas approved by the National Grid Environmental Scientist and shown on the approved permit access plans.

8.9 Site Staging and Parking

During the project planning and permitting process, locations shall be identified for designated crew parking areas, material storage, and staging areas. Where possible, these areas should be located outside of buffer zones, watershed protection areas, and other environmentally sensitive areas. Any proposed locations shall be evaluated for all sensitive receptors and for new projects requiring permitting, shall be incorporated onto permitting and access plans.

8.10 Soil Stockpiling

Soil stockpiles shall be located in upland areas and, if in close proximity to wetlands and wetland buffers, shall be enclosed by staked straw bales or another erosion control barrier. The stockpiling of stone, drill spoils and other unconsolidated material on construction mats shall be avoided unless determined necessary due to access and work pad constraints. Additional controls, such as watertight mud boxes and geotextile/filter fabric over or between construction mats shall be considered for stockpile management. If material is placed on construction mats and falls through into wetlands, the material must be removed by hand. Saturated soils shall be allowed to dewater prior to off-site transport for sufficient time to ensure that water/sediment is not deposited onto construction mats or public roads during transport.

8.11 Top Soil/High Organic Content Soil

When the work site requires excavation and grading, the top soil shall be stockpiled separately from the material excavated. This top soil shall be spread as a top dressing over the disturbed area during restoration of the site.

In some instances where work is occurring within wetlands, high organic content soil may be displaced. Such high organic content soil shall be segregated from other excavated materials and stockpiled for use in wetland restoration areas. Care shall be taken to minimize the handling of high organic content soil. Preferably, the soil shall be stockpiled in one location until it is moved to the restoration area.

9.0 Stone Wall Dismantling and Re-building

Removal or alteration of stonewalls shall be avoided, whenever possible. As appropriate, some stonewalls removed or breached by construction activities shall be repaired or rebuilt. Rebuilt stone walls shall be placed on the same alignment that existed prior to temporary removal, to the extent that it shall not interfere with operations. The removal and rebuilding of stone walls requires approval from the National Grid Environmental Scientist and Property Legal, and may require several weeks lead time for coordination. Note that not all states allow this technique and that dismantling may not be allowed at all due to quality or significance of the wall. Once a stone wall has been identified as requiring dismantling, the following procedures shall be followed:

- Identify stone wall that is required to be temporarily dismantled and notify project team that a site visit is warranted to review the stone wall.
- The National Grid Environmental Scientist, with support from Property Legal and/or cultural/historical consultant, shall determine if permitting or additional permissions are required prior to dismantling stone wall.
- Once permit or permissions have been received, full documentation of wall dimensions (measurements and photographs) shall be submitted to the National Grid Environmental Scientist. Documentation of the wall dimensions shall be marked onto a copy of the applicable EFI access plan (or equivalent plan) with a useful reference for future locating such as GPS coordinates and/or measurement from a permanent reference point (closest structure location or closest cross street, etc.). The wall shall be photographed from all sides with a written description of the photograph (i.e. southern side of wall looking north). In addition, documentation of the length of wall to be dismantled shall be recorded. Take special care to note if granite property bounds (or other marker) are located within the wall so additional survey can be accomplished prior to dismantling in cases where the stone wall represents a property boundary. Site visits by project team (which shall include the National Grid Environmental Scientist) are a mandatory requirement prior to dismantling.
- No dismantling shall take place until documentation has been submitted to the National Grid Environmental Scientist and approved as sufficient documentation.
- Stones from the wall shall be removed from the work area and temporarily stored in nearby location, away from wetlands; buffer zones; rare species habitat and other historical/archeological concerns.
- Avoid dismantling via the “bulldozer” method when possible as this method makes it nearly impossible to rebuild the wall in the same alignment due to its uncontrolled nature. Dismantling shall be conducted either by hand, with stones stacked as they are removed, or on less “sensitive” walls to use an excavator with a thumb to grab each stone and build a stockpile. Significant ground disturbance below the wall shall be avoided.

- Once construction and access in the area has been completed, the wall shall be rebuilt to pre-dismantled conditions or better. If rebuilding a stone wall can not be placed on the same alignment that existed prior to temporary removal, approval from the National Grid Environmental Scientist and Property Legal is required. **Note that if the wall represents a legal property boundary or is historically or culturally significant (or was previously determined to be in a very high quality condition), a professional stone masonry company may be required to document wall alignment, and conduct the dismantling and rebuilding.**

10.0 Avian Nest Removal

Avian nest removal shall be done in accordance with EG-304. Consult the National Grid Environmental Scientist prior to removing any nests. There are seasonal restrictions of the removal of avian nests and federal or state permits may be necessary prior to removal.

11.0 Drilling Fluids and Additives

When installing subsurface structures, there may be a need to utilize drilling aids such as slurries, borehole sealants, and other additives. All necessary steps shall be taken by National Grid personnel and contractors to prevent potential adverse effects on drinking water aquifers, groundwater quality, and wetlands when utilizing drilling aids. Efforts should be made to utilize natural bentonite clay-type materials, in place of polymer-based drilling aids. Regardless of the specific product type, the following requirements shall be met:

- Drilling aids must be NSF certified and manufactured to NSF-ANSI 60 standards. https://www.nsf.org/newsroom_pdf/NSF-ANSI_60_watemarked.pdf
- Product use must be in accordance with manufacturer's specifications and instructions.
- National Grid personnel or their contractor shall provide all the necessary information regarding the proposed product to be used to National Grid's Environmental Sustainability, Compliance and Licensing & Permitting Department as early as possible in the project planning phase. If the work is being performed by a contractor, this information must be included as part of their initial bid package.
- If polymer-based products are proposed for use, product information shall be included in all related environmental regulatory filings and frac-out plans, if possible.
- A qualified individual shall be designated who will confirm/verify and document the specific use of a drilling aid at each location. This will include add-mix ratios, surface area treated, volume of water within excavation, volumes/weight of additives used, and any other measurements specified by the manufacturer. No mixing will be allowed in the drilled shaft excavation.
- The Contractor or National Grid crew performing the work is responsible for neutralizing all drilling products, as applicable, in accordance with the manufacturer's specifications. This shall be performed following removal from the excavation and while held in holding tanks. A

qualified person shall be designated by the Contractor who will confirm/verify and document the appropriate neutralization activity at each location, as necessary.

- Waste drilling aids (neutralized or not) or soils that may have come into contact with drilling aids will not be disposed of on National Grid properties, discharged to any ground surface or subsurface, waterbodies, wetlands or placed on 3rd party properties.
- All product use must be completed in strict adherence with the management, storage, mixing, transporting, disposing and any other requirements of state and federal regulatory approvals and permits, as applicable.
- Relevant documentation shall be maintained by the Contractor or National Grid crew performing the work, and shall include volume of material treated and disposed and the location/facility at which it was disposed.
- National Grid will not be identified as the disposal generator for any polymer based slurry waste or additives generated by Contractor activities.
- The Contractor or National Grid crew performing the work assumes full responsibility for the safe storage of all polymers and additives during use and also assumes full responsibility for improper use and application of said polymers and additives that are deemed to have contravened aquifer and/or groundwater quality.
- National Grid reserves the right to refuse and terminate the use of any specific drilling aid at any time.

Regardless of the type of drilling aid utilized, the Contractor or National Grid crew performing the work is responsible for properly treating, containerizing, testing, transporting and disposing of any/all fluids and solids generated during their activities. All wastes must be disposed of in accordance with federal and state regulations. Relevant documentation shall be maintained and shall include volume of material treated and disposed and the location/facility at which it was disposed.

12.0 Water Withdrawal for Geotechnical Investigations

The use of water during geotechnical drilling operations may be required, and is most common during the “drive and wash” drilling technique, where 4- or 6-inch diameter casing is driven into the ground, and the soil inside the casing is washed out using a pump and hollow rods. Soil samples are generally collected at periodic intervals using a split spoon sampler (e.g., every 5 vertical feet).

The National Grid Environmental Scientist and/or Project Environmental Monitor may approve withdrawals from wetlands and waterways on a case-by-case basis should the geotechnical team advise no other options are available. Generally, the amount of water required for withdrawal is between 100 and 200 gallons, and the water is then recycled continuously in the drilling process. Certain scenarios may require additional water usage if water is lost down the boring (e.g., lost due to bedrock fractures during rock coring). The following general guidance should be adhered to when determining whether water withdrawals may be allowed during geotechnical investigations on the ROW. Approval from the National Grid Environmental Scientist and/or Project Environmental Monitor is required prior to initiating water withdrawals during geotechnical investigations.

- Withdrawals from perennial streams, ponds, lakes and large wetlands systems are preferred over small isolated wetlands to ensure the water level, water table, and hydroperiod are not affected. Prior to start of work, the Contractor shall identify which water source they prefer to withdraw from. The National Grid Environmental Scientist and/or the Project Environmental Monitor will confirm whether these sources are appropriate.
- Care should be taken to avoid alteration of wetlands or the beds and banks of surface waters. Examples of alterations include, but are not limited to, the following:
  - (a) the changing of pre-existing drainage characteristics, flushing characteristics, salinity distribution, sedimentation patterns, flow patterns and flood retention areas;
  - (b) the lowering of the water level or water table;
  - (c) the destruction of vegetation; and
  - (d) the changing of water temperature, biochemical oxygen demand (BOD), and other physical, biological or chemical characteristics of receiving waters.
- Wetlands and waterways providing habitat for rare species should be avoided unless all other options are exhausted. Under no circumstances should water be withdrawn from a Vernal Pool.
- Withdrawal pipes or stingers should be elevated off the bottom of wetlands and streams during the duration of pumping. Additionally, fabric or screening should be covering the withdrawal pipes to eliminate inadvertent harm to wildlife.
- Withdrawals should be performed in a manner that does not damage vegetation, disturb sediment, or result in the release of temporary or permanent fill material (e.g., sediment, spoils, or turbid water) into the wetland/waterway. Additional detail from geotechnical experts may be required to solidify BMP recommendations.
- Any water used for geotechnical drilling operations (including water withdrawn from surface water, brought on-site, or from other sources) shall be discharged into the open borehole or to an upland area such that the water infiltrates to the ground and is not discharged to a wetland or surface water resource area. Consultation with the National Grid Environmental Scientist and/or the Project Environmental Monitor is required if this is not feasible. At no time should water withdrawals result in a temporary or permanent fill/discharge of material (e.g. sediment, spoils, or turbid water) into the wetland or waterway.
- If water sourcing options is not determined prior to mobilization, necessary water shall be brought in by tank truck. Should withdrawal from surface water sources become necessary during soil boring work, the National Grid Environmental Scientist and/or the Project Environmental Monitor shall be notified prior to beginning withdrawal. If initial withdrawal from surface water is approved by the National Grid Environmental Scientist and/or the Project Environmental Monitor, the driller may withdraw from the surface water, as long as the above criteria are met.
- If excessive water withdrawal is necessary, the National Grid Environmental Scientist and/or the Project Environmental Monitor shall be consulted to determine whether the water source is appropriate for withdrawal.
- In New Hampshire, withdrawals made from state-owned property require written permission from

the agency with primary responsibility for monitoring and/or maintaining the site.

13.0 Gates

When not in use, gates shall be locked with a company-approved lock or double locked with the property owner's lock. New gates may be installed during a project, however, installation of a gate requires permission from the property owner, and may require environmental permitting. Consult with National Grid Real Estate and the National Grid Environmental Scientist prior to installing a new gate, as well as with the appropriate engineering department for the current company gate specifications. Refer to BMPs in **Appendix 4**. Installation of ROW access restrictions (e.g., stone, bollards, other) at road crossings also require consultation with the National Grid Environmental Scientist and Property Legal.

14.0 Signage

Specific signage may be required by permits or be specified in the EFI to limit access in certain sensitive areas. Signs shall be used to clarify allowed access and sensitive areas, such as:

- "No snow stockpiling beyond this point";
- "Approved access (to structures A-F)";
- "Do not cross this area until construction mats are in place";
- "No vehicle crossing";
- "Areas to avoid"; and
- "Environmentally Sensitive Area – Keep Out."

Signs shall be used in conjunction with snow fencing or other physical barriers as demarcation for sensitive areas (e.g., rare species areas, sensitive archeological locations, etc.) that need to be protected and avoided by construction activities. In addition, permit signs required by the regulatory agencies shall be present (i.e. MADEP, RIDEM, EPA (SWPPP), ACOE, etc) at construction sites and/or ROW access points. Construction signage shall be installed and maintained by the contractor performing the work during the project. Absence of signage does not eliminate the need to comply with access plans, permit conditions, and other regulatory requirements. Refer to BMPs in **Appendix 4**.

15.0 Refueling and Maintenance Operations

15.1 Spill Prevention and Response Plan

Spill controls shall be provided on every field vehicle. Bulk storage of fuels (55 gallons or greater) shall be approved by the National Grid Environmental Scientist prior to being brought on site. The need for a field spill plan shall be evaluated specific to the project for regulatory requirements under SPCC regulations or local ordinances. A field spill plan would include information on fuels and oils being used, approximate amounts in each container or type of equipment, location, fueling location, secondary containment, response and notification procedures, including contact phone numbers, etc. All personnel shall be briefed on spill prevention and response prior to the commencement of construction. The state-specific EI-501 and EG-502 shall be followed in the event of a spill.

Typical construction activities do not require the use or storage of large quantities of oil or hazardous materials (i.e., greater than 55 gallons). However, oil and/or hazardous materials (OHM) may be required in limited quantities to support construction or vehicle operations. Best practices shall be followed in the use and storage of OHM which include but are not limited to: storage and refueling greater than 100 feet from resource areas; maintenance of spill response equipment at work locations sufficient to handle incidental releases from operating equipment; general training for on-site personnel for spill clean up response for incidental releases of OHM; and contracting with an on-call spill response contractor that is capable of managing incidental and significant releases of OHM. There may situations that additional precautions shall be required for the storage or use of OHM (i.e., within wellhead protection areas, GA/GAA areas, Zone IIs). Storage of OHM shall be done in accordance with any applicable regulatory requirements.

15.2 Field Refueling

Small equipment such as pumps and generators shall be placed in small swimming pools or on absorbent blankets/pads, to contain any accidental fuel spills. Small swimming pools with absorbent blankets/pads, and/or other secondary containment, shall be used for refueling of fixed equipment in wetlands and should be maintained to prevent accumulation of precipitation.

15.3 Grease, Oil, and Filter Changes

Routine vehicle maintenance shall not be conducted on project sites.

15.4 Other Field Maintenance Operations

When other vehicle or equipment maintenance operations (such as emergency repairs) occur, company personnel or contractors at field locations shall bring vehicles or equipment to an access location a minimum of 100 feet away from environmentally sensitive areas (e.g., wetlands or drinking water sources). A paved area, such as a parking lot or roadway, is a preferred field maintenance location to minimize the possibility of spills or releases to the environment.

Crews shall take all usual and reasonable environmental precautions during repair or maintenance operations. Occasionally, it is infeasible to move the affected vehicle or equipment from an environmentally sensitive area to a suitable access area. When this situation occurs, precautions shall be taken to prevent oil or hazardous material release to the environment. These precautions include (but are not limited to) deployment of portable basins or similar secondary containment devices, use of ground covers, such as plastic tarpaulins, and precautionary placement of floating booms on nearby surface water bodies.

15.5 Tools and Equipment

Cleaning of tools and equipment shall be conducted away from environmentally sensitive areas (such as wetlands, buffer zones or drinking water sources) to the maximum extent possible. A paved area such as a parking lot or roadway is preferred, to minimize the possibility of spill or release to the environment. Crews shall wipe up all minor drips or spills of grease and oil at field locations.

16.0 Stabilization Deadlines for Projects Subject to EPA Construction General Permit

16.1 Deadlines to Initiate Stabilization Activities (Permanent and Temporary)

Soil stabilization measures shall be implemented immediately whenever earth-disturbing activities have permanently or temporarily ceased on any portion of the project. The following are some examples of activities that constitute initiation of stabilization:

- Preparing the soil for vegetative or non-vegetative stabilization;
- Applying mulch or other non-vegetative product to the exposed area;
- Seeding or planting the exposed area;
- Finalizing the arrangements to have stabilization product fully installed in compliance with the deadlines to complete stabilization in Section 15.2 below.

16.2 Deadlines to Complete Stabilization Activities (Permanent and Temporary)

As soon as practicable, but no later than 14 calendar days or 7 calendar days (for areas discharging to a sensitive water) after the initiation of soil stabilization measures commence the following should be completed:

- For vegetative stabilization, all activities necessary to initially seed or plant the area to be stabilized; and
- For non-vegetative stabilization, the installation or application of all such non-vegetative measures.

16.3 Vegetative Stabilization (all except for arid, semi-arid, or on agricultural lands)

- Provide established uniform vegetation (e.g., evenly distributed without large bare areas), which provides 70% or more of the density of coverage that was provided by vegetation prior to commencing earth-disturbing activities. Avoid the use of invasive species as cover.
- For final stabilization, vegetative cover must be perennial; and
- Immediately after seeding or planting a disturbed area to be vegetatively stabilized, a non-vegetative erosion control must be implemented to the area while the vegetation is becoming established. Examples include; mulch and rolled erosion control products.

16.4 Vegetative Stabilization (Agricultural Lands)

- Disturbed areas on land used for agricultural purposes that are restored to their pre-construction agricultural use are not subject to vegetative stabilization standards.

16.5 Non-Vegetative Stabilization

If using non-vegetative controls to stabilize exposed portions of your site, or if you are using such controls to temporarily protect areas that are being vegetatively stabilized, you must provide effective non-vegetative cover to stabilize any such exposed portions of the site. Examples of non-vegetative stabilization techniques include, but are not limited to, rip-rap, gabions, and geotextiles.

17.0 Clean-up and Restoration Standards

The following steps shall be taken once construction has been completed at each location along the ROW or within the project site. The following are minimum guidelines for clean-up and stabilization standards. Please refer to permit conditions for project-specific related standards. Refer to the EFI for applicable permit requirements and to determine if the site needs to be reviewed and approved by the permitting authorities prior to removal of erosion controls.

17.1 Removal of Sedimentation and Erosion Controls

After all work has been satisfactorily completed and vegetation has been re-established to a minimum of 75% cover, and upon approval by the National Grid Environmental Scientist, all non-biodegradable materials (e.g., siltation fencing, straw bale strings, stakes, straw wattle mesh casing, etc.) shall be disposed of properly off-site.

Dependent on permit requirements, sedimentation and erosion controls may not be allowed to be removed until after inspection and approval by one or more permitting authority. In most cases, removed straw bales may be used to mulch disturbed areas. Remaining straw bales that do not block the flow of water may be left in place unless they are required to be removed pursuant to permit conditions. Straw bales that block the flow of water shall be removed.

Prior to project construction being completed, the project team will develop post-construction inspection intervals to ensure timely removal of temporary BMPs. BMPs will be removed when the area is stabilized, which typically occurs when the area has either naturally stabilized (75% cover), or seed and mulch that was installed has achieved 75% cover.

17.2 In-Situ Restoration

Unless otherwise specified in permits or prescribed by the National Grid Environmental Scientist or the Project Environmental Consultant, all disturbed areas, including stream banks, wetlands and access routes, shall be restored following the completion of work. When the work is completed and construction mats have been removed, the National Grid Environmental Scientist or Project Environmental Consultant shall conduct an inspection. Wetlands shall be inspected for build up of sand or other materials that may have fallen through construction mats. Care shall be taken to inspect wetland crossings carefully after construction mat removal to ensure any materials are properly removed and disposed of off-site.

<u>Restoration of Soil Compaction</u>. If rutting or soil compaction following construction mat removal is observed, the area shall be returned to pre-existing conditions, and comparable to the surrounding area, by light hand raking or by back-blading with machinery. Restoration shall be overseen by the Project Environmental Consultant or National Grid Environmental Scientist. Deep ruts (>12”) shall be filled in using available, loose soil from the work area.

Seeding and Mulching. If adequate root and seed stock are absent and have been stripped from the area, graded sites shall be promptly stabilized by applying an approved seed mix and mulching with straw to reduce erosion and visual impact. Seeding and mulching shall be completed as soon as possible following completion of work at the site. For some wetland areas, natural re-vegetation may be more appropriate than seeding disturbed sites. Wetland areas where adequate root and seed stock are absent will be seeded using an approved wetland native seed mix. For some wetland areas, natural re-vegetation may be more appropriate than seeding disturbed sites. Refer to BMPs in **Appendix 4** for seed mix tables and mulch ratio tables.

If needed, the import of quality topsoil onto the ROW will be required. Topsoil should be tested, and approved by the Project Environmental Consultant or National Grid Environmental Scientist to determine its suitability for site conditions. Fertilizers will be approved on a case-by-case basis.

For upland areas, the disturbed vegetation and soil shall be restored and stabilized[4] by regrading the area to pre-existing conditions, if needed, seeding (if adequate root and seed stock are absent) and mulching the exposed soil, and removing strings and stakes from straw bales and using broken up straw bales for the mulch. Siltation fencing, strings and stakes shall be removed for disposal as ordinary waste. Refer to BMPs in **Appendix 4** for seed mix tables and mulch ratio tables.

For sites with excess boulders, additional boulders could be used at proposed and existing gate locations to use on either side of the gates as a deterrent for unauthorized vehicle access or be placed along the edges of work pads where steep slopes are present for safety purposes. The final placement of boulders should be reviewed prior to installation with Real Estate and the National Grid Environmental Scientist or Project Environmental Consultant.

Unless otherwise specified in Project-specific permit conditions, the National Grid Environmental Scientist or Project Environmental Consultant shall develop an inspection frequency to monitor restored areas for stabilization, germination and successful revegetation.

17.3 Invasive Species

All equipment shall be certified clean[5] utilizing the attached form (**Appendix 5**) or equivalent as approved by the vendor prior to mobilization to the work site. The vendor shall use the certification from provided as **Appendix 5** to document compliance with invasive species management BMPs. Clean is defined as being free of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials prior to being brought to the project site. Any equipment that has been placed or used within areas containing invasive species within the project site shall be cleaned of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials at the site of the invasive species prior to being moved to other areas on the project

[4] For projects subject to the 2012 CGP, stabilization is required within 14 days, or within 7 days for sensitive areas.

[5] The **Appendix 5** certification form (or equivalent as approved by National Grid Environmental Scientist) shall be used to document the clean certification

site to prevent the spread of invasive species from one area to another[6]. **Equipment shall be cleaned prior to being removed at the completion of the project: exceptions to this requirement shall be determined on a case-by-case basis.** Consult with the National Grid Environmental Scientist prior to discharging or disposing of any waste water or waste material from the cleaning of equipment.

17.4 Cleaning of Equipment

At the completion of the project, equipment shall be cleaned prior to being de-mobilized to prevent tracking of material onto roads and causing safety issues. Consult with the National Grid Environmental Scientist prior to discharging or disposing of any waste water or waste material from the cleaning of equipment.

17.5 Access Roads

Constructed gravel roads shall be left in place following project completion unless permit conditions require their removal. Refer to the specific permit conditions for these provisions. If the road is to be removed, the crushed stone and geotextile fabric shall be removed from the work site. Seeding and/or mulching of gravel roads is generally not required, unless necessary to prevent erosion. Pre-existing sandy soils within mapped rare turtle habitat shall not be seeded unless directed by the National Grid Environmental Scientist so as to not alter nesting habitat.

17.6 Stone Work Pads

Unless permit conditions or property owner's require the removal of constructed stone work pads following project completion, constructed work pads shall be left in place. Refer to the specific permit conditions for these provisions.

17.7 Construction Materials on ROWs

As soon as the structure work has been completed, all used parts and trash are to be picked up and removed from the project site. Retired poles shall be removed in accordance with National Grid Engineering Standard SP.06.01.301. In some cases, the used material from structure work may be temporarily stored at the work area by placing it out of the wetlands or other sensitive resource area until work in the adjacent areas has been completed. However, treated wood poles shall never be stored in standing water or in wetlands. If the project is cancelled, all material shall be removed from the project site. Excess material brought to the project site shall be removed upon project completion. Consult with the National Grid Environmental Scientist on whether the work site shall be restored in addition to the measures outlined above

17.8 Improved Areas

Yards, lawns, agricultural areas, and other improved areas shall be returned to a condition at least equal to that which existed at the start of the project. Off-ROW access shall never be assumed and shall be coordinated through Real Estate before being implemented. Depending on the access point, construction matting or other BMPs may be required to prevent ruts, lawn damage, or other property damage.

[6] On ROW projects where multiple wetlands may be dominated by the same invasive species, cleaning may not be required for movement along the ROW. Check with the National Grid Environmental Scientist for guidance.

Restoration following the completion of work and any use of improved areas shall be conducted in accordance with the measures outlined above.

17.9 Property Damage

All damage to property occurring as a result of a project shall be immediately repaired or replaced. In some locations, it may be desirable to document pre-existing damage prior to work commencing in that area in order to demonstrate afterwards that the damage did not result from the project. Work crews, the Project Environmental Consultant or the National Grid Environmental Scientist shall document repairs that were performed in response to damage from unauthorized vehicle use.

17.10 Overall Work Site

Upon satisfactory completion of work, the construction personnel shall remove all work-related trailers, buildings, rubbish, waste soil, temporary structures, and unused materials belonging to them or used under their direction during construction, or waste materials from previous construction and maintenance operations. All areas shall be left clean, without any litter or equipment (wire, pole butts, anchors, insulators, cross-arms, cardboard, coffee cups, water bottles, etc.) and restored to a stable condition and as near as possible to its original condition, where feasible. Debris and spent equipment shall be returned to the operating facility or contractor staging area for disposal or recycling (cardboard) as appropriate in accordance with EI-111.

17.11 Material Storage/Staging and Parking Areas

Upon completion of all work, all material storage yards, staging areas, and parking areas shall be completely cleared of all waste and debris. Unless otherwise directed or unless other arrangements have been made with an off ROW or off-property owner, material storage yards and staging areas shall be returned to the condition that existed prior to the installation of the material storage yard or staging area. Regardless of arrangements made with a landowner, all areas shall be restored to their pre-construction condition or better. Also any temporary structures erected by the construction personnel, including fences, shall be removed by the construction personnel and the area restored as near as possible to its original condition, including seeding and mulching as needed.

18.0 Notification of Emergency Work

Because it is sometimes difficult to identify wetlands and other sensitive environmental areas, the National Grid Environmental Scientist shall be notified within 24 hours or by the next working day whenever emergency off-road repair work takes place. Although the routine maintenance and emergency repair work is generally allowed, due to site conditions or the scope of the project, notification to the regulating agencies may be required.

19.0 Appendices

APPENDIX 1: Glossary
APPENDIX 2: Acronyms

APPENDIX 3:	Storm Water, Wetlands & Priority Habitat Environmental Compliance Site Inspection / Monitoring Report Form
APPENDIX 4:	BMP Drawings and Guidelines
APPENDIX 5:	Certification Sheet for Invasive Species Control
APPENDIX 6:	Snow Disposal Guidelines

Appendix 1 – Glossary

Access Road – An existing, periodically maintained road often consisting of gravel and/or exposed soils or vegetated with grasses but devoid of woody vegetation, that is visible on aerial photography and shown on ROW T-sheets. May include newly permitted permanent roads (i.e., roads to be constructed in accordance with a project-specific permit).

Access Route - A pathway previously used or proposed to be used by crews for access along the ROW. Routes may be shown on ROW T-sheets or previous project access plans but are not improved as maintained gravel/exposed soil roads. Access routes may be mown and can consist of trails utilized by recreational vehicles.

Action Logs – Project-specific log used to document action items required for permit compliance. The log identifies timeframes for completion and responsible parties. The log is typically updated by the Project Environmental Consultant or the National Grid Environment Scientist and circulated to the project team on a weekly, or more frequent, basis.

Bank – The transitional slope immediately adjacent to the edge of a surface water body, the upper limit of which is usually defined by a break in slope, or, for a wetland, where a line delineated in accordance with applicable state and federal regulations that indicates a change from wetland to upland.

BMP – Best Management Practice. Individual engineered constructions or operating procedures intended to minimize and mitigate soil disturbance, erosion, sedimentation, turbid discharges, and/or impacts to sensitive receptors.

Clean - Free of plant matter (stems, flowers, roots, etc), soil, or other deleterious materials prior to being brought to the project site.

Clean Gravel – Gravel is a type of coarse-grained soil that consists of small stones and other mineral particles. Clean Gravel shall meet the requirements in accordance with National Grid Standard Construction Specification for Electric Stations (Engineering Standard SP.08.00.001) Clean Gravel will not have fine materials that could lead to a turbid discharge.

Clean Stone (Crushed Stone) – Clean Stone (Crushed Stone) shall meet the requirements in accordance with National Grid Standard Construction Specification for Electric Stations (Engineering Standard SP.08.00.001). Clean Stone will not have fine materials that could lead to a turbid discharge.

Clearing – The cutting of trees and large bushes by hand and/or mechanical means.

Compost Socks – Tubular devices comprised of non-degradable, photodegradable, or biodegradable mesh tubing containing organic compost matrix. Compost socks are effective for intercepting site runoff, trapping sediment, and treating for soluble pollutants by filtering stormwater runoff. . Compost socks are a useful sedimentation control device along construction site perimeters, as check dams in drainage channels, as a slope interruption practice on long and/or steep slopes, and around drain or street curb inlets.

Construction Mats **- C**onstruction, swamp, and timber mats ("construction mats") are generic terms used to describe structures that distribute equipment weight to minimize disturbance to wetland soil and vegetation while facilitating passage and providing work platforms for workers and equipment. They are comprised of sheets or mats made from a variety of materials in various sizes.

Corduroy Road – Corduroy roads are cut trees and/or saplings with the crowns and branches removed, and the trunks lined up next to one another.

Dewatering Basin – An established containment area for saturated materials and pumped discharges. This measure is used for the purpose of de-watering soils prior to transport off site or for use in another location on site, and for allowing suspended sediment to settle out of pumped discharges.

Detention/Retention Basin – A detention/retention basin is designed for the purpose of detaining or retaining water. A dewatering basin is a form of detention basin

Dewatering – Use of a system of pumps, pipes and temporary holding dams to drain or divert waterways or wetlands, or lower the groundwater table before and during excavation activities.

Drainage Ditch or Swale – A clearly noticeable channel that is typically dry, except after precipitation events. Intermittent and perennial streams and rivers are not included in this definition.

Dredge – To dig, excavate, or otherwise disturb the contour or integrity of sediments in the bank or bed of a wetland, a surface water body, or other area within the regulating bodies' jurisdiction.

Dredge Spoils – Material removed as the result of dredging.

Embankment – A protective bank constructed of mounded earth or fill materials located between a roadway (or rail bed) and a seasonal stream or other wetland.

Environmental Field Issue – Document that contains copies of all project-specific environmental permits and summarizes all environmental permit conditions. The EFI is prepared by the Project Environmental Consultant or the National Grid Environment Scientist and copies are provided to the Project Manager, Construction Supervisor(s), and other team members as appropriate.

Environmental Monitoring Records – Examples of checklists and/or monitoring reports suggested for use by the Company Environmental Engineer to document conformance of the project with this Environmental Guidance and or project specific permit/license conditions.

Environmental Scientist – Formerly Environmental Engineer. The National Grid Environmental Department representative for the project or the territory where the work is located. For a map of Environmental Department staff territories, refer to the Environmental page of the National Grid infonet.

Environmentally Sensitive Areas – Examples of environmentally sensitive areas that may be found on National Grid properties are rivers, streams, ponds, lakes, wetlands, bogs, swamps, salt marshes, rare species habitat, wellhead protection areas, cultural sites, parks, preserves, schools and as otherwise defined by Federal, State or local regulations. Refer to EG-301.

Erosion Controls – The utilization of methods to prevent soil detachment and minimize displacement or washing down slopes by rainfall or run-off. Common practices include, but are not limited to:

(a) Temporary and Permanent Seeding.

(b) Mulching, Soil Binders, Tackifiers.

(c) Erosion Control Blankets.

(d) Hydraulic Erosion Control.

Excavate/Excavation – To dig, remove, or form a cavity or a hole in an area within the department's jurisdiction.

Fill (n.) – Any rock, soil, gravel, sand or other such material that has been deposited or caused to be deposited by human activity.

Fill (v.) – To place or deposit materials in or on a wetland, surface water body, bank or otherwise in or on an area within the jurisdiction of the department.

Flats – Relatively level landforms composed of unconsolidated mineral and organic sediments usually mud or sand, that are alternately flooded and exposed by the tides and that usually are continuous with the shore.

Frozen Condition – Field conditions when the upper portion of the ground surface freezes or when areas of standing water freeze solid such that vehicle passage over these areas is supported without any resulting soil disturbance. The frozen conditions must have been affected by severe cold (maximum daily temperatures less than 32 degrees F) for a continuous 2-week period.

GAA – Rhode Island groundwater classification, groundwater resources that are known, or presumed to be suitable for drinking water use without treatment, and are located in one of the three areas described below.

a) The state's major stratified drift aquifers that are capable of serving as a significant source for a public water supply ("groundwater reservoirs") and the critical portion of their recharge area as delineated by DEM;

b) The wellhead protection area for each public water system community water supply well. Community water supply wells are those that serve resident populations and have at least 15 service connections or serve at least 25 individuals, e. g. municipal wells and wells serving nursing homes, condominiums, mobile home parks, etc.; and

c) Groundwater dependent areas that are physically isolated from reasonable alternative water supplies and where existing groundwater warrants the highest level of protection. At present only Block Island has been designated as meeting this criterion.

GA – Rhode Island groundwater classification, groundwater resources that are known, or presumed to be suitable for drinking water use without treatment. However, groundwater classified by GA does not fall within any of the three priority areas described under the GAA classification.

Grade/Grading – The movement of soil and fill material to change the elevation of the land. The term refers to the combined actions of excavating and filling to change elevation or shape.

Grubbing – The removal of stumps/roots by mechanical means during site preparation activities.

Immediately - As soon as practicable, but no later than the end of the next work day, following the day when the earth-disturbing activities have temporarily or permanently ceased.

In-kind Replacement - Replacement using the same material, functional inverts, diameter and length as the existing item. In-kind replacement includes the substitution of a structure with a similar structure in approximately the same location as is practicable, and is approximately the same in design. The design may be altered to meet applicable utility standards, and may include alternate materials designed to prolong the life of that service.

Intermittent Stream – A stream that flows for sufficient time to develop and maintain a defined channel, but which might not flow during dry portions of the year.

In the Dry – Work done either during periods of low water or behind temporary diversions, such as Earth Dike / Drainage Swale and Lined Ditches designed and installed in accordance with best management practices.

Limit of Work/Disturbance – The approved project limits within regulated areas. All project related activities in regulated areas must be conducted within the approved limit of work/disturbance. The limit of work/disturbance shall be depicted on the approved permit site plans and in the EFI plans. Where it is warranted National Grid may require that these limits be identified in the field by flagging, construction fencing, and/or perimeter erosion controls.

Long-Term Restoration Logs - Project-specific log used to document restoration required following the completion of construction or as areas of the project have been completed (i.e., segments of ROW for a multi-mile project). The log is typically updated by the Project Environmental Consultant or the National Grid Environment Scientist and circulated to the project team on a weekly basis.

Low Flow Conditions – Low water flow that generally occurs during the summer, as a result of decreased precipitation and the removal of water by increased evaporation and evapotranspiration by vegetation. Work done under low-flow conditions minimizes the potential for environmental damage. The USACE defines the calendar dates for low flow conditions in its New England state-specific Programmatic General Permits.

Low Ground Pressure – Equipment that meets the USACE GP state-specific defined Pounds per Square Inch (PSI) ground pressure when loaded. Use of LGP equipment ***requires approval*** from the National Grid Environmental Scientist.

Marsh – A wetland:

a) That is distinguished by the absence of trees and shrubs;
b) Dominated by soft-stemmed herbaceous plants such as grasses, reeds, and sedges; and
c) Where the water table is at or above the surface throughout the year, but can fluctuate seasonally.

Methods – Are the construction practices and procedures that take place through choosing the proper equipment, trucks and labor to execute the earth moving activities based on the existing conditions and implementing creative and sensitive scheduling for the daily activities.

NHESP - Natural Heritage Endangered Species Program; a department within the Massachusetts Division of Fisheries and Wildlife that is responsible for protecting the 176 species of vertebrate and invertebrate animals and 259 species of native plants that are officially listed as Endangered, Threatened or of Special Concern in Massachusetts.

Perennial – A stream that contains water at all times except during extreme drought.

Permanently Ceased – Is applicable to earth disturbance activities when clearing and excavation within any area of the Project that will not include permanent structures has been completed.

Person-in-Charge – A National Grid Project Engineer, Manager, Supervisor, Field Construction Coordinator or equivalent Contractor personnel assigned to oversee and coordinate work activities.

Processed Gravel – Processed Gravel shall meet the requirements in accordance with National Grid Standard Construction Specification for Electric Stations (Engineering Standard SP.08.00.001). Processed Gravel will not have fine materials that could lead to a turbid discharge. Gravel consisting of inert material that is hard, durable stone and is free from loam and clay, surface coatings and deleterious materials.

Regulating Body – Federal, State, or local authority that has jurisdiction over resource areas that may be impacted by company operations

Regulated Wetland Area – Those areas that are subject to federal, state or local wetland regulation, including certain buffer or adjacent areas.

Repair – The restoring of an existing legal structure by partial replacement of work, or broken, or unsound parts (Env-Wt 101.73).

Replacement – The substitution of a new structure for an existing legal structure with no change in size, dimensions, location, configuration, construction, or which conforms in all material aspects to the original structure

Right-of-Way – A corridor of land where National Grid has legal rights (either fee ownership, lease or easement) to construct, operate, and maintain an electric power line and/or natural gas pipeline and may include work on customer owned properties.

River – A watercourse that is larger than a perennial stream and flows all year long.

Routine Utility Rights-of-Way Maintenance Activity – Includes but is not limited to vegetation management and repair or replacement of existing utility structures.

Sedimentation Controls – Silt fences, straw bales, compost socks/berms and other barrier devices strategically placed to intercept and treat sediment-laden site runoff.

Sensitive Water - Includes any sediment or nutrient impaired water or a water that is identified by the state, tribe or EPA as Tier 2, 2.5 or Tier 3 for antidegradation purposes.

Siltation Curtain – An impervious barrier erected to prevent silt and sand and/or fines from being washed into a wetland, surface water body or other area of concern.

Surface Water Body or Surface Waters – Those portions of waters which have standing or flowing water at or on the surface of the ground.

Spill Prevention, Control and Countermeasure Plans – Required for site operations that involve the storage of 1,320 gallons or greater of fuel and oils, both in storage containers and stored in equipment. Response actions to spills and releases are specified in these plans.

Stormwater Pollution Prevention Plan – A site-specific, written document that, among other things: (1) identifies potential sources of stormwater pollution at a construction site; (2) describes stormwater control measures to reduce or eliminate pollutants in stormwater discharge from a construction site; and (3) identifies procedures the operator will implement to comply with the terms and conditions of EPA NPDES Construction General Permit (CGP). SWPPPs must be prepared, maintained on-site, and amended as necessary in order to obtain NPDES permit coverage for specific construction site stormwater discharges under the EPA NPDES CGP.

Temporarily Ceased - Is applicable when there are earth disturbance activities such as clearing, grading, and/or excavation that are not complete, but will be idle in one area for a period of up to 14 or more calendar days, and which will resume in the future. The 14 calendar day timeframe begins as soon as you now that construction work on a portion of the Project will be left incomplete and idle. In circumstances where there are unanticipated delays and you do not know at first how long the work stoppage will continue, the requirement to immediately initiate stabilization is triggered as soon as you know with reasonable certainty that work will be stopped for 14 or more additional calendar days.

Tidal Wetlands – A wetland whose vegetation, hydrology or soils are influenced by periodic inundation or tidal waters.

Topsoil – The uppermost part of the soil, ordinarily moved in tillage, or its equivalent in uncultivated soils and ranging in depth from 2 to 10 inches.

Turbidity – The condition in which solid particles suspended in water make the water cloudy or even opaque in extreme cases.

United States Geological Survey Topographic Map – A map that uses contour lines to represent the three-dimensional features of a landscape on a two-dimensional surface. These maps use a line and symbol representation of natural and artificially created features in an area.

Wetland – An area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation (more than 50 percent) typically adapted for life in saturated soil conditions (hydric soils). Wetlands include but are not limited to swamps, marshes, bogs, and similar areas.

Work Site – An area where work is performed.

Worker – Company employee, contractor, consultant working on site.

Zone II - Massachusetts - That area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides which result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, Zone IIs shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock , or a recharge boundary).

Appendix 2 – Acronyms

ASTM	American Society for Testing and Materials
BMP	Best Management Practices
EFI	Environmental Field Issue
EG	Environmental Guidance
EPA	Environmental Protection Agency
GA/GAA	Rhode Island Groundwater Classifications – see glossary
LGP	Low Ground Pressure
MA	Massachusetts
MA DEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation
NE	New England
NH	New Hampshire
NH DES	New Hampshire Department of Environmental Services
NHESP	Natural Heritage Endangered Species Program
NPDES	National Pollutant Discharge Elimination System
OHM	Oil and/or Hazardous Materials
PSI	Pounds per square inch
RI	Rhode Island
RI DEM	Rhode Island Department of Environmental Management
RI CRMC	Rhode Island Coastal Resources Management Council
RI SESC	Rhode Island soil erosion and sediment control
ROW	Right-of-Way
RTE	Rare, Threatened or Endangered
SPCC	Spill Prevention, Control and Countermeasure
SWPPP	Storm Water Pollution Prevention Plan
TOY	Time-of-Year
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VT	Vermont

VT DEC	Vermont Department of Environmental Conservation
Zone II	Massachusetts Groundwater Protection district – see glossary

Appendix 3

See EG303NE_Appendix3_Reporting Form published separately

National Grid
Storm Water, Wetlands & Priority Habitat Environmental Compliance
Site Inspection / Monitoring Report

Project Name: | **Date:**

City / Town: | **Time:**

WO / WR #

IHC or Contractor? (Company Name):

Current Weather Conditions:

Precipitation Since Last Inspection (Date, Est. Duration and Est. Amount from Each Storm):

Activities / Structures / Locations Inspected:

Identify Locations / Activities / Structures within Designated Priority Habitat (Identify Rare species Observations, if any) and Mitigation / Restoration Measures Implemented:

Any Significant Discharges of Sediment to Water Bodies or Wetlands? (If "yes", state locations):

Compliance with SWPPP Storm Water Controls, O&M Plan, Order of Conditions or Other Applicable Environmental Requirements? (Explain if "no" for any feature inspected):

Additional BMPs or Other Corrective Action Needed and, if so, Where?

Compliance with Previous Observations?

National Grid
Storm Water, Wetlands & Priority Habitat Environmental Compliance
Site Inspection / Monitoring Report

Are Spill Control Supplies Available	**Yes**	**No**
Are Oil and / or Hazardous Materials Stored On Site?	**Yes**	**No**
If So, Are they Properly Labeled and Managed?	**Yes**	**No**
Are Wastes Stored On Site?	**Yes**	**No**
If So, Are they Properly Managed?	**Yes**	**No**

Miscellaneous (e.g., dumping?):

Comments:

Inspection Completed by (Name, Title, Company):

Inspector's Signature for Certification:

National Grid Environmental Dept. Representative - Signature for Certification:

Date:

Appendix 4 – BMPs

See EG303NE_Form1 for a list of BMPS

See EG303NE_Form2 for BMP details

	BMP #	Measure
Sediment & Erosion Controls	SEC-1	Weed free bale barrier
	SEC-2	Sediment control fence
	SEC-3	Silt fence / weed free barrier
	SEC-4	Silt Soxx
	SEC-5	Straw Wattle
	SEC-6	Erosion Control Blanket - Ditch
	SEC-7	Erosion Control Blanket - Slope
	SEC-8	Hydroseeding with Tackifier (slope stabilization)
	SEC-9	Mulch materials, rates and uses (from NY)
	SEC-10	Seeding options - Upland Seed Mixes
	SEC-11	Seeding options - Wetland Seed Mix
	SEC-12	Distribution Pole Erosion Control

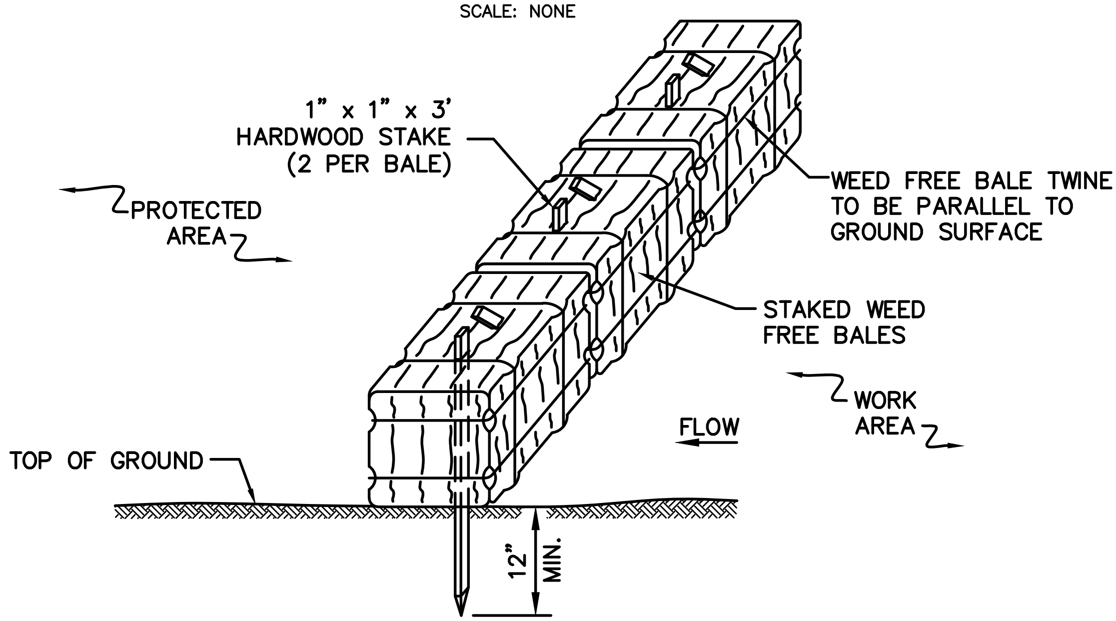
Crossing Measures	CM-1	Prefabricated mats
	CM-2	Construction mat bridge
	CM-3	Construction mat layout (with transition)
	CM-4	Construction mat layout (with transition & BMPs)
	CM-5	Construction mat - Air Bridge
	CM-6	Corduroy road
	CM-7	Rock Ford
	CM-8	Temporary construction entrance / exit
	CM-9	Temporary construction culvert
	CM-10	Access way stabilization
	CM-11	Construction signage
	CM-12	Construction Mat Anchoring

Advanced Applications	AA-1	Reinforced silt fence
	AA-2	Sediment filter
	AA-3	Stone check dams
	AA-4	Straw / haybale check dam
	AA-5	Waterbar
	AA-6	Sandbag check dam
	AA-7	Earth dike
	AA-8	Drainage swale and lined ditch
	AA-9	Sedimentation basin
	AA-10	Dewatering basin - Small scale
	AA-11	Dewatering basin - Large scale
	AA-12	Dirtbag
	AA-13	Concrete waste sump

	AA-14	Outpak concrete washout
Advanced Applications	AA-15	Barrier fence (construction fence)
	AA-16	ROW gates / fences
	AA-17	Bollard
	AA-18	Dust control
	AA-19	Catch Basin Inlet Protection
	AA-20	Silt Sack
	AA-21	Turbidity Curtain
	AA-22	Siltsoxx Amphibian & Reptile Crossing #1
	AA-23	Siltsoxx Amphibian & Reptile Crossing #2
	AA-24	Siltsoxx Amphibian & Reptile Crossing #3
	AA-25	Cultural Avoidance

BMP DETAIL

SCALE: NONE



NOTES:

1. THE GROUND SHALL BE PREPARED TO PROVIDE COMPLETE CONTACT WITH THE BALES.

BMP PICTURE

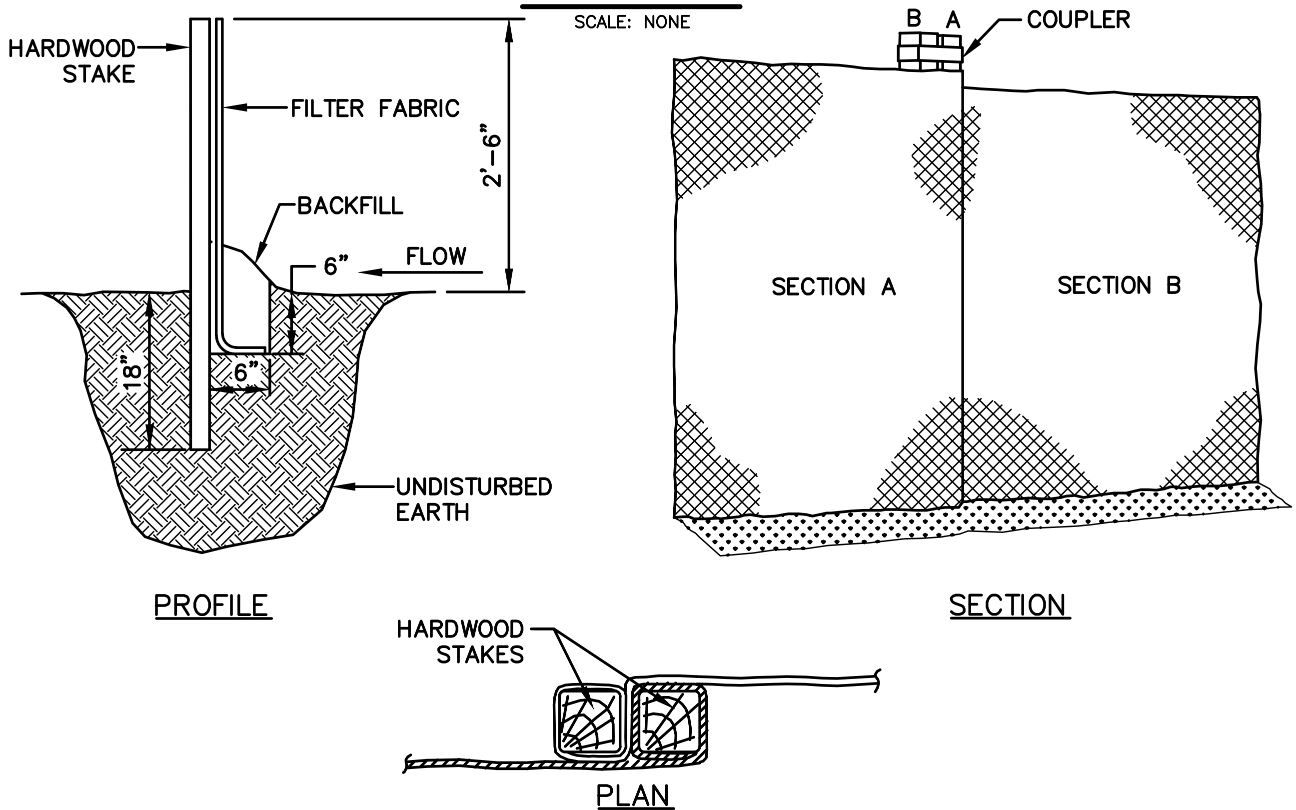
nationalgrid	ENVIRONMENTAL GUIDANCE	Doc. No.	EG-303NE
		Page: 7-2	Rev. No. 4
		Date	02/20/18

SUBJECT
Access, Maintenance and Construction
Best Management Practices

Reference
EP No. 3 - Natural Resource
Protection (Chapter 6)

BMP DETAIL

SCALE: NONE



BMP PICTURE

File: Sediment_Fence.dwg

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SEC-2
SEDIMENT CONTROL FENCE

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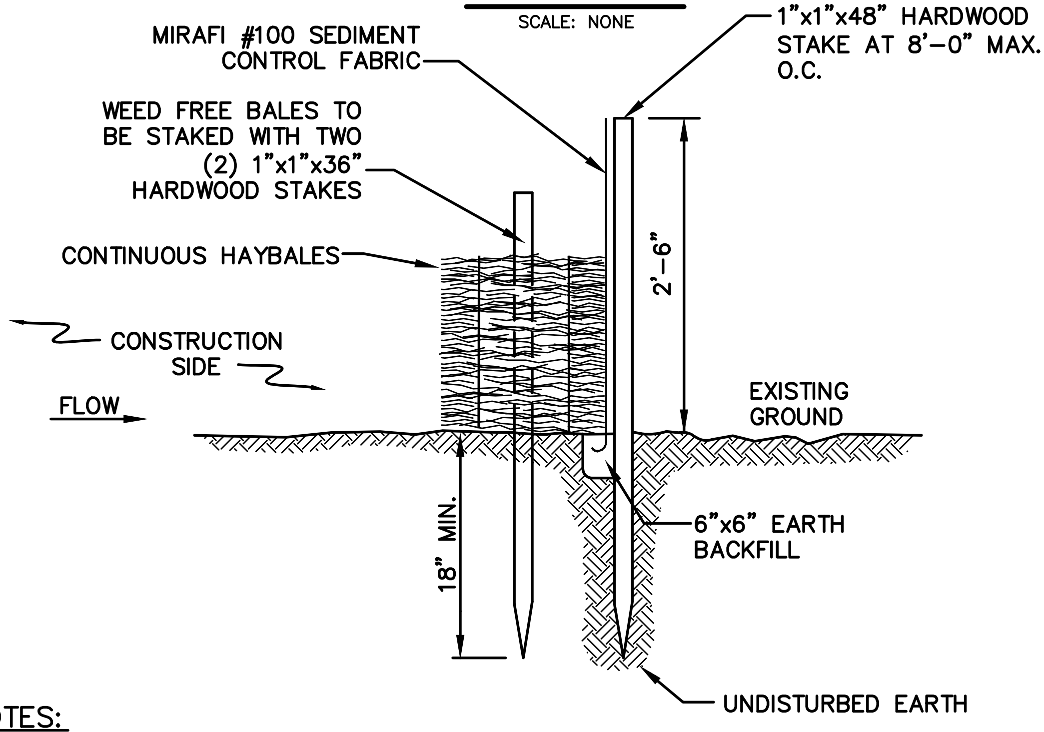
		Date	02/20/18

SUBJECT	Reference
Access, Maintenance and Construction Best Management Practices	EP No. 3 - Natural Resource Protection (Chapter 6)

BMP DETAIL

SCALE: NONE



NOTES:

1. BALES SHALL BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING THE ADJACENT BALES.
2. BALES SHALL BE SECURELY ANCHORED IN PLACE BY TWO (2) 1"X1"X36" HARDWOOD STAKES DRIVEN THROUGH THE BALES. THE FIRST STAKE IN EACH BALE SHALL BE ANGLED TOWARD PREVIOUSLY LAID BALE TO FORCE BALES TOGETHER.
3. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
4. BALES SHALL BE REMOVED AND REPLACED WHEN THEY BECOME FILLED WITH SEDIMENT AND BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
5. BALES SHALL BE REMOVED WHEN THE EMBANKMENTS STABILIZE.
6. BALES TO BE TWINE BOUND.

BMP PICTURE

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SEC-3
SILT FENCE /
WEED FREE BARRIER

File: Silt_Fence_&_Barrier.dwg

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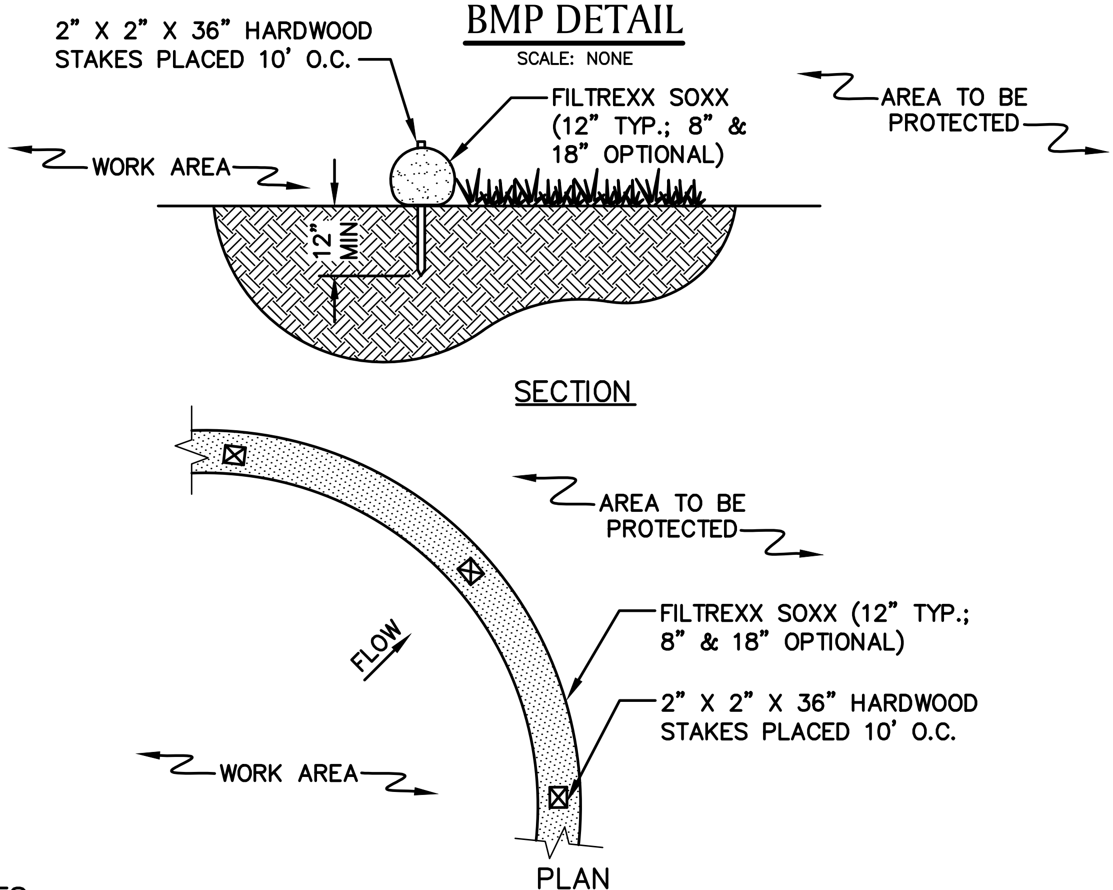
		Date	02/20/18

SUBJECT	Reference
Access, Maintenance and Construction Best Management Practices	EP No. 3 - Natural Resource Protection (Chapter 6)

BMP DETAIL

SCALE: NONE



NOTES

1. PRODUCT TO BE FILTREXX SILT SOXX OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. ALL MATERIAL TO MEET FILTREXX SPECIFICATIONS.
3. FILTER MEDIA FILL TO MEET APPLICATION REQUIREMENTS.
4. MESH CONTAINMENT MATERIAL SHOULD BE KNITTED PHOTODEGRADABLE OR BIODEGRADABLE MATERIAL, WITH OPENING SIZES BETWEEN 1/8" – 3/8".
5. COMPOST MEDIA SHOULD HAVE PARTICLE SIZE WHERE 99% < 2", 50% > 1/2".
6. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

*** PICTURE AND DETAIL PROVIDED BY FILTREXX LAND IMPROVEMENT SYSTEMS**
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SEC-4
SILT SOXX *

File: SiltSOXX.dwg

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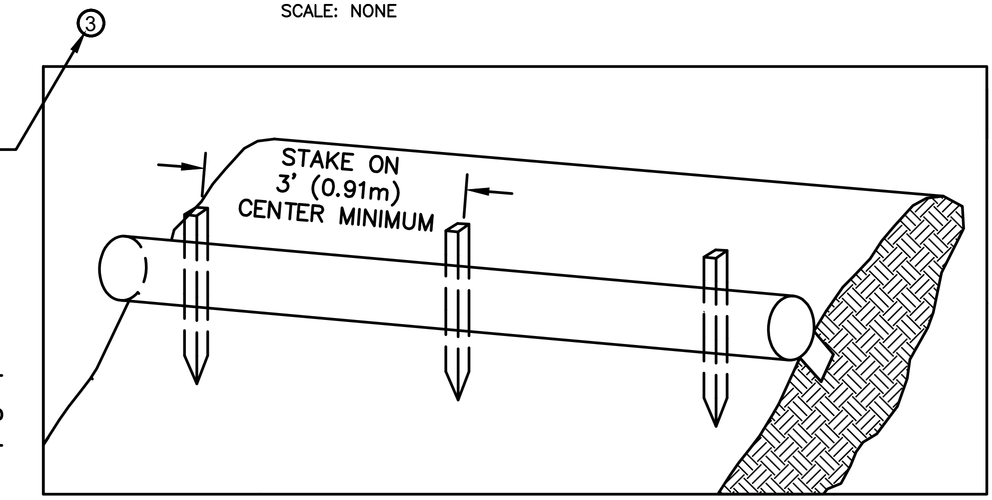
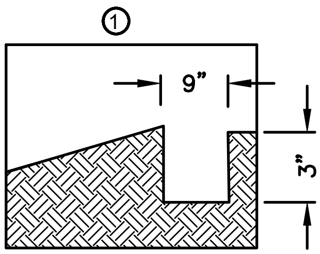
Access, Maintenance and Construction Best Management Practices	EP No. 3 - Natural Resource Protection (Chapter 6)

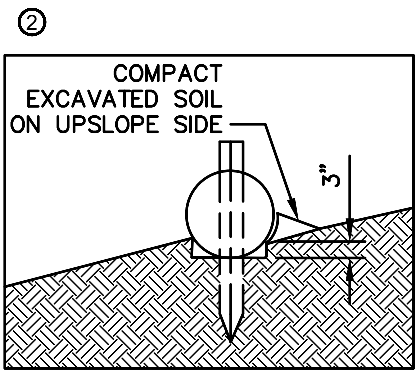
BMP DETAIL

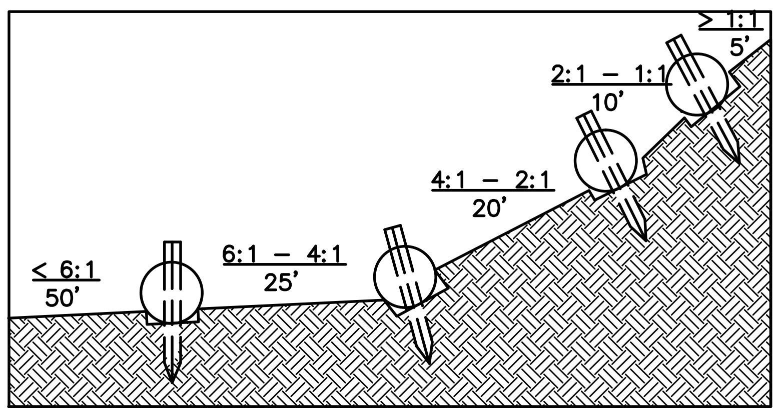
SCALE: NONE

CIRCLED NUMBERS CORRESPOND TO INSTALLATION NOTES FOR THIS STRAW WATTLE BMP DETAIL (TYP.)









TYPICAL WATTLE SPACING DETAIL

NOTES:

1. PRODUCT TO BE TENSAR NORTH AMERICAN GREEN STRAW WATTLE OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. TYPICAL WATTLE SPACING BASED ON SLOPE GRADIENT. COORDINATE SPACING AND LOCATION WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
3. MINIMUM 12" DIAMETER WATTLES SHOULD BE USED FOR HIGHLY DISTURBED AREAS (I.E., HEAVILY USED ACCESS ROAD WITH ADJACENT WETLAND) AND MINIMUM 9–10" WATTLES SHOULD BE USED FOR LESS DISTURBED SOILS.

INSTALLATION NOTES:

1. BEGIN AT THE LOCATION WHERE THE WATTLE IS TO BE INSTALLED BY EXCAVATING A 2–3" DEEP X 9" WIDE TRENCH ALONG THE CONTOUR OF THE SLOPE. EXCAVATED SOIL SHOULD BE PLACED UPSLOPE FROM THE ANCHOR TRENCH.
2. PLACE THE WATTLE IN THE TRENCH SO THAT IT CONTOURS TO THE SOIL SURFACE. COMPACT SOIL FROM THE EXCAVATED TRENCH AGAINST THE WATTLE ON THE UPHILL SIDE. ADJACENT WATTLES SHOULD TIGHTLY ABUT.
3. SECURE THE WATTLE WITH 18–24" HARDWOOD STAKES EVERY 3–4' AND WITH A STAKE ON EACH END. STAKES SHOULD BE DRIVEN THROUGH THE MIDDLE OF THE WATTLE LEAVING AT LEAST 2–3" OF STAKE EXTENDING ABOVE THE WATTLE. STAKES SHOULD BE DRIVEN PERPENDICULAR TO THE SLOPE FACE.

File: Straw_Wattle.dwg

*** DETAIL AND PICTURE PROVIDED BY TENSAR NORTH AMERICAN GREEN**
APPROVED BY: VICE PRESIDENT, ENVIRONMENTAL SERVICES

SEC-5
STRAW WATTLE * (1 OF 2)

BMP PICTURE

STRAW WATTLE – SHALLOW SLOPE (≤4:1)
(ALTERNATE STAKING)

ALTERNATE STAKING INSTALLATION NOTES:

1. ON SHALLOW SLOPES (≤4:1), STRAW WATTLE MAY BE SECURED WITH 18–24" HARDWOOD STAKES DRIVEN AGAINST THE SIDES OF THE WATTLE INSTEAD OF THROUGH. STAKES SHALL ALTERNATE SIDES, AND BE SPACED 3–4' MAX.
2. TWINE SHALL BE TIED FROM STAKE TO STAKE, CRISS–CROSSING THE STRAW WATTLE. TIE TWINE TO STAKES BELOW THE HEIGHT OF THE WATTLE.

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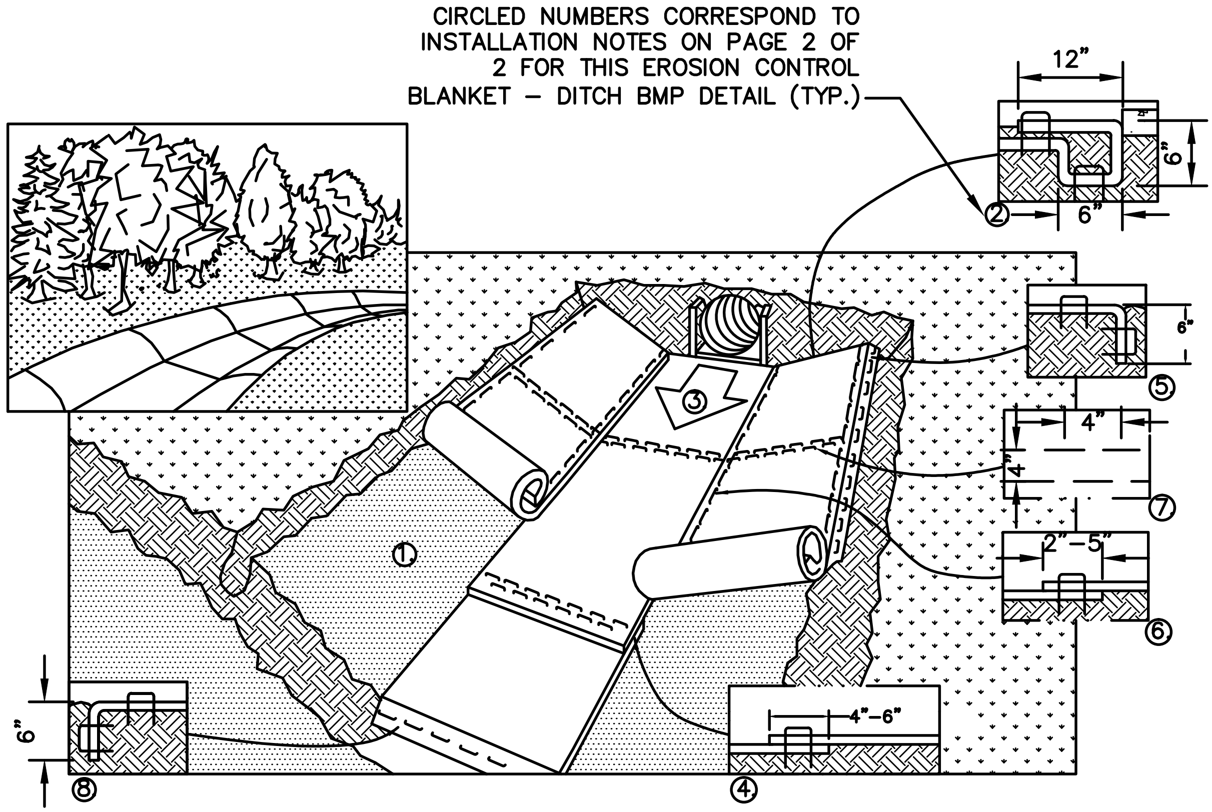
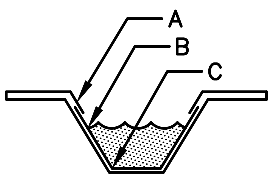
SUBJECT	Reference
Access, Maintenance and Construction Best Management Practices	EP No. 3 - Natural Resource Protection (Chapter 6)

BMP DETAIL

SCALE: NONE





CRITICAL POINTS

A. OVERLAPS AND SEAMS
B. PROJECTED WATER LINE
C. CHANNEL BOTTOM/SIDE SLOPE VERTICES

NOTES:

1. PRODUCT TO BE NORTH AMERICAN GREEN EROSION CONTROL BLANKET OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. HORIZONTAL STAPLE SPACING SHOULD BE ALTERED IF NECESSARY TO ALLOW STAPLES TO SECURE THE CRITICAL POINTS ALONG THE CHANNEL SURFACE.
3. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY ANCHOR THE ROLLED EROSION CONTROL PRODUCTS (RECP's).

*** PICTURE AND DETAIL PROVIDED BY TENSAR NORTH AMERICAN GREEN**

APPROVED BY: VICE PRESIDENT, ENVIRONMENTAL SERVICES

SEC-6

EROSION CONTROL BLANKET - DITCH * (1 OF 2)

BMP DETAIL

INSTALLATION NOTES:

1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE CHANNEL BY ANCHORING THE RECP's IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30 CM) OF RECP's EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE RECP's WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMAPCT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF RECP's BACK OVER SEED AND COMPACTED SOIL. SECURE RECP's OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) ACROSS THE WIDTH OF THE RECP's.
3. ROLL CENTER RECP's IN DIRECTION OF WATER FLOW IN BOTTOM OF CHANNEL. RECP's WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP's MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. ™ WHEN USING THE DOT SYSTEM , STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. PLACE CONSECUTIVE RECP's END OVER END (SHINGLE STYLE) WITH A 4" - 6" (10 CM -15 CM) OVERLAP. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER TO SECURE RECP's.
5. FULL LENGTH EDGE OF RECP's AT TOP OF SIDE SLOPES MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
6. ADJACENT RECP's MUST BE OVERLAPPED APPROXIMATELY 2" - 5" (5 CM -12.5 CM) (DEPENDING ON RECP's TYPE) AND STAPLED.
7. IN HIGH FLOW CHANNEL APPLICATIONS, A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FOOT (9 M - 12 M) INTERVALS. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER OVER ENTIRE WIDTH OF THE CHANNEL.
8. THE TERMINAL END OF THE RECP's MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.

BMP PICTURE

*** PICTURE AND DETAIL PROVIDED BY TENSAR NORTH AMERICAN GREEN**

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SEC-6
EROSION CONTROL BLANKET - DITCH * (2 OF 2)

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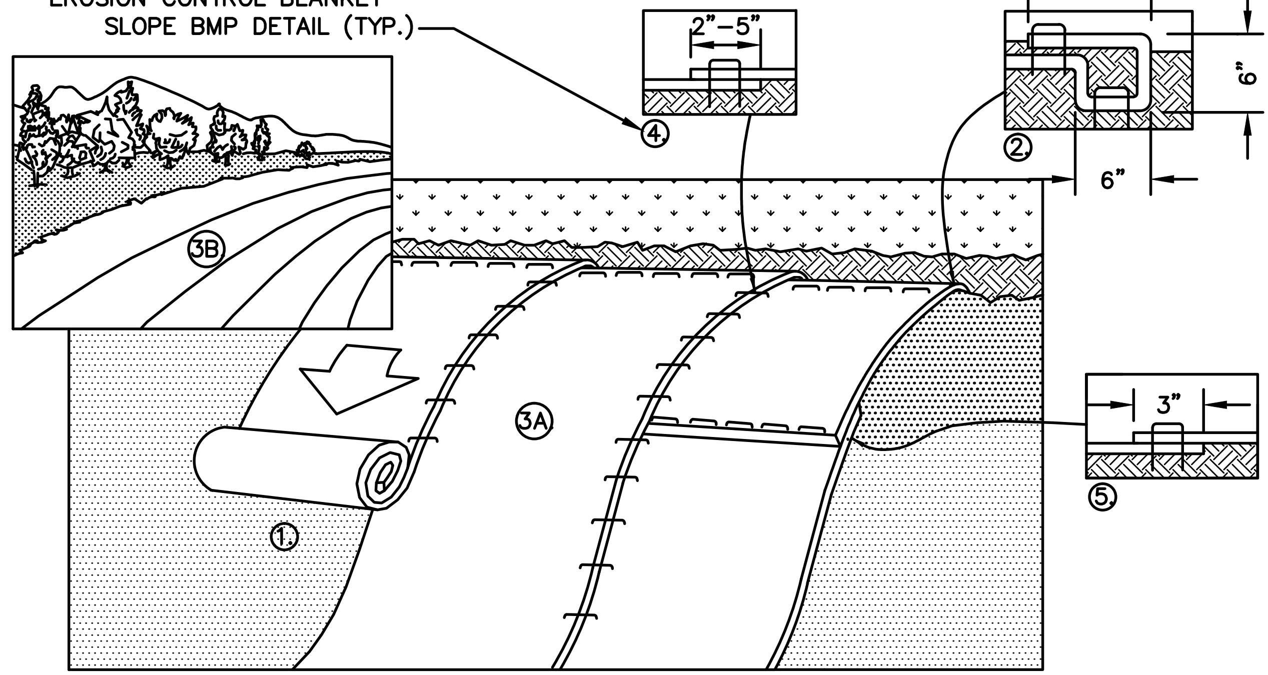
BMP DETAIL

SCALE: NONE



NOTES:

1. PRODUCT TO BE NORTH AMERICAN GREEN EROSION CONTROL BLANKET OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLES OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY SECURE THE RECP's.

INSTALLATION NOTES:

1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECP's), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL–O–SEED DO NOT SEED PREPARED AREA. CELL–O–SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE RECP's IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30 CM) OF RECP's EXTENDED BEYOND THE UP–SLOPE PORTION OF THE TRENCH. ANCHOR THE RECP's WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF RECP's BACK OVER SEED AND COMPACTED SOIL. SECURE RECP's OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) APART ACROSS THE WIDTH OF THE RECP's.
3. ROLL THE RECP's (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. RECP's WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP's MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES ™ IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM , STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGES OF PARALLEL RECP's MUST BE STAPLED WITH APPROXIMATELY 2" – 5" (5 CM – 12.5 CM) OVERLAP DEPENDING ON RECP's TYPE.
5. CONSECUTIVE RECP's SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" (7.5 CM) OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" (30 CM) APART ACROSS ENTIRE RECP's WIDTH.

File: Erosion_Blanket_Slope.dwg

*** PICTURE AND DETAIL PROVIDED BY TENSAR NORTH AMERICAN GREEN**
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SEC-7
EROSION CONTROL BLANKET - SLOPE * (1 OF 2)

BMP PICTURE

*** PICTURE AND DETAIL PROVIDED BY TENSAR NORTH AMERICAN GREEN**
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SEC-7
EROSION CONTROL BLANKET - SLOPE * (2 OF 2)

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BMP PICTURE

NOTES:

1. COORDINATE MIXTURE TYPE AND APPLICATION AREAS WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST PRIOR TO CONSTRUCTION.
2. A MINIMUM OF 1500 LBS. PER ACRE OF A PAPER/CORN FIBER OR EQUIVALENT WITH NATURAL TACKIFIERS WILL BE USED ON SLOPES LESS THAN 3:1.
3. A BFM (BONDED FIBER MATRIX) WILL BE USED ON SLOPES GREATER THAN 2:1.
4. A FGM (FLEXIBLE GROWTH MATRIX) OR ESM (EXTREME SLOPE MATRIX) WILL BE USED ON SLOPES GREATER THAN 1:1.
5. REFER TO BMP #10 FOR SEED MIXTURE OPTIONS.

File: Hydroseeding.dwg

*** PICTURE PROVIDED BY TENSAR NORTH AMERICAN GREEN**
*** TACKIFIER INFORMATION PROVIDED BY FILTREXX LAND IMPROVEMENT SYSTEMS AND TENSAR NORTH AMERICAN GREEN**

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SEC-8
HYDROSEEDING WITH TACKIFIER
(SLOPE STABILIZATION) *

BMP

Definition

Applying coarse plant residue or chips, or other suitable materials, to cover the soil surface.

Purpose

The primary purpose is to provide initial erosion control while a seeding or shrub planting is establishing. Mulch will conserve moisture and modify the surface soil temperature and reduce fluctuation of both. Mulch will prevent soil surface crusting and aid in weed control. Mulch is also used alone for temporary stabilization in non-growing months.

Conditions Where Practice Applies

On soils subject to erosion and on new seedings and shrub plantings. Mulch is useful on soils with low infiltration rates by retarding runoff.

Criteria

Site preparation prior to mulching requires the installation of necessary erosion control or water management practices and drainage systems.

Slope, grade and smooth the site to fit needs of selected mulch products.

Remove all undesirable stones and other debris to meet the needs of the anticipated land use and maintenance required.

Apply mulch after soil amendments and planting is accomplished or simultaneously if hydroseeding is used.

Select appropriate mulch material and application rate or material needs. Determine local availability.

Select appropriate mulch anchoring material.

NOTE: The best combination for grass/legume establishment is straw (cereal grain) mulch applied at 2 ton/acre (90 lbs./1000sq.ft.) and anchored with wood fiber mulch (hydromulch) at 500 – 750 lbs./acre (11 – 17 lbs./1000 sq. ft.). The wood fiber mulch must be applied through a hydroseeder immediately after mulching.

NOTE:

1. PICTURE DEPICTS STRAW MULCH APPLICATION (FROM MULCH SPREADER) ON STEEP SLOPE WITH AN IMPROVED DRAINAGE SWALE.
2. COORDINATE MULCH MATERIALS AND RATES WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

UPLAND ROW RESTORATION MIX – GENERAL

Species Composition Options:

- Andropogon gerardii; Niagra Big Bluestem
- Schizachyrium scoparium; Little Bluestem
- Elymus Canadensis; Canada Wild Rye
- Elymus virginicus; Virginia Wildrye
- Lolium multiflorum; Annual Ryegrass
- Sorghastrum nutans; Indiangrass
- Chamaecrista fasciculate; Partridge Pea
- Desmodium canadense; Showy Tick Trefoil
- Helioposis helianthoides; Ox–Eye Sunflower
- Panicum virgatum; Switchgrass
- Rudbeckia hirta; Black Eyed Susan
- Poa palustris; Fowl Bluegrass
- Agrostis perennans; Upland Bentgrass
- Agrostis alba; Redtop
- Festuca rubra; Red Fescue
- Lotus corniculatus; Birds–Foot Trefoil
- Chrysanthemum leucanthem; Ox–Eye Daisy
- Aster novae–angliae; New England Aster

Example Seed Mixes:

1. Native Upland wildlife forage and Cover Meadow Mix – Ernst Conservation Seeds (ERNMX–123)
2. Eastern Ecotype Native Grass Mix– Ernst Conservation Seeds (ERNMX–177)
3. New England Native Warm Season Grass Mix – New England Wetland Plants, Inc.
4. New England Logging Road Mix – New England Wetland Plants, Inc.
5. Northeast Upland Wildflower/Restoration Erosion Mix – Southern Tier Consulting (STCMX–2)

UPLAND ROW RESTORATION MIX – DRY/ROCKY SITES

Species Composition Options:

- Festuca rubra; Red Fescue
- Schizachyrium scoparium; Little Bluestem
- Elymus Canadensis; Canada Wild Rye
- Bouteloua gracillis; Blue Grama
- Lolium multiflorum; Annual Ryegrass
- Lolium perenne; Perennial Ryegrass
- Agrostics scabra; Rough Bentgrass
- Agrostis perennans; Upland Bentgrass
- Sorghastrum nutans; Indiangrass

Example Seed Mixes:

1. New England Erosion Control/ Restoration Mix for Dry Sites – New England Wetland Plants, Inc.
2. Ernst Conservation Seeds and similar companies can create a custom seed mix matching the composition above (with site specific additions if necessary).

WETLAND ROW RESTORATION MIX

Species Composition Options:

- Agrostis stolonifera; Creeping Bentgrass
- Poa trivialis; Rough Bluegrass
- Alopecurus arundinaceus; Creeping Meadow Foxtail
- Lolium multiflorum; Annual Ryegrass
- Festuca rubra; Creeping Red Fescue
- Elymus virginicus; Virginia Wildrye
- Schizachyrium scoparium; Little Bluestem
- Andropogon gerardii; Niagra Big Bluestem
- Carex vulpinoidea; Fox sedge
- Panicum virgatum; Switchgrass
- Agrostis scabra; Rough Bentgrass
- Aster novae-angliae; New England Aster
- Eupatorium perfoliatum; Boneset
- Euthamia graminifolia; Grass Leaved Goldenrod
- Scirpus atrovirens; Green Bulrush
- Verbene hastate; Blue Vervain
- Juncus effusus; Soft Rush
- Scirpus cyperinus; Wool Grass
- Panicum clandestinum; Deertongue

Example Seed Mixes

1. New England Erosion Control/Restoration Mix for Detention Basins and Moist Sites — New England Wetland Plants, Inc.
2. Northeast Wetland Grass Seed Mix — Southern Tier Consulting (STCMX-7)
3. Ernst Conservation Seeds and similar companies can create a custom seed mix matching the composition above (with site specific additions if necessary).

GERNERAL NOTES:

1. Seed mixes described herein are intended to cover a variety of typical new england landscapes. However, site specific seed mixes will need to be evaluated in coastal or mountainous regions.
2. Seed mixes described herein are intended for general ROW restoration. Site specific wetland seed mixes may be required by local, state and/or federal regulators for certain impacts to wetlands.
3. All seed mixes are to be approved by National Grid Environmental Scientist prior to construction and must conform with all project permits.
4. Seedbed preparation and maintenance as well as temporary erosion and sediment controls are crucial to the establishment of newly seeded areas. Coordinate with National Grid Environmental Scientist on seed bed preparation and maintenance as well as temporary erosion and sediment controls prior to construction.

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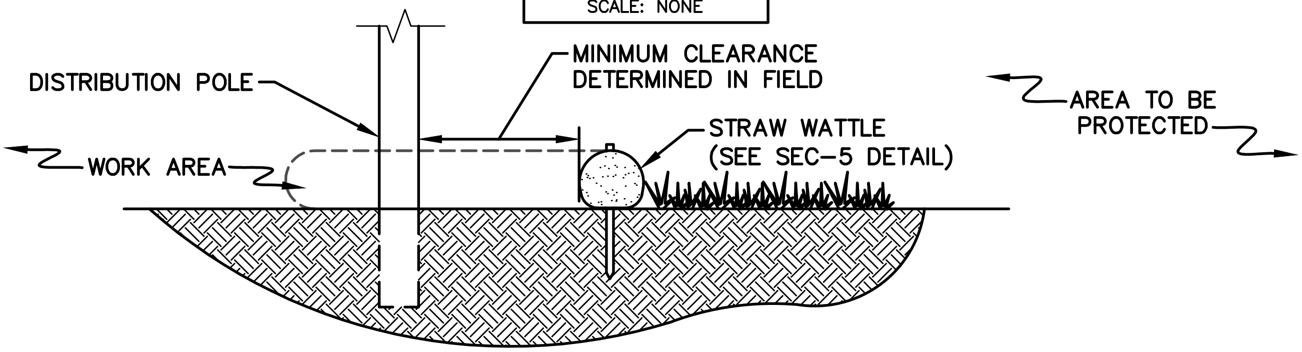
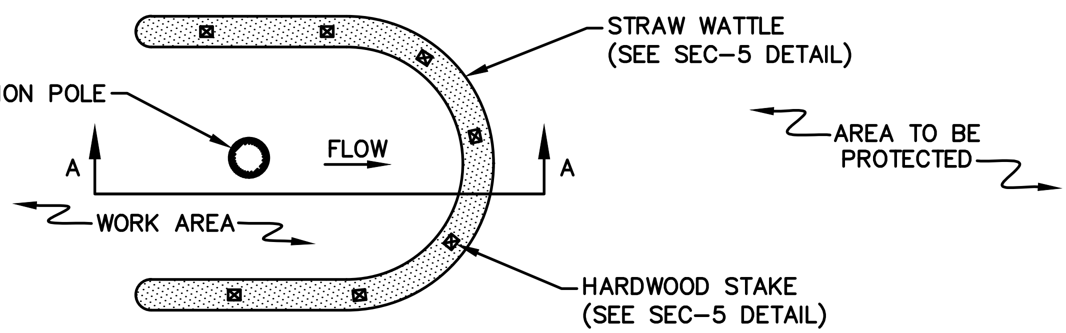
BMP DETAIL

SCALE: NONE



SECTION A-A



PLAN

NOTES

1. PRODUCT TO BE STRAW WATTLE OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST (SEE SEC-5 BMP DETAIL).
2. STRAW BALE BARRIER PER SEC-1 BMP DETAIL TO BE AN AVAILABLE ALTERNATE DEPENDING ON SITE CONDITIONS AT THE DIRECTION OF NATIONAL GRID ENVIRONMENTAL SCIENTIST (SEE FIGURE 2).
3. MINIMUM CLEARANCE BETWEEN POLE AND EROSION CONTROL TO BE DETERMINED BY CONDITIONS OF POLE INSTALLATION/REPLACEMENT WORK AND ASSOCIATED DISTURBANCE.

BMP PICTURE

FIGURE 1: TYP. STRAW WATTLE APPLICATION

FIGURE 2: ALT. STRAW BALE APPLICATION

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SEC-12
DISTRIBUTION POLE
SEDIMENT CONTROL

File: SiltSOXX.dwg

BMP PICTURE

SCALE: NONE

NOTES:

1. PRODUCT TO BE ALTURNAMATS' PREFABRICATED MATS OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. PRODUCT AVAILABLE IN 4X8' UNITS.
3. IF MATS ARE INSTALLED IN A WETLAND AREA, INSTALL EROSION CONTROLS TO CONTAIN MATERIAL UTILIZED IN THE MAT TRANSITIONS.

*** PICTURE PROVIDED BY ALTURNAMATS**

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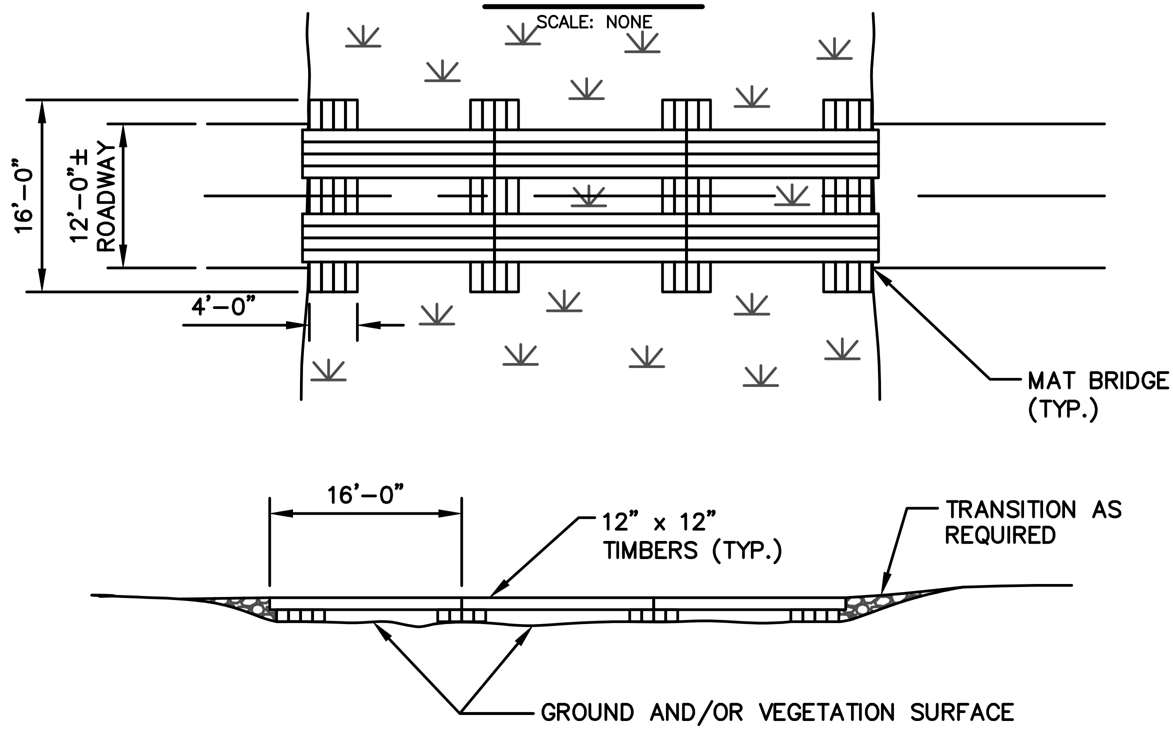
CM-1
PREFABRICATED MATS *

File: Prefab_Mats.dwg

BMP DETAIL



NOTES:

1. IF MATS ARE INSTALLED IN A WETLAND AREA, INSTALL EROSION CONTROLS TO CONTAIN MATERIAL UTILIZED IN THE MAT TRANSITIONS.

BMP PICTURE

CM-2
CONSTRUCTION MAT BRIDGE
(1 OF 2)

BMP PICTURE - SINGLE SPAN

SCALE: NONE

NOTES:

1. WHERE STREAM WIDTH ALLOWS, INSTALL CONSTRUCTION MATS TO SPAN THE WATERCOURSE IN ITS ENTIRETY WITHOUT STRINGER PLACEMENT IN THE WATER OR ANY RESTRICTION OF STREAM FLOW.

2. INSTALLATION OF THE CONSTRUCTION MAT BRIDGE SHALL NOT DAMAGE THE STREAM BED AND BANKS. WHERE POSSIBLE, FOOTERS SHALL BE PLACED PARALLEL TO THE TOP OF THE STREAM BANKS, WITH ACCESS MATTING PLACED ACROSS THE TOP OF THE STRINGERS DISTRIBUTING THE WEIGHT OF THE CONSTRUCTION EQUIPMENT.

3. AT STREAM CROSSINGS THAT CANNOT BE SPANNED BY A SINGLE SECTION OF CONSTRUCTION MATTING, AND WHERE PERMITS ALLOW, STRINGERS SHALL BE PLACED ATOP THE STREAM BED PARALLEL TO THE FLOW OF WATER.

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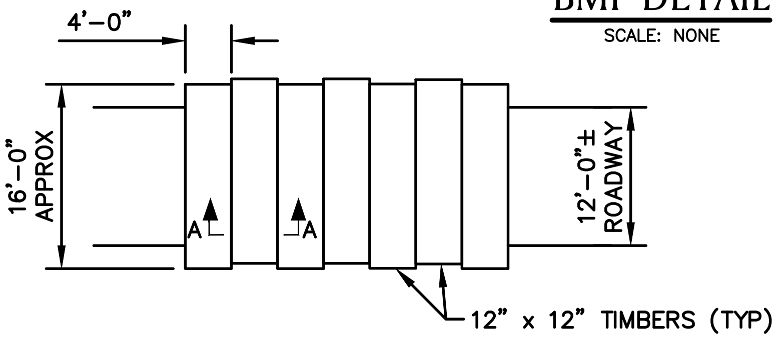
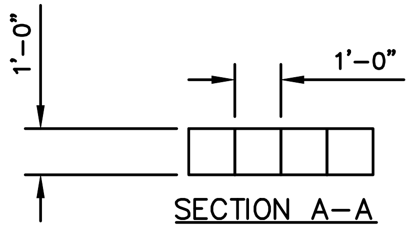
BMP DETAIL

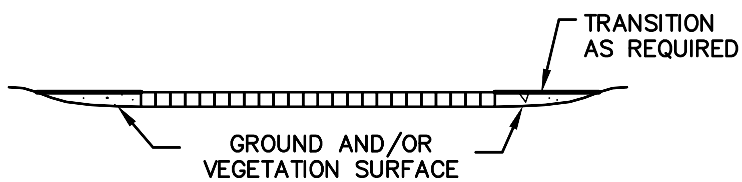
SCALE: NONE



TYPICAL PLAN VIEW



SECTION A–A
TYPICAL MAT SECTION
BOLTED TOGETHER



TYPICAL SECTION VIEW

NOTES:

1. TO BE INSTALLED IF NECESSARY TO PREVENT RUTTING, TO ACCESS STRUCTURES.
2. THIS DETAIL SHOWS TYPICAL DIMENSIONS. SOME CONTRACTOR'S CONSTRUCTION MATS ARE DIMENSIONALLY DIFFERENT FROM WHAT IS SHOWN HERE.
3. DEPENDENT ON SITE CONDITIONS, MULTIPLE LAYERS OF CONSTRUCTION MATS MAY BE INSTALLED.

BMP PICTURE

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CM-3
CONSTRUCTION MAT LAYOUT
(WITH TRANSITION)

File: Swamp_Mat_Layout.dwg

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BMP DETAIL

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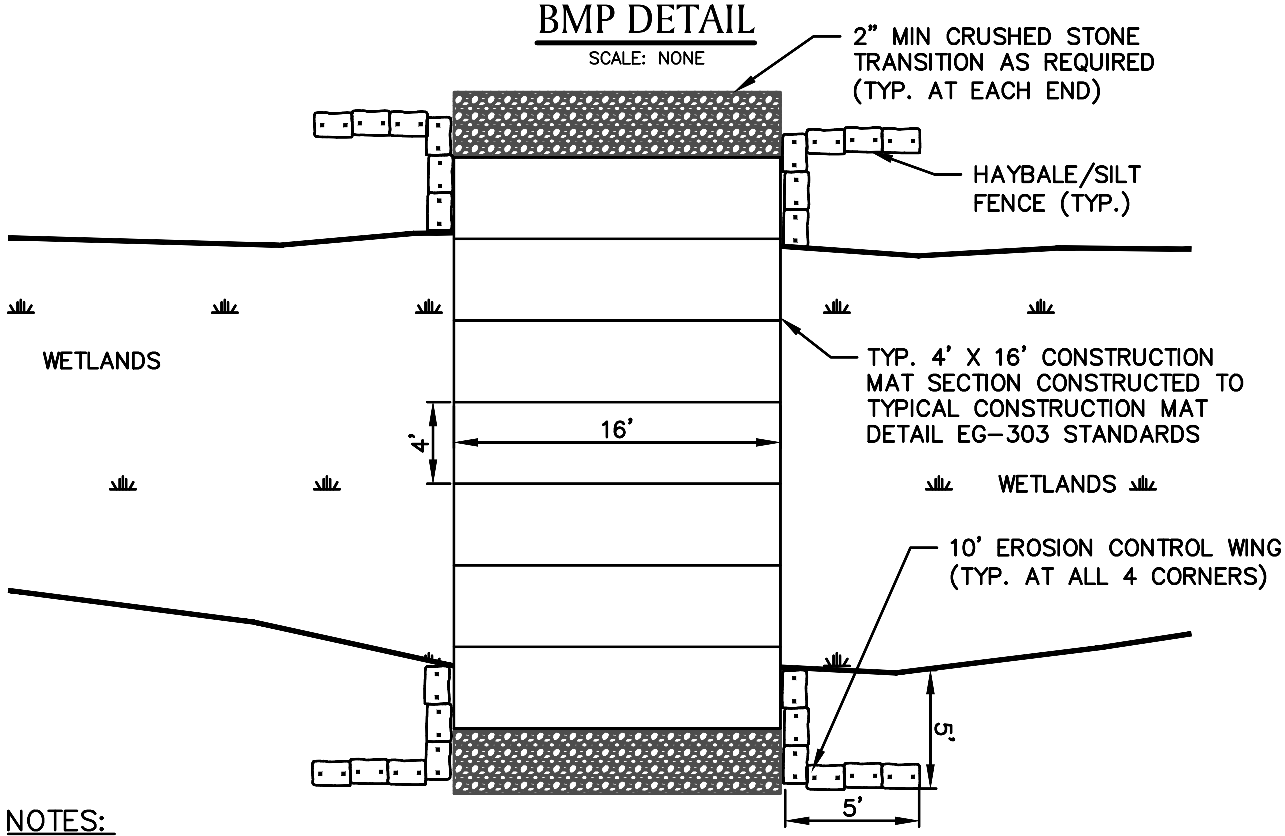

NOTES:
1. ADD FILTER FABRIC AS NEEDED UNDER STONE TRANSITION RAMPS.
2. ALL MEASUREMENTS AND LOCATIONS ARE APPROXIMATE.

BMP PICTURE

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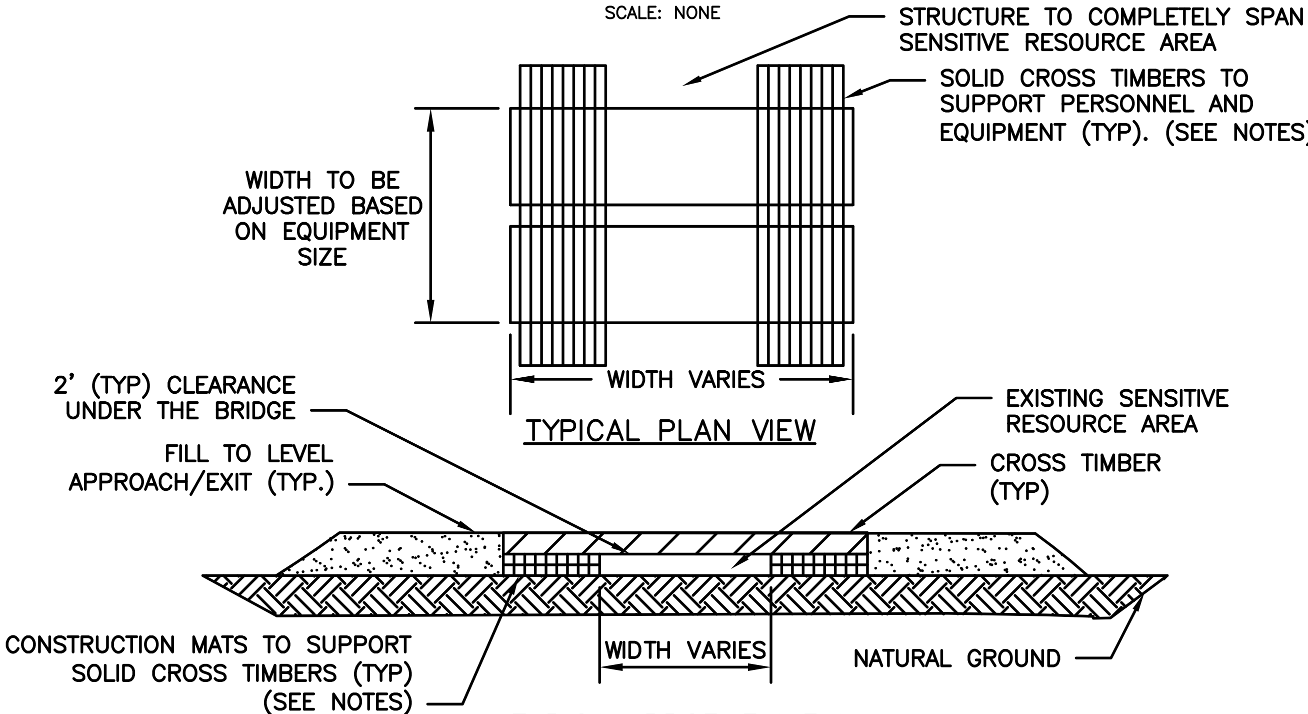
CM-4
CONSTRUCTION MAT LAYOUT
(WITH TRANSITION AND BMPs)

File: Swamp_Mat_Transition and BMPs.dwg

BMP DETAIL

SCALE: NONE



NOTES:

1. THE DETAIL SHOWN IS CONCEPTUAL. CONSTRUCTION MATS AND CROSS TIMBERS SHALL BE SIZED AND SELECTED BASED ON SPAN WIDTH, CROSSING EQUIPMENT AND FIELD CONDITIONS.
2. THE NUMBER OF CONSTRUCTION MATS MAY VARY DEPENDING ON THE CLEARANCE HEIGHT.
3. EQUIPMENT AND PERSONNEL LOAD SHALL BE DISTRIBUTED ON ALL TIMBERS.
4. EACH EQUIPMENT OPERATOR AND USER OF THE FIELD BRIDGE SHALL BE FAMILIAR WITH THE DESIGN AND THE MAXIMUM EQUIPMENT AND PERSONNEL LOADS.
5. THIS DETAIL MAY NOT BE APPLICABLE IN ALL FIELD CONDITIONS.
6. INSTALL EROSION CONTROLS ADJACENT TO THE CULVERT ENDS TO PROTECT THE WATERWAY FROM ROADWAY DEBRIS.

BMP PICTURE

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CM-5
CONSTRUCTION MAT - AIR BRIDGE

File: Swamp_Mat_AIR BRIDGE.dwg

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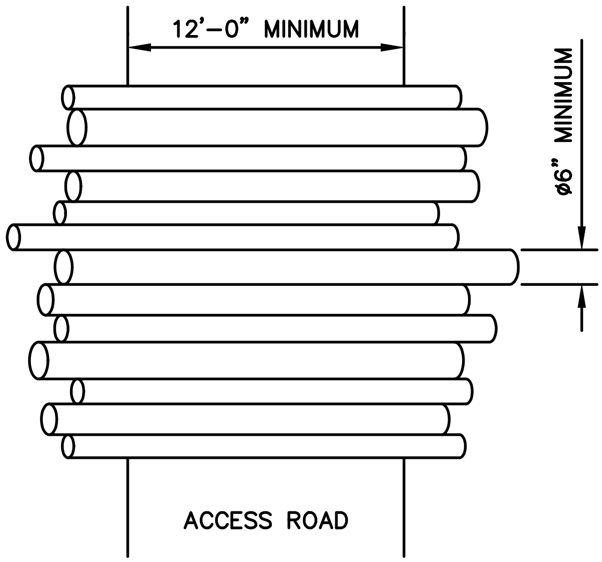
BMP DETAIL

SCALE: NONE



RANDOM LENGTH AND DIAMETER LOGS PLACED ACROSS AN ACCESS ROAD

NOTE:

1. A SIMILAR BRUSH MAT INSTALLATION CONSISTING OF SMALLER DIAMETER STEMS AND LOGS CAN BE USED.
2. CORDUROY ROADS SHALL ONLY BE USED IN EMERGENCIES OR AFTER APPROVAL FROM THE PROJECT ENVIRONMENTAL CONSULTANT OR NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

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CM-6
CORDUROY ROAD

File: Corduroy_Road.dwg

SUBJECT	Reference
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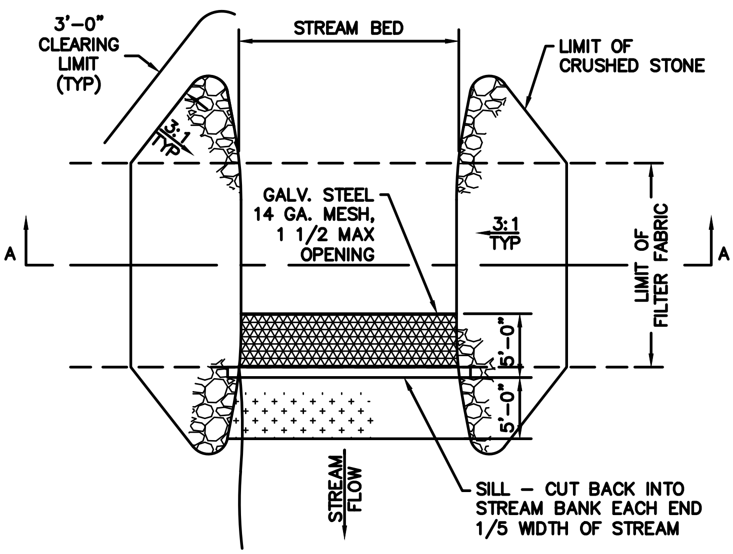
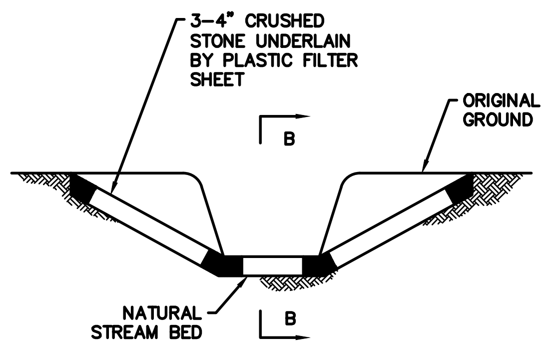
BMP DETAIL

SCALE: NONE

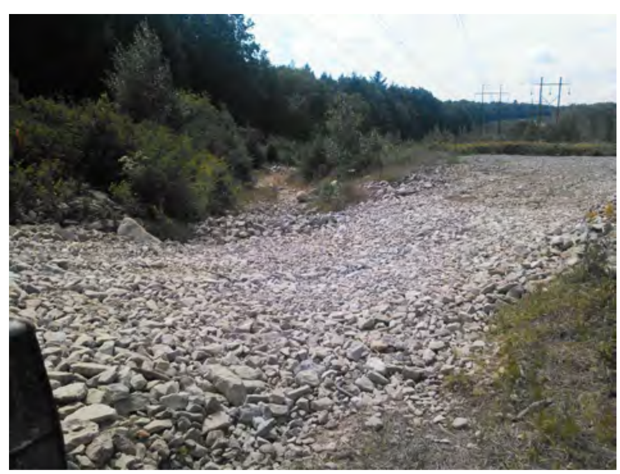


PLAN VIEW



SECTION 'A–A'

BMP PICTURE



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CM-7
ROCK FORD

File: Rock_Ford.dwg

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ENVIRONMENTAL GUIDANCE

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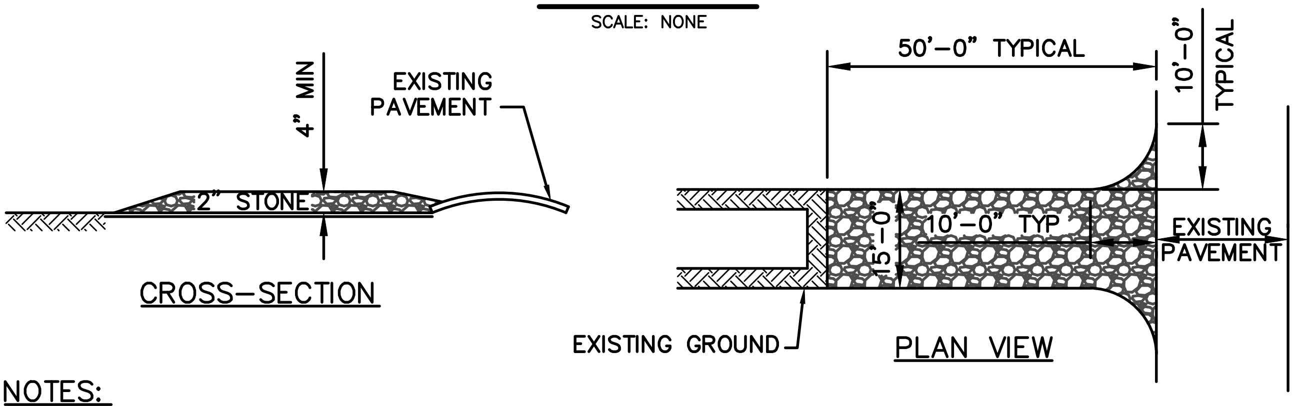
BMP DETAIL

SCALE: NONE



NOTES:

1. STONE SIZE – USE 2" STONE (MINIMUM) TO 6" STONE (MAXIMUM)
2. LENGTH – GREATER THAN OR EQUAL TO 50 FEET
3. THICKNESS – 4"
4. WIDTH – FIFTEEN (15) FOOT TYP., BUT NOT LESS THAN FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. SURFACE WATER – ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS ENTRANCE. IF PIPING IS IMPRACTICAL, MOUNTABLE BERM SHALL BE PERMITTED.
6. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH SHALL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
7. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED.
8. THE CLEAN STONE SHOULD BE INSTALLED OVER A GEOTEXTILE FABRIC. GEOTEXTILE FABRIC MAY BE OMITTED FOR PERMANENT CONSTRUCTION ENTRANCES/EXITS ON A CASE-BY-CASE BASIS WITH THE APPROVAL OF THE NATIONAL GRID ENVIRONMENTAL SCIENTIST.
9. FOLLOWING CONSTRUCTION, THE CONSTRUCTION ENTRANCE/EXIT SHALL BE REMOVED AND THE AREA GRADED, SEEDED, AND MULCHED AS NEEDED. ENTRANCE/EXITS MAY REMAIN DEPENDING UPON FUTURE ACCESS NEEDS AND/OR PROJECT-SPECIFIC APPROVALS BUT REQUIRES APPROVALS FROM THE NATIONAL GRID ENVIRONMENTAL SCIENTIST AND PROPERTY LEGAL.

BMP PICTURE

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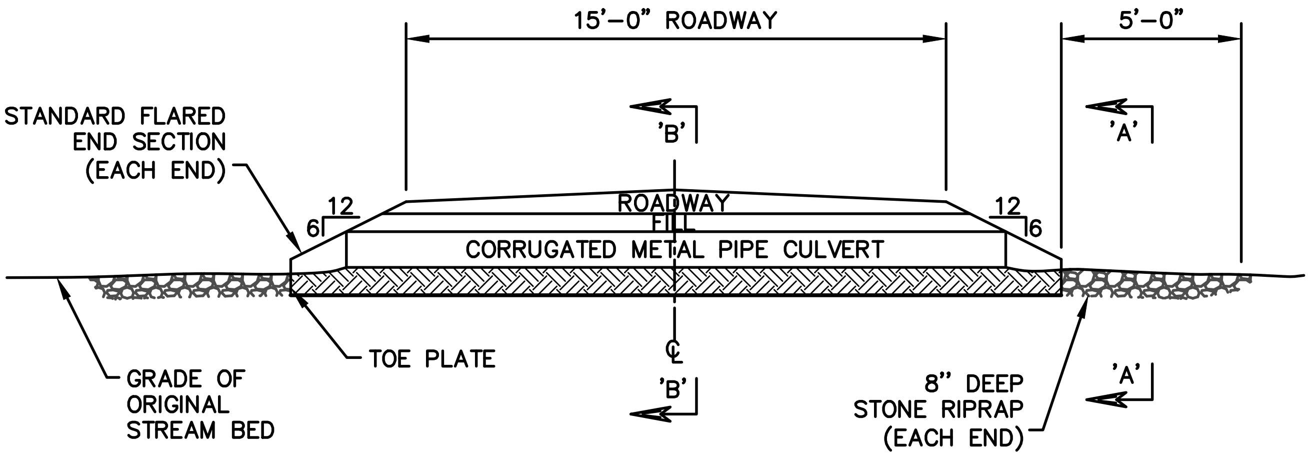
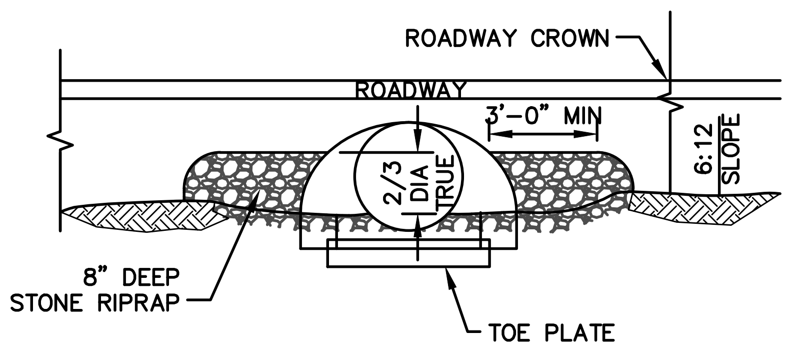
CM-8
TEMPORARY CONSTRUCTION ENTRANCE/ EXIT

BMP DETAIL

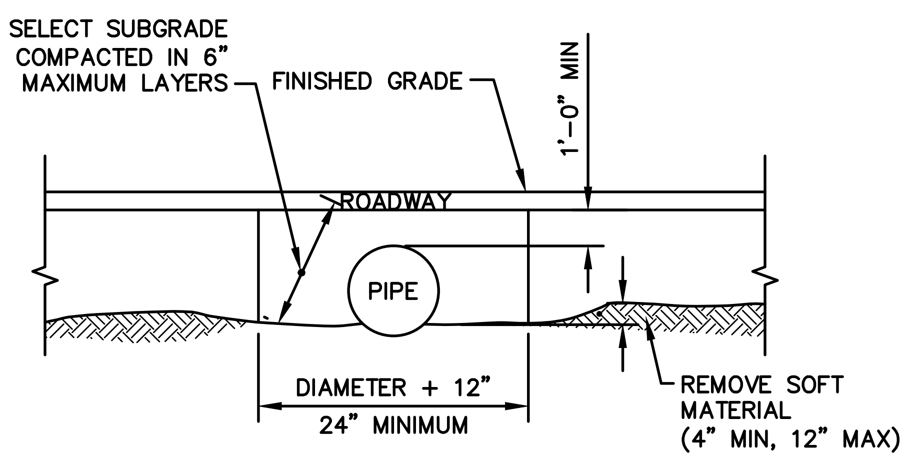
SCALE: NONE



CROSS SECTION



SECTION 'A–A'
(SAME BOTH ENDS)



SECTION 'B–B'

CM-9
TEMPORARY CONSTRUCTION
CULVERT (1 OF 2)

BMP DETAIL

NOTES:

SCALE: NONE

1. CULVERT DESIGN AND LAYOUT SHALL BE COORDINATED WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST (NGES).
2. CROWN ROADWAY 1/2 INCH PER FOOT.
3. LAY THE CULVERT STRAIGHT AND AS NEARLY AS POSSIBLE ALONG THE EXISTING STREAM BED AND WITH THE INVERTS AT OR SLIGHTLY BELOW BED ELEVATION.
4. CORRUGATED METAL PIPE IS TO BE GALVANIZED STEEL, OR ALUMINIZED STEEL (TYPE 2), WITH BOLTED CONNECTORS.
5. DIAMETERS SHALL BE AS PER THE PROJECT DRAWINGS AND THE SPECIFICATION. THE PIPE GAGE SHALL BE AS FOLLOWS:

DIAMETER (INCHES)	GAGE
12" – 15"	.004"
18" – 24"	.079"
30" – 36"	.109"

6. INSTALLATION OF CULVERTS LARGER THAN 36 INCH DIAMETER SHALL REQUIRE SPECIAL ENGINEERING DESIGN.
7. SELECT SUBGRADE SHALL BE A GRANULAR MATERIAL AS DESCRIBED IN NYSDOT SPECIFICATION ITEM 203–2.02C, OR AS APPROVED BY A NGES.
8. STONE RIPRAP SHALL BE AS DESCRIBED IN NYSDOT SPECIFICATION ITEM 203–2.02D, WITH 8 INCH MAXIMUM SIZE, OR AS APPROVED BY A NGES. EXCEPT WHERE PROTECTED BY STONE, ALL EMBANKMENT SLOPES ARE TO BE STABILIZED, MULCHED AND SEEDED AS PER PROJECT SPECIFICATIONS.
9. OUTLET SHOULD BE CONFIGURED NOT TO CREATE HYDRAULIC JUMP OR PLUNGE POOL.
10. INSTALL EROSION CONTROLS ADJACENT TO THE CULVERT ENDS TO PROTECT THE WATERWAY FROM ROADWAY DEBRIS.

BMP PICTURE

File: Temp_Constr_Culvert.dwg

CM-9
TEMPORARY CONSTRUCTION
CULVERT (2 OF 2)

BMP PICTURE

NOTE:

1. PICTURE SHOWS VIEW OF ACCESS WAY STABILIZATION ADJACENT TO A WETLAND.
2. COORDINATE STABILIZATION DESIGN AND PRODUCT WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

File: Access_Stabilization.dwg

CM-10
ACCESS WAY STABILIZATION

BMP PICTURE


NO ACCESS – WETLAND/STREAM CROSSING MATS REQUIRED

NO ACCESS – A.) PROJECT LIMITS E.G. ROW LIMITS
B.) HISTORICAL/CULTURAL
C.) ENVIRONMENTALLY SENSITIVE E.G. THREATENED & ENDANGERED
D.) OTHER

APPROVED ACCESS

CM-11
CONSTRUCTION SIGNAGE

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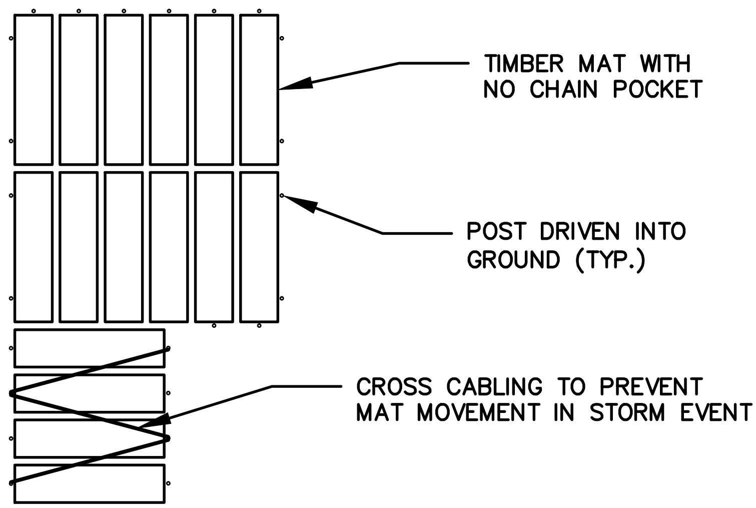
SUBJECT
Access, Maintenance and Construction
Best Management Practices

Reference
EP No. 3 - Natural Resource
Protection (Chapter 6)

BMP DETAIL 1

SCALE: NONE



TYPICAL PLAN VIEW

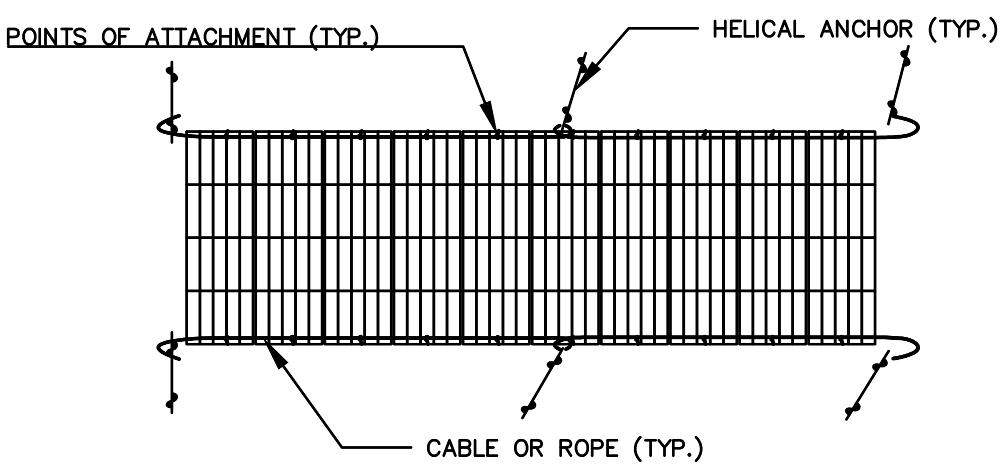
NOTES:

1. EXAMPLES OF ANCHORING ONLY. MATTING CONTRACTOR SHALL PROPOSE THE METHOD OF ANCHORING BASED ON FIELD CONDITIONS.
2. ANCHORING METHOD TO BE APPROVED BY THE NATIONAL GRID ENVIRONMENTAL SCIENTIST AND TRANSMISSION LINE CONSTRUCTION SUPERVISOR.

BMP DETAIL 2

NOTES:

1. TYPICAL HELICAL ANCHOR AND CABLE CONFIGURATION FOR MAT CONTAINMENT IN FLOODPLAINS/LAND SUBJECT TO FLOODING.
2. TYPICAL POINTS OF ATTACHMENT HEAVY STAPLES, EYE BOLTS OR OTHER SUITABLE HARDWARE TO SECURE ATTACHMENT OF MAT TO LINEAR CABLE. IF CHAIN POCKETS ARE PRESENT IN THE MATS CABLE OR ROPE CAN BE LOOPED THROUGH RODS.



File: Const_Mat_Anchoring.dwg

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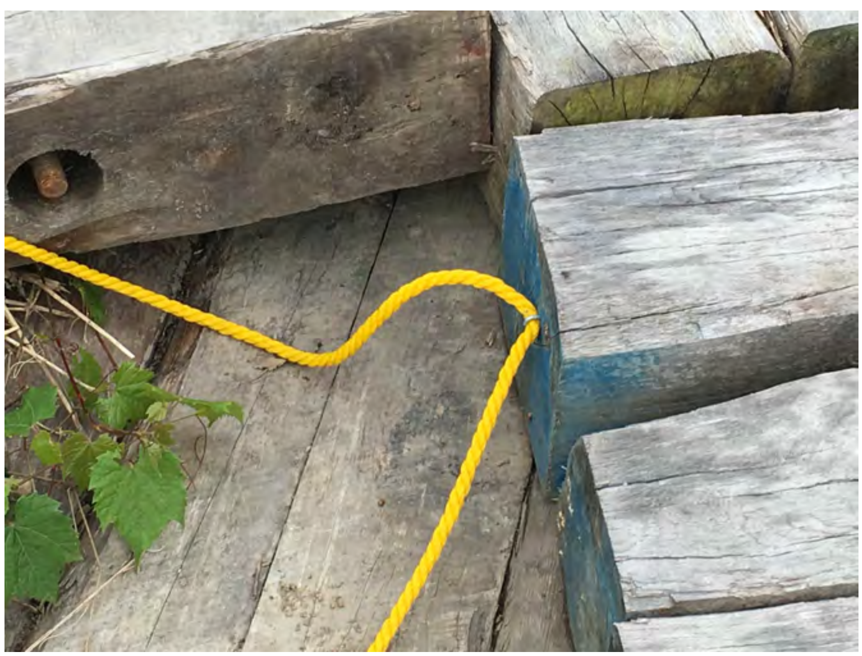
CM-12
EXAMPLE OF CONSTRUCTION MAT ANCHORING (1 OF 2)

BMP PICTURE 1

BMP PICTURE 2



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CM-12
EXAMPLE OF CONSTRUCTION MAT ANCHORING (2 OF 2)

BMP DETAIL

SCALE: NONE

WIRE BACKED SILT FENCE

MUTUAL INDUSTRIES WIRE BACKED SILT FENCE
PART # 1776–14–24
36" X 100'
36" MISF 1776 FABRIC
24" 14GA WIRE MESH
OPENING OF MESH 2" X 4"
FABRIC HOG RINGED EVERY 12"–18" ALONG THE TOP OF THE FENCE

ROLL WEIGHT 40 LBS

32 ROLLS PER PALLET

NOTES:

1. PRODUCT TO BE MUTUAL INDUSTRIES' WIRE BACKED SILT FENCE OR APPROVED EQUAL BY NATIONAL ENVIRONMENTAL SCIENTIST.
2. COORDINATE INSTALLATION METHOD AND LOCATION WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

File: Reinforced_Silt_Fence.dwg

*** PICTURE AND DETAIL PROVIDED BY MUTUAL INDUSTRIES**
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AA-1
REINFORCED SILT FENCE *

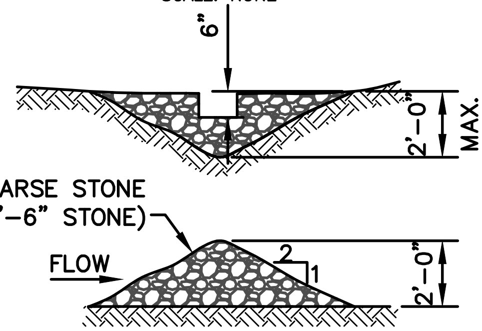
BMP PICTURE

NOTE:

1. PICTURE SHOWS SEDIMENT FILTER WITHIN A WETLAND.

BMP DETAIL

SCALE: NONE



STONE CHECK DAM

NOTES:

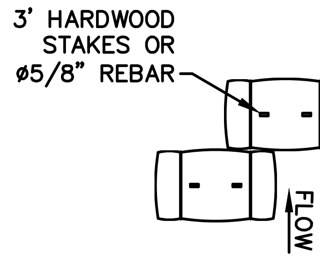
1. USE CHECK DAMS TO SLOW WATER FLOWS AND AS SMALL SEDIMENT TRAPS IN DITCHES ALONG ACCESS ROADS.
2. CLEAN SEDIMENT AND REPLACE DAMS AS NECESSARY.
3. THE CENTER OF THE CHECK DAM MUST BE AT LEAST 6" LOWER THAN THE OUTER EDGES.
4. COORDINATE SPACING WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
5. MAX. SPACING: TOE OF THE UPSTREAM DAM IS SAME ELEVATION AS TOP OF DOWNSTREAM DAM.
6. STONE SHALL BE FREE OF FINE PARTICLES TO PREVENT TURBID DISCHARGES.

BMP PICTURE

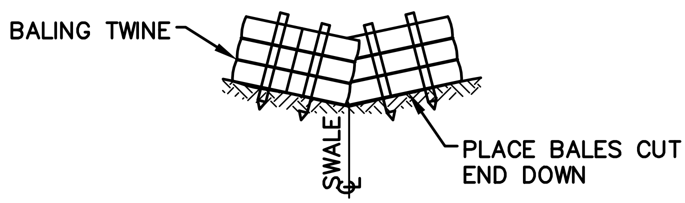
NOTE: A SMALLER STONE SIZE IS SHOWN IN THIS PICTURE.

BMP DETAIL

SCALE: NONE



PLAN VIEW



SECTION VIEW

NOTES:

1. USE CHECK DAMS TO SLOW WATER FLOWS AND AS SMALL SEDIMENT TRAPS IN DITCHES ALONG ACCESS ROADS.
2. CLEAN SEDIMENT AND REPLACE DAMS AS NECESSARY.
3. COORDINATE SPACING WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

AA-4
STRAW / HAYBALE CHECK DAM

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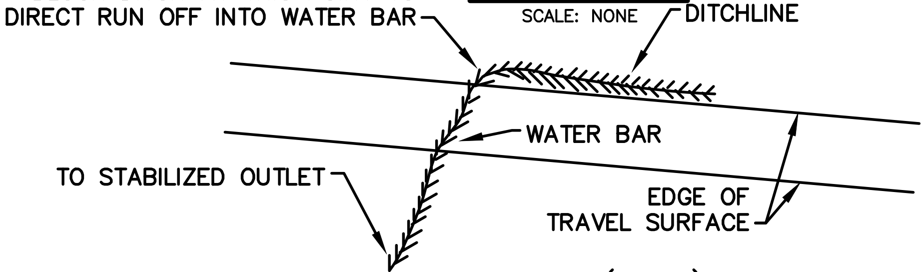
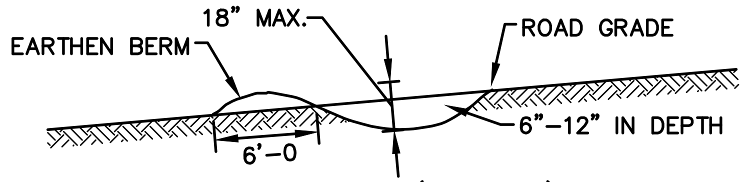
BMP DETAIL

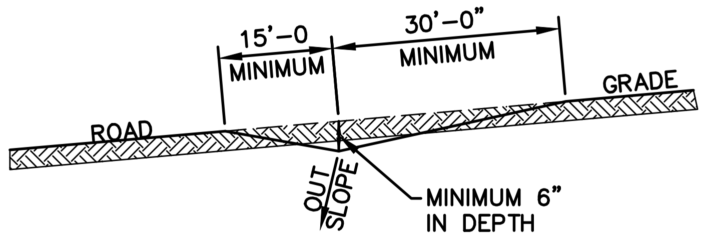
SCALE: NONE



WATERBAR (PLAN)



WATERBAR (SECTION)



DISCHARGE (SECTION)

NOTE:

1. LINE WITH 2"–6" STONE UNDERLAIN BY GEOTEXTILE FILTER FABRIC, KEYED INTO ROAD SURFACE AT LEAST 10 FEET EACH SIDE OF WATERBAR.
2. COORDINATE SPACING WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

File: Waterbar.dwg

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AA-5
WATERBAR

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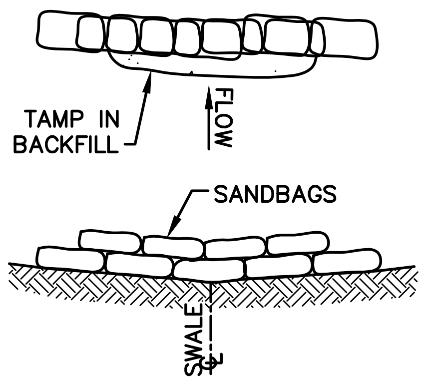
BMP DETAIL

SCALE: NONE



SANDBAG CHECK DAM

NOTES:

1. USE CHECK DAMS TO SLOW WATER FLOWS AND AS SMALL SEDIMENT TRAPS IN DITCHES ALONG ACCESS ROADS.
2. CLEAN SEDIMENT AND REPLACE DAMS AS NECESSARY.
3. COORDINATE SPACING WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

NOTE:

1. PICTURE DOES NOT DEPICT "TAMP IN BACKFILL"

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AA-6

SANDBAG CHECK DAM

File: Sand_Bag_Check.dwg

BMP PICTURE

NOTE:

1. EXACT SIZE, LOCATION AND DESIGN IS DEPENDANT ON SITE CONDITIONS, AND LOCAL AND STATE REGULATIONS. COORDINATE THIS BMP WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST PRIOR TO CONSTRUCTION.

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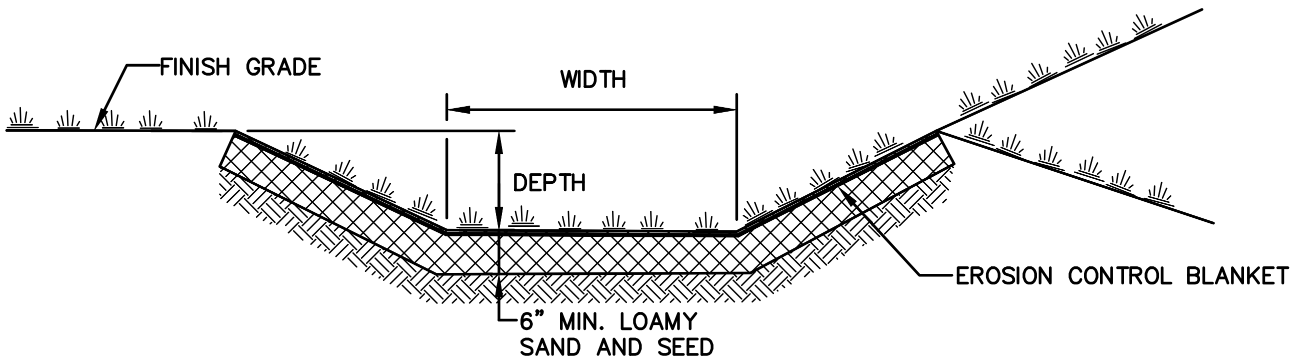
BMP DETAIL

SCALE: NONE



NOTES:

1. WIDTH AND DEPTH OF SWALE, AND EROSION CONTROL BLANKET TYPE TO BE COORDINATED WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. REFER TO DETAILS SEC-10 AND SEC-11 FOR SEED MIXTURE OPTIONS.

BMP PICTURE

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AA-8

DRAINAGE SWALE AND LINED DITCH

File: Lined_Drainage_Swale.dwg

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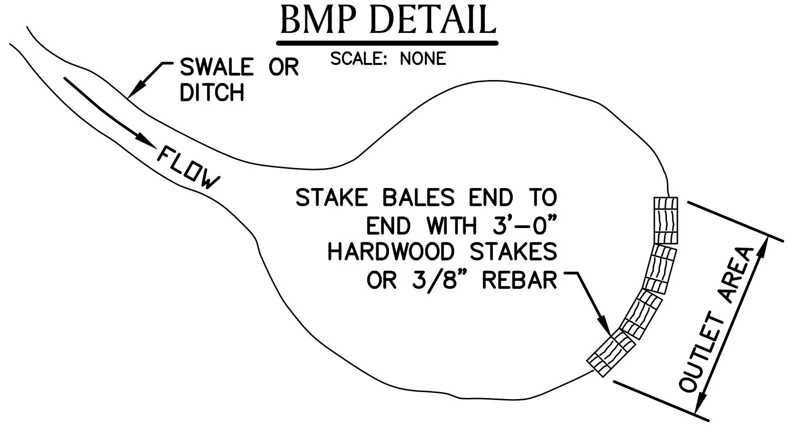
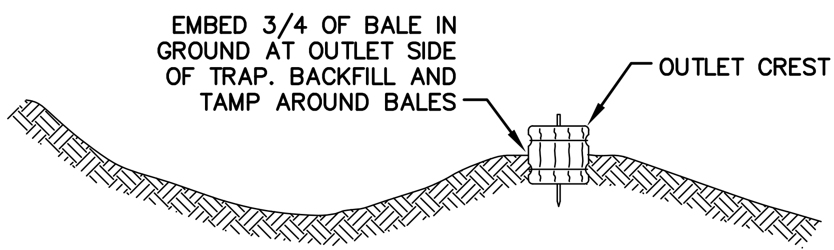
BMP DETAIL

SCALE: NONE





TYPICAL PROFILE

NOTES

1. SIZE, SHAPE AND PROFILE OF SEDIMENT WILL VARY ACCORDING TO ANTICIPATED FLOW VOLUME AND SURROUNDING TERRAIN AND SHALL BE COORDIANTED WITH THE NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. THE BASIN SHALL BE CUT BELOW THE GROUNDLINE. FILL SHALL NOT BE USED TO HOLD WATER UNLESS ROLLED AND COMPACTED.
3. OUTLET AREA IS TO REMAIN FREE OF EXCAVATION SPOILS.
4. OUTLET CREST ELEVATION SHALL BE LOWER THAN INLET ELEVATION AND AT LEAST 1'–0" BELOW THE TOP OF THE BASIN.ARMOUR SLOPES >8% IN OUTLET AREA WITH STONE OF APPROPRIATE SIZE TO PREVENT SCOUR.
5. ARMOUR SLOPES >8% IN OUTLET AREA WITH STONE OF APPROPRIATE SIZE TO PREVENT SCOUR.

BMP PICTURE

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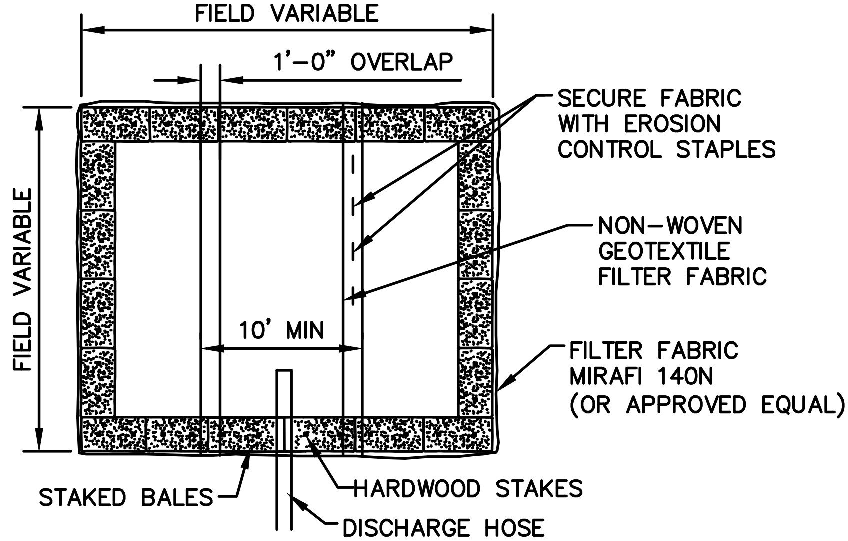
AA-9
SEDIMENTATION BASIN

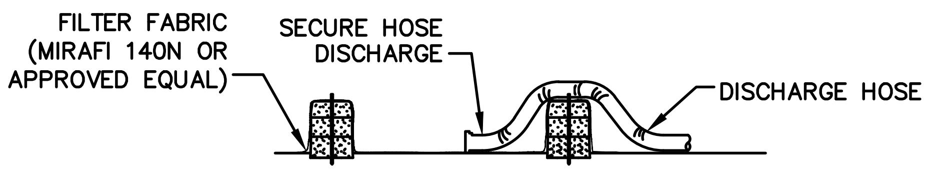
File: Sedimentation_Basin.dwg

BMP DETAIL

SCALE: NONE



PLAN VIEW



CROSS–SECTION

NOTES:

1. NUMBER OF BALES MAY VARY DEPENDING ON SITE CONDITIONS,
2. THE BASIN TO BE SIZED TO PREVENT DISCHARGE WATER FROM OVERTOPPING BASIN.
3. KEEP AS FAR FROM WETLANDS AS PRACTICAL.
4. CLEAN AND REMOVE AS SOON AS DEWATERING IS COMPLETE.

BMP PICTURE

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AA-10
DEWATERING BASIN
(SMALL SCALE)

File: Dewat_Bas_Small.dwg

BMP PICTURE

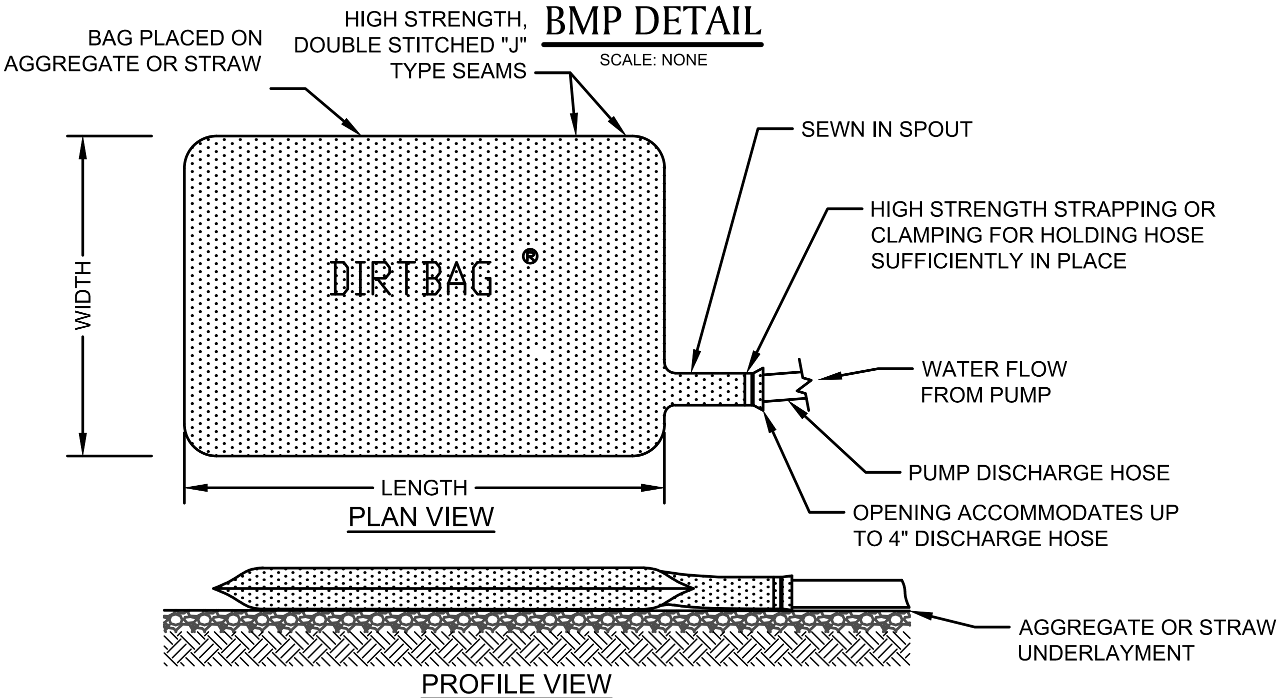
NOTE:

1. EXACT SIZE, LOCATION AND DESIGN IS DEPENDANT ON SITE CONDITIONS, AND LOCAL AND STATE REGULATIONS. COORDINATE THIS BMP WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST PRIOR TO CONSTRUCTION.

AA-11
DEWATERING BASIN -
LARGE SCALE

BMP DETAIL

SCALE: NONE



NOTE:
ONCE PUMPING COMMENCES, THE DIRT BAG SHALL BE MONITORED FREQUENTLY TO ASSURE THAT THE CONNECTIONS ARE SECURELY FASTENED AND THE RATE OF WATER DELIVERY TO THE STRUCTURE IS LOW ENOUGH TO PREVENT UNFILTERED WATER FROM FLOWING FROM THE HOSE CONNECTIONS OR BAG.

BMP PICTURE

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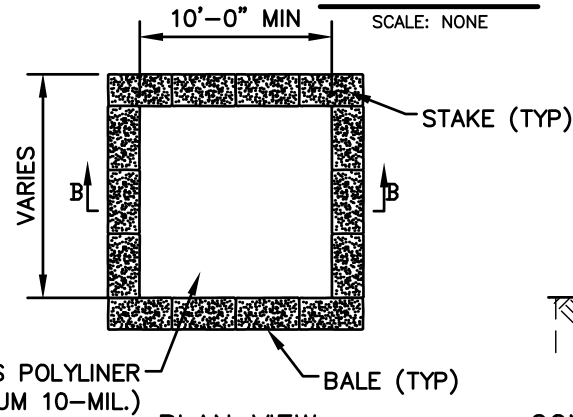
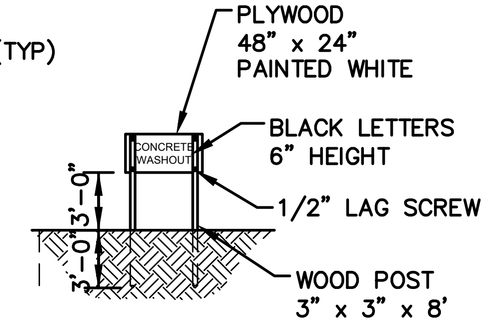
BMP DETAIL

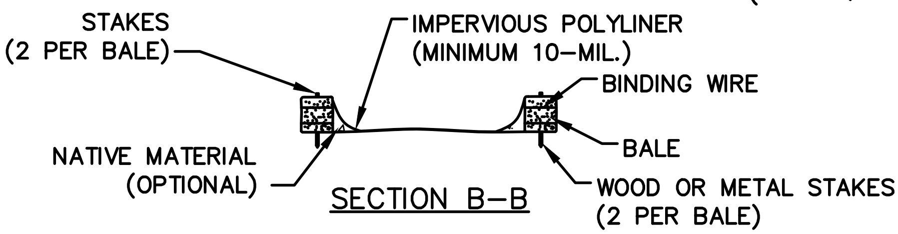
SCALE: NONE



PLAN VIEW
TYPE "ABOVE GRADE"
WITH BALES



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)



SECTION B–B

NOTES:

1. NUMBER OF BALES MAY VARY DEPENDING ON SITE CONDITIONS. COORDINATE SIZE AND LOCATION OF CONCRETE WASTE SUMP WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. KEEP AS FAR FROM DRAINAGE CHANNELS AND WETLAND AREAS AS PRACTICAL.
3. SUMPS TO BE CLEANED AND WASTE CONCRETE REMOVED AND PROPERLY DISPOSED OF UPON COMPLETION OF WORK.
4. SEE ADDITIONAL NOTES ON DETAIL AA–14.

BMP PICTURE

File: Conc_Waste_Sump.dwg

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AA-13
CONCRETE WASTE SUMP

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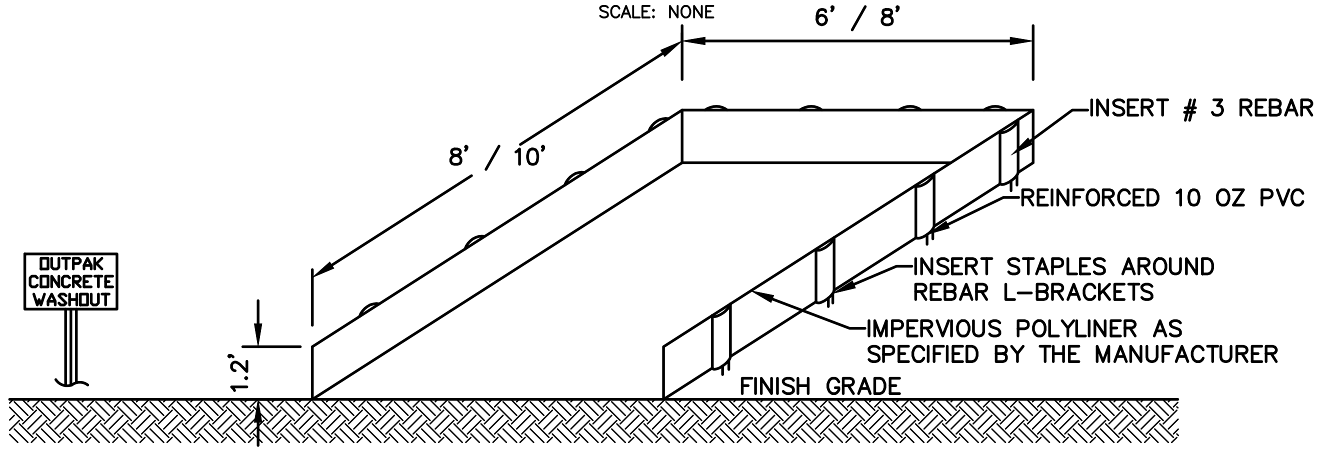
BMP DETAIL

SCALE: NONE



CROSS SECTION

NOTES:

1. PRODUCT TO BE OUTPAK PVC CONCRETE WASHOUT OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT.
3. SIGNS SHALL BE PLACED AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT.
4. THE CONCRETE WASHOUT AREA WILL BE REPLACED AS NECESSARY TO MAINTAIN CAPACITY FOR WASTE CONCRETE AND OTHER LIQUID WASTE.
5. WASHOUT RESIDUE SHALL BE REMOVED FROM THE SITE AND DISPENSED OF AT AN APPROVED WASTE SITE.
6. DO NOT MIX EXCESS AMOUNTS OF FRESH CONCRETE OR CEMENT ON-SITE.
7. DO NOT WASH OUT CONCRETE TRUCKS INTO STORM DRAINS, OPEN DITCHES, STREETS, OR STREAMS.
8. AVOID DUMPING EXCESS CONCRETE IN NON-DESIGNATED DUMPING AREAS.
9. LOCATE WASHOUT AREA AT LEAST 50' FROM STORM DRAIN, OPEN DITCHES, OR WATERBODIES. COORDINATE LOCATION WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.
10. WASH OUT WASTES INTO THE OUTPAK WASHOUT WHERE THE CONCRETE CAN SET, BE BROKEN UP, AND THEN DISPOSED OF PROPERLY.
11. A SECURE, NON-COLLAPSING, NON-WATER COLLECTING COVER MUST BE PLACED OVER CONCRETE WASHOUT PRIOR TO PREDICTED WET WEATHER TO PREVENT ACCUMULATION AND OVERFLOW OF PRECIPITATION.

BMP PICTURE

File: Outpak_Washout.dwg

*** PICTURE AND DETAIL PROVIDED BY OUTPAK WASHOUT**
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AA-14
OUTPAK CONCRETE WASHOUT *

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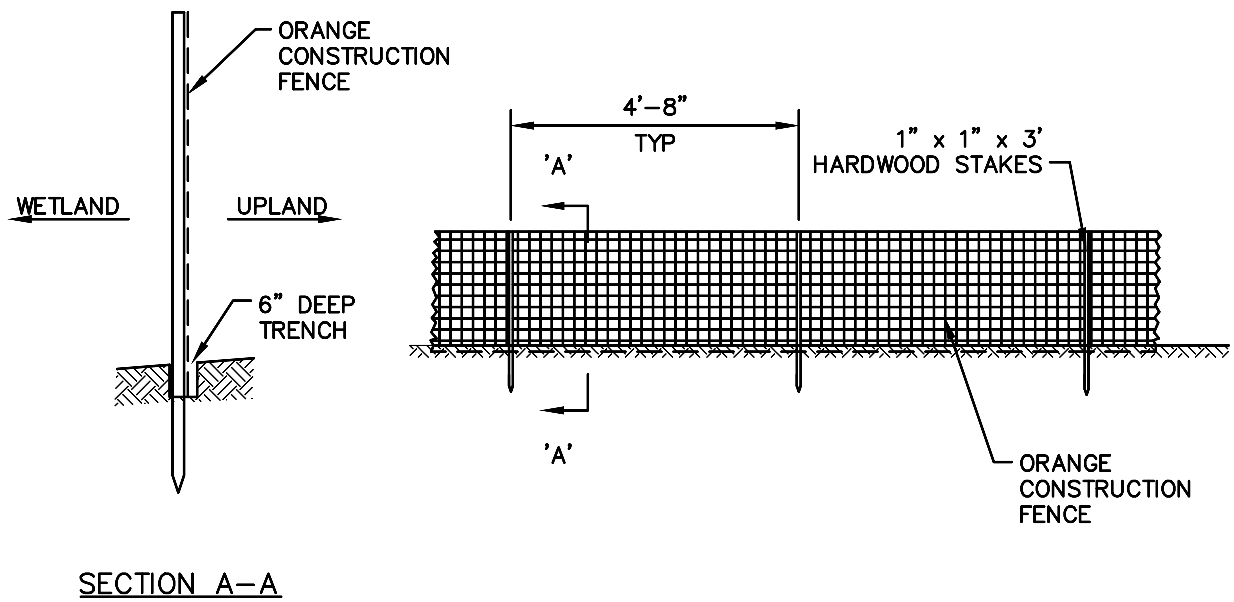
BMP DETAIL

SCALE: NONE



BMP PICTURE

File: Barrier_Fence.dwg

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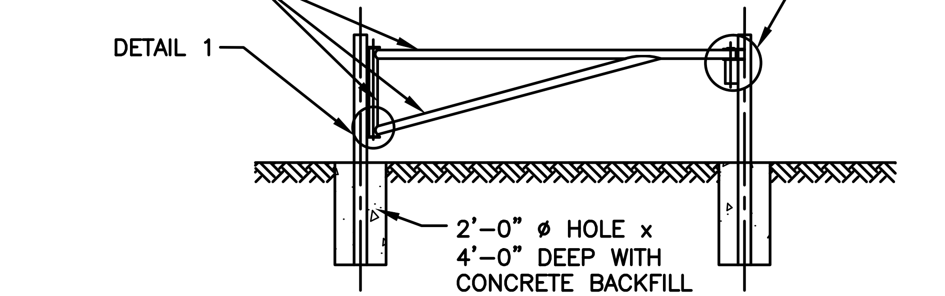
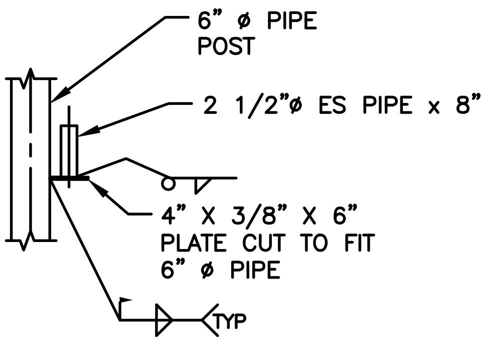
AA-15
BARRIER FENCE
(CONSTRUCTION FENCE)

BMP DETAIL

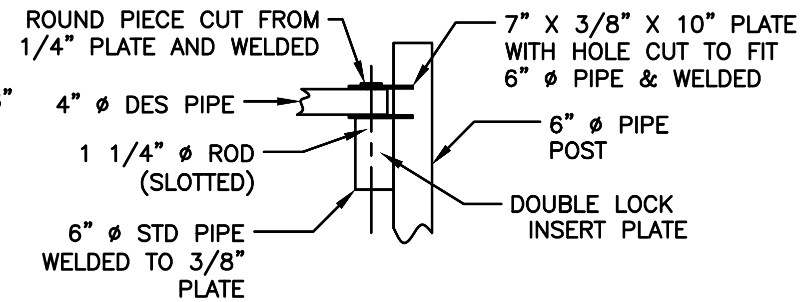
SCALE: NONE





DETAIL 1

SIMILAR DETAIL AT TOP



DETAIL 2

NOTES:

1. ALL GATE STEEL PIPES SHALL BE IN ACCORDANCE WITH ASTM A–501, PLATES SHALL BE ASTM A–36.
2. ALL STEEL PIPES SHALL BE PRIMED WITH ZINC–CHROMATE PRIMER AND FINISHED WITH AN APPROVED OSHA "SAFETY YELLOW" TOP COAT COMPATIBLE WITH THE PRIMER AND FOR EXTERIOR EXPOSURE.
3. REFLECTORS SHALL BE SPACED AT 3 FEET ALONG THE LENGTH OF THE CROSSBAR AND BRACE
4. BACKFILL AT POSTS TO BE COMPACTED.

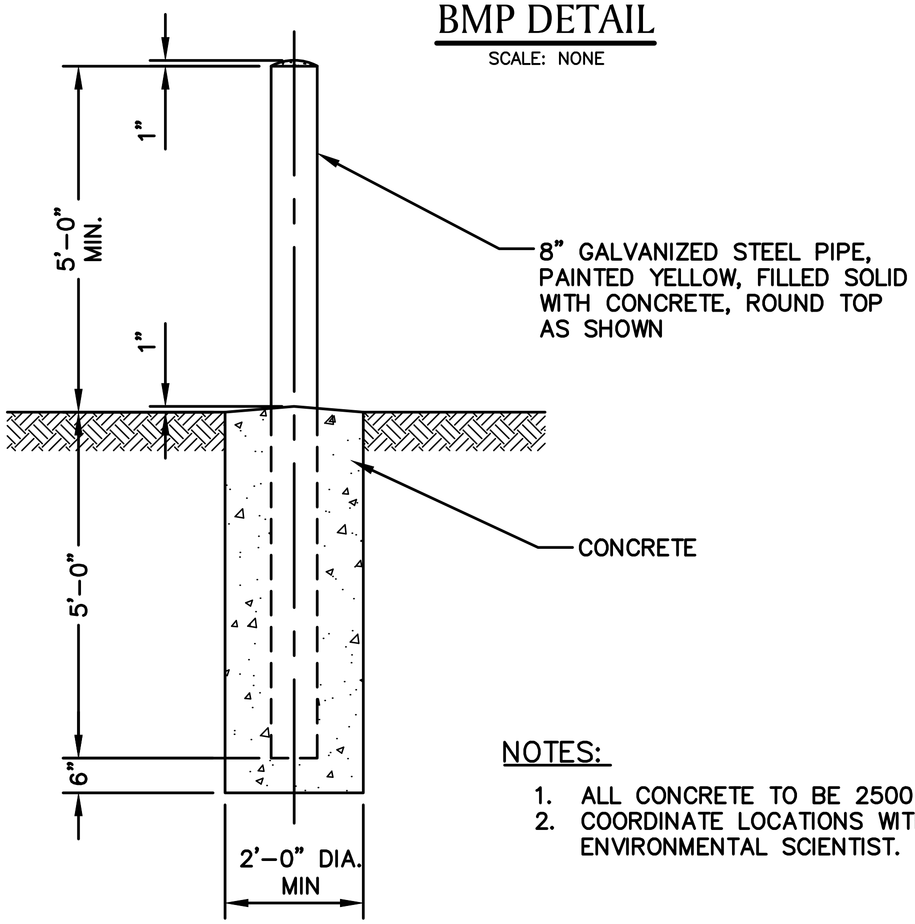
BMP PICTURE

AA-16
ROW GATE / FENCE

nationalgrid ENVIRONMENTAL GUIDANCE	Doc. No.	EG-303NE
	Page: 7-45	Rev. No. 4
	Date	02/20/18
SUBJECT Access, Maintenance and Construction Best Management Practices	Reference EP No. 3 - Natural Resource Protection (Chapter 6)	

BMP DETAIL

SCALE: NONE



NOTES:

1. ALL CONCRETE TO BE 2500 P.S.I. MINIMUM.
2. COORDINATE LOCATIONS WITH NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

File: Bollard.dwg

APPROVED BY: VICE PRESIDENT, ENVIRONMENTAL SERVICES

AA-17
BOLLARD

BMP

Definition

The control of dust resulting from land-disturbing activities.

Purpose

To prevent surface and air movement of dust from disturbed soil surfaces that may cause off-site damage, health hazards, and traffic safety problems.

Conditions Where Practice Applies

On construction roads, access points, and other disturbed areas subject to surface dust movement and dust blowing where off-site damage may occur if dust is not controlled.

Design Criteria

Construction operations should be scheduled to minimize the amount of area disturbed at one time. Buffer areas of vegetation should be left where practical. Temporary or permanent stabilization measures shall be installed. No specific design criteria is given; see construction specifications below for common methods of dust control.

Water quality must be considered when materials are selected for dust control. Where there is a potential for the material to wash off to a stream, ingredient information must be provided to the local permitting authority.

Construction Specifications

A. Non-driving Areas – These areas use products and materials applied or placed on soil surfaces to prevent airborne migration of soil particles.

Vegetative Cover – For disturbed areas not subject to traffic, vegetation provides the most practical method of dust control (see Section 3).

Mulch (including gravel mulch) – Mulch offers a fast effective means of controlling dust. This can also include rolled erosion control blankets.

Spray adhesives – These are products generally composed of polymers in a liquid or solid form that are mixed with water to form an emulsion that is sprayed on the soil surface with typical hydroseeding equipment. The mixing ratios and application rates will be in accordance with the manufacturer's recommendations for the specific soils on the site. In no case should the application of these adhesives be made on wet soils or if there is a probability of precipitation within 48 hours of its proposed use. Material Safety Data Sheets will be provided to all applicators and others working with the material.

B. Driving Areas – These areas utilize water, polymer emulsions, and barriers to prevent dust movement from the traffic surface into the air.

Sprinkling – The site may be sprayed with water until the surface is wet. This is especially effective on haul roads and access routes.

Polymer Additives – These polymers are mixed with water and applied to the driving surface by a water truck with a gravity feed drip bar, spray bar or automated distributor truck. The mixing ratios and application rates will be in accordance with the manufacturer's recommendations. Incorporation of the emulsion into the soil will be done to the appropriate depth based on expected traffic. Compaction after incorporation will be by vibratory roller to a minimum of 95%. The prepared surface shall be moist and no application of the polymer will be made if there is a probability of precipitation within 48 hours of its proposed use. Material Safety Data Sheets will be provided to all applicators working with the material.

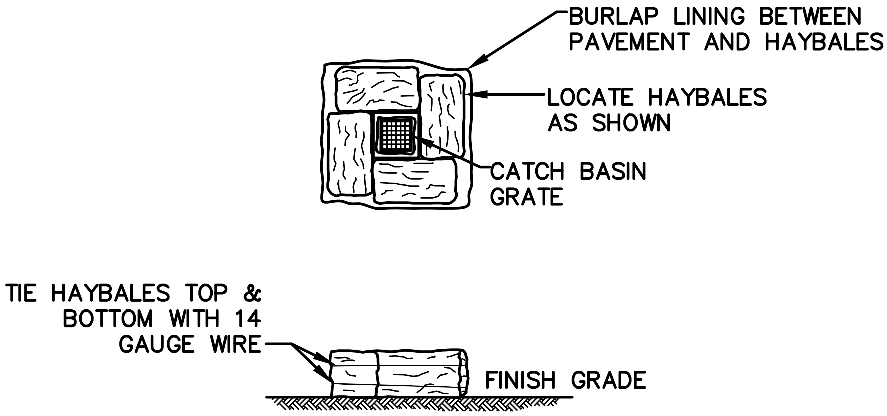
Barriers – Woven geotextiles can be placed on the driving surface to effectively reduce dust throw and particle migration on haul roads. Stone can also be used for construction roads for effective dust control.

Windbreak – A silt fence or similar barrier can control air currents at intervals equal to ten times the barrier height. Preserve existing wind barrier vegetation as much as practical.

SUBJECT	Reference
Access, Maintenance and Construction Best Management Practices	EP No. 3 - Natural Resource Protection (Chapter 6)

BMP DETAIL

SCALE: NONE



NOTES:

1. SURROUND STREET DRAINAGE STRUCTURE INLET WITH HAY BALES PRIOR TO CONSTRUCTION AND MAINTAIN UNTIL CONSTRUCTION IS COMPLETED. ACCUMULATED SEDIMENTS SHALL BE REMOVED.
2. HAYBALES PLACED ON PAVEMENT SHALL HAVE BURLAP PLACED BETWEEN PAVEMENT AND HAYBALE

BMP PICTURE

AA-19
CATCH BASIN INLET PROTECTION

nationalgrid	ENVIRONMENTAL GUIDANCE	Doc. No.	EG-303NE
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SUBJECT
Access, Maintenance and Construction
Best Management Practices

Reference
EP No. 3 - Natural Resource
Protection (Chapter 6)

BMP DETAIL

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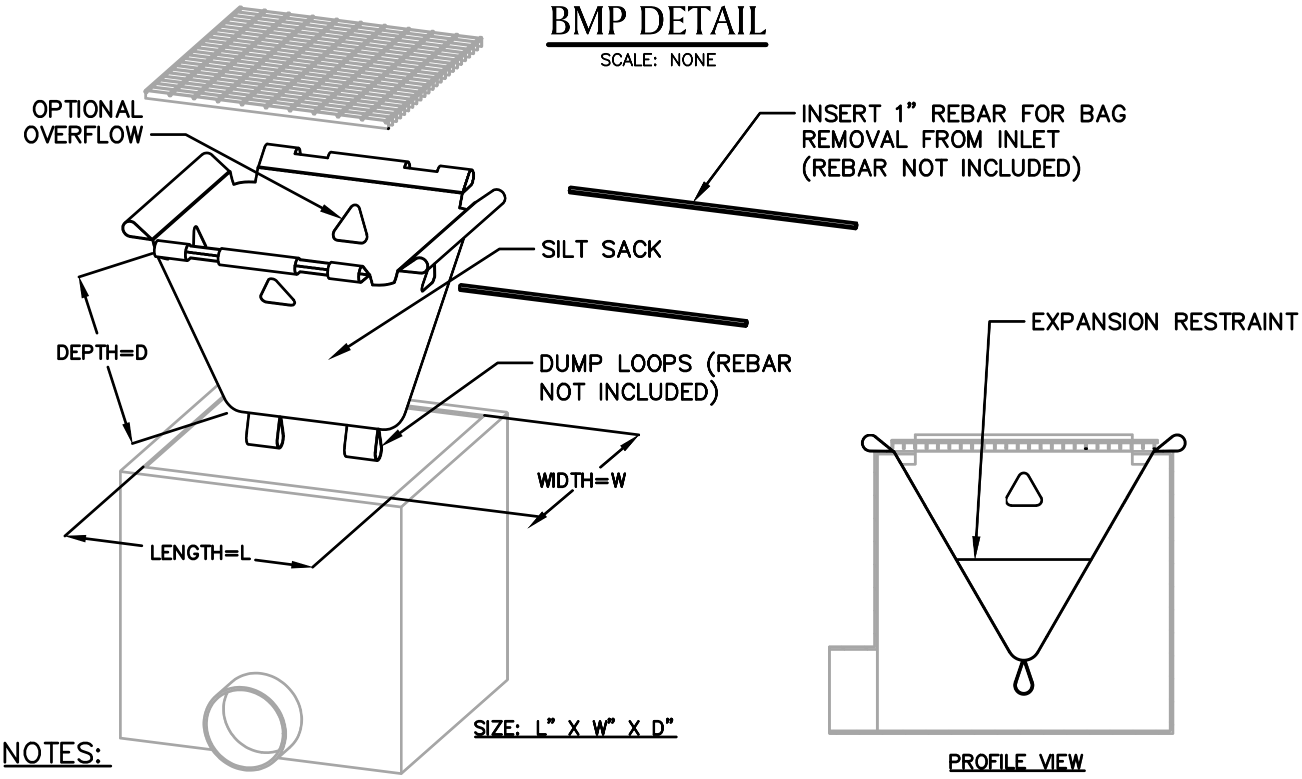

NOTES:

1. PRODUCT TO BE SILT SACK OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. THE USE OF A SILT SACK OPTIONAL OVERFLOW AND OVERALL DIMENSIONS ARE TO BE COORDINATED WITH A NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP PICTURE

*** DETAIL PROVIDED BY ACF ENVIRONMENTAL**
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AA-20
SILT SACK *

File: SILT SACK.dwg

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SUBJECT	Reference
Access, Maintenance and Construction Best Management Practices	EP No. 3 - Natural Resource Protection (Chapter 6)

BMP DETAIL

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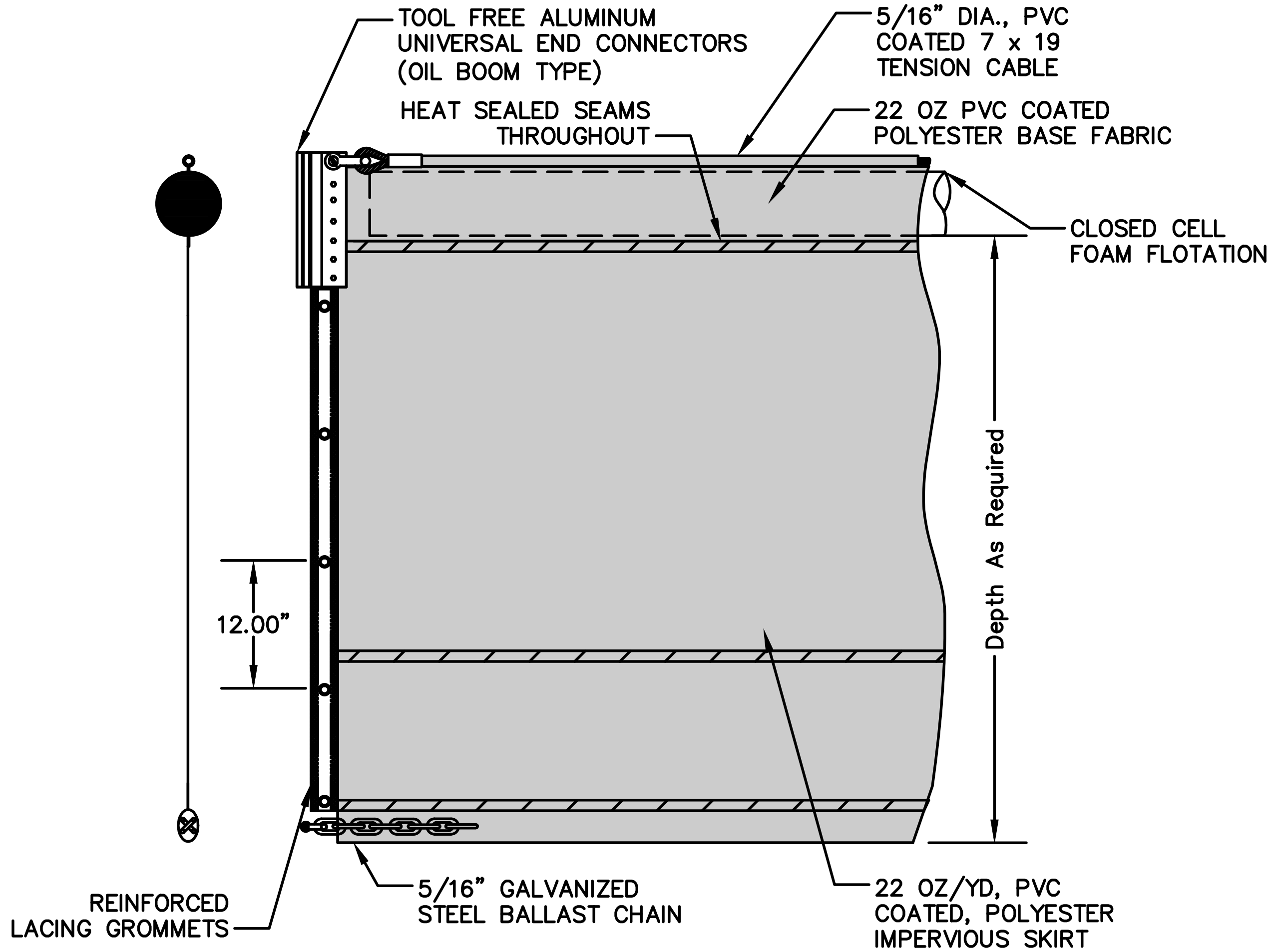


BMP PICTURE

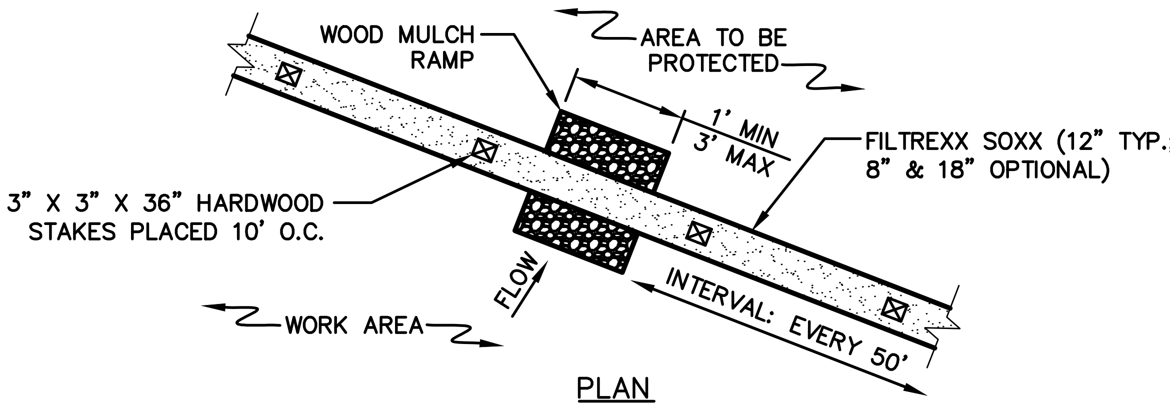
*** DETAIL PROVIDED BY BROCKTON EQUIPMENT / SPILLDAM INC.**
APPROVED BY: VICE PRESIDENT, ENVIRONMENTAL SERVICES
PRINTED COPIES ARE NOT DOCUMENT CONTROLLED. FOR LATEST AUTHORIZED VERSION PLEASE REFER TO THE NATIONAL GRID ENVIRONMENTAL INFONET SITE.

AA-21
TURBIDITY CURTAIN *

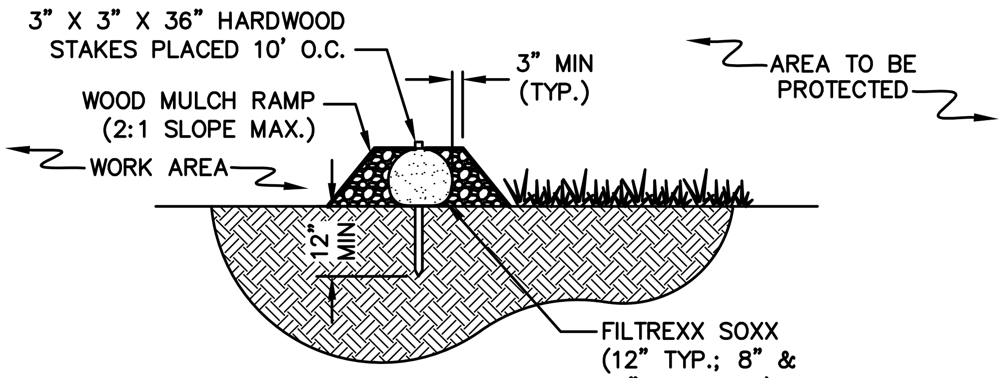
File: Turbidity_Curtain.dwg

BMP DETAIL

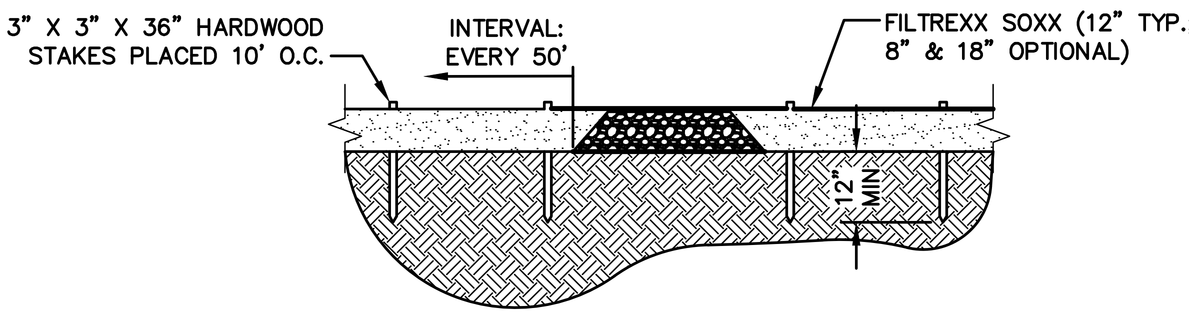
SCALE: NONE



PLAN



SECTION



PROFILE

NOTES

1. PRODUCT TO BE FILTREXX SILT SOXX OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. ALL MATERIAL TO MEET FILTREXX SPECIFICATIONS.
3. FILTER MEDIA FILL TO MEET APPLICATION REQUIREMENTS.
4. NON-MONOFILAMENT CONTAINMENT MATERIAL SHOULD BE KNITTED PHOTODEGRADABLE OR BIODEGRADABLE MATERIAL, WITH OPENING SIZES BETWEEN 1/8" – 1/4".
5. COMPOST MEDIA SHOULD HAVE PARTICLE SIZE WHERE 99% < 2", 50% > 1/2".
6. COMPOST MATERIAL TO BE DISPOSED OF ON-SITE, OR IN ACCORDANCE WITH ENVIRONMENTAL PERMITS AS APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
7. WOOD MULCH RAMP IS OPTIONAL DEPENDING ON SUBSTRATE/SITE CONDITIONS, AND TO BE APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP # AA-22
SILTSOXX AMPHIBIAN & REPTILE CROSSING #1 (1 OF 2)

BMP PICTURE

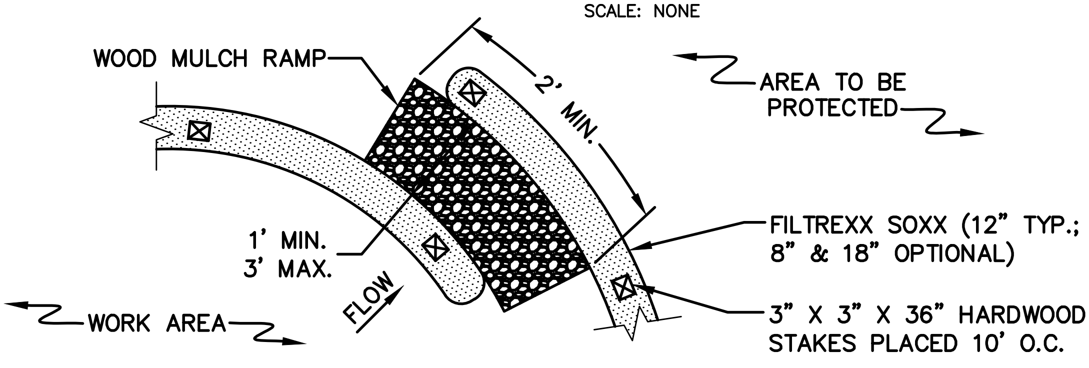
SALAMANDER AND SNAKE CROSSING #1

ALTERNATE WOOD MULCH RAMP SILTSOXX NOTES:

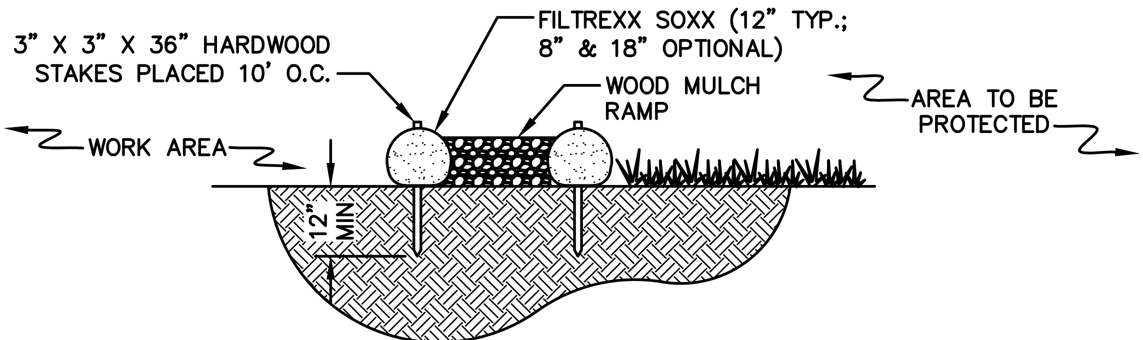
1. SILTSOXX, BY FILTREX INTERNATIONAL, OR APPROVED EQUAL PRODUCT SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES.
2. BMP SHOULD ONLY BE UTILIZED IN AREAS WHERE RARE SALAMANDER AND SNAKE HABITAT OCCURS, OR AT THE DIRECTION OF THE NATIONAL GRID ENVIRONMENTAL SCIENTIST.

BMP DETAIL

SCALE: NONE



PLAN



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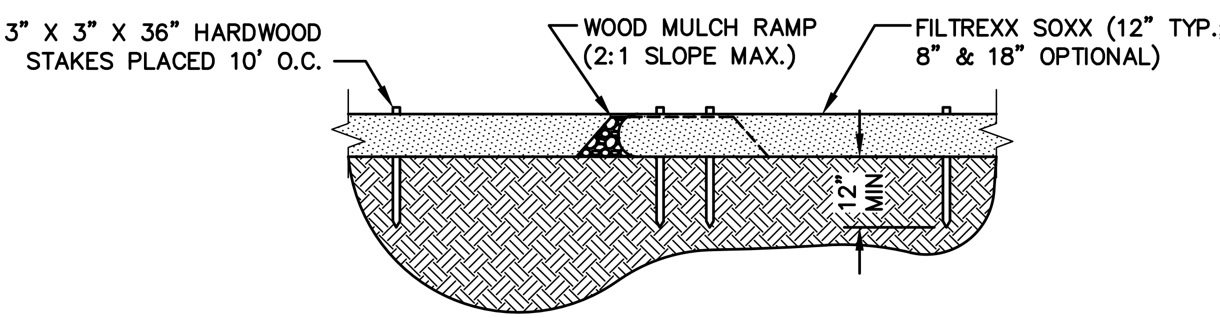

PROFILE

NOTES

1. PRODUCT TO BE FILTREXX SILT SOXX OR APPROVED EQUAL BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
2. ALL MATERIAL TO MEET FILTREXX SPECIFICATIONS.
3. FILTER MEDIA FILL TO MEET APPLICATION REQUIREMENTS.
4. NON–MONOFILAMENT CONTAINMENT MATERIAL SHOULD BE KNITTED PHOTODEGRADABLE OR BIODEGRADABLE MATERIAL, WITH OPENING SIZES BETWEEN 1/8" – 1/4".
5. COMPOST MEDIA SHOULD HAVE PARTICLE SIZE WHERE 99% < 2", 50% > 1/2".
6. COMPOST MATERIAL TO BE DISPOSED OF ON–SITE, OR IN ACCORDANCE WITH ENVIRONMENTAL PERMITS AS APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
7. WOOD MULCH RAMP IS OPTIONAL DEPENDING ON SUBSTRATE/SITE CONDITIONS, AND TO BE APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
8. GAPS TO BE SPACED EVERY 50 FT, IF POSSIBLE GIVEN WETLAND PERMIT CONDITIONS.

BMP PICTURE

SILTSOXX AMPHIBIAN & REPTILE CROSSING #2

ALTERNATE WOOD MULCH RAMP SILTSOXX NOTES:

1. SILTSOXX, BY FILTREX INTERNATIONAL, OR APPROVED EQUAL PRODUCT SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURER'S GUIDELINES.
2. BMP SHOULD ONLY BE UTILIZED IN AREAS WHERE RARE SALAMANDER AND SNAKE HABITAT OCCURS OR AT THE DIRECTION OF THE NATIONAL GRID ENVIRONMENTAL SCIENTIST.

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SUBJECT Access, Maintenance and Construction Best Management Practices		Reference EP No. 3 - Natural Resource Protection (Chapter 6)	

BMP DETAIL

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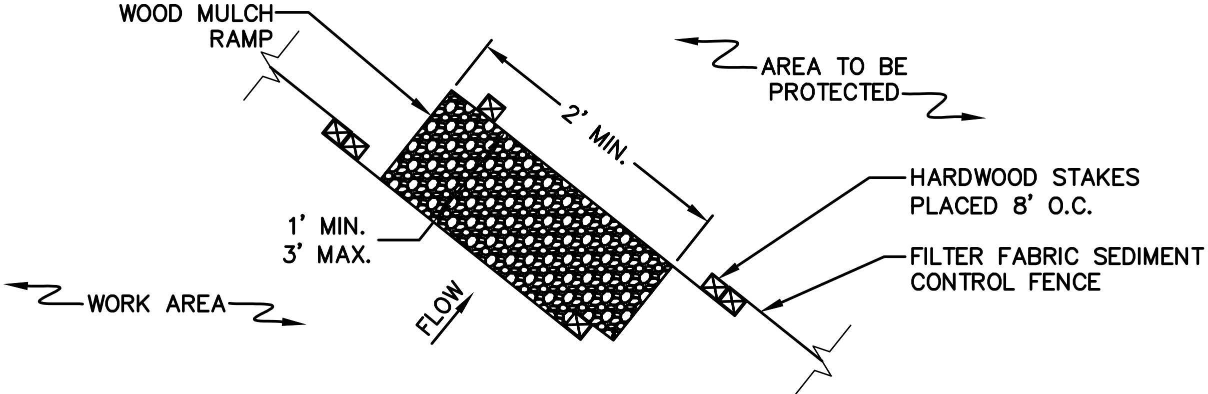

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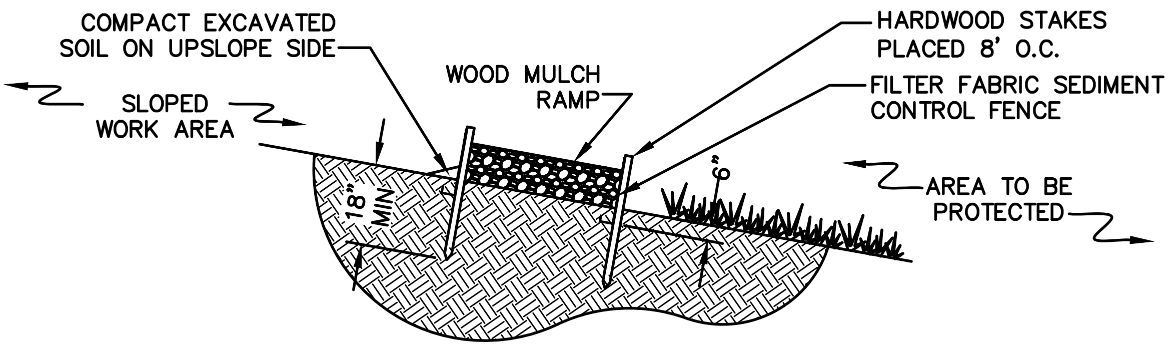

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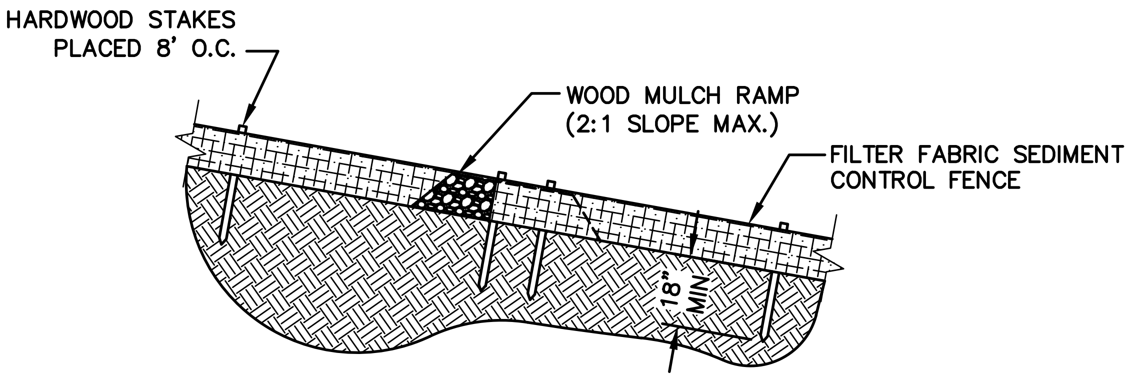

PROFILE

NOTES

1. IN AREAS WHERE SLOPES OR RUN–OFF VOLUME PROHIBIT USE OF SILTSOXX, CROSSINGS CAN BE PROVIDED THROUGH TRENCHED SILT FENCE.
2. INTALL SILT FENCE TO SPECIFICATIONS IN EG303 APPENDIX 7 "SEC–2 SEDIMENT CONTROL FENCE."
3. WOOD MULCH RAMP IS OPTIONAL DEPENDING ON SUBSTRATE/SITE CONDITIONS, AND TO BE APPROVED BY NATIONAL GRID ENVIRONMENTAL SCIENTIST.
4. GAPS TO BE SPACED EVERY 50 FT, IF POSSIBLE GIVEN WETLAND PERMIT CONDITIONS.

File: Alternate_Siltsoxx.dwg

APPROVED BY: VICE PRESIDENT, ENVIRONMENTAL SERVICES

BMP # AA-24
SILT FENCE AMPHIBIAN & REPTILE CROSSING #3

nationalgrid	ENVIRONMENTAL GUIDANCE	Doc. No.	EG-303NE
		Page: 7-55	Rev. No. 4
		Date	02/20/18

SUBJECT	Reference
Access, Maintenance and Construction Best Management Practices	EP No. 3 - Natural Resource Protection (Chapter 6)

BMP DETAIL

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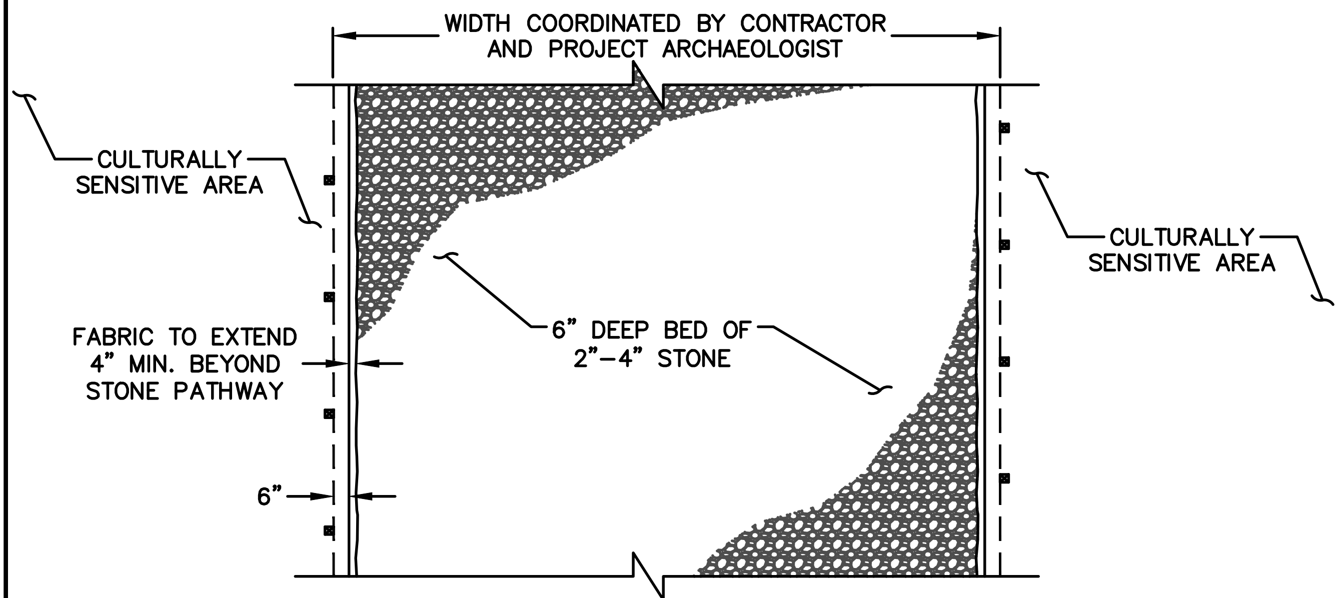
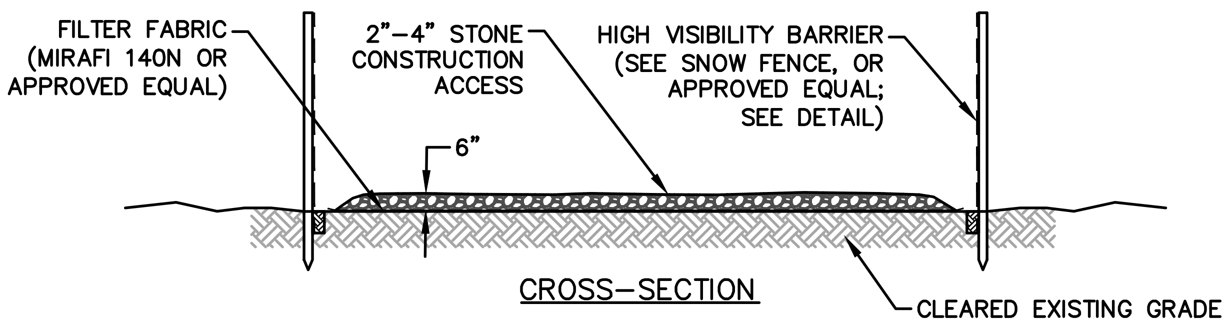


PLAN VIEW



CROSS-SECTION

NOTES:

1. ARCHAEOLOGICAL SITE BOUNDARIES, AS DEFINED BY INTENSIVE ARCHAEOLOGICAL SURVEY AND SITE AVOIDANCE AND PROTECTION PLANS, WILL BE DEMARCATED BY STAKING BY THE PROJECT ARCHAEOLOGIST.
2. GEOTEXTILE AND STONE MAY REMAIN IN PLACE FOLLOWING CONSTRUCTION IF PERMANENT PROTECTION IS NECESSARY AND DEPENDENT ON EASEMENT RIGHTS.
3. WHERE APPROVED BY THE PROJECT-SPECIFIC SAPP, CONSTRUCTION MATTING MAY BE ADDED OVER, OR IN PLACE OF, THE FABRIC AND STONE.
4. INSTALLATION AND REMOVAL OF FABRIC AND STONE, EROSION CONTROLS, AND/OR CONSTRUCTION MATTING WILL BE MONITORED BY THE PROJECT ARCHAEOLOGIST AT EACH LOCATION(S).
5. INSTALLATION OF THESE MEASURES WILL BE CONDUCTED WITH LOW-GROUND PRESSURE VEHICLES WHERE FEASIBLE.
6. WHERE REQUIRED BY THE PROJECT-SPECIFIC SAPP, TEMPORARY, HIGH VISIBILITY PROTECTIVE FENCING (E.G., SNOW FENCE OR PLASTIC FENCE) WILL BE ERECTED ALONG THE SITE BOUNDARIES OUTSIDE OF THE WORKSPACE WITHIN THE ROW IN ORDER TO PREVENT VEHICLES FROM TRAVELING THROUGH THOSE SITE AREAS DURING CONSTRUCTION. THE PROTECTIVE FENCE WILL BE POSTED WITH "NO TRESPASSING" SIGNS, SO THAT THE SITES CAN BE AVOIDED BY ALL CONSTRUCTION RELATED ACTIVITIES. THE FENCING WILL BE REMOVED UPON COMPLETION OF THE PROJECT. THE INSTALLATION AND REMOVAL OF FENCING WILL BE MONITORED BY THE PROJECT ARCHAEOLOGIST.

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BMP # AA-25

CULTURAL AVOIDANCE (1 OF 2)

BMP PICTURES

BMP # AA-25
CULTURAL AVOIDANCE (2 OF 2)

APPENDIX 5
CERTIFICATION FORM FOR INVASIVE SPECIES CONTROL

Certain permit conditions, therefore a Condition of Contracts for the Prime Contractor, any Subcontractors, and any equipment or mat vendors for ***National Grid Projects*** shall be required to Certify their equipment[7] {each piece of equipment used on site} as 'clean'[8].

_________________________________ (*name of firm*) hereby Certifies that

_________________________________ (*make, model, and/or type*)

____________________________________ (*equipment ID tag or #)* meets the following

1. before entry on to the job site, has been sufficiently cleaned to remove all accumulated mud, debris, plant fragments, and detritus that could harbor seeds, roots, or plant fragments of so-called invasive plant species; and

2. that the above piece of equipment has neither been off-loaded nor operated in the interval between cleaning and delivery to the jobsite.

3. that equipment deployed in areas of invasive species (as identified in project plans) shall be cleaned prior to redeployment.

____________________________ (*signed*) _____________ (*dated*)

____________________________ (*printed name*) _____________________________ (*title*)

____________________________ (*Firm*)

The signed original of this form {one for each piece of equipment (or lot[9] of mats)} is to be given to the NG Construction Supervisor assigned to the project.

---

[7] Equipment may include, but is not limited to bulldozers, excavators, backhoes, bucket trucks (tracked or wheeled), pulling equipment, concrete trucks, compressors, drilling equipment, and mats (composite, wood, or other materials).

[8] With regard to invasive species, the definition of clean means free of accumulated mud, debris, plant fragments, and detritus that could harbor seeds, roots, or plant fragments of so-called invasive plant species.

[9] Lot of mats is the number of mats that may be transported by one forwarder/truck at a time.

Appendix 6 – Snow Disposal Guidelines

See EG303NE_App6 published separately

APPENDIX 6
SNOW DISPOSAL GUIDELINES

Finding a place to dispose of collected snow poses a challenge. While we are all aware of the threats to public safety caused by snow, collected snow that is contaminated with road salt, sand, litter, and automotive pollutants such as oil also threatens public health and the environment.

As snow melts, road salt, sand, litter, and other pollutants are transported into surface water or through the soil where they may eventually reach the groundwater. Road salt and other pollutants can contaminate water supplies and are toxic to aquatic life at certain levels. Sand washed into water bodies can create sand bars or fill in wetlands and ponds, impacting aquatic life, causing flooding, and affecting our use of these resources.

There are several steps that should be taken to minimize the impacts of snow disposal on public health and the environment.

- **DO NOT** dump snow into any water body, including rivers, the ocean, reservoirs, ponds, or wetlands. In fact, a buffer of at least 50 feet between any snow disposal area and any the high-water mark of any surface water should be kept. A silt fence or equivalent barrier should be securely placed between the snow storage area and the high-water mark. In addition to water quality impacts and flooding, snow disposed in surface waters can cause navigational hazards when it freezes into ice blocks.
- **DO NOT** dump snow within a wellhead protection area (e.g., a Zone II), in a high or medium-yield aquifer, or within 75 feet of a private well, where road salt may contaminate water supplies**. Ask an Environmental Department representative for guidance in determining if a proposed disposal area is located within one of these sensitive areas.**
- Avoid disposing of snow on top of storm drain catch basins or in storm water drainage swales or ditches. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.
- All debris in a snow storage area should be cleared from the site and properly disposed of no later than May 15 of each year the area is used for snow storage.

Under extraordinary conditions, when all land-based snow disposal options are exhausted, disposal of snow that is not obviously contaminated with road salt, sand, and other pollutants may be allowed near (within 50 feet) or even in certain water bodies under certain conditions.

In these dire situations, **notify the Environmental Department** so that the local Conservation Commission and the appropriate MassDEP Regional Service Center (in MA), RI DEM Office of Water Resources – RIPDES

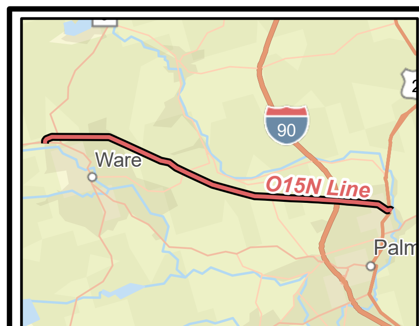
Program (in RI), NH Department of Environmental Services – NHDES (in NH) and VT Department of Environmental Conservation - VT DEC (in VT) can be contacted before disposing of snow in a water body.

In emergency situations and after consulting an Environmental Department representative the following guidance should be followed:

- Dispose of snow in open water with adequate flow and mixing to prevent ice dams from forming.
- Do not dispose of snow in saltmarshes, vegetated wetlands, certified vernal pools, shellfish beds, mudflats, drinking water reservoirs and their tributaries, wellhead protection areas, or other environmentally sensitive areas.
- Do not dispose of snow where trucks may cause shoreline or stream bank damage or erosion.

Appendix 5-3

Visual Simulations



Palmer to Ware Improvement Project

Figure 5-9: Location 1, Thompson Street
Existing Conditions

Page 1 of 1

Source: MassGIS, National Grid, VHB

Date: 11/22/2024

nationalgrid

vhb

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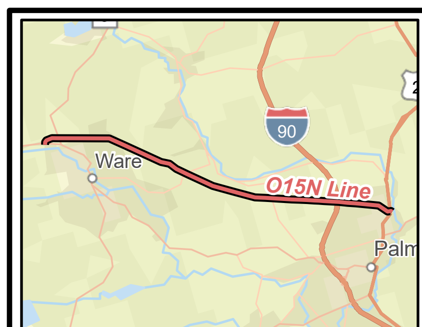


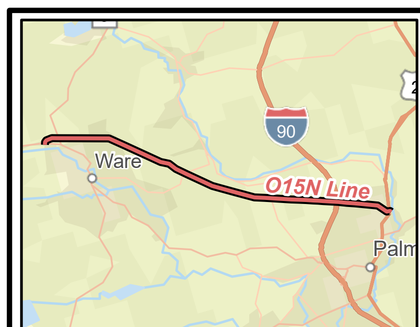
Palmer to Ware Improvement Project

Figure 5-10: Location 1, Thompson Street
Proposed Conditions

Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 11/22/2024



Palmer to Ware Improvement Project

Figure 5-11: Location 2, Old Farm Road
Existing Conditions

Page 1 of 1

Source: MassGIS, National Grid, VHB

Date: 11/22/2024

nationalgrid

vhb

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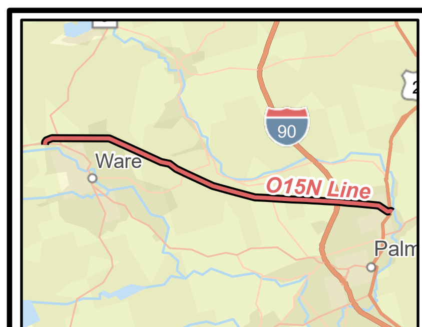

Palmer to Ware Improvement Project

Figure 5-12: Location 2, Old Farm Road
Proposed Conditions

Page 1 of 1

Source: MassGIS,National Grid,VHB

Date: 11/22/2024

Appendix 5-4

Gradient's EMF Modeling Analysis

Electric and Magnetic Field (EMF) Modeling Analysis for the National Grid 69-kV O15N Asset Condition Refurbishment Project

Prepared for

National Grid
40 Sylvan Road
Waltham, MA 02451

August 26, 2024

GRADIENT

www.gradientcorp.com
One Beacon Street, 17th Floor
Boston, MA 02108
617-395-5000

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Abbreviations

A	Ampere
AC	Alternating Current
BPA	Bonneville Power Administration
DC	Direct Current
EF	Electric Field
EHS	Extra High Strength
EMF	Electric and Magnetic Field
G	Gauss
GIS	Geographic Information Systems
Hz	Hertz
ICNIRP	International Commission on Non-Ionizing Radiation Protection
kV	Kilovolt
kV/m	Kilovolts Per Meter
MA EFSB	Massachusetts Energy Facilities Siting Board
MF	Magnetic Field
mG	Milligauss
MRI	Magnetic Resonance Imaging
MVA	Megavolt-Ampere
MW	Megawatt
OPGW	Optical Ground Wire
RMS	Root Mean Square
ROW	Right-of-Way
T	Tesla
US	United States
WHO	World Health Organization
µT	Microtesla

1 Introduction and Summary

National Grid requested that Gradient perform an independent modeling assessment of the electric and magnetic field (EMF) levels associated with the 69-kilovolt (kV) O15N Asset Condition Refurbishment Project between the Ware Substation in Ware, Massachusetts (MA), and the Palmer Substation in Palmer, MA. This Project involves reconductoring the existing 69-kV overhead O15N line and replacing the existing wood polearm tower structures with steel pole braced and engineered steel structures between the two substations. The existing 3/8" extra high strength (EHS) steel shield wire will be replaced with optical ground wire (OPGW). The route is to be rebuilt to 115 kV standards but will operate at 69 kV. The total Project route is approximately 10 miles in length.

Gradient is a Boston-based environmental and risk sciences consulting firm, nationally renowned for its specialties in toxicology, epidemiology, risk assessment, forensic chemistry, EMF assessment, contaminant fate and transport modeling, risk-based remedial alternatives assessment, and the application of database management and Geographic Information Systems (GIS) tools for addressing environmental contamination. For over 25 years, Gradient scientists have prepared EMF assessments in support of permitting for proposed overhead and underground transmission line projects, electrical substation projects, electrical generation facility projects, and renewable energy projects (*e.g.*, offshore wind, solar, battery storage). Gradient has provided EMF consulting services to regulatory agencies, electric utility companies, municipal utilities, and renewable energy companies. Gradient scientists have experience testifying at regulatory hearings and presenting on EMF at meetings with regulators, stakeholders, and the general public. Gradient scientists have published book chapters and journal articles on EMF-related topics, including the 2019 book chapter "Low-Frequency Magnetic Fields: Potential Environmental Health Impacts" in the 2nd edition of the *Encyclopedia of Environmental Health* (Volume 3).

For this EMF assessment, EMF modeling was conducted at a height of 1 meter (3.28 feet) above the ground surface for two representative right-of-way (ROW) cross sections. We performed EMF modeling for the existing overhead circuit configuration in the ROW cross sections (referred to in the report as "pre-Project" case) and for two post-Project cases: (1) for the overhead circuit configuration and current loadings on the O15N line representative of the in-service year operating at 69-kV, and (2) for a second post-Project case with current loadings on the O15N line representative of the in-service year operating at 115-kV. This second post-Project case was included because the O15N circuits are being rebuilt using 115-kV framing and phase conductor spacing so as to provide the capability to increase the line voltage and power delivery at a later date. For representative cross section 1 that occurs from the Ware Substation to Structure 119, the O15N line is the only line present in the ROW. For cross section 2, which occurs from Structure 119 to the Palmer Substation, the 69-kV X176 line is present in the ROW as well, and this line was included in the EMF modeling for this cross section to determine the cumulative EMF levels at the ROW edges. EMF modeling was conservatively conducted for the location of lowest conductor sag[1] for each cross section. Modeling was conducted for both annual average and system peak load levels; for system peak load levels, modeling was conducted for both a base case with East-West bias where Millennium, Northfield, and Mass Power are out of service (referred to as the "base case"), and a sensitivity case with West-East bias where Bear Swamp and Stony Brook are out of service (referred to as the "sensitivity case").

[1] As provided by National Grid, a minimum conductor height above ground of 23 feet was used for pre-Project and post-Project modeling of the two representative cross sections based on state code clearance requirements. Modeling at the location of lowest conductor sag is conservative because this is the location with the least clearance between the lines and the ground surface and is thus representative of the highest EMF levels that will be found beneath the lines.

As discussed in more detail in Section 2 of this report, a number of national and international organizations have developed EMF exposure guidelines or limits designed to protect humans against any adverse health effects (*e.g.*, see Table 2.1). The limit values should not be viewed as demarcation lines between "safe" and "dangerous" levels of EMFs, but rather, levels that assure safety with adequate margins to allow for uncertainties in the science. For magnetic fields (MFs), these health-based guidelines range from about 1,000 to 10,000 milligauss (mG). The International Commission on Non-Ionizing Radiation Protection (ICNIRP) guideline for allowable public exposure to 60-hertz (Hz) MFs is 2,000 mG, while the ICNIRP guideline for allowable public exposure to 60-Hz electric fields (EFs) is 4.2 kilovolts per meter (kV/m) (ICNIRP, 2010).

As discussed in Section 3 of this report, for both of the representative cross sections, all modeled pre-Project and post-Project EMF levels, including within the ROW and at the ROW edges, are well below the ICNIRP health-based guidelines. Table 1.1 summarizes the modeled pre-Project and post-Project MF results at the ROW edges.[2] As shown in the table, the modeling results for all of the post-Project modeling scenarios indicate that the Project will result in decreased MF levels at the left ROW edge (and beyond it) as compared to pre-Project MF levels. At the right ROW edge, post-Project MFs are slightly higher than pre-Project MFs for some scenarios, though the magnitudes of the increases are small (<1.1 mG). The maximum edge-of-ROW MF levels observed for the post-Project modeling cases are for the system peak sensitivity case load levels (11.47 mG and 11.34 mG for the left and right ROW edges, respectively), and these maximum edge-of-ROW MF levels remain only about 0.6% of the ICNIRP health-based guideline of 2,000 mG. Moreover, MF levels continue to drop off rapidly with increasing distance from the ROW edges.

Table 1.2 shows that pre-Project and post-Project modeled EF levels at the ROW edges are well below the ICNIRP health-based guideline of 4.2 kV/m for all modeled cases. Because EFs are not dependent on conductor loading (*i.e.*, current), only negligible differences in edge-of-ROW EFs were obtained for the different post-Project loading cases (annual average, system peak base case, and system peak sensitivity case) that were modeled for each of the two post-Project O15N line operating cases. Because EFs are dependent on voltage, EFs for the post-Project 115-kV operation of the O15N line are higher compared to the post-Project 69-kV operation, though the magnitudes of the increases are small (<0.3 kV/m). At the left ROW edge, the modeling results indicate that the Project will result in small decreases to EFs for all modeled scenarios. At the right ROW edge, the modeled post-Project EFs are slightly higher compared to pre-Project EFs for Cross Section 1, though the magnitudes of the increases are small (<0.3 kV/m) for all cases; for Cross Section 2, there is no difference between pre-Project and post-Project EFs at the right ROW edge.

Table 1.1 Summary of Modeled Pre-Project and Post-Project Edge-of-ROW Magnetic Field Levels for the Representative ROW Cross Sections

Representative Cross Section	Magnetic Field (mG)					
	Left Edge-of-ROW			Right Edge-of-ROW		
	Pre-Project	Post-Project (69-kV)	Post-Project (115-kV)	Pre-Project	Post-Project (69-kV)	Post-Project (115-kV)
Average Annual Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	4.68	2.36	1.91	2.15	2.33	1.89
Cross Section 2: Structure 119 to Palmer #503 Substation	4.45	2.15	1.77	1.23	1.36	1.41

[2] Because the modeled cross sections are for facing towards the Palmer Substation, the left edge-of-ROW is generally equivalent to the eastern edge-of-ROW, while the right edge-of-ROW is generally equivalent to the western edge-of-ROW.

Representative Cross Section	Magnetic Field (mG)					
	Left Edge-of-ROW			Right Edge-of-ROW		
	Pre-Project	Post-Project (69-kV)	Post-Project (115-kV)	Pre-Project	Post-Project (69-kV)	Post-Project (115-kV)
System Peak Base Case Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	2.17	1.07	0.88	1.00	1.06	0.87
Cross Section 2: Structure 119 to Palmer #503 Substation	1.85	1.26	1.16	1.18	1.27	1.30
System Peak Sensitivity Case Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	22.80	11.47	9.25	10.48	11.34	9.14
Cross Section 2: Structure 119 to Palmer #503 Substation	21.71	10.95	8.85	3.96	4.78	5.04

Notes:
kV = Kilovolt; mG = Milligauss; ROW = Right-of-Way.
Left and right ROW edges are as shown on the Appendix A cross section diagrams.

Table 1.2 Summary of Modeled Pre-Project and Post-Project Edge-of-ROW Electric Field Levels for the Representative ROW Cross Sections

Representative Cross Section	Electric Field (kV/m)					
	Left Edge-of-ROW			Right Edge-of-ROW		
	Pre-Project	Post-Project (69-kV)	Post-Project (115-kV)	Pre-Project	Post-Project (69-kV)	Post-Project (115-kV)
Average Annual Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	0.36	0.12	0.20	0.08	0.18	0.29
Cross Section 2: Structure 119 to Palmer #503 Substation	0.35	0.13	0.20	0.07	0.07	0.07
System Peak Base Case Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	0.35	0.12	0.19	0.08	0.17	0.29
Cross Section 2: Structure 119 to Palmer #503 Substation	0.34	0.12	0.20	0.07	0.07	0.07
System Peak Sensitivity Case Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	0.35	0.12	0.19	0.08	0.17	0.29
Cross Section 2: Structure 119 to Palmer #503 Substation	0.34	0.12	0.20	0.07	0.07	0.07

Notes:
kV = Kilovolt; kV/m = Kilovolts per Meter; ROW = Right-of-Way.
Left and right ROW edges are as shown on the Appendix A cross section diagrams.

Section 2 of this report describes the nature of EMFs, provides values for EMF levels from common sources, and reports on EMF exposure guidelines. Section 3 outlines the EMF modeling procedures for calculating EMF strengths as a function of lateral distance perpendicular from an electric transmission line (or distribution line) and provides tabular results for the modeled cross sections. Section 4 summarizes the conclusions, and the Reference list provides the references for published literature and exposure guidelines cited in this report. Appendix A provides cross section diagrams, showing both existing (pre-Project) and post-Project overhead conductor arrangements, for the representative cross sections, while Appendices B and C provide graphical MF and EF profiles, respectively, for each modeled route segment and line loading scenario. Appendix D provides a summary of the current status of scientific reports regarding potential health effects of power-frequency EMF exposures.

2 Nature of Electric and Magnetic Fields

All matter contains electrically charged particles. Most objects are electrically neutral because positive and negative charges are present in equal numbers. When the balance of electric charges is altered, we experience electrical effects. Common examples are the static electricity attraction between a comb and our hair or a static electricity spark after walking on a synthetic rug in the wintertime. Electrical effects occur both in nature and through our society's use of electric power (generation, transmission, and consumption).

2.1 Units for EMFs Are Kilovolts per Meter (kV/m) and Milligauss (mG)

The electrical tension on utility power lines is expressed in volts or kilovolts (1 kV = 1,000 V). Voltage is the "pressure" of the electricity and can be envisioned as analogous to the pressure of water in a plumbing system. The existence of a voltage difference between power lines and ground results in an EF, usually expressed in units of kV/m. The size of the EF depends on the line voltage, the separation distance between lines and ground, and other factors.

Power lines also carry an electric current that creates a MF. The units for electric current are amperes (A), which is a measure of the "flow" of electricity. Electric current is analogous to the flow of water in a plumbing system. The MF produced by an electric current is usually expressed in units of gauss (G) or mG (1 G = 1,000 mG).[3] The size of the MF depends on the electric current, the distance to the current-carrying conductor, and other factors.

2.2 There Are Many Natural and Man-Made Sources of EMFs

Everyone experiences a variety of natural and man-made EMFs. EMF levels can be steady or slowly varying (often called direct current [DC] fields), or EMF levels can vary in time (often called alternating current [AC] fields). When the time variation corresponds to that of standard North American power line currents (*i.e.*, 60 cycles per second), the fields are called 60-Hz EMFs, or power-frequency EMFs.

Man-made MFs are common in everyday life. For example, many childhood toys contain magnets. Such permanent magnets generate strong, steady (DC) MFs. Typical toy magnets (*e.g.*, refrigerator door magnets) have fields of 100,000-500,000 mG. On a larger scale, Earth's core also creates a steady DC MF that can be easily demonstrated with a compass needle. The size of the Earth's MF in the northern US is about 550 mG (*i.e.*, less than 1% of the levels generated by typical refrigerator door magnets).

2.3 Power-Frequency EMFs Are Found Near Electric Lines and Appliances

In North America, electric power transmission lines, distribution lines, and electric wiring in buildings carry AC currents and voltages that change size and direction at a frequency of 60 Hz. These 60-Hz currents and voltages create 60-Hz EMFs nearby. The size of the MF is proportional to the line current, while the size of the EF is proportional to the line voltage. The EMFs associated with electrical wires and electrical equipment decrease rapidly with increasing distance away from the electrical wires. Specifically, EMFs

[3] Another unit for MF levels is the microtesla (μT) (1 μT = 10 mG).

from three-phased, balanced conductors decrease in proportion to the square of the distance from the conductors (*i.e.*, 1/distance^2) (IEEE, 2014).

When EMF derives from different wires or conductors that are in close proximity, or adjacent to one another, the level of the net EMF produced will be somewhere in the range between the sum of EMF from the individual sources and the difference of the EMF from the individual sources. EMF may partially add, or partially cancel, but because adjacent wires are often carrying current in opposite directions, the EMF produced tends generally to cancel. Notably, for three-phase transmission line conductors, the sum of currents going in, for example, the forward direction at any instant, are equal to the sum of currents going in the backward direction.

EMFs in the home arise from electric appliances, indoor wiring, grounding currents on pipes and ground wires, and outdoor distribution or transmission circuits. Inside residences, typical baseline 60-Hz MF levels (away from appliances) range from 0.5-5.0 mG.

Higher 60-Hz MF levels are found near operating appliances. For example, can openers, mixers, blenders, refrigerators, fluorescent lamps, electric ranges, clothes washers, toasters, portable heaters, vacuum cleaners, electric tools, and many other appliances generate MF levels in the range of 40-300 mG at distances of 1 foot (NIEHS, 2002). MF levels from personal care appliances held within half a foot (*e.g.*, shavers, hair dryers, massagers) can produce average fields of 600-700 mG. At school and in the workplace, lights, motors, copy machines, vending machines, video-display terminals, electric pencil sharpeners, electric tools, electric heaters, and building wiring are all sources of 60-Hz MFs.

Recognizing that magnetic resonance imaging (MRI) is a source of DC fields rather than 60-Hz fields, MRIs are a diagnostic procedure that puts humans in much larger, but steady, MF (*e.g.*, levels of 20,000,000 mG). The scanning MF superimposed on the large, steady static field (which is the source of the characteristic audio noise of MRI scans) exposes the body to time-varying MF similar to time-varying power-frequency MF.

2.4 State, National, and International Guidelines for Power-Frequency EMFs

Table 2.1 shows guidelines for 60-Hz AC EMFs from national and international health and safety organizations that are designed to be protective against any adverse health effects. The limit values should not be viewed as demarcation lines between safe and dangerous levels of EMFs, but rather, levels that assure safety with an adequate margin to allow for uncertainties in the science. Appendix D provides more information on the health-effects science underlying the available exposure guidelines, as well as a summary of EMF health-effect conclusions from international scientific, health, and safety organizations, and governmental public health agencies. As part of its International EMF Project, the World Health Organization (WHO) has conducted comprehensive reviews of EMF health-effects research and existing standards and guidelines. The WHO website for the International EMF Project (WHO, 2024) notes: "The main conclusion from the WHO reviews is that EMF exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on health."

The US has no federal standards limiting either residential or occupational exposure to 60-Hz EMFs. The Massachusetts Energy Facilities Siting Board (MA EFSB) assesses EMF levels on a case-by-case basis with a focus on practical options to reduce magnetic fields along transmission line rights-of-way. Some states, including New York and Florida, have adopted EMF guidelines that are not health-effect based and have typically been adopted to maintain the *status quo* for EMFs on and near a transmission line ROW.

Table 2.1 60-Hz AC EMF Guidelines Established by International Health and Safety Organizations

Organization	Electric Field	Magnetic Field
American Conference of Governmental and Industrial Hygienists (ACGIH) (occupational)	25 kV/m[1]	10,000 mG[1] 1,000 mG[2]
International Commission on Non-Ionizing Radiation Protection (ICNIRP) (general public)	4.2 kV/m[3]	2,000 mG[3]
International Commission on Non-Ionizing Radiation Protection (ICNIRP) (occupational)	8.3 kV/m[3]	10,000 mG[3]
Institute of Electrical and Electronics Engineers (IEEE) Standard C95.1™-2019 (general public)	5.0 kV/m[4]	9,040 mG[4]
Institute of Electrical and Electronics Engineers (IEEE) Standard C95.1™-2019 (occupational)	20.0 kV/m[4]	27,100 mG[4]

Notes:

AC = Alternating Current; EMF = Electric and Magnetic Field; Hz = Hertz; kV/m = Kilovolts per Meter; mG = Milligauss.

(1) The ACGIH guidelines for the general worker (ACGIH, 2024).

(2) The ACGIH guideline for workers with cardiac pacemakers (ACGIH, 2024).

(3) ICNIRP (2010).

(4) IEEE (2019); developed by the IEEE International Committee on Electromagnetic Safety (ICES).

3 EMF Modeling

3.1 Software Program Used for Modeling EMFs for Overhead Line Cross Sections

The "EMF and Corona Effects Analysis" spreadsheet-based EMF calculation program, designed by the Bonneville Power Administration (BPA) of the US Department of Energy, was used to calculate EMFs.[4] This program operates using Maxwell's equations, which accurately apply the laws of physics as related to electricity and magnetism (EPRI, 1982, 1993). Modeled fields using this program are both precise and accurate for the input data used. The results of the model have been checked against results from other software (*e.g.*, Southern California Edison's FIELDS program), confirming that the implementation of the laws of physics in this program is consistent.

3.2 Power-Line Loads

MFs produced by the three-phase overhead lines were modeled using line loadings and conductor phase angles provided by National Grid. The current per phase satisfies the relationship:

(Eq. 3.1)

$$S = \sqrt{3} \times V \times I_{phase}$$

where:

S	=	The power in kilovolt-amperes (kVA)
V	=	The line voltage in kilovolts (kV)
I_{phase}	=	The current per phase in amperes (A)

Thus, the current per phase conductor is:

(Eq. 3.2)

$$I_{phase} = \frac{S}{\sqrt{3} \times V}$$

Real power is typically expressed in megawatts (MW) (*P*), and apparent power in megavolt-amperes (MVA) (*S*).[5,6] To convert between power quoted in MW to MVA, one must divide MW by the power factor.

[4] BPA's "EMF and Corona Effects Analysis" spreadsheet-based EMF calculation program reports the root mean square (RMS) values of the real "maximum" rotating electric and magnetic fields, *i.e.*, the RMS values of the semi-major axis magnitudes of the field ellipse that are known as $B_{Maximum}$ or B_{Max} and $E_{Maximum}$ or E_{Max}. While some instruments relying on three fixed orthogonal coils (*e.g.*, fixed-coil instruments like the EMDEX II) calculate the sum of the squares of magnetic fields detected by each orthogonal coil separately and thus report a different metric (*e.g.*, $B_{Resultant}$ or B_{Res}; sometimes referred to as $B_{Product}$ or B_{prod}), B_{Res} and E_{Res} are recognized as being artefactual in nature- *i.e.*, not actual physical entities like B_{Max} and E_{Max} (IEEE, 2021).

[5] MVA is apparent power and is the vector sum of real (active) and imaginary (reactive) power. MW and MVA are not the same unless the power factor = 1.0, which, in a practical AC circuit, is generally not the case.

[6] 1 MVA = 1,000 kVA.

Both pre-Project and post-Project electric current and voltage values provided by National Grid are summarized by line loading scenario (annual average and system peak load levels) in Table 3.1, for the O15N line as well as the X176 line present in Cross Section 2. There are two sets of system peak load levels corresponding to both a base case with East-West bias where Millennium, Northfield, and Mass Power are out of service (referred to as the "base case"), and a sensitivity case with West-East bias where Bear Swamp and Stony Brook are out of service (referred to as the "sensitivity case"). As indicated in the table, the post-Project 69-kV operation scenario and the post-Project 115-kV operation scenario generally refer to a lower and a higher power delivery, respectively, for the O15N circuit.

Table 3.1 Summary of Line Load Levels for Modeled Line Loading Scenarios

Line	Line Segment	Pre-project		Post-project: 69-kV Operation		Post-project: 115-kV Operation	
		Voltage (kV)	Current (A)	Voltage (kV)	Current (A)	Voltage (kV)	Current (A)
Annual Average Load Levels							
O15N	Cross Sections 1 and 2: Ware #1 Substation to Palmer #503 Substation	70.58	84.73	70.58	81.48	117.66	65.80
X176	Cross Section 2: Structure 119 to Palmer #503 Substation	118.68	102.44	118.68	101.97	118.69	107.98
System Peak Base Case Load Levels							
O15N	Cross Sections 1 and 2: Ware #1 Substation to Palmer #503 Substation	69.67	39.31	69.66	37.00	116.13	30.19
X176	Cross Section 2: Structure 119 to Palmer #503 Substation	118.46	99.44	118.45	98.86	118.46	101.92
System Peak Sensitivity Case Load Levels							
O15N	Cross Sections 1 and 2: Ware #1 Substation to Palmer #503 Substation	69.52	413.09	69.48	395.77	115.93	319.12
X176	Cross Section 2: Structure 119 to Palmer #503 Substation	118.12	344.06	118.09	340.58	118.11	371.25

Notes:
A = Ampere; kV = Kilovolt.

3.3 Project Representative Cross Sections

Gradient modeled EMFs expected to exist 1 meter (3.28 feet) above the ground surface for the two representative ROW cross sections, which differ in the presence of the X176 line (see Appendix A). The representative ROW cross sections include the following:

- Cross section 1 is for a ROW segment leaving the Ware #1 Substation, where the O15N line is the only transmission line present in the 100-ft ROW. The existing O15N line is centered 39 feet from the left ROW edge. The proposed monopole will be located 54 feet from the left ROW edge. Cross section 1 is representative of 8 miles of the Project route, from the Ware Substation to existing Structure 119.
- Cross section 2 is for a 2-mile long ROW segment between Structure 119 and the Palmer #503 Substation where the X176 overhead transmission line is also present in the ROW along with the O15N line. The ROW width is 250 feet, and the X176 line is centered 110 feet away from the right ROW edge. The existing O15N line is centered 39 feet away from the left ROW edge, and the proposed structure will be located 54 feet away from the left ROW edge.

National Grid provided cross section reference drawings showing both existing (pre-Project) and proposed (post-Project) overhead conductor arrangements, which are attached to this report as Appendix A. These cross sections are for facing towards the Palmer Substation, meaning that the left edge-of-ROW is generally equivalent to the eastern edge-of-ROW, while the right edge-of-ROW is generally equivalent to the western edge-of-ROW. Conductor phasing arrangements are shown on the cross section drawings.

EMF levels were modeled for both pre-Project and post-Project ROW conditions as a function of distance perpendicular to the direction of current flow for each route segment, assuming that the transmission lines run straight. Modeling was performed assuming the minimum ROW widths as discussed above and shown in each representative cross section drawing (Appendix A); this resulted in conservative estimates of edge-of-ROW EMF levels, as EMF levels will be lower at the ROW edges with a wider ROW. Variation in the height of the nearby grade along the ROW was not accounted for, given that the general National Grid policy is to model EMF for the most conservative location of lowest conductor sag (*i.e.*, closest to the ground surface). As provided by National Grid, a minimum conductor height above ground of 23 feet was used for pre-Project and post-Project modeling of both the O15N and X176 transmission lines. The EMF modeling was conducted out to 50 feet beyond both ROW edges, illustrating the continued decline in EMF levels beyond the ROW edges for the assumed ROW widths.

3.4 EMF Modeling Results

3.4.1 Magnetic Field Results

Results of the MF modeling for the two representative cross sections are summarized in Table 3.2 and in the figures in Appendix B. In the Appendix B figures, Panel (a) shows the pre- and post-Project modeling results for annual average load levels, Panel (b) shows the pre- and post-Project modeling results for the system peak base case load levels, and Panel (c) shows the pre- and post-Project modeling results for the system peak sensitivity case load levels. All figures show results for the post-Project 69-kV and 115-kV operating cases for the O15N line.

The MF modeling results show that all model-predicted MF values, including those within the ROWs, remain well below the ICNIRP health-based guideline of 2,000 mG for allowable public exposure to 60-Hz MFs. Modeled post-project MFs at the left ROW edge are lower than pre-Project cases for all modeled scenarios, indicating that the Project will result in reduced MFs at the left ROW edge and beyond it. At the right ROW edge, modeled post-Project MFs are slightly higher than pre-Project levels for some modeled scenarios, though the magnitudes of the increases are small (<1.1 mG). In all cases, as illustrated by Table 3.2, MFs drop off rapidly with increased lateral distance from the overhead lines, such that MF levels decrease to negligible levels at short distances beyond the ROW edges.

Table 3.2 Summary of Modeled Pre-Project and Post-Project Magnetic Field Levels for the Representative ROW Cross Sections

Representative Cross Section	Modeling Case	Magnetic Field (mG)				
		50 ft from Left ROW Edge	Left ROW Edge	Maximum Within ROW	Right ROW Edge	50 ft from Right ROW Edge
Annual Average Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	Pre-Project	1.05	4.68	18.44	2.15	0.69
	Post-Project (69-kV)	0.70	2.36	11.83	2.33	0.67
	Post-Project (115-kV)	0.57	1.91	9.56	1.89	0.54
Cross Section 2: Structure 119 to Palmer #503 Substation	Pre-Project	0.97	4.45	27.37	1.23	0.58
	Post-Project (69-kV)	0.82	2.15	26.37	1.36	0.67
	Post-Project (115-kV)	0.75	1.77	28.10	1.41	0.69
System Peak Base Case Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	Pre-Project	0.49	2.17	8.56	1.00	0.32
	Post-Project (69-kV)	0.32	1.07	5.37	1.06	0.30
	Post-Project (115-kV)	0.26	0.88	4.38	0.87	0.25
Cross Section 2: Structure 119 to Palmer #503 Substation	Pre-Project	0.40	1.85	26.57	1.18	0.55
	Post-Project (69-kV)	0.58	1.26	25.93	1.27	0.61
	Post-Project (115-kV)	0.56	1.16	26.80	1.30	0.62
System Peak Sensitivity Case Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	Pre-Project	5.14	22.80	89.90	10.48	3.35
	Post-Project (69-kV)	3.42	11.47	57.48	11.34	3.25
	Post-Project (115-kV)	2.76	9.25	46.34	9.14	2.62
Cross Section 2: Structure 119 to Palmer #503 Substation	Pre-Project	4.55	21.71	92.83	3.96	1.84
	Post-Project (69-kV)	3.51	10.95	86.99	4.78	2.39
	Post-Project (115-kV)	3.17	8.85	95.80	5.04	2.49

Notes:
ft = Feet; kV = Kilovolt; mG = Milligauss; ROW = Right-of-Way.

3.4.2 Electric Field Results

Pre- and post-Project EF modeling results for the representative cross sections are shown in Table 3.3 and in the figures in Appendix C. In the Appendix C figures, Panel (a) shows the pre- and post-Project modeling results for annual average load levels, Panel (b) shows the pre- and post-Project modeling results for system peak base case load levels, and Panel (c) shows the pre- and post-Project modeling results for the system peak sensitivity case load levels. All figures show results for the post-Project 69-kV and 115-kV operating cases for the O15N line.

Although EFs are not dependent on conductor loading (*i.e.*, current), separate results are provided for the different load levels due to small differences in voltages of the O15N circuits that were provided by National Grid. In all cases, the modeled edge-of-ROW EFs are well below the ICNIRP health-based guideline of 4.2 kV/m. Modeled post-project EFs at the left ROW edge are lower than pre-Project levels for all modeled scenarios, indicating that the Project will result in reduced EFs at the left ROW edge and beyond it. At the right ROW edge, the modeled post-Project EFs are slightly higher compared to pre-Project EFs for Cross Section 1, though the magnitudes of the increases are small (<0.3 kV/m) for all cases; for Cross Section 2, there is no difference between pre-Project and post-Project EFs at the right ROW edge. For each of the modeled loading scenarios, the maximum edge-of-ROW increase of 0.21 kV/m was obtained for the post-Project 115-kV operation of the O15N line in Cross Section 1.

Table 3.3 Summary of Modeled Pre-Project and Post-Project Electric Field Levels for the Representative ROW Cross Sections

Representative Cross Section	Modeling Case	Electric Field (kV/m)				
		50 ft from Left ROW Edge	Left ROW Edge	Maximum Within ROW	Right ROW Edge	50 ft from Right ROW Edge
Annual Average Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	Pre-Project	0.05	0.36	0.89	0.08	0.01
	Post-Project (69-kV)	0.04	0.12	0.99	0.18	0.04
	Post-Project (115-kV)	0.07	0.20	1.65	0.29	0.07
Cross Section 2: Structure 119 to Palmer #503 Substation	Pre-Project	0.05	0.35	1.98	0.07	0.03
	Post-Project (69-kV)	0.04	0.13	1.98	0.07	0.02
	Post-Project (115-kV)	0.07	0.20	1.98	0.07	0.02
System Peak Base Case Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	Pre-Project	0.05	0.35	0.88	0.08	0.01
	Post-Project (69-kV)	0.04	0.12	0.98	0.17	0.04
	Post-Project (115-kV)	0.07	0.19	1.63	0.29	0.07
Cross Section 2: Structure 119 to Palmer #503 Substation	Pre-Project	0.05	0.34	1.98	0.07	0.03
	Post-Project (69-kV)	0.04	0.12	1.98	0.07	0.02
	Post-Project (115-kV)	0.07	0.20	1.98	0.07	0.02
System Peak Sensitivity Case Load Levels						
Cross Section 1: Ware #1 Substation to Structure 119	Pre-Project	0.05	0.35	0.88	0.08	0.01
	Post-Project (69-kV)	0.04	0.12	0.98	0.17	0.04
	Post-Project (115-kV)	0.07	0.19	1.63	0.29	0.07
Cross Section 2: Structure 119 to Palmer #503 Substation	Pre-Project	0.05	0.34	1.97	0.07	0.03
	Post-Project (69-kV)	0.04	0.12	1.97	0.07	0.02
	Post-Project (115-kV)	0.07	0.20	1.97	0.07	0.02

4 Conclusions

Gradient performed an independent EMF assessment for the National Grid 69-kV O15N Asset Condition Refurbishment Project, which will involve reconductoring the existing 69-kV overhead O15N line and replacing existing wood polearm tower structures with steel pole braced and engineered steel structures between the Ware and Palmer Substations. The total Project route is approximately 10 miles in length. As discussed in this report, EMF modeling was conducted at a height of 1 meter (3.28 feet) above the ground surface for two representative ROW cross sections. EMF modeling was performed for a pre-Project case, as well as two post-Project cases, namely for an in-service year case assuming the O15N line operates at 69-kV and for an in-service year case assuming the line operates at 115-kV. For each case, EMF modeling was conducted for both annual average and system peak load levels, including for both a base case and a sensitivity case for system peak load levels.

As described in this report, our EMF modeling analysis demonstrated that all model-predicted, post-Project MF levels for the representative cross sections, including for both annual average and system peak load levels, are well below the ICNIRP health-based guideline for allowable public exposure to 60-Hz MFs (2,000 mG; ICNIRP, 2010). At the left ROW edge (and beyond it), our modeling analysis shows that the Project will result in reductions to MF levels as compared to pre-Project MF levels for all modeled scenarios. At the right ROW edge, modeled post-Project MFs are slightly higher than pre-Project MFs for some scenarios, though the magnitudes of the increases are small (<1.1 mG). The EMF modeling analysis also showed that, for the representative cross sections, all model-predicted, post-Project edge-of-ROW EF levels are well below the ICNIRP health-based guideline for allowable public exposure to 60-Hz EFs (4.2 kV/m; ICNIRP, 2010). Our modeling analysis indicates that the Project will result in only small changes (<0.3 kV/m) to EFs at the ROW edges across the modeling results, with decreased EFs at the left ROW edge for both cross sections, and for the right ROW edge, either increased EFs (Cross Section 1) or no change to EFs (Cross Section 2).

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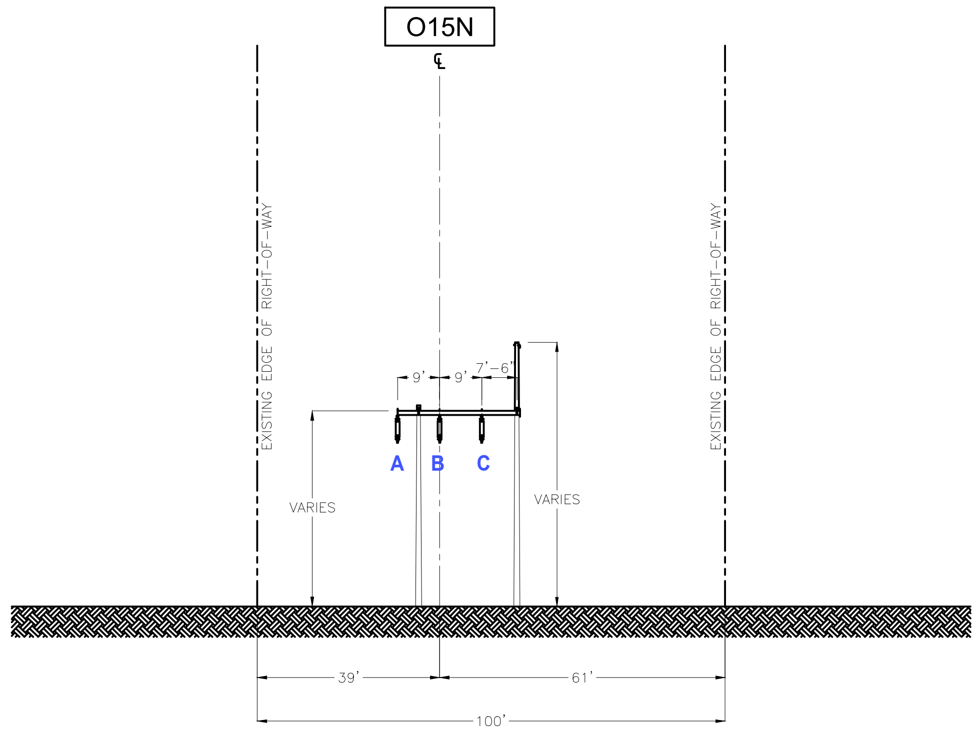
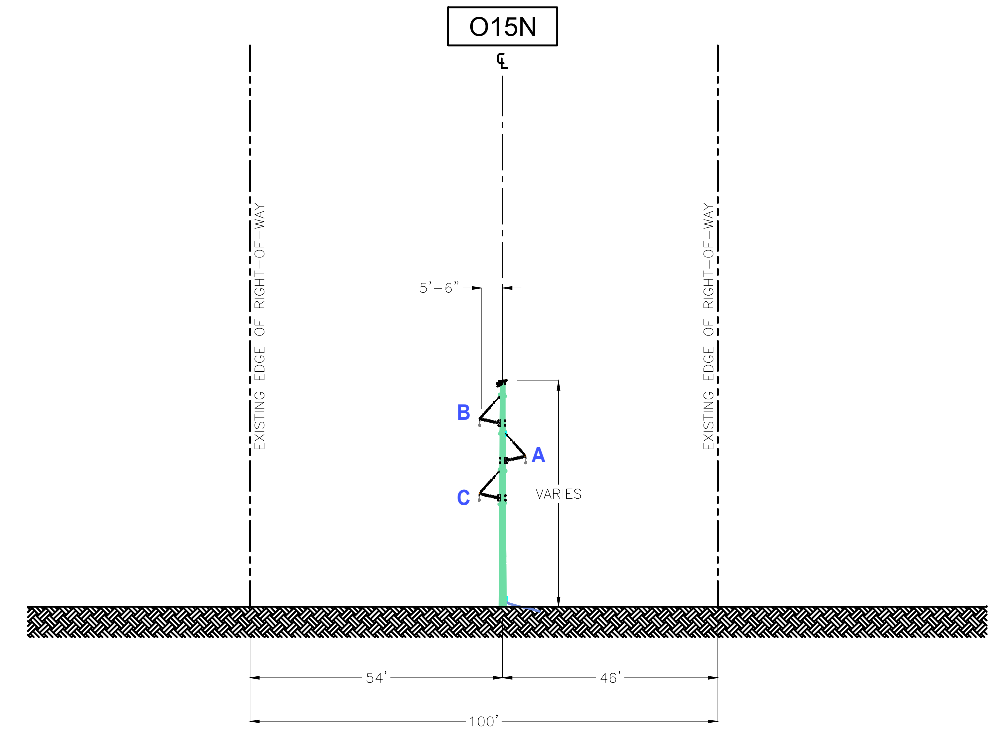
Appendix A

Representative Pre-Project and Post-Project ROW Overhead Line Cross Sections

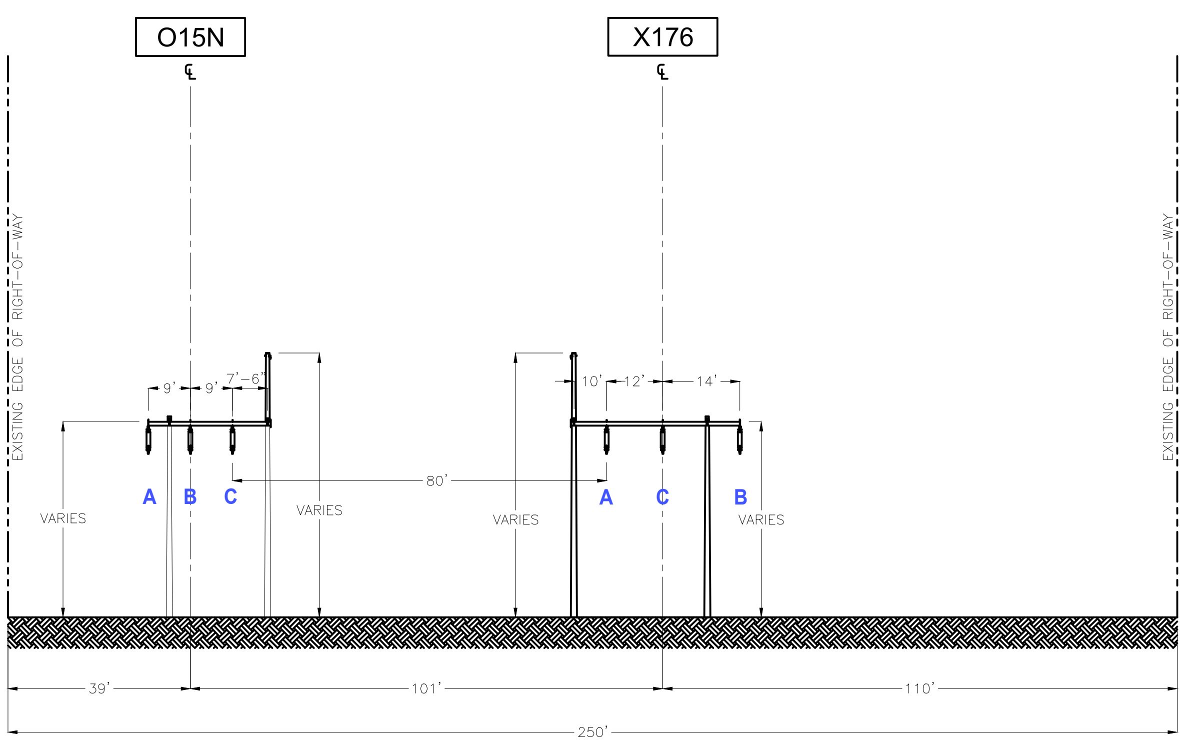
NOTE:
ALL CROSS SECTIONS
ARE LOOKING TOWARDS
PALMER SUBSTATION



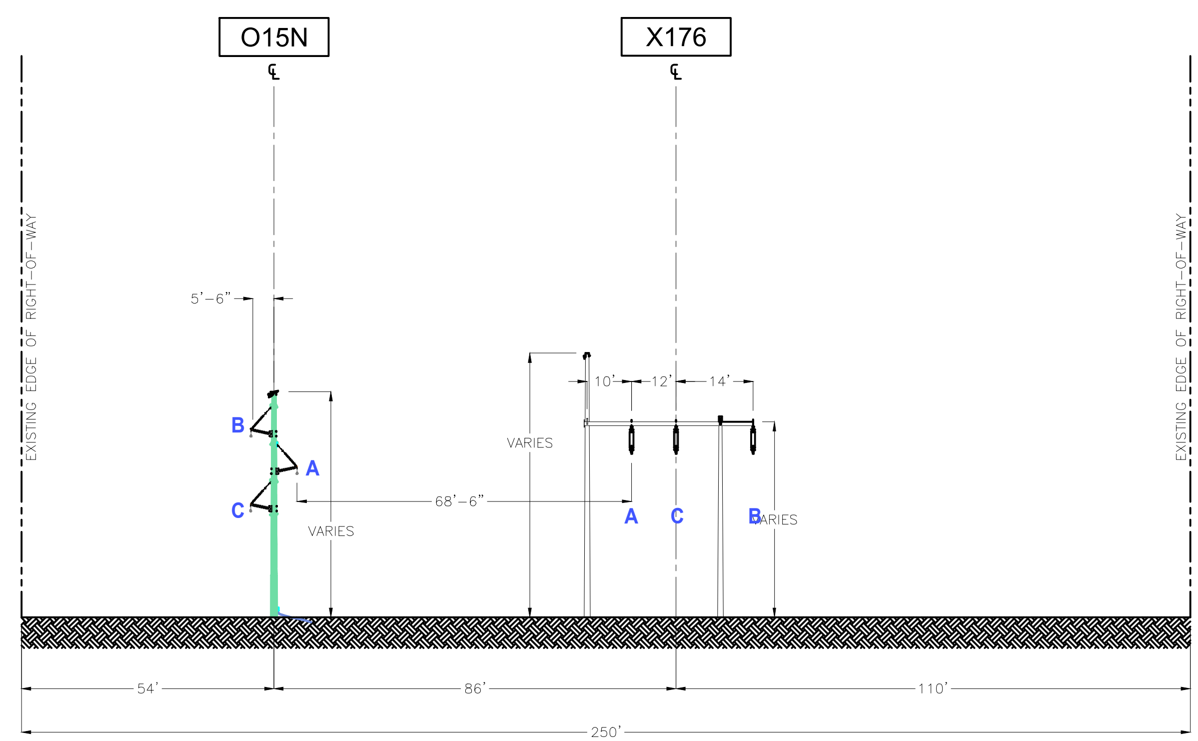
EXISTING ROW CONFIGURATION
WARE THROUGH EXISTING STRUCTURE 119
8 MILES



PROPOSED ROW CONFIGURATION
WARE THROUGH EXISTING STRUCTURE 119
8 MILES



EXISTING ROW CONFIGURATION
EXISTING STRUCTURE 119 THROUGH PALMER
2 MILES



PROPOSED ROW CONFIGURATION
EXISTING STRUCTURE 119 THROUGH PALMER
2 MILES

VER	DATE	VERSION DESCRIPTION	PREPARED	REVIEWED	APPROVED
0	10/11/23	INITIAL RELEASE	JAC	MDCR	GEB
1	04/12/24	CORRECTED DIMENSIONS	GEB	MDCR	GEB

VERSION 1

nationalgrid

PREPARED BY	JAC	04/12/24
REVIEWED BY	MDCR	04/12/24
APPROVED BY	GEB	04/12/24
SCALE	NTS	
SHEET	1	OF 1
INDEX		

O15N LINE WARE TO PALMER SUB
O15N 69kV TRANSMISSION LINE
PROPOSED CROSS SECTION

INCHES ON ORIGINAL

Appendix B

Magnetic Field Profiles for Each Representative ROW Cross Section

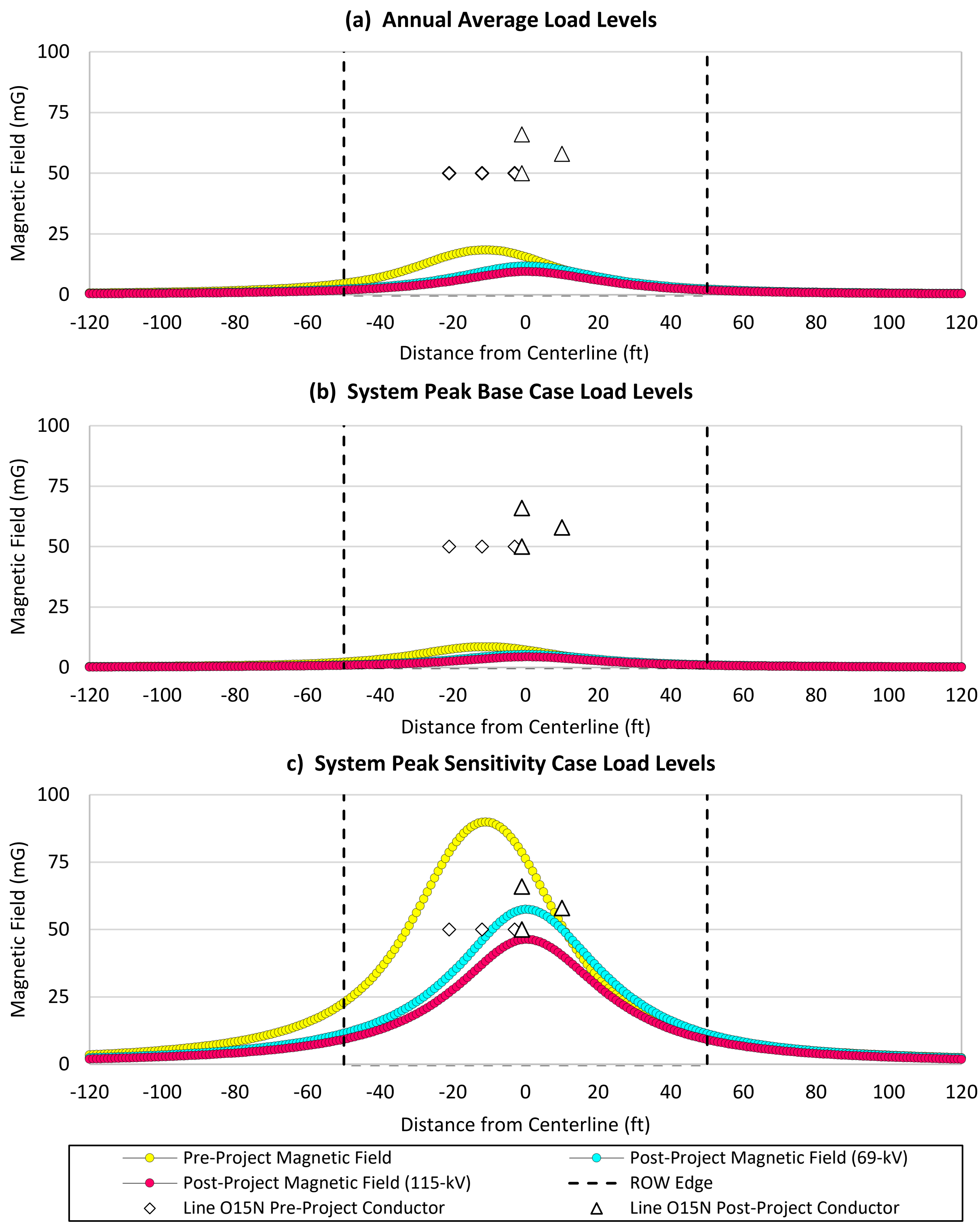


Figure B.1 Magnetic Field Modeling Results at 1 Meter Aboveground for Representative ROW Cross Section 1 from Ware #1 Substation to Structure 119. ft = Feet; kV = Kilovolt; mG = Milligauss; ROW = Right-of-Way. Panels (a), (b), and (c) show the results for annual average, system peak base case, and system peak sensitivity case load levels, respectively. Conductor locations on the graphs are not to scale and are provided to show relative locations.

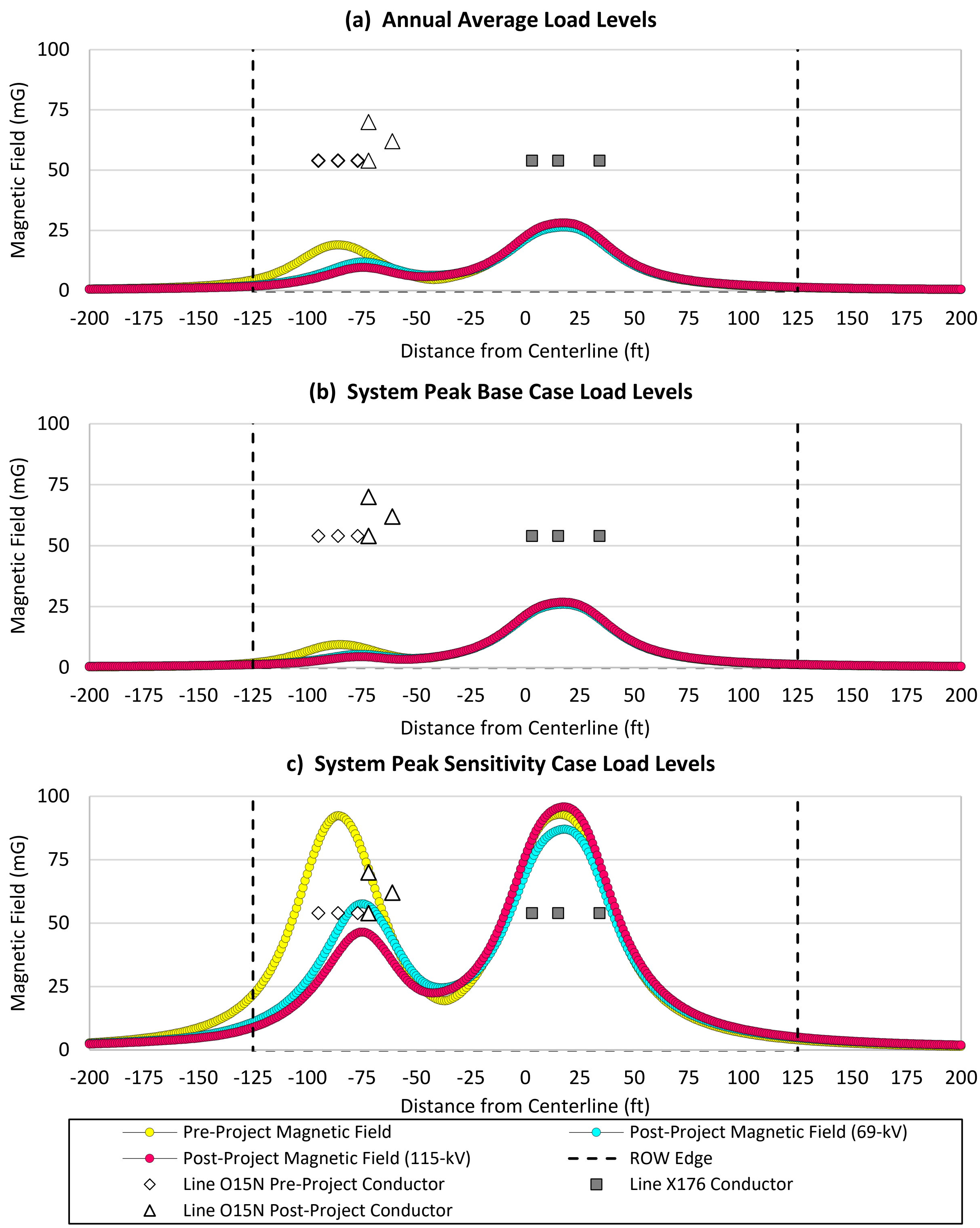


Figure B.2 Magnetic Field Modeling Results at 1 Meter Aboveground for Representative ROW Cross Section 1 from Structure 119 to Palmer #503 Substation. ft = Feet; kV = Kilovolt; mG = Milligauss; ROW = Right-of-Way. Panels (a), (b), and (c) show the results for annual average, system peak base case, and system peak sensitivity case load levels, respectively. Conductor locations on the graphs are not to scale and are provided to show relative locations.

Appendix C

Electric Field Profiles for Each Representative ROW Cross Section

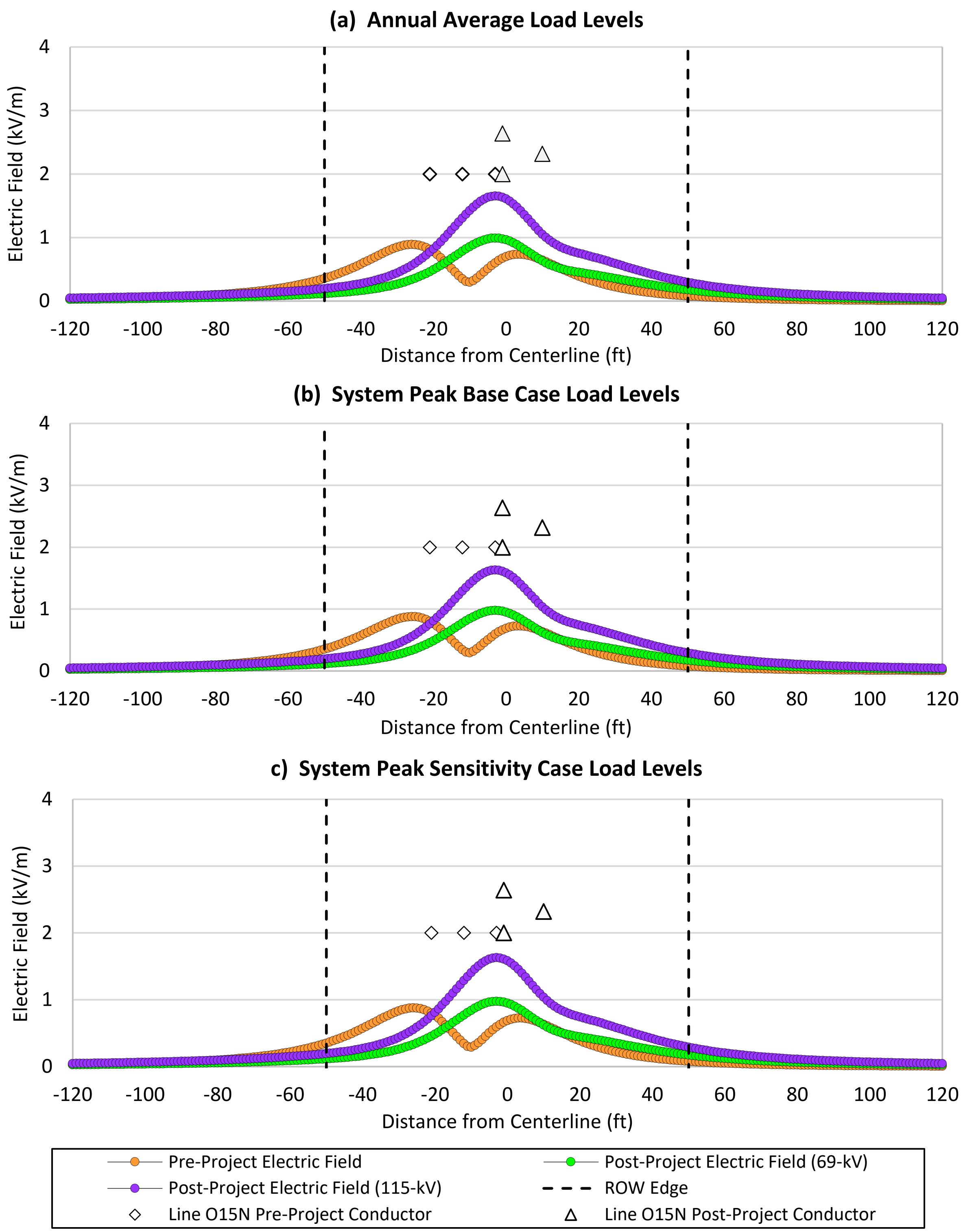


Figure C.1 Electric Field Modeling Results at 1 Meter Aboveground for Representative ROW Cross Section 1 from Ware #1 Substation to Structure 119. ft = Feet; kV = Kilovolt; kV/m = Kilovolts Per Meter; ROW = Right-of-Way. Panels (a), (b), and (c) show the results for annual average, system peak base case, and system peak sensitivity case load levels, respectively. Conductor locations on the graphs are not to scale and are provided to show relative locations.

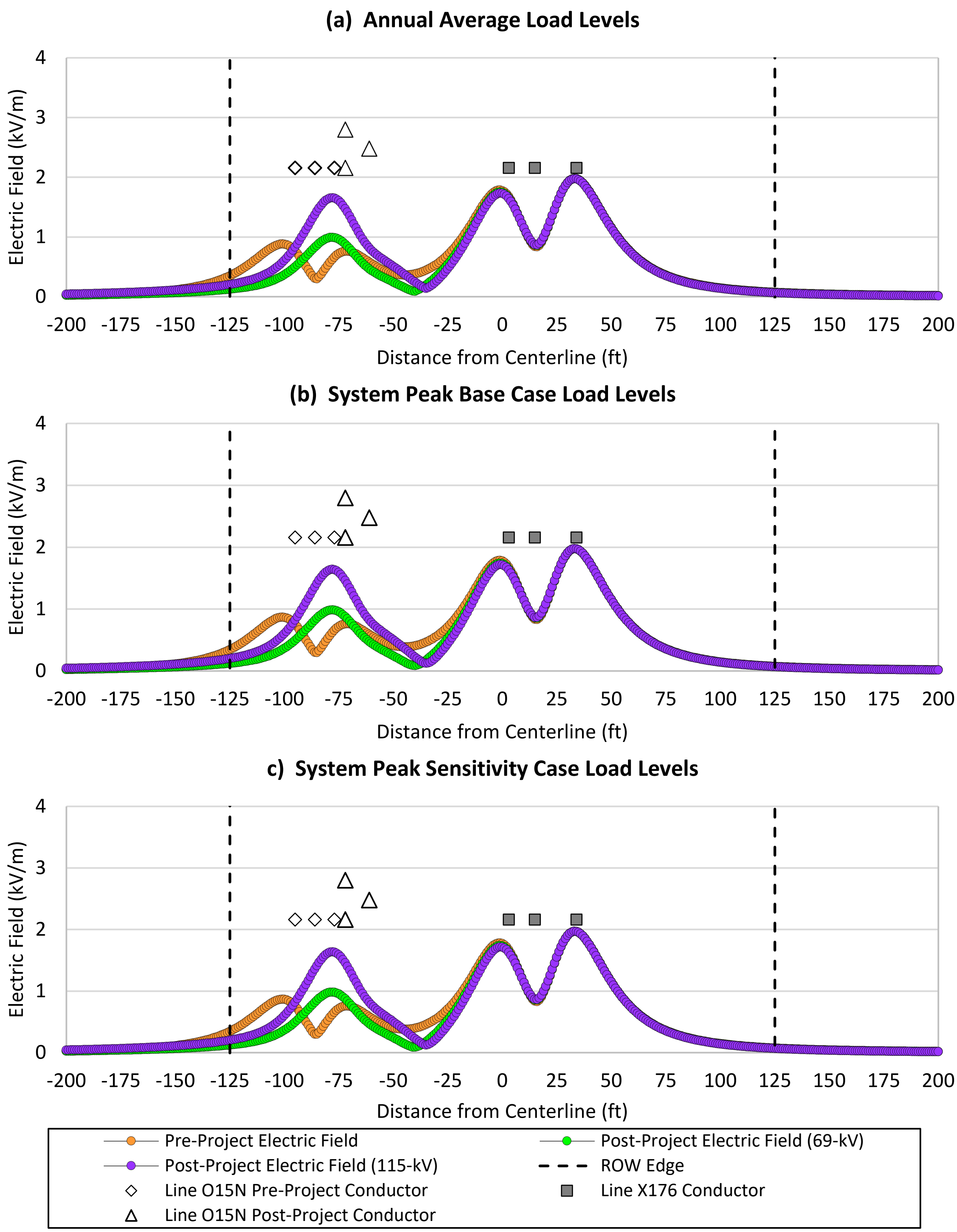


Figure C.2 Electric Field Modeling Results at 1 Meter Aboveground for Representative ROW Cross Section 1 from Structure 119 to Palmer #503 Substation. ft = Feet; kV = Kilovolt; kV/m = Kilovolts Per Meter; ROW = Right-of-Way. Panels (a), (b), and (c) show the results for annual average, system peak base case, and system peak sensitivity case load levels, respectively. Conductor locations on the graphs are not to scale and are provided to show relative locations.

Appendix D

Summary of Current Status of Health-Effect Conclusions for 60-Hz Alternating Current Electric and Magnetic Fields

Summary of Current Status of Health-Effect Conclusions for 60-Hz Alternating Current (AC) Electric and Magnetic Fields (EMFs)

Introduction

Electric and magnetic fields (EMFs) are invisible lines of force associated with anything that generates, transmits, or uses electricity, including high-voltage transmission lines and substations, as well as the overhead and underground distribution lines on residential streets, home wiring, and household appliances. As illustrated by Figure D.1, power-frequency (60-hertz [Hz]) alternating current (AC) EMFs are an extremely low frequency form of non-ionizing electromagnetic radiation. Electric fields (EFs) from power lines, which are usually expressed in units of kilovolts per meter (kV/m), are a product of the voltage difference between power lines and ground. Magnetic fields (MFs) are produced by the electric current carried on power lines and are usually expressed in units of gauss (G) or milligauss (mG) (1 G = 1,000 mG).[1] Unlike ionizing radiation (*e.g.*, ultraviolet rays, X-rays, gamma rays), power-frequency EMFs do not carry enough energy to break molecular bonds and damage DNA, biological cells, or tissues.

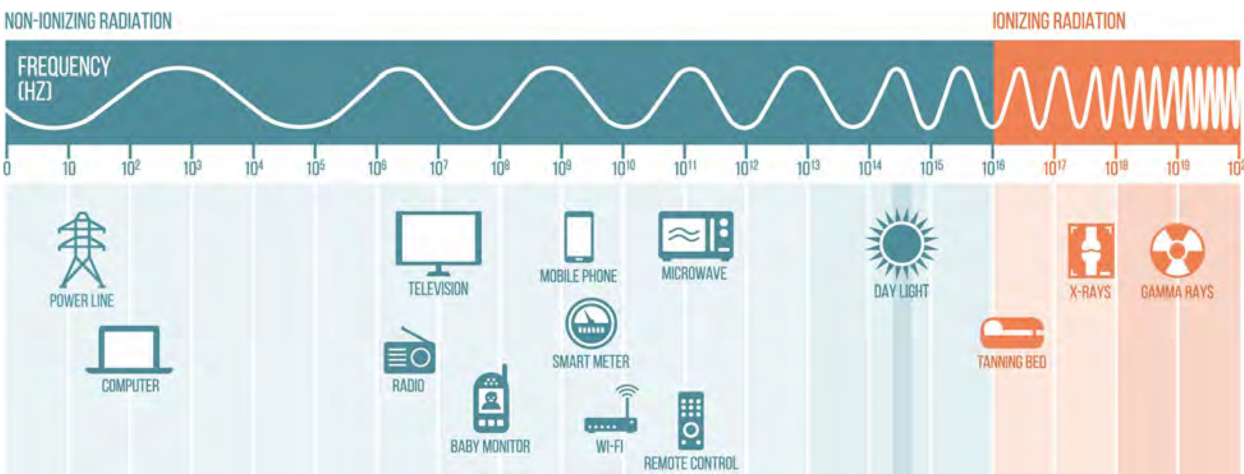


Figure D.1 The Electromagnetic Spectrum. EF = Electric Field; EMF = Electric and Magnetic Field; Hz = Hertz; MF = Magnetic Field; US = United States. As shown in the figure, the US electric power system operates at 60 Hz, and EMFs are thus frequently described as extremely low frequency (ELF) fields (*e.g.*, ELF-MFs and ELF-EFs).

Since the late 1970s when exposure to power-frequency EMFs emerged as a public health concern, following the reporting of epidemiological associations suggesting that children residing in greater proximity to overhead power lines may have a small increased risk of childhood leukemia, there has been a massive international research effort to understand whether and how power-frequency EMFs could cause childhood leukemia and other diseases (see Moulder, 2000). As described in more detail below, the three major lines of health-effects investigation for power-frequency EMFs consist of epidemiology studies of human populations, laboratory animal studies, and mechanistic studies. The biological effects of power-frequency EMFs have now been the focus of scientific research for over four decades, totaling thousands

[1] Another unit for MF levels is the microtesla (μT) (1 μT = 10 mG).

of published studies and tens of millions of dollars of research funding. More than 40 epidemiology studies alone have investigated statistical associations between residential EMF exposures or surrogates of exposure (*e.g.*, distance to transmission lines) and risk of childhood leukemia (Schmidt *et al*., 2021), and epidemiology studies have investigated associations for risks of other health endpoints, including brain cancer, breast cancer, adult leukemia and lymphoma, reproductive and developmental effects, and neurodegenerative diseases.

With a knowledge base that now totals 40 years of scientific research and thousands of published studies, scientists have not been able to identify a plausible mechanism whereby biological processes can be adversely affected by typical levels of power-frequency EMFs. Despite advancements in study designs and larger and larger study populations, the epidemiological associations with childhood leukemia risk remains weak and inconsistent; as discussed later, more recent epidemiology studies with improved study designs and larger study populations have tended to observe weaker associations, and frequently no association at all, as compared to older studies. The scientific basis for reported statistical associations for risk of childhood leukemia remains unexplained, as many subsequent experimental and mechanistic studies have been unable to identify a biologic process whereby power-frequency EMFs can exert such an effect. Moreover, studies of carcinogenicity in animals exposed to elevated levels of EMF have been overwhelmingly negative and do not support the hypothesis that EMF exposure is a significant risk factor for carcinogenesis (NIEHS, 2002). Overall, the accumulated EMF health-effects data fail to provide a clear and coherent picture whereby the levels of power-frequency EMFs that we encounter in our daily lives present a hazard to human health.

It is the consensus opinion of a number of public health agencies and expert scientific committees, including the United States (US) National Institute for Environmental Health Sciences (NIEHS), the World Health Organization (WHO), and the US Environmental Protection Agency (US EPA), that there are no confirmed chronic (*e.g.*, long-term) human health risks from exposure to power-frequency EMFs, such as increasing the risk of developing cancer. In 1999, the NIEHS published its final report for the Electric and Magnetic Fields Research and Public Information Dissemination Program (EMF-RAPID) that was authorized and funded in 1992 by the US Congress to conduct fundamental scientific research to clarify the potential for health risks from power-frequency EMF exposure (NIEHS, 1999). An extensive range of laboratory toxicology and exposure characterization studies were conducted as part of the EMF-RAPID program, with the NIEHS concluding in its final report (NIEHS, 1999):

> The ultimate goal of any risk assessment is to estimate the probability of disease in an exposed population…The NIEHS believes that the probability that ELF-EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal, scientific support that exposure to this agent is causing any degree of harm.

NIEHS further addressed the body of health-effects evidence in a seminal 2002 question and answer (Q&A) booklet on power-frequency EMFs (NIEHS, 2002):

> Over the past 25 years, research has addressed the question of whether exposure to power-frequency EMF might adversely affect human health. For most health outcomes, there is no evidence that EMF exposures have adverse effects. There is some evidence from epidemiology studies that exposure to power-frequency EMF is associated with an increased risk for childhood leukemia. This association is difficult to interpret in the absence of reproducible laboratory evidence or a scientific explanation that links magnetic fields [MFs] with childhood leukemia.

Currently, on its website,[2] NIEHS (2024) states that utility "Power Lines" fall into the "non-Ionizing" radiation category, and goes on to explain, "Non-ionizing: low-level radiation…is generally perceived as harmless to humans."

In 2007, the WHO published one of the most comprehensive health risk assessments of EMF in the power-frequency range, in which the WHO critically reviewed the cumulative epidemiologic and laboratory research, taking into account the strength and quality of individual research studies (WHO, 2007a). WHO concluded overall:

> Acute biological effects have been established for exposure to ELF electric and magnetic fields [EMFs] in the frequency range up to 100 kHz that may have adverse consequences on health. Therefore, exposure limits are needed. International guidelines exist that have addressed this issue. Compliance with these guidelines provides adequate protection. Consistent epidemiological evidence suggests that chronic low intensity ELF magnetic field [MF] exposure is associated with an increased risk of childhood leukaemia. However, the evidence for a causal relationship is limited, therefore, exposure limits based upon epidemiological evidence are not recommended, but some precautionary measures are warranted (WHO, 2007a) .

As part of its International EMF Project, the WHO has continued to conduct comprehensive reviews of EMF health-effects research and existing standards and guidelines, and has not changed its conclusion that the health-effects evidence for power-line frequencies of EMF does not support a causal relationship of EMF exposure with increased childhood leukemia risk or with other adverse health effects (WHO, 2024a).

US EPA has not established any hazard levels or exposure standards for power-frequency EMFs. On its webpage focused on "Electric and Magnetic Fields [EMFs] from Power Lines," US EPA (2023) states, "Scientific studies have not clearly shown whether exposure to EMF increases cancer risk."[3]

As discussed more below, there is consistency in the conclusions from expert and governmental reviews of the full body of EMF health-effects research performed by international scientific, health, and safety organizations, and governmental public health agencies, that there are no confirmed chronic health risks for power-frequency EMF. While the possible linkage between ELF-MF exposure and risk of childhood leukemia remains a continued focus of researchers, findings from recent studies arguably only add to the uncertainties in this body of evidence. As described below, recent findings are suggestive of a decline in the association between ELF-MF exposure and risk of childhood leukemia in studies of more recent time periods (*e.g.*, post-1990s). These findings cannot be readily explained by MF exposures, and researchers continue to investigate the potential roles of confounding factors and sources of bias as alternative explanations for the observed epidemiological associations (*e.g.*, Amoon *et al*., 2022; Nguyen *et al*., 2022; Amoon *et al*., 2019).

Below, we continue our summary of the current status of power-frequency EMF health-effect conclusions with a brief discussion of the lines of scientific investigation that apply to understanding the potential human health effects of any exposure, including power-frequency EMF. We then present the status of EMF health-effect conclusions from international scientific, health, and safety organizations, and governmental public health agencies. This is followed by a discussion of recent research publications focused on the potential linkage between residential exposure to power-frequency MFs and risk of childhood leukemia, which continues to be the subject of updated epidemiological analyses and systematic reviews. Our review concludes with a summary of available health-based exposure guidelines established by international health

[2] https://www.niehs.nih.gov/health/topics/agents/emf/.
[3] https://www.epa.gov/radtown/electric-and-magnetic-fields-power-lines.

and safety organizations, which are designed to be protective against adverse health effects, as well as state guidelines for power-frequency EMFs.

Lines of Scientific Inquiry into EMF Health Effects

Epidemiology

Because of the statistical associations reported by early EMF epidemiology studies, the International Agency for Research on Cancer (IARC), which is part of WHO, classified power-line MFs as a 'possible' (Group 2B) carcinogen in 2002 (IARC, 2002).[4,5] IARC's cancer classification for power-line MFs was based on "limited" evidence from humans concerning childhood leukemia, "inadequate" evidence from humans concerning all other cancer types, and "inadequate" evidence from animals. Even though some epidemiology studies continue to provide weak suggestions of power-frequency MF health risk, the results among the studies remain inconsistent, poorly linked to actual MF exposures, and insufficient to demonstrate a causal relationship.

Epidemiology can provide statistical, correlative results between presumed exposures and disease patterns in human populations, but such associations are not able to establish causation. That is, while a laboratory scientist can precisely set exposure conditions, randomly allocate groups to be exposed or non-exposed, do careful pathology on the outcome, and can read the results blindly (*i.e.*, without knowing the exposure history), epidemiology is an observational science and cannot utilize these same rigorous scientific methods. Additional problems confound the interpretation of the power-frequency EMF epidemiology. For example, few of the epidemiology studies used actual measurements of MF exposure, and none of the exposure assessments were based on plausible mechanisms of interaction, or on validated MF metrics. Also, an epidemiologic study that reports 'statistically significant' associations is only testing that significance against the role of random chance, given the size of the populations studied. If other sources of uncertainty in epidemiologic studies were to be quantitatively included in the confidence interval (*e.g.*, confounding factors, measurement error, selection bias, misclassification), the margin of error would become wider and may well overlap a null outcome (*i.e.*, 'no association'). Reviews of MF epidemiology emphasize this point, namely that the error bars in reported results do not reflect all sources of uncertainty, and, consequently, the results are less indicative of an actual "statistically significant" link than typical confidence intervals suggest.

Laboratory Animal Studies

Hundreds of laboratory animal studies have examined the biological effects of power-frequency MF exposure in mammalian species expected to have reactions similar to humans. Support from such studies would make interpretation of power-frequency MF epidemiology less clouded and uncertain. However, these other lines of scientific evidence weigh against assigning a causal basis to the associations reported by epidemiology. Scientists have not been able to identify an established laboratory bioassay or animal

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[4] Note that IARC's Group 2B possible human carcinogen classification was specific to ELF-MF. For ELF-EF, IARC concluded that there was "inadequate evidence" of carcinogenicity in humans. In general, the remaining health concerns related to power-frequency EMFs are now focused primarily on ELF-MFs rather than ELF-EFs. ELF-EFs are generally considered to be of potential lesser health concern than MFs due to consistent null findings from early research studies and because they are readily shielded by conductive objects like trees and vegetation, as well as buildings. Because they are readily shielded, power lines are generally not significant sources of long-term average EF exposure, even for populations residing nearby to utility rights-of-way (ROWs).

[5] Other agents classified as Group 2B possible human carcinogens by IARC include aloe vera, picked vegetables, and gasoline fumes. Coffee was classified as a Group 2B possible human carcinogen for about 25 years until 2016 when it was re-assessed by IARC and re-classified into Group 3 not classifiable as to its carcinogenicity to humans. Both consumption of red meat and drinking very hot beverages are classified as Group 2A probable human carcinogens by IARC.

model by which power-line MFs can be shown to consistently initiate or accelerate biological changes related to cancer risk. Lifetime exposures to high levels of 60-Hz MFs have been tested in numerous animal studies (using different species), with results failing to show that 60-Hz MFs can initiate or exacerbate any disease or pre-cancerous condition, even in genetically modified and susceptible animals. For example, research by the National Toxicology Program (NTP) extensively tested elevated, lifetime 60-Hz AC MF exposures, and the study scope and quantity of animals tested is unlikely to ever be duplicated (Moulder, 2000). The NTP study found no cancer risks, even at high MF exposure levels (1 to 2 milliteslas [mT], or 10,000 to 20,000 mG). Such animal testing is the foundation (or "gold standard") for probing health effects, because it is often through such exhaustive animal studies that regulators can determine what (if any) aspect of an exposure (*e.g.*, what chemicals or what MF parameter [*e.g.*, frequency, intensity, duration, polarization]) should be regulated.

Mechanistic Studies

Studies of 'mechanisms of action' utilize well-established laws of physics, chemistry, and biology to predict and understand how MFs might alter the function of biological structures like cell membranes or genetic (DNA) molecules. Mechanistic MF research to date, representing extensive efforts by scientists worldwide, has not been able to identify plausible mechanisms or causal pathways by which typical levels of power-line MFs can cause adverse health effects. MF interactions with biological systems have been analyzed carefully in light of the biophysics of electromagnetic field interactions with matter in general and biological molecules in particular. Unlike ionizing radiation (*e.g.*, ultraviolet rays, X-rays, gamma rays), non-ionizing radiation does not carry enough energy to break molecular bonds,

The applicability of fundamental physics to all systems, and to biology in particular, permits evaluation of the interaction of MFs with ions, molecules, cells, and organisms. The conclusions are that typical power-line MFs do not create disturbances that are detectable above the many sources of disturbance (electrical, thermal agitation, and other 'noise') that are naturally present in living systems. Notably, a common medical procedure, magnetic resonance imaging (MRI), exposes patients to extremely intense static and time varying MFs *via* both the main static field and the oscillating gradient MFs that generate the MRI image. Yet, such treatments leave no biomarkers of exposure and are safer than conventional X-ray images and computerized tomography (CT) scans or nuclear medicine images. In fact, many studies have been conducted to examine the ability of human beings to detect the existence of MFs, but no convincing evidence of such a sensory ability has been found.

Consideration of different parameters of MF exposure (frequency, intensity, duration, wave shape, polarization, modulation, intermittency, *etc.*) have revealed no firm basis on which to attribute a potential for adverse biological effects to the specific values of, for example, any of the following EMF metrics: (1) electric or MF magnitudes, (2) the fundamental frequency or to harmonic frequencies, (3) continuous exposure *vs*. intermittent exposure, (4) time-averaged fields *vs*. peak fields, (5) constant-frequency MFs *vs*. variable-frequency MFs. Over the years, many hypotheses have been proposed regarding how MFs may elicit a carcinogenic response and many analyses have been performed; however, diligent attention by scientists has not yielded identified aspects, levels, or durations of MF exposure that can be traced to increased cancer risk through a chain of causal events. Without an understanding of mechanism, it remains unknown as to what, if any, aspect of MF exposure should be controlled to reduce health risks.

Integration of Lines of Health-Effects Evidence

Biological-effect evidence that may establish the existence of a health impact is often illustrated as a 'three-legged stool' (Figure D.2), where strength in each line of evidence (each leg) is required for overall strength and stability, and weakness in any one leg makes the stool unstable. That is, lack of support from all three lines of evidence restricts the conclusions that can be drawn as to the existence of a human health risk. The three legs are: (1) exposure/disease correlations in human populations (epidemiology); (2) empirical laboratory animal studies at controlled and elevated levels of exposure; and (3) *in vitro* and/or mechanistic studies of the agent's mode of action.

Figure D.2 Three-Legged Stool: Health-Effects Research Looks at Three Independent Lines of Evidence – Cellular and Molecular Studies (Mechanism of Action), Laboratory Animal Studies, and Population Studies (Epidemiology). To understand toxicity, support is required in each area.

For low-frequency MFs, evidence suggesting adverse health effects derives primarily from leg (1), but there is a profound lack of support from animal studies and mechanistic studies (legs [2] and [3]). In fact, much of the evidence from legs (2) and (3) suggests an absence of health risks from ELF-MF exposure.

Mechanistic evidence (leg 3) is crucial, as living organisms rely upon the same physical laws that govern all matter. As shown in Figure D.3 below, physics forms the basis of chemistry, which forms the basis of biology and, in turn, forms the basis of physiology and medicine. Hence, even though there is an increase in complexity as you move up in this hierarchy, each successive layer must obey the fundamental laws found to be valid for the layer below. At the most fundamental level are the laws of physics, which have been validated by experiment and internal consistency. Maxwell's laws of electromagnetism are accepted to be invariant in time and space, and their accuracy in describing the interactions between electromagnetic fields and matter underlies the functioning of virtually all technology. No exceptions have been found, despite constant challenges and tests. Likewise, physics has been found to be valid in complex systems, encompassing chemistry, biology, technology, and medicine. Simple conservation laws (*e.g.*, conservation of mass+energy, conservation of electric charge, and conservation of linear and angular momentum) apply universally, without exception.

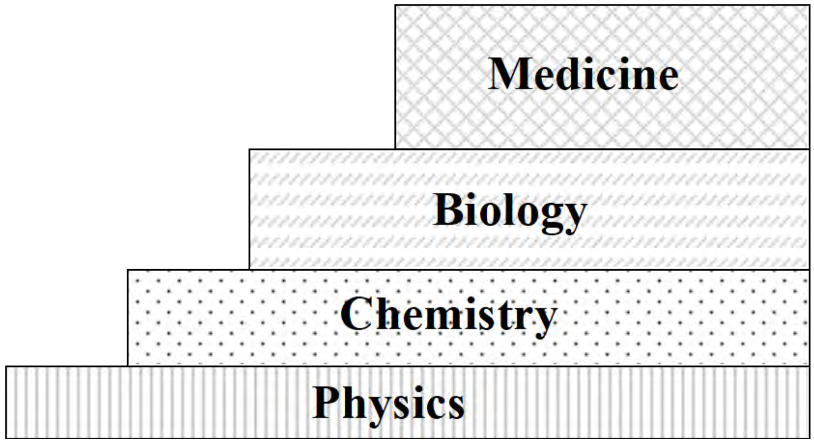

Figure D.3 Each Scientific Discipline Rests on the Underlying Laws of a More Basic Discipline

In order for MFs to cause changes within living cells, the fields must in some manner modify molecules or structures in the organism. By their very definition, MFs interact with matter only by exerting force on stationary or moving electric charges. At sufficiently high levels, these forces will add thermal energy or change the configuration of a charged biological molecule or structure. However, the magnitudes of natural forces that cells use (and are sensitive to) have been measured, and the results demonstrate that biological structures can withstand forces far larger than can be generated by typical MFs. Cells and organs function properly in spite of many internal sources of interfering thermal, chemical, electrical, and physical force effects, which exceed by a large factor the forces that can be caused by power-line MFs.

In summary, for MFs to alter physiological function, initiate dysfunction, or cause the onset of disease in humans or animals there must exist a mechanism by which magnetic forces alter molecules, chemical reactions, cell membranes, or biological structures (*i.e.*, DNA, RNA, plasma membranes, mitochondria). A MF is not a foreign molecular or chemical agent, and biological plausibility must be assessed with this in mind. The initial physical step sets off the following causal chain that must be completed in order to make any connection to disease:

Magnetic fields ⇒ matter (physics) ⇒ molecules (chemistry) ⇒ organisms (biology) ⇒ disease

A necessary condition for MFs to impact on human or ecosystem biology is that the MF-induced changes have to exceed chemical and thermal changes from natural or background influences. Changes in biological molecules are coupled to MFs through changes in forces on electrically charged structures, which in turn, must be coupled to metabolically important chemical processes (*e.g.*, reaction rates or transport rates).

Summary of EMF Health-Effect Conclusions from International Scientific, Health, and Safety Organizations, and Governmental Public Health Agencies

As summarized below, a number of international scientific, health, and safety organizations, and governmental public health agencies have reviewed the EMF health-effects literature and provided their interpretations of the EMF health-effects science. Below, we have compiled summaries that are illustrative of the current positions of a number of international scientific, health, and safety organizations, and governmental public health agencies, regarding the EMF health-effects science and the potential for human health risks arising from power-frequency EMF exposure. As discussed below, it is the consensus opinion of a number of international scientific, health, and safety organizations, and public health agencies, including the WHO, US EPA, and NIEHS, that there are no confirmed chronic human health risks for everyday exposures to power-frequency EMFs, including risk of cancers.

None of the international scientific, health, and safety organizations, and governmental public health agencies that have conducted comprehensive (*i.e.*, weight-of-evidence)[6] reviews of the EMF health-effects science have concluded that there is a sound scientific basis for causally linking long-term exposure to power-frequency EMFs with chronic health risks, and for justifying a need for health-based standards and exposure guidelines to protect against chronic health risks. As noted below and discussed more in the section on "EMF Standards and Guidelines," two international health and safety organizations (International Commission on Non-Ionizing Radiation Protection [ICNIRP] and the International Committee on Electromagnetic Safety [ICES]) have developed health-based exposure guidelines for power-frequency EMFs that are based on protection against acute or short-term effects (*e.g.*, electrostimulation). It also bears mentioning that a number of public health agencies do not even address power-frequency EMF health-effects concerns or provide recommendations on EMF exposure guidelines for power-frequency fields. This suggests that, even though the public's power-frequency EMF exposure is ubiquitous, the potential threat of a health hazard from power-line EMFs is not viewed as sufficiently established to warrant regulation. For example, the US Food and Drug Administration (US FDA), the Centers for Disease Control and Prevention (CDC), the Agency for Toxic Substances and Disease Registry (ATSDR), the Consumer Product Safety Commission (CPSC), the Office of the Surgeon General, and the NTP have not promulgated guidelines on power-frequency EMF exposure limits.

International scientific, health, and safety organizations, and governmental public health agencies, have provided the following conclusions regarding the EMF health-effects science and the potential for human health risks:

American Cancer Society (ACS) (2022):[7] "The possible link between electromagnetic fields and cancer has been a subject of controversy for several decades. It's not clear exactly how electromagnetic fields, a form of low-energy, non-ionizing radiation, could increase cancer risk. Plus, because we are all exposed to different amounts of these fields at different times, the issue has been hard to study."

US EPA (2023):[8] US EPA has not established any hazard levels or exposure standards for power-frequency EMFs, and US EPA states that "Scientific studies have not clearly shown whether exposure to EMF increases cancer risk."

European Commission, Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) (2015):[9]

> In research on health effects of EMF, the lack of clearly focused working hypotheses for chosen biological endpoints is accentuated by the lack of an established biological or biophysical mechanism of action at environmental exposure levels. This does not allow researchers to conclude on the most relevant exposure parameter, and usually several alternative measures of exposure are evaluated (for instance field strength, exposure frequency, cumulative exposure, time since first exposure, *etc.*). In addition, some studies

[6] Weight-of-evidence approaches for reviewing health-effects evidence are well accepted in the public health field, and include such key elements as evaluating the entire body of relevant study findings, including from different types of studies (*e.g.*, epidemiological studies, laboratory animal studies, human clinical studies, mechanistic studies); assessing study quality and giving more weight to higher quality studies when weighing evidence; and using established, transparent, and systematic methods for integrating study evidence and reaching causal conclusions.

[7] https://www.cancer.org/cancer/risk-prevention/radiation-exposure/extremely-low-frequency-radiation.html.

[8] https://www.epa.gov/radtown/electric-and-magnetic-fields-power-lines.

[9] http://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_o_041.pdf.

> use multiple end-points which are equally prone to false positive results, without adequate statistical corrections. Good research practice requires that all hypotheses evaluated are clearly stated and that all results pertaining to them are reported. Selective reporting, with emphasis on significant findings that were not specified in advance, can mislead the assessment by ignoring the issue of multiple testing…. The new epidemiological studies are consistent with earlier findings of an increased risk of childhood leukaemia with estimated daily average exposures above 0.3 to 0.4 μT [3 – 4 mG]. As stated in the previous [SCENIHR] Opinions, no mechanisms have been identified and no support is existing from experimental studies that could explain these findings, which, together with shortcomings of the epidemiological studies prevent a causal interpretation.

ICNIRP (2010):[10] ICNIRP (2010) conducted a comprehensive review of the body of scientific evidence related to potential adverse health effects from general public and occupational exposure to low frequency AC EMFs, concluding:

> The epidemiological and biological data concerning chronic conditions were carefully reviewed and it was concluded that there is no compelling evidence that they are causally related to low-frequency EMF exposure…. [A] causal relationship between magnetic fields [MFs] and childhood leukemia has not been established. The absence of established causality means that this effect cannot be addressed in the basic restrictions.

ICNIRP (2010) acknowledged the epidemiological evidence, suggesting that long-term exposure to 50-60 Hz MFs might be weakly associated with an increased risk of childhood leukemia, and pointed to uncertainties in this evidence, including the roles of "a combination of selection bias, some degree of confounding and chance" as explaining the epidemiological findings. In addition, ICNIRP (2010) highlighted how "no biophysical mechanism has been identified and the experimental results from the animal and cellular laboratory studies do not support the notion that exposure to 50-60 Hz magnetic fields [MFs] is a cause of childhood leukemia."

Based on basic restrictions for protection against acute health effects (*e.g.*, retinal phosphenes, nerve and muscle stimulation, shocks and burns, surface electric-charge effects such as perception), ICNIRP (2010) has established a health-based guideline for allowable general public exposure to power-frequency MF at 2,000 mG, (200 μT), and a health-based guideline for allowable general public exposure to power-frequency EF at 4.2 kV/m. Importantly, ICNIRP (2010) describes its exposure guidelines as "limiting exposure to electric and magnetic fields (EMF) that will provide protection against <u>all established adverse health effects</u>" [underline emphasis added].

The ICES within the Institute of Electrical and Electronics Engineers (IEEE) (2019)[11] conducted an updated review of the scientific and medical research literature, and retained its safety guidelines for general public exposure to 60 Hz MF and EF at 9,040 mG (904 μT) and 5.0 kV/m, respectively. IEEE (2019) specifically evaluated the evidence of possible adverse health effects for chronic low-level EMF exposure, reaching the following conclusions for exposures to electric, magnetic, and electromagnetic fields at frequencies between 0 Hz and 300 GHz:

> 1. "The weight-of-evidence provides no credible indication of adverse effects caused by chronic exposures below levels specified in this standard."

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[10] International Commission for Non-Ionizing Radiation Protection (ICNIRP). 2010. "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (1 Hz to 100 kHz)." *Health Phys.* 99(6):818–836.

[11] Institute of Electrical & Electronics Engineers (IEEE). 2019. "C95.1-2019 IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic and Electromagnetic Fields 0 to 300 GHz." IEEE Standards Coordinating Committee 39, NY: IEEE, Inc.

2. "No biophysical mechanisms have been scientifically validated that would link chronic exposures below levels specified in this standard to adverse health effects."

3. "Based on the collective findings of recent reviews, the weight of the evidence continues to indicate that chronic exposure at levels specified in this standard is unlikely to cause adverse health effects."

National Cancer Institute (NCI) (2022)[12] notes on its webpage focused on "Electromagnetic Fields and Cancer" that "No mechanism by which ELF-EMFs or radio frequency radiation could cause cancer has been identified…. Studies of animals have not provided any indications that exposure to ELF-EMFs is associated with cancer." Regarding the evidence from epidemiological studies, NCI (2022) concludes:

> Most of the research has focused on leukemia and brain tumors, the two most common cancers in children. Studies have examined associations of these cancers with living near power lines, with magnetic fields [MFs] in the home, and with exposure of parents to high levels of magnetic fields [MFs] in the workplace. No consistent evidence for an association between any source of non-ionizing EMF and cancer has been found.

NIEHS (2024),[13] which funded and orchestrated a large laboratory-research program on power-frequency EMF, points out on its website that utility "Power Lines" fall into the "non-Ionizing" radiation category. On the website, NIEHS goes on to explain, "Non-ionizing: low-level radiation which is generally perceived as harmless to humans."

WHO published a lengthy monograph (WHO, 2007a) for its "Health Risk Assessment" of power-frequency EMF in 2007, as part of its International EMF Project, and came to several conclusions. WHO (2007a) concluded overall:

> Acute biological effects have been established for exposure to ELF electric and magnetic fields [EMFs] in the frequency range up to 100 kHz that may have adverse consequences on health. Therefore, exposure limits are needed. International guidelines exist that have addressed this issue. Compliance with these guidelines provides adequate protection. Consistent epidemiological evidence suggests that chronic low intensity ELF magnetic field [MF] exposure is associated with an increased risk of childhood leukaemia. However, the evidence for a causal relationship is limited, therefore exposure limits based upon epidemiological evidence are not recommended, but some precautionary measures are warranted.

Specifically, with respect to the interpretation of epidemiology associations, the summary section on p. 12 in WHO (2007a) states:

> Uncertainties in the hazard assessment include the role that control selection bias and exposure misclassification might have on the observed relationship between magnetic fields [MFs] and childhood leukaemia. In addition, virtually all of the laboratory evidence and the mechanistic evidence fail to support a relationship between low-level ELF magnetic fields [MFs] and changes in biological function or disease status. Thus, on balance, the evidence is not strong enough to be considered causal, but sufficiently strong to remain a concern.

[12] https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet.
[13] https://www.niehs.nih.gov/health/topics/agents/emf/.

WHO released a fact sheet in June 2007 (WHO, 2007b) to accompany its full environmental health criteria monograph, and it contained similar conclusions regarding important limitations to the epidemiological evidence for childhood leukemia:

> However, the epidemiological evidence is weakened by methodological problems, such as potential selection bias. In addition, there are no accepted biophysical mechanisms that would suggest that low-level exposures are involved in cancer development. Thus, if there were any effects from exposures to these low-level fields, it would have to be through a biological mechanism that is as yet unknown. Additionally, animal studies have been largely negative. Thus, on balance, the evidence related to childhood leukaemia is not strong enough to be considered causal.

WHO (2007b) went on to discuss how the scientific evidence for other health endpoints was even weaker than that for childhood leukemia:

> A number of other adverse health effects have been studied for possible association with ELF magnetic field [MF] exposure. These include other childhood cancers, cancers in adults, depression, suicide, cardiovascular disorders, reproductive dysfunction, developmental disorders, immunological modifications, neurobehavioural effects and neurodegenerative disease. The WHO Task Group concluded that scientific evidence supporting an association between ELF magnetic field [MF] exposure and all of these health effects is much weaker than for childhood leukaemia. In some instances (*i.e.*, for cardiovascular disease or breast cancer) the evidence suggests that these fields do not cause them.

Therefore, WHO (2007b) recommended, "policies based on the adoption of arbitrary low exposure limits are not warranted."

WHO (2024b) maintains and updates a website[14] for its International EMF Project where it provides summaries of existing standards and guidelines and fact sheets, as well as scientific reviews of EMF health-effects research. On this website,[15] WHO (2024a) states, "[T]he main conclusion from the WHO reviews is that EMF exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on health." On another webpage with an EMF Q&A,[16] WHO provides the following conclusions regarding EMF health-effects research:

> Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals. Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields. However, some gaps in knowledge about biological effects exist and need further research. (WHO, 2016)

[14] https://www.who.int/health-topics/electromagnetic-fields#tab=tab_1.
[15] https://www.who.int/teams/environment-climate-change-and-health/radiation-and-health/protection-norms.
[16] https://www.who.int/news-room/questions-and-answers/item/radiation-electromagnetic-fields.

Summary of Recent Research Publications on Childhood Leukemia

The potential linkage between residential exposure to power-frequency MFs[17] (*i.e.*, ELF-MFs) and risk of childhood leukemia continues to be the subject of updated epidemiological analyses and systematic reviews. In particular, Amoon *et al*. (2022) published an updated analysis that included pooled results from epidemiology studies published from 2010 to 2020 of MFs and childhood leukemia. Led by researchers in the Department of Epidemiology at the University of California, Los Angeles (UCLA) and the Los Angeles County Department of Public Health, this study observed no increased risk of leukemia among children exposed to greater MF levels (odds ratio [OR] = 1.01, for exposure ≥0.4 μT [4 mG] compared with exposures <0.1 μT [1 mG]). The results of the pooled analysis, which combined the primary individual-level data (24,994 cases, 30,769 controls) from either new or updated epidemiological studies conducted in California, Italy, the United Kingdom, and Denmark, are supportive of other study findings indicating a decline in reported leukemia risks from epidemiological studies using more recent (*i.e*., post-1990s) data. Specifically, Amoon *et al*. (2022) concluded, "[O]ur results do not show the risk increase observed in previous pooled analysis and, over time, show a decrease in effect to no association between MF and childhood leukemia."

Consistent with the Amoon *et al*. (2022) findings, researchers from the WHO's IARC reported findings from the Childhood Leukaemia International Consortium (CLIC) supporting a lack of association between occupational ELF-MF exposure of parents and leukemia risk for their children (Talibov *et al*., 2019). Talibov *et al*. (2019) conducted a pooled analysis of individual-level data from 11 case-control studies (9,723 childhood leukemia cases, 17,099 controls) and reported ORs that were not statistically different from one for both paternal and maternal ELF-MF exposures and leukemia risk (including all leukemia subtypes, as well as specifically acute lymphoblastic leukemia [ALL] and acute myeloid leukemia [AML]), indicating no elevation in childhood leukemia risk with increased parental MF exposure. Based on their findings, Talibov *et al*. (2019) concluded:

> In conclusion, using a large international pool of case–control studies and a detailed quantitative JEM [job-exposure matrix], we did not find any evidence for an association between fathers' occupational ELF-MF exposures around the time of conception or mothers' occupational ELF-MF exposures during pregnancy and leukaemia in their offspring. Considering our findings and those of previous smaller less consistent studies together suggests that parental ELF-MF exposure plays no relevant role in the aetiology of childhood leukaemia.

Several meta-analysis and systematic review studies have been published in the last couple years, and despite often examining the results from a similar body of epidemiology studies, have reached different conclusions regarding the strength of the epidemiological evidence for ELF-MF exposure and risk of childhood leukemia. Seomun *et al*. (2021) reported statistically significant associations between exposure to ELF-MFs and childhood leukemia for their meta-analysis that included 27 case-control studies. Since case-control studies are subject to selection bias, as well as other methodological problems, Seomun *et al*. (2021) acknowledged their exclusive reliance on case-control studies as an important limitation to their analysis that reduces the strength of their findings. For their systematic review and meta-analysis of case-control studies and cohort studies, Brabant *et al*. (2022) reported findings indicating a statistically significant association between ELF-MF and childhood leukemia, with analyses indicating that this association was driven by results from studies performed before 2000.

[17] As mentioned previously, most of the remaining health concerns related to power-frequency EMFs are thus focused on MFs rather than EFs.

Onyije *et al*. (2022) conducted an "umbrella review" of environmental risk factors for childhood ALL that integrated findings from previously published systematic reviews or meta-analyses. For ELF-MF, Onyije *et al*. (2022) concluded that there was "some" level of evidence for an association between postnatal ELF-MF exposure and childhood ALL, in particular for the highest MF-exposed categories; in contrast, they concluded that exposure to low doses of ionizing radiation during childhood and general pesticide exposure during pregnancy were both "strongly" associated with childhood ALL. They highlighted ELF-MF as "an example where the epidemiological association was established more than 20 years ago but concerns about bias and the lack of biological plausibility of the association have precluded any conclusions on causality." The English abstract for the Herkert *et al*. (2021)[18] integrative review, which analyzed five case-control studies published between 2012 and 2020 that investigated the association between exposure to ELF-MF and risk of childhood leukemia, includes the following overall conclusion: "Due to methodological heterogeneity and confounding variables in the analyzed articles, the authors concluded that it was not possible to demonstrate the relationship between low-frequency non-ionizing radiation sources and the development of childhood leukemia." Similarly, for their recent review paper, Schmidt *et al*. (2021) emphasized how ELF-MF has yet to be "verified" as a risk factor for childhood leukemia, and they pointed to the lack of a plausible biological mechanism and the inadequate evidence from experimental animal studies: "However, how ELF-MF may cause leukemia is unknown – until today, no plausible biological mechanism has been found, and experimental *in vitro* and *in vivo* studies do not confirm the results of the epidemiological studies."

Finally, epidemiological studies continue to investigate possible alternative explanations for the observed epidemiological associations between ELF-MF exposure and risk of childhood leukemia, with postulated factors including socioeconomic status, residential mobility, residential dwelling type, viral contacts, environmental tobacco smoke, dietary agents, traffic density (as a proxy for air pollution exposure), pesticides, and corona ions (Crespi *et al*., 2019). Using the large dataset from the California Power Line Study (CAPS), several recent studies have examined potential bias and/or confounding from factors that include potential pesticide exposures associated with commercial plant nurseries located in areas underneath power lines (Nguyen *et al*., 2022), dwelling type (*e.g*., single-family homes *vs*. apartments/mobile dwellings; Amoon *et al*., 2020), and residential mobility (Amoon *et al*., 2019). While none of the investigated sources of potential bias and/or confounding have been found to explain the entirety of previously observed associations between power-frequency MFs and risk of childhood leukemia, these studies have reported some findings requiring additional investigation. For example, Nguyen *et al*. (2022) reported findings suggesting close residential proximity to nurseries as an independent risk factor for childhood leukemia, but not as an explanation for observed associations between power-frequency EMFs and childhood leukemia risk; however, they discussed how their ability to fully assess its potential confounding role was limited by the small numbers of study subjects with both high ELF-MF exposures and with close proximity to power lines and plant nurseries. Based on analyses they conducted to probe the confounding effect of residential mobility, Amoon *et al*. (2019) concluded, "We conclude that uncontrolled confounding by residential mobility had some impact on the estimated effect of EMF exposures on childhood leukemia, but that it was unlikely to be the primary explanation behind previously observed largely consistent, but unexplained associations." An additional study using the CAPS data (Crespi *et al*., 2019) conducted modeling analyses to examine the interaction between distance from high voltage lines and calculated MF levels as exposure metrics, and reported findings that "argue against magnetic fields [MFs] as a sole explanation for the association between distance and childhood leukemia and in favor of some other explanation linked to characteristics of power lines."

[18] The full paper is only available in Portuguese and has not been reviewed.

EMF Standards and Guidelines

The US has no federal standards limiting either residential or occupational exposure to 60-Hz AC EMFs. The Massachusetts Energy Facilities Siting Board (MA EFSB) assesses EMF levels on a case-by-case basis with a focus on practical options to reduce magnetic fields along transmission line rights-of-way (ROWs). Some states, including New York and Florida, have adopted EMF guidelines that are not health-effect based and have typically been adopted to maintain the *status quo* for EMFs on and near a transmission line ROW.

Table D.1 shows health-based exposure guidelines established by international health and safety organizations that are designed to be protective against adverse health effects. As mentioned earlier, these exposure guidelines are based on protection against acute or short-term effects (*e.g.*, electrostimulation) as these organizations have concluded that the health-effects evidence is too inconsistent and weak to justify a need for or to support the development of exposure guidelines for chronic health risks. ICNIRP (2010) concluded that there was not sufficient evidence to support the development of an exposure guideline specific to long-term exposure, citing both the lack of any consistent increases in any types of cancer (*e.g.*, hematopoietic, mammary, brain, skin tumors) in large-scale, long-term laboratory animal studies and the weak and inconsistent evidence from human epidemiological studies, including those addressing risk of childhood leukemia. For example, ICNIRP (2010) concluded:

> It is the view of ICNIRP that the currently existing scientific evidence that prolonged exposure to low frequency magnetic fields [MFs] is causally related with an increased risk of childhood leukemia is too weak to form the basis for exposure guidelines. In particular, if the relationship is not causal, then no benefit to health will accrue from reducing exposure.

The limit values should not be viewed as demarcation lines between safe and dangerous levels of EMFs but, rather, levels that assure safety with an adequate margin to allow for uncertainties in the science. This is because they incorporate safety factors; for example, the ICNIRP general public MF guideline of 2,000 mG incorporates a safety factor of 5. In summary, available exposure guidelines such as the ICNIRP general public exposure guidelines are generally applied for both short-term and long-term exposures, and are reasonable for use in both contexts, because there is no scientific rationale for separate guidelines focused specifically on long-term EMF exposure.

Table D.1 60-Hz AC EMF Guidelines Established by International Health and Safety Organizations

Organization	Electric Field	Magnetic Field
American Conference of Governmental and Industrial Hygienists (ACGIH) (occupational)	25 kV/m[(1)]	10,000 mG[(1)] 1,000 mG[(2)]
International Commission on Non-Ionizing Radiation Protection (ICNIRP) (general public)	4.2 kV/m[(3)]	2,000 mG[(3)]
International Commission on Non-Ionizing Radiation Protection (ICNIRP) (occupational)	8.3 kV/m[(3)]	10,000 mG[(3)]
Institute of Electrical and Electronics Engineers (IEEE) Standard C95.1™-2019 (general public)	5.0 kV/m[(4)]	9,040 mG[(4)]
Institute of Electrical and Electronics Engineers (IEEE) Standard C95.1™-2019 (occupational)	20.0 kV/m[(4)]	27,100 mG[(4)]

Notes:
AC = Alternating Current; EMF = Electric and Magnetic Field; Hz = Hertz; kV/m = Kilovolts Per Meter; mG = Milligauss.
(1) The ACGIH guidelines for the general worker (ACGIH, 2024).
(2) The ACGIH guideline for workers with cardiac pacemakers (ACGIH, 2024).
(3) ICNIRP (2010).
(4) IEEE (2019); developed by the IEEE International Committee on Electromagnetic Safety (ICES).

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