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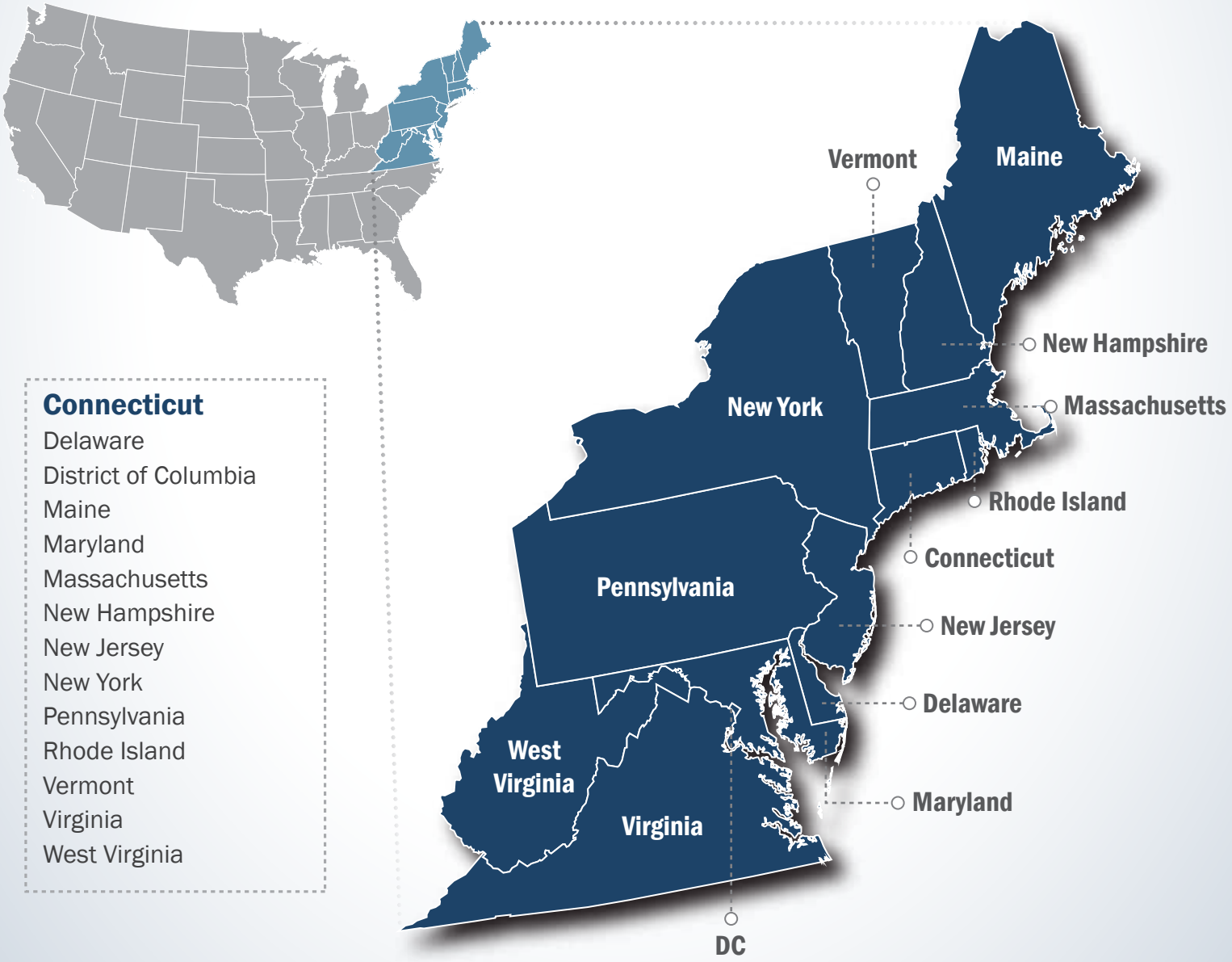
Nationwide Public Safety Broadband Network

Final Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 1 - CHAPTERS 1-3



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SEPTEMBER 2017

First Responder Network Authority

Nationwide Public Safety Broadband Network

Final Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 1 - CHAPTERS 1-3

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Cooperating Agencies
Federal Communications Commission
General Services Administration
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U.S. Department of Agriculture—U.S. Forest Service
U.S. Department of Agriculture—Natural Resource Conservation Service
U.S. Department of Commerce—National Telecommunications and Information Administration
U.S. Department of Defense—Department of the Air Force
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September 2017

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Errata Sheet

FirstNet Nationwide Public Safety Broadband Network

Final Programmatic Environmental Impact Statement for the East United States Region

September 2017

This document presents errata and clarifications to the Final Programmatic Environmental Impact Statement (Final PEIS) for the East region of the FirstNet nationwide public safety broadband network (NPSBN) in response to new information received during the Final PEIS publication process. This new information includes changes to guidance from the Council on Environmental Quality (CEQ), addition of a federally listed species, and additional comments received from the Federal Communications Commission (FCC) and the United States (U.S.) Fish and Wildlife Service (USFWS). In those responses that FirstNet acknowledges agreement with the comment or that additional information was received during final publication, this errata sheet serves in lieu of actual insertion of the corrected language and is incorporated by reference in the Final PEIS.

Changes to CEQ Guidance on Consideration of Greenhouse Gas Emissions

On August 5, 2016, the CEQ published its *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews*. This guidance formed part of the basis for the climate change analysis in the Final PEIS. On March 28, 2017, an Executive Order entitled *Promoting Energy Independence and Economic Growth* was issued, directing the CEQ to rescind this guidance. As a result of the Executive Order, the CEQ has rescinded this guidance.

Addition of the Rusty Patched Bumble Bee

The USFWS issued a final rule to list the rusty patched bumble bee (*Bombus affinis*) on January 11, 2017 with an effective date of February 10, 2017. The effective date was subsequently extended to March 21, 2017. The rusty patched bumble bee is listed as endangered with its range including Maine, Massachusetts, and Virginia.

Additional Comments Received from the FCC

Additional comments were received from the FCC during the final production process of the Final PEIS regarding best management practices (BMPs) and mitigation measures for wildlife as well as threatened and endangered species and species of conservation concern found in Chapter 17, BMPs and Mitigation Measures. Although the comments could not be addressed directly in the Final PEIS due to the timing of their receipt, each comment is presented in Table 1.

Table 1: FCC Comments and Responses

BMP/Mitigation Measure	Comment	Response
Section 17.6.2: Wildlife		
Minimize vehicular harm of animals migrating between seasonal habitats by locating activities, roads, and infrastructure away from these areas or installing barriers along roadsides.	Some areas with protected tortoises may require reduced speed limits on access roads.	FirstNet agrees that this BMP may be appropriate to protect listed tortoises where warranted as indicated by site-specific conditions and requirements, and incorporates by reference.
Control the spread of invasive animals and plants by coordinating mowing schedules and assisting agencies and groups with ROW permits, washing mowers and equipment between sites, and educating staff.	I would like to see mowing height of 18 inches or higher to avoid fatalities to tortoises and snakes. This probably requires a separate bullet as it is not directly related to invasive species.	FirstNet agrees that this BMP may be appropriate to protect listed tortoises or snakes where warranted as indicated by site-specific conditions and requirements, and incorporates by reference.
Develop “good housekeeping” procedures to ensure that sites are kept clean of debris, garbage, and or waste.	I suggest adding a sentence to specify the elimination of microtrash in California Condor range (small bits of trash that Condors pick up and ingest).	The range of the California Condor does not include the East region of the U.S.
Turn off all unnecessary lighting at night.	Add: “If nighttime lighting is required, use motion sensor security lights that are activated as needed.”	FirstNet agrees with the recommended change and incorporates by reference.

BMP/Mitigation Measure	Comment	Response
The following BMPs and mitigation measures are recommended by USFWS, including guidelines on communications tower siting (*2012a, 2013b*): "...2. If collocation is not feasible and a new tower or towers are to be constructed, it is strongly recommended that the new tower(s) should be not more than 199 feet above ground level (AGL), and that construction techniques should not require guy wires. Such towers should be unlighted if Federal Aviation Administration (FAA) regulations and lighting standards (*FAA 2007, Patterson 2012, FAA 2013 lighting circular anticipated update* [1]) permit. Additionally, the Federal Communications Commission (FCC) through recent rulemaking now requires that new towers > 450 ft AGL contain no red-steady lights. FCC also recommends that new towers 350-450 ft AGL also contain no red-steady lights, and they will eventually recommend that new towers < 350 ft AGL convert non-flashing lights to flash with existing flashing lights. LED lights are being suggested as replacements for all new construction and for retrofits, with the intent of future synchronizing the flashes. Given these dynamics, the Service recommends using lattice tower or monopole structures for all towers < 200 ft AGL and for taller towers where feasible. The Service considers the less than 200 ft AGL option the 'gold standard' and suggests that this is the environmentally preferred industry standard for tower placement, construction and operation—i.e., towers that are unlit, unguyed, monopole or lattice, and less than 200 ft AGL..."	Delete: "they will eventually recommend that." I understand that you are referencing text from the USFWS but my edits reflect the current situation. Inconsistent use of < vs. "less than"	FirstNet understands that the USFWS has updated their tower siting guidance, and has issued its *Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning* (USFWS 2016). See Table 2 for further discussion.

[1] Current FAA guidance (*FAA 2016*) requires lighting for towers greater than 200 feet.

BMP/Mitigation Measure	Comment	Response
... 6. If taller (> 199 ft AGL) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used.[ ] Unless otherwise required by the FAA, only white strobe or red strobe lights (red preferable since it is generally less displeasing to the human eye at night), or red flashing incandescent lights should be used at night, and these should be the minimum number, minimum intensity (< 2,000 candela), and minimum number of flashes per minute (i.e., longest duration between flashes/'dark phase') allowable by the FAA. The use of solid (non-flashing) warning lights at night should be avoided (Patterson 2012, Gehring et al. 2009)—see recommendation #2 above. Current research indicates that solid red lights attract night-migrating birds at a much higher rate than flashing lights (Gehring et al. 2009, Manville 2007, 2009). Recent research indicates that use of white strobe, red strobe, or red flashing lights alone provides significant reductions in bird fatalities (Patterson 2012, Gehring et al. 2009).	I prefer the more clarifying term "non-flashing" [in place of "solid"].	FirstNet agrees with the recommended change and incorporates by reference.
Additional tower lighting BMPs are described in Section 11.6.2.2, Project-Type Specific BMPs and Mitigation Measures.	Should nest exclusion devices be mentioned? Eagle and osprey nests on towers are an increasingly challenging issue for the industry. MBTA and BGEPA prevent access to the tower site when the nest has eggs or young. Nest exclusion devices can sometimes work to reduce nest construction and use. But the devices are not 100% effective. Certain regions of the country struggle with this issue more than other regions.	As stated in the FEIS, nest exclusion devices would be required where warranted as indicated by site-specific conditions and requirements.
Follow the FAA requirements to eliminate steady-burning flashing obstruction lights and use only flashing obstruction lights in accordance with FAA Advisory Circulars AC 70/7460-1L and AC 150/5345-43H (FAA 2016a; FAA 2016b; FCC 2017). [Note: this BMP is listed in two separate places in Chapter 11.]	I am very happy to see this in here. Actually it is an FCC document. Here is the link to the most current version.[2]	The guidance for using flashing obstruction lights is referenced in both FAA and FCC documentation.

[2] https://www.fcc.gov/sites/default/files/Light_Changes_Information_Update_Jan_2017.pdf

BMP/Mitigation Measure	Comment	Response
Section 17.6.4: Threatened and Endangered Species and Species of Conservation Concern		
Avoid removal or disturbance of forest to the maximum extent practicable and ensure that any unavoidable forest impacts do not result in the loss of listed snails, butterflies, bird breeding habitat, or bat roost sites or hibernacula.	I suggest replacing this ["forest"] with "native vegetation (forests, sagebrush, grassland, etc.)".	The following sentence is added after the sentence quoted: "Avoid or minimize disturbance of other native vegetation habitat (such as sagebrush, grassland, etc.) as practicable or feasible."
NA	The USFWS may have site-specific and species specific BMPs. Maybe you don't want to include this in the more general PEIS BMPs, but a simple sentence stating that the project would follow USFWS BMPs for individual towers.	FirstNet and/or its partners would consult with the USFWS and other resource agencies as appropriate. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work to determine the potential impacts on listed species at specific proposed activity locations, once those locations are determined, and any additional BMPs or mitigation measures would be determined at that time.

BGEPA = Bald and Golden Eagle Protection Act; BMP = best management practice; DOI = U.S. Department of Interior; MBTA = The Migratory Bird Treaty Act; NA = not applicable; not assessed; PEIS = Programmatic Environmental Impact Statement; USFWS = U.S. Fish and Wildlife Service

Additional Comments Received from the USFWS

Additional comments were received from the USFWS during the final production process of the Final PEIS; although the comments could not be addressed directly in the document due to the timing of their receipt, each comment is presented in Table 2. The comments have been individually addressed, and the relevant sections of the Final PEIS are identified.

Table 2: USFWS Comments and Responses

Comment Text	Response	Relevant Section(s) in Final PEIS
Overall Comments		
There is a disconnect between how the PEIS will be implemented in the tiered NEPA process. The PEIS as we saw contains no guidance for how the tiered NEPA should be conducted. Nor does it include the standards that should apply for the tiered analyses. Federal agencies have responsibilities to ensure that all levels of NEPA are implemented appropriately, and retain the authority and legal liability for the decisions that are made (40 CFR § 1506.5). Therefore, ensuring the adequacy of any tiered NEPA is essential. The FEIS and Record of Decision (ROD) should make commitments to the following. Conduct a supplemental EIS that: • Analyzes, using an eco-regional or landscape ecology framework, the potential impacts within each Region; • Provides specific guidance on how to conduct NEPA at the site-specific scale; and • Stipulates the roles and responsibilities and the management and oversight process that will be used by FirstNet to ensure that all applicable CEQ guidance is being incorporated into decision making.	Of necessity, the environmental review in the Final PEIS is presented at a regional and programmatic level, as site-specific projects have not yet been determined. Site-specific actions, once defined, would be evaluated against the analyses presented in the programmatic review for future NEPA compliance. In addition, site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. FirstNet is still developing its site-specific review process, incorporating comments received from cooperating and consulting agencies. Once the process, including roles and responsibilities, has been determined, FirstNet will release a Supplemental PEIS. Agencies will also have the opportunity to provide input on the Supplemental PEIS, which will address, at a minimum, the following: • An outline and/or process for conducting analyses of the potential impacts within each Region using a resource-appropriate framework (such as an ecoregional or landscape ecology framework for biological impacts), as practicable and feasible; • Specific guidance on how to conduct NEPA analysis at the site-specific scale; and • An explanation of the roles and responsibilities and the management and oversight process that will be used by FirstNet to ensure that all applicable CEQ guidance is incorporated into decision making.	Section 1.2
Please update all citations to reflect new Eagle Rule, where applicable.	In December 2016, the USFWS issued revised regulations for non-purposeful take permits for eagles and their nests (*81 FR 91494*). Among other changes, revisions were made to permit application and permit issuing criteria, compensatory mitigation standards, and permit duration.	Specific Regulatory Considerations section of all Affected Environment Wildlife sections (X.1.6.2)

Comment Text	Response	Relevant Section(s) in Final PEIS
Many times in the PEIS, activities are categorized as "temporary and isolated" but it's unclear what this means or how it will apply to tiered analyses. I recommend being more specific or providing examples where you can when this phrase is used. It's a bit overused in the document so it raised questions on what it means in each situation.	In the deployment or construction phase of the NPSBN, many activities would likely be short-term and localized, meaning that impacts would generally be of short duration and limited to individual locations in the regional context. An example of a short-term activity could include installing a simple piece of equipment on an existing tower. Both impact duration and geographic extent inform the significance of potential impacts at the programmatic level. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work; in these cases, both duration and extent would be re-evaluated to determine impact significance at the project level. As explained in the introductory text of each Environmental Consequences section (Sections 3.2, 4.2, 5.2, etc.) it is possible that, for some effect types, impact ratings could be *less than significant* at the programmatic level yet *potentially significant* at the site-specific level (although with BMPs and mitigation measures this is expected to be rare). For example, while potential impacts from a specific FirstNet project taking place in a single wetland may not rise to the level of significance at the programmatic level (based on the programmatic impact significance criteria), such impacts could be considered *potentially significant* at the site-specific level when applying site-specific significance criteria. As another example, if it is determined that the environmentally preferred location for a new wireless communication tower requires an access road that could impact an historic property, the effect to the particular property could be adverse locally, but not at the programmatic level based on the established criteria. In these scenarios, site-specific BMPs may be needed in addition to those outlined in the Final PEIS Any additional BMPs would be determined as part of the site-specific environmental review, as required, and likely in coordination with the appropriate resource agencies.	Various Environmental Consequences sections

Comment Text	Response	Relevant Section(s) in Final PEIS
Portions of the PEIS that we did not review but may help with some of our comments may come from any specification of significance criteria and how it will be used in tiered NEPA analyses, how cumulative impacts will be treated in the tiered NEPA stage, and a description of the proposed mitigation for all impacts (including RF emissions-monitoring for example?).	Description of the process by which site-specific NEPA analysis will be conducted will be provided in the Supplemental PEIS. This process will address, in part, both significance criteria at the site-specific level as well as how cumulative impacts will be considered. Proposed mitigation measures and BMPs, including those associated with RF emissions, are described in Chapter 11.	Section 1.2 and 17.6.2
Section 2.0: Proposed Action		
The proposed action references "use [of] existing infrastructure to the maximum extent economically desirable." Examples would be extremely beneficial for use in tiered analyses.	It is anticipated that site-specific analyses will address, as needed, use of existing infrastructure as well as new installations. This process will be considered in the Supplemental PEIS. Some examples of the use of existing infrastructure could include: • Collating an antenna on an existing cell tower; • Installing new fiber in an existing subsurface conduit; • Installing a point of presence or data center equipment within an existing building; and • Hanging a new aerial fiber line on existing poles.	Sections 1.2 and 2.1
In describing the proposed infrastructure, I would recommend including diagrams, if possible, so people can understand how the system will interface across different platforms.	Figure 1 below provides a diagram of FirstNet's notional deployment approach. Please visit FirstNet's website[3] for additional informational materials on the system.	Section 2.1

[3] https://firstnet.gov/

Comment Text	Response	Relevant Section(s) in Final PEIS
When describing deployable technologies, the PEIS states that they would be used to supplement areas where fixed infrastructure cannot be erected, due to "a variety of factors." It would be helpful to describe those factors as they relate to the physical environment or events for which the deployable technologies would be used. This will help tie in the analyses within the tiered assessments.	The specific circumstances in which deployable technologies could be used, as well as the types of deployable technology, have not yet been determined. As discussed in Section 2.1 of the Final PEIS, the use of deployables may be preferred, for instance, over permanent, fixed infrastructure where physical limitations preclude permanent installations, such as where significant impacts to sensitive receptors cannot be mitigated or where existing coverage needs to be supplemented during a large-scale planned (such as the Super Bowl) or emergency event (such as Hurricane Katrina). Remote or inaccessible areas may also lend themselves to deployable technologies. Final selection of permanent and deployable technologies will involve a variety of technical, environmental, and economic factors as practical and feasible.	Section 2.1.2.3
Where generators would be used in deployable technologies, can you provide guidance on the type of fuel and any fuel spill minimization measures you would recommend in tiered assessments and mitigation?	For the analysis in the Final PEIS, it was assumed that diesel generators would be used, although this will be determined during later stages of project development and design. The Final PEIS includes BMPs to address the potential for spills, including preparing a Spill Prevention, Control, and Countermeasure Plan to prevent, contain, and report accidental spills; and inspecting and maintaining tanks and equipment containing oil, fuel, or chemicals for drips or leaks to prevent spills to the ground or directly into waterbodies.	Section 2.1, all Environmental Consequences Air Quality sections (X.2.12.4), and Chapter 17

Comment Text	Response	Relevant Section(s) in Final PEIS
In the RF emission section, the PEIS references USFWS reports and agency memoranda that state that RF emissions could be harmful to migratory birds. Can you provide references to the memoranda? (lines 587-589 in 2-18-2-19)	The Final PEIS cites three references by Dr. Manville (*2007, 2009, and 2014*), consisting of presentations and proceedings entitled *U.S. Fish & Wildlife Service Concerns Over Potential Radiation Impacts of Cellular Communication Towers on Migratory Birds and Other Wildlife – Research Opportunities*, *Towers, Turbines, Power Lines, and Buildings – Steps Being Taken by the U.S. Fish and Wildlife Service to Avoid or Minimize Take of Migratory Birds at These Structures*, and *Status of U.S. Fish and Wildlife Service Developments with Communication Towers with a Focus on Migratory Birds: Updates to Service Staff Involved with Tower Issue*s, respectively. In addition, the Draft PEIS Public Comments chapter (Chapter 14) of the Final PEIS cites a comment letter from the Department of Interior dated October 11, 2016, which includes information on how RF emissions could be harmful to migratory birds. The October 11, 2016 letter also includes, as an enclosure, another letter from the Department of Interior dated February 7, 2014; this letter provides comments on the proposed implementing procedures for the NPSBN and includes information on RF emission and their potential effects to migratory birds.	Section 2.4

Comment Text	Response	Relevant Section(s) in Final PEIS
Section 3.0: Wildlife and Vegetation		
Regarding migratory birds and direct mortality, reference to causes of mortality should include those listed in the updated communication tower guidance from FWS. See page 1 of that guidance for reasons for mortality, which are a little more specific than those listed in the PEIS.	The USFWS' *Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning* (*USFWS 2016*) elaborates on the specific causes of bird mortality as follows: "Given the height, structural engineering needs (i.e., guy wires), and obstruction lighting requirements, communication towers may cause direct and indirect bird mortality through: 1. Collisions - Birds that are attracted to tower lights and aggregate in the lighting zone, circle the tower and collide with the tower, guy wires, other birds, or fall to the ground from exhaustion (Longcore et al. 2012b, Gauthreaux and Belser 2006, Erickson et al. 2005). 2. Construction, operation, and maintenance activities - Adults, eggs, or nestlings can experience direct mortality through: a. Trauma or death during vegetation removal; b. Trauma or death during tower maintenance; and c. Death of eggs or nestlings when actions or activities cause adults to abandon nests. 3. Significant loss of fat reserves in adults due to the energy expenditure of circling towers, leading to reduced survival during long migrations (Norris and Taylor 2006, Gehring and Walker 2012)." In addition, the *Recommended Best Practices* provide updated avoidance and minimization measures. Those measures replace the USFWS guidelines on communications tower siting in Chapter 11.	All Environmental Consequences Wildlife sections (X.2.6.4) and Section 17.6.2
There is no mention of lighting in causes of direct mortality to migratory birds on page 3.2.6-18. This information is crucial and is the focus of the new lighting standards issued in the 2015 FAA circular AC 70/7460-1L.	The discussion of bird collisions with towers during operations has been updated in the Final PEIS to include details on lighting as a cause of avian mortality. In addition, reference to the FAA lighting standards has been included in that discussion and added to the BMPs in Chapter 11.	All Environmental Consequences Wildlife sections (X.2.6.4) and Section 17.6.2

Comment Text	Response	Relevant Section(s) in Final PEIS
This section also refers to the number of species listed under MBTA as "some" so I recommend listing the number since the word "some" is subjective. (I believe it's 1,027.)	Thank you for your comment. The estimated number of species listed under the MBTA is noted.	All Environmental Consequences Wildlife sections (X.2.6.4)
Please define "poor fliers".	In this context, FirstNet considers poor flying birds as those that are more vulnerable to colliding with structures. In general, these birds have relatively short wings and have high ratios of body weight to wing area. In addition, some diving birds, for example, have relatively solid bones which make them less buoyant in the water. This makes it easier for them to dive underwater, but it also makes them relatively poor fliers in comparison to birds with lighter bone structures.	All Environmental Consequences Wildlife sections (X.2.6.4)
The PEIS states that "avian mortalities or injuries can also result from vehicle strikes and nest disturbance during construction activities, although they typically occur as isolated events." Do you have information to support this statement? Car collisions and habitat disturbance is much more far reaching than isolated events. See Longcore et al 2013. Here is a graph below showing mortality from cars in that publication [see Figure 2 below].	In the deployment or construction phase of the NPSBN, construction vehicle traffic and ground disturbance would be generally short-term and localized, meaning that impacts would generally be of short duration and limited to individual locations in the regional context. Both impact duration and geographic extent inform the significance of impact at the programmatic level. The annual U.S. avian mortality from vehicle strikes is not expected to be significantly affected by the Preferred Alternative.	All Environmental Consequences Wildlife sections (X.2.6.4)
In addition, destruction of habitat can result in direct mortality at a larger scale due to land clearing for facilities and access roads. Therefore, with any new construction in this proposed action, direct mortality would likely be more than isolated events.	See response immediately above. It is anticipated that construction would not affect large land areas (at the programmatic level), and the use of existing infrastructure is preferred.	All Environmental Consequences Wildlife sections (X.2.6.4)

Comment Text	Response	Relevant Section(s) in Final PEIS
Under Effects to Migration or Migratory Patterns, the PEIS states that "project infrastructure and the temporary nature of the deployment activities would result in impacts to large populations of migratory birds, but more likely that individual birds could be impacted. " This might be described more in your cumulative impacts section, but if it's not, I would recommend elaborating on this topic there. I'm also not sure it's an accurate statement- see the mortality table above [see Figure 2 below].	The Final PEIS states, "It is unlikely that the limited amount of infrastructure, the amount of RF emissions generated by Project infrastructure, and the temporary nature of the deployment activities would result in impacts to large populations of migratory birds, but more likely that individual birds could be impacted." As indicated above, deployment would be short-term and limited to specific locations, would not generally affect large land areas, and would preferentially use existing infrastructure. The Final PEIS further states that "implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further help to avoid or minimize potential impacts to migratory pathways." The following are some examples of BMPs from Section 11.6.2): • Avoid development in areas that contain high densities of breeding or wintering birds, in high wildlife use areas, migratory staging areas, woodlots, riparian corridors, Audubon Important Bird Areas, nature preserves, state and national parks, state forests, fish and wildlife areas, and other publicly owned properties. • Follow, as practicable or feasible, the suggested practices by the Avian Power Line Interaction Committee to minimize impacts to migratory birds through collision and electrocution. • Avoid activities within migratory bird flyways and in the immediate vicinity of bat roosts to the extent practicable.	All Environmental Consequences Wildlife sections (X.2.6.4) and Section 17.6.2
In the discussion of Effects from Invasive Species, I would recommend noting how invasive species impact vegetation around facilities and access roads, thus altering the landscape and resulting in impacts to habitat cumulatively and possibly on specific project locations where more specific analyses are performed.	The Final PEIS indicates that invasive species can impact vegetation in disturbed areas, which would include areas around facilities and access roads, although this impact is expected to be *less than significant* at the programmatic level. It also includes BMPs and mitigation measures to reduce impacts from invasive species. Once determined, the site-specific review process would provide means to further evaluate impacts to vegetative and wildlife resources.	All Environmental Consequences Terrestrial Vegetation, Wildlife, and Threatened and Endangered Species and Species of Conservation Concern sections (X.2.6.3; X.2.6.4; X.2.6.6) and Sections 17.6.1 and 17.6.2

Comment Text	Response	Relevant Section(s) in Final PEIS
Where the PEIS describes specific impacts from the different proposed projects (wired projects vs wireless projects), I would recommend cross walking these potential impacts to the diagrams or the same text descriptions found in section 2.0. I found I had to go back and forth between the two sections to figure out which facilities the PEIS was referring to and how they related to the proposed ones in section 2.0.	A detailed description of the Proposed Action is provided in Section 2.1, which provides the basis for the impact determinations for the resources listed in each of the various Environmental Consequences sections. While your comment is noted, it is not practical to repeat descriptions of the project types in the many instances they are mentioned throughout the Environmental Consequences sections.	Section 2.1
Under wireless projects, the PEIS states that for new wireless communication towers, deployment activities are expected to be temporary and isolated, but this is not the case if the new communication towers (or existing ones) use guy wires.	In the context of the Final PEIS, the term *deployment* refers to the construction of infrastructure, or the process staging deployable technologies for use. The Final PEIS includes a number of BMPs and mitigation measures designed to avoid the use of guy wires on communication towers, or where not avoidable, to reduce their avian impacts by other measures. Impacts to birds are considered to be *less than significant* for deployment or construction of the Preferred Alternative and *less than significant* with BMPs and mitigation measures incorporated for operations.	All Environmental Consequences Wildlife sections (X.2.6.4)

BMP = best management practice; CEQ = Council on Environmental Quality; CFR = Code of Federal Regulations; MBTA = Migratory Bird Treaty Act; NEPA = National Environmental Policy Act; NPSBN = nationwide public safety broadband network; PEIS = Programmatic Environmental Impact Statement; RF = radio frequency; USFWS = U.S. Fish and Wildlife Service

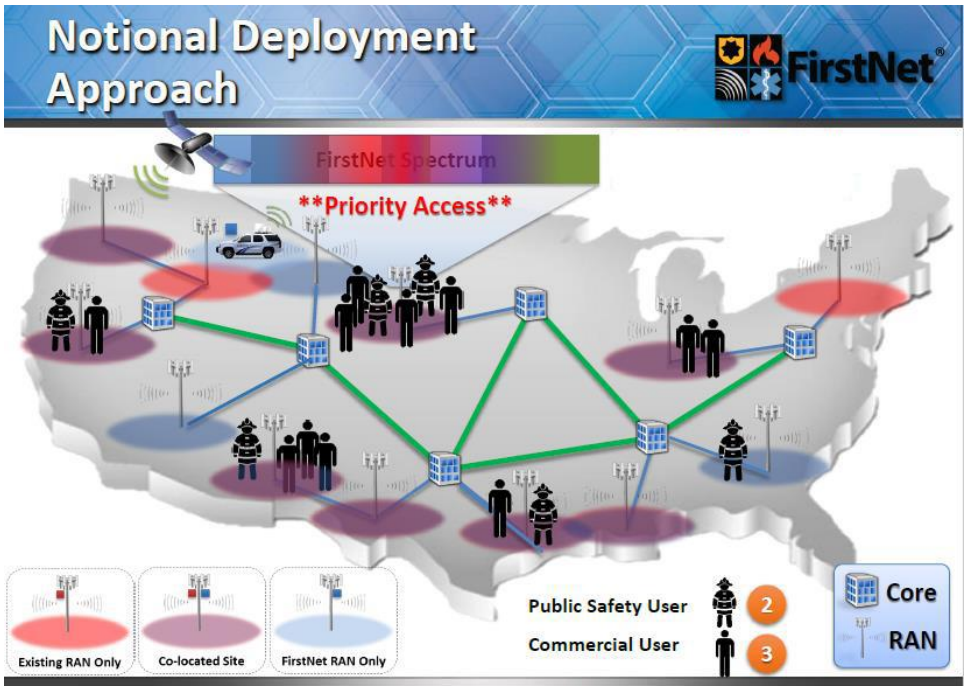

Figure 1: FirstNet's Notional Deployment Approach

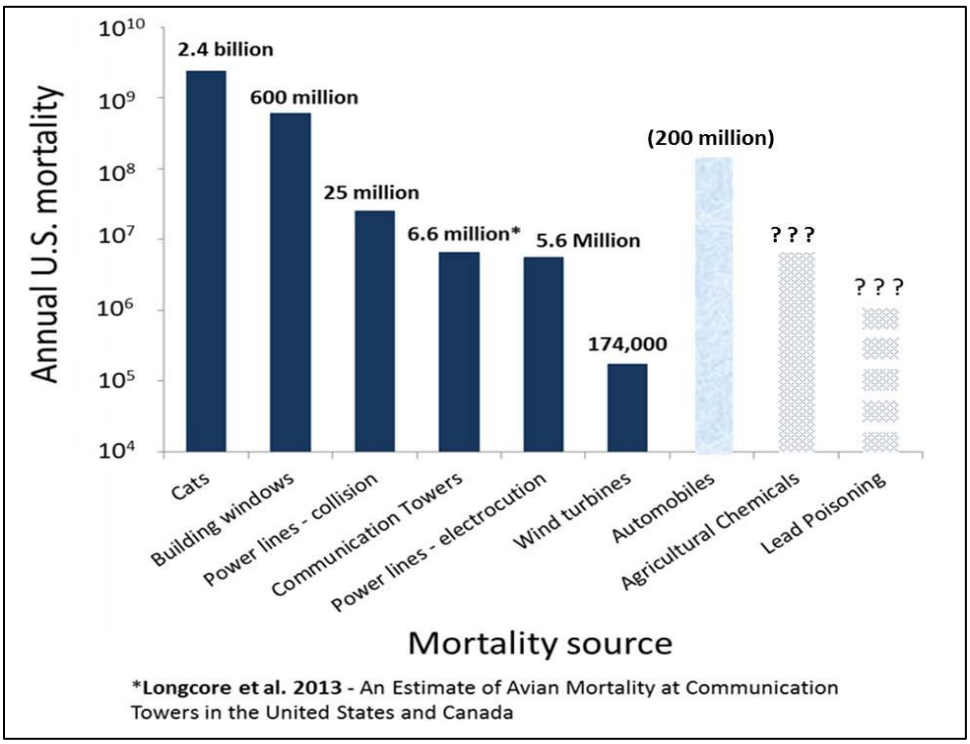

Figure 2: An Estimate of Avian Mortality at Communication Towers in the U.S. and Canada (Provided by the USFWS)

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Nationwide Public Safety Broadband Network

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VOLUME 1 - CHAPTER 1

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U.S. Department of Energy
U.S. Department of Homeland Security

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1. INTRODUCTION

1.1. OVERVIEW AND BACKGROUND

Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (Pub. L. No. 112-96, Title VI, 126 Stat. 156 *(*codified at 47 USC § 1401 et seq.) (the Act) created and authorized the First Responder Network Authority (FirstNet) to ensure the establishment of a nationwide public safety broadband network (NPSBN) based on a single, national network architecture (47 U.S.C. § 1422(b)). FirstNet was created as an independent authority within the Department of Commerce's National Telecommunications and Information Administration (NTIA), the Executive Branch agency that is principally responsible for advising the president on telecommunications and information policy issues.

The Act meets a long-standing and critical national infrastructure need to create a nationwide broadband network that would, for the first time, allow police officers, fire fighters, emergency medical service professionals, and other public safety officials to effectively communicate with each other across agencies and jurisdictions. The NPSBN (i.e., the Proposed Action) is intended to cover all 50 states, 5 territories, and the District of Columbia.

The Act charges FirstNet with taking all actions necessary to ensure the building, deployment, and operation of NPSBN, by, at a minimum:

- Ensuring nationwide standards for use and access to the network (47 U.S.C. § 1426(b)(1)(A));
- Issuing open, transparent, and competitive requests for proposals to the private sector (47 U.S.C. § 1426(b)(1)(B));
- Encouraging use of existing commercial wireless infrastructure to speed deployment (47 U.S.C. § 1426(b)(1)(C)); and
- Managing and overseeing private sector entities that build, operate, and maintain the network (47 U.S.C. § 1426(b)(1)(D)).

In addition to these requirements, the Act mandates careful consideration of rural areas. This includes requiring FirstNet, to the maximum extent economically desirable, to include deployment phases with substantial rural coverage milestones as part of each construction and deployment phase of the network (47 U.S.C. § 1426(b)(3)).

The lack of interoperability in public safety communications, and the hazards associated with it, has been known within the public safety community and the telecommunications industry for quite some time. In 1996, the Public Safety Wireless Advisory Committee (PSWAC), which was established by the Federal Communications Commission (FCC) and NTIA in 1995, published a report on the current state of public safety wireless communications (Public Safety Wireless Advisory Committee, 1996).

The report identified three major problems:

1. The radio frequencies allocated to public safety were congested and growing more so;
2. The ability of officials from different public safety agencies to communicate with each other was limited due to multiple frequency bands, incompatible equipment, and a lack of standardization in repeater spacing and transmission formats; and
3. Public safety officials were unable to effectively pursue their missions because they were not able to take advantage of cutting-edge communications technologies that would make their job performance safer and more efficient.

The report concluded that "unless immediate measures are taken to alleviate spectrum shortfalls and promote interoperability, Public Safety agencies will not be able to adequately discharge their obligation to protect life and property in a safe, efficient, and cost effective manner" (Public Safety Wireless Advisory Committee, 1996). The report went on to describe interoperability issues that hampered emergency response activities in the 1993 World Trade Center bombing in New York City and the 1995 Oklahoma City bombing of the Alfred P. Murrah Federal Building. It further emphasized that these concerns also applied to more routine, day-to-day emergency response activities, and that the needs of the public safety community – with regard to security, resilience, redundancy,[1] and coverage – were unique and mission-critical.

Although these communications challenges that face the public safety community were known, the true genesis of the NPSBN lies with the 9/11 Commission Report (the Report), published on July 22, 2004 (National Commission on Terrorist Attacks upon the United States, 2004a). This report analyzed the terrorist attacks of September 11, 2001 and sought to provide recommendations and new paths forward to ensure greater public safety based on the events that transpired on that day. The Commission interviewed more than 1,200 individuals and reviewed millions of pages of documents in an effort to understand how the attacks were possible and how to best attempt to prevent such a tragedy from ever recurring.

The Report identified a critical need for improved communications capabilities for the public safety community through the "expedited and increased assignment of radio spectrum for public safety purposes" (National Commission on Terrorist Attacks upon the United States, 2004b). As numerous on-site reports from public safety personnel at the World Trade Center, the Pentagon, and Somerset County, Pennsylvania indicated, the lack of interoperable communications capability among the multiple police, fire, and emergency medical services personnel hampered rescue efforts and in many cases likely led to an increased loss of life. Hundreds of police officers and fire fighters, including off-duty personnel who reported to the scene to engage in rescue efforts upon learning of the events that were unfolding, were killed in the line of duty; this amounted to the largest loss of first responders in a single event anywhere in history (National Commission on Terrorist Attacks upon the United States, 2004b). In 2012, the Act created FirstNet with the primary purpose of designing, building, and operating a dedicated public safety communications network to provide first responders with the tools they need to do their jobs

[1] Redundancy refers to the duplication of equipment or processes to help maintain continuity of operations.

more effectively, and to minimize the loss of life in the event of any future natural or manmade emergencies or disasters.

The Act also establishes a process allowing states and territories to determine whether to participate in the FirstNet proposed network for that state or conduct their own deployment of a radio access network (RAN) in their respective states (47 U.S.C. § 1442(e)). A state that chooses to deploy its own RAN is required by the Act to follow certain procedures, including submitting an alternative plan to the FCC for deployment/construction, maintenance, and operation of the RAN within that state. If the FCC approves the alternative plan, the state could apply to NTIA for a grant to construct the RAN within the state, and must apply to NTIA to lease spectrum capacity from FirstNet (47 U.S.C. § 1442(e)(3)(C)).

The Act establishes in the U.S. Department of the Treasury a fund known as a "Network Construction Fund". This fund must be used by FirstNet to carry out its statutory mission. The source of the funds to be deposited came from the proceeds of incentive auctions that are authorized under the Act. Prior to the deposit of proceeds from the incentive auctions, Congress authorized NTIA to borrow up to $2 billion from the Treasury, in order for FirstNet to carry out its responsibilities under the Act (47 U.S.C. § 1427(a)). However, NTIA is required to reimburse the Treasury, without interest, for any of the funds borrowed with the proceeds it receives from incentive auctions.

As a federal entity, FirstNet is required to comply with the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. *§* 4321 *et seq.*), which requires that the government examine the environmental, social, historic, and cultural impacts of its Proposed Actions before it irretrievably commits resources to undertake them. Furthermore, FirstNet must comply with its own NEPA implementing instructions, which were finalized and published in the Federal Register (79 FR 23945 [April 29, 2014]). FirstNet published a Notice of Intent (NOI) in the Federal Register to prepare five coordinated Programmatic Environmental Impact Statements (PEISs) (79 FR 67156 [November 12, 2014]). The PEISs analyze the potential direct, indirect, and cumulative impacts of the proposed action as well as alternative approaches to the construction, operation, and maintenance of the NPSBN on natural, cultural, and social resources. Each of the five PEISs analyzes potential impacts in a particular region of the country.

1.2. PROGRAMMATIC APPROACH AND TIERING

A programmatic environmental document, such as the five coordinated PEISs being developed for the Proposed Action, is prepared when an agency is proposing to carry out a broad action, program, or policy. FirstNet has determined that the design, deployment/construction, and operation of the NPSBN is a broad action with nationwide implications. This approach, which considers the full planning area, provides for the broadest and most extensive NEPA analysis in order to support the balancing of different considerations, including social, economic, historic, and environmental issues. Furthermore, the programmatic approach creates a comprehensive analytical framework that assesses potential impacts expected from the program as a whole. It also supports any subsequent site-specific environmental analyses that may be required for

individual actions at specific locations, once they are identified. Finally, and as discussed in the introduction to each of the Environmental Consequences sections, the programmatic approach allows FirstNet to identify and define four categories of potential impact as described below:

- *Potentially significant,* where there is substantial evidence that an effect may be significant;
- *Less than significant with best management practices (BMPs) and mitigation measures incorporated* (as defined through the consultation with the relevant resource agency), where the use of BMPs and mitigation measures would be expected to reduce an effect from a *potentially significant* impact to a *less than significant* impact;
- *Less than significant,* where the action creates impacts but no significant impacts; or
- *No impact,* which applies where an action does not create an impact.

To streamline the NEPA process and avoid repetition, the White House Council on Environmental Quality (CEQ) regulations encourage federal agencies to develop a tiered approach to their analyses (40 Code of Federal Regulations [CFR] § 1502.20), by working from broad, general NEPA documents addressing large-scale program-level impacts and decisions down to site-specific documents.[2] The PEISs are intended to provide broad analysis and direction regarding the overall potential impacts of the NPSBN. When a proposed network design is ready, and specific sites are proposed for deployment, the decision to deploy the NPSBN would not be revisited; instead subsequent memoranda, Categorical Exclusions (CEs), Environmental Assessments (EAs), or EISs would be "tiered" off of the PEISs, and would summarize, or incorporate by reference, much of the detailed analyses presented in the PEISs as a means of streamlining the NEPA process (40 CFR § 1500.4[I]).

Site-specific actions, once defined, would be evaluated against the analyses presented in the programmatic review for future NEPA compliance. In addition, site-specific analysis may be required, depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. FirstNet is still developing its site-specific review process, incorporating comments received from cooperating and consulting agencies. Once the process, including roles and responsibilities, has been determined, FirstNet will release a Supplemental PEIS. Agencies will also have the opportunity to provide input on the Supplemental PEIS, which will address, at a minimum, the following:

- An outline and/or process for conducting analyses of the potential impacts within each Region using a resource-appropriate framework (such as an ecoregional or landscape ecology framework for biological impacts), as practicable and feasible;
- Specific guidance on how to conduct NEPA at the site-specific scale; and
- An explanation of the roles and responsibilities and the management and oversight process that will be used by FirstNet to ensure that all applicable CEQ guidance is being incorporated into decision-making.

[2] To search for and locate CFR records, see the Electronic Code of Federal Regulations (e-CFR): www.ecfr.gov.

The primary objectives of each PEIS are to:

- Identify and assess potential impacts on the natural and human environment[3] that would result from implementation of the Proposed Action;
- Describe and evaluate reasonable alternatives, including the Preferred Alternative, a No Action Alternative, and other alternatives that would avoid or minimize adverse effects to the environment;
- Identify and recommend specific BMPs and mitigation measures, as necessary, to avoid or minimize potential environmental, social, historic, and cultural impacts; and
- Facilitate public, tribal, and agency involvement in identifying significant environmental impacts.

1.3. PROJECT REGIONS AND DESCRIPTION OF THE PROPOSED ACTION AREA

FirstNet, in consultation with CEQ, decided to analyze the potential impacts of the NPSBN in five regions, as shown in Figure 1.3-1. The single, unified analysis for the entire NPSBN has been divided into the five regions as described above in order to provide a greater depth of information and to more efficiently support FirstNet's mission objectives. The FirstNet PEIS Proposed Action area would cover the geography of the 50 states, the 5 territories, the District of Columbia, and 567 tribal nations.

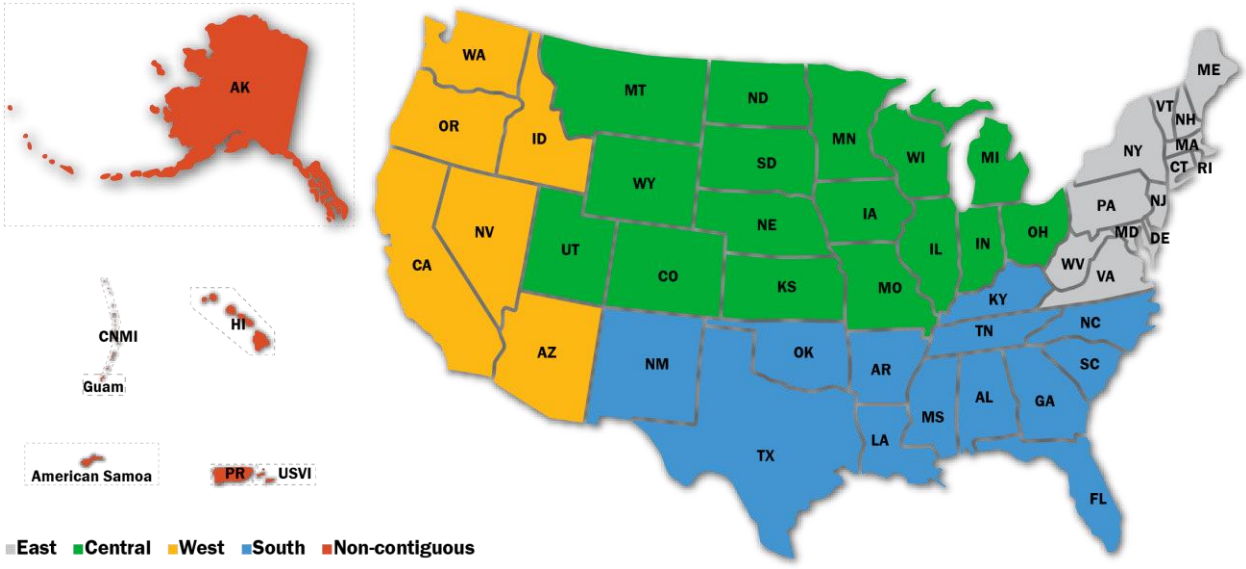

Figure 1.3-1: FirstNet PEIS Regions of Analysis

This PEIS focuses on the East region encompassing 13 states and the District of Columbia. This PEIS contains analysis for Connecticut, the District of Columbia, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia. The FirstNet East region covers 7 percent of the United States land

[3] The human environment is natural and the physical (e.g., structures) environment, and the association of people and their activities to those environments.

mass, yet the regional population comprises approximately 23 percent of the total United States population (U.S. Census Bureau, 2015). To aid the reader, the existing environment and environmental consequences are compiled into state-specific chapters.

1.4. PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to develop the NPSBN. The NPSBN is intended to facilitate the use of rugged, easy-to-use devices, and provide a set of applications and services on a single, interoperable platform built to open, non-proprietary commercially-available standards for emergency and daily public safety communications. These applications and services would enhance the ability of the public safety community to perform more reliably, effectively and safely. The NPSBN would also provide a backbone to allow for improved communications by carrying high-speed data, location information, images, and, eventually, streaming video. This capability is envisioned to increase situational awareness during an emergency, thereby improving the ability of the public safety community to effectively engage and respond.

The FirstNet network would be "hardened" from the physical, user access, and cyber security perspectives, to be more resilient to impacts from natural and man-made disasters. Hardening refers to a variety of methods that may be used to make a structure more resistant to failure, whether through physical reinforcement of a structure, redundant sources of emergency power, or additional firewalls and cybersecurity measures. These efforts would be designed not only to ensure that the network has greater resistance to system failure than what is currently available, but also that it can recover more rapidly should failure occur at any point in the system. The goal would be to provide not only interoperability, but also improved operability in the event of a natural or manmade disaster or emergency. The network operating standards are envisioned to also provide local control to public safety agencies, allowing for more control over the configuration, deployment, and management of multiple types of Information Technology resources, referred to as provisioning, as well as device features, and reporting.

The Proposed Action is needed to address existing deficiencies in public safety communications interoperability, durability, and resiliency that have been highlighted in recent years for the ways in which they have hindered response activities in high profile natural and manmade disasters and emergencies. Today, first responders rely on numerous separate, incompatible, and often proprietary Land Mobile Radio (LMR) networks. This makes it difficult, and at times impossible, for emergency responders from different jurisdictions to communicate, especially during major emergencies that require a multi-jurisdictional response (National Task Force on Interoperability, 2005).

During the September 11 attacks, members of the public safety community, who risked their own safety on behalf of others, were unable to communicate with each other on radio systems operating on different, incompatible frequencies. Additionally, emergency messages could not reach first responders as wireless and wire-line networks were overwhelmed with traffic. At the Pentagon, commanders had to resort to sending runners with paper messages to forward instructions to those trying to save as many lives as possible.

In the years that followed these events, the federal government provided billions of dollars and valuable radio spectrum to promote interoperability and improve operations (Congressional Research Service, 2011). Subsequent emergencies and disasters, however, have shown that public safety response is still often compromised by an inability to communicate due to radio systems operating on different, incompatible frequencies. This is largely the result of the fragmented initial design and uncoordinated upgrades of public safety communications. Most upgrades were planned and executed at the local level; what was lacking was an overarching plan to connect all first responders under one dedicated interoperable system.

Four years after September 11, the Hurricane Katrina disaster response in August 2005 highlighted the equally fundamental challenge of operability. The collapse of critical infrastructure proved challenging throughout most of the region affected, as failures in one sector led to failures in others. The physical communications infrastructure in Louisiana, Mississippi, and Alabama was devastated, with more than 3 million customer telephone lines destroyed; in New Orleans, only two FM and two AM radio stations out of 41 survived the storm and subsequent flooding. Almost 2,000 cell towers were knocked out, which severely degraded LMR communications. At one time, more than 35 Public Safety Answering Points (PSAPs) were out of service, which resulted in a weeks-long, sustained loss of 911 services in some parts of the region (Miller, R., 2006). This rendered the issue of interoperability moot, since the equipment and infrastructure on which the system relied were not operable to begin with (U.S. House of Representatives, 2005).

Many of these same challenges presented themselves again in October 2013 when Hurricane Sandy battered the northeast U.S. At the peak of the storm, approximately 25 percent of all cell sites across 10 states and the District of Columbia were out of service, resulting in the same loss of basic operability seen in previous events (Hurricane Sandy Task Force, 2013). The loss of power and loss of backhaul capacity[4] significantly impacted the functionality of the telecommunications infrastructure in the affected regions; one of the recommendations of the Hurricane Sandy Rebuilding Task Force was to “develop a resilient power strategy for wireless and data communications infrastructure and consumer equipment" (Hurricane Sandy Task Force, 2013). This underscored the need for a disaster-resistant network that could continue to function in an emergency, and that could recover quickly from a failure at a single point somewhere in the system without that point failure causing a ripple effect of failures throughout the system.

In May 2014, the National Public Safety Telecommunications Council (NPSTC) published its final report, Defining Public Safety Grade Systems and Facilities, which provides information and recommendations for resiliency and durability in a communications system designed to resist failures due to manmade or natural disasters (National Public Safety Telecommunications Council, 2014). The NPSBN is intended to have a higher level of redundancy and resiliency than current commercial networks in order to support the public safety community effectively.

[4] Backhaul capacity refers to the ability of a network to transfer data from a radio base station or cell site to a larger core network. These connections are typically made via fiber optic cable and microwave technology.

1.5. FEDERAL AGENCY PARTICIPATION

1.5.1. Lead Agency

As noted in Section 1.1, Overview and Background, FirstNet is the lead agency for the environmental review consistent with NEPA, the National Historic Preservation Act of 1966 (NHPA) Section 106 consultation process, and the Endangered Species Act (ESA) Section 7 consultation process for the Proposed Action. As the lead agency, FirstNet is directing the development of the five PEISs, the tribal consultation process, and has initiated consultation with the U.S. Fish and Wildlife Service (USFWS) to determine the likelihood of potential effects on listed species and migratory birds. FirstNet is also coordinating with cooperating agencies to ensure compliance with the laws, regulations, and Executive Orders (EOs) discussed in Section 1.8, Overview of Relevant Laws and Executive Orders and Appendix C, Environmental Laws and Regulations.

1.5.2. Cooperating Agencies

Lead agencies, such as FirstNet, that are preparing a NEPA document are required to do so in cooperation with other federal, state, and/or local agencies with jurisdiction by law or with special expertise with respect to an environmental impact involved in the proposal (40 CFR 1508.5). Outside of the scoping process, this cooperation can be formalized between the lead agency and another agency with a Memorandum of Understanding that formalizes the cooperating agency status and responsibilities.

In letters dated January 16, 2015, FirstNet invited 37 federal agencies to participate in the development of the PEISs as cooperating agencies. Nine agencies accepted the invitation: the NTIA, FCC, the General Services Administration (GSA), the U.S. Department of Agriculture's (USDA) Rural Utilities Service (RUS), the USDA's U.S. Forest Service (USFS), the USDA's Natural Resources Conservation Service (NRCS), the U.S. Department of Defense's Department of the Air Force, the U.S. Department of Energy (DOE), and the U.S. Department of Homeland Security (DHS), including the Federal Emergency Management Agency (FEMA), the U.S. Coast Guard (USCG), and the U.S. Customs and Border Protection (CBP). Appendix A contains a complete list of those agencies invited to become cooperating agencies.

1.5.3. Consulting Parties

Under the Act, FirstNet is required to conduct all consultation and network planning activities in a given state or territory through a governor-appointed State Single Point of Contact (SPOC) (47 U.S.C. § 1442(d)). In a letter dated April 29, 2015, FirstNet invited all 56 SPOCs to be consulting parties on the development of the PEISs, in order to promote transparency and partnership with the SPOCs. As of the date of publication, 15 SPOCs accepted the invitation, which afforded them the opportunity to review and comment on draft documents prior to public release.

1.6. CULTURAL RESOURCES CONSULTATION

As a federal entity, FirstNet has obligations under the NHPA to understand and address the potential impacts of its proposed undertakings on historic properties; one of the ways in which this is accomplished is through consultation with State Historic Preservation Offices (SHPOs) and government-to-government consultation with federally-recognized American Indian tribes. As the lead agency for compliance with Section 106 of the NHPA, FirstNet is committed to meaningful engagement with Tribal Nations. In a letter dated January 30, 2015, FirstNet contacted tribal leaders and Tribal Historic Preservation Officers (THPOs), where applicable, to initiate formal, government-to-government consultation with all 567 federally-recognized American Indian tribes. As of the date of publication, FirstNet received responses from 52 tribes with requests to consult on the Proposed Action.

1.7. THE NEPA PROCESS AND PUBLIC INVOLVEMENT

Under CEQ guidance for public involvement in the NEPA process, agencies shall seek to involve the public in preparing environmental documents such as this PEIS (40 CFR § 1506.6). These efforts include providing notice to potentially interested parties, holding public meetings, soliciting comments, and making this PEIS available to the public.

This section provides an overview of the overall PEIS public involvement process (see Section 1.7.1) and, more specifically, the scoping process for the Draft PEISs (see Section 1.7.2) and public comments made on the Draft PEIS for the East region (see Section 1.7.3).

1.7.1. Public Involvement

NEPA requires draft and final versions of a PEIS to be published, fostering public involvement through two public opportunities: 1) the scoping public comment period prior to the preparation and publication of the Draft PEIS, and 2) the Draft PEIS public comment period prior to the preparation and publication of the Final PEIS. FirstNet has engaged with the public to provide opportunities for comment in full compliance with the letter and spirit of the law.

1.7.2. Scoping

The content of a Draft PEIS is based on a process called "scoping." The regulations implementing NEPA require that scoping be included in the environmental analysis process (40 CFR 1501.7). Scoping for the Draft PEIS included several key elements: 1) gathering information and ideas from the public and key stakeholder groups, such as the public safety community, about the analytical issues related to the NPSBN; 2) making determinations about which issues should be analyzed; and, 3) identifying alternatives to the proposal that warranted analysis. The scoping process is ongoing and critical to informing agency actions, in that it begins before the PEIS analyses are initiated and continues throughout document development.

On November 12, 2014, FirstNet published a NOI in the *Federal Register* to prepare five coordinated PEISs *(*79 FR 67156 [November 12, 2014]). Publication of the Draft PEIS kicked off a 45-day public scoping comment period wherein members of the public were able to submit comments to FirstNet via traditional mail or via e-mail. A series of public meetings were also

held where participants had the opportunity to learn about the Proposed Action, talk directly with FirstNet environmental staff, and provide input regarding the scope and analysis of the Proposed Action. The public meetings were held in the following locations:

- Washington, D.C. - Tuesday, November 25, 2014; 4-8 p.m.
- Honolulu, HI - Tuesday, December 2, 2014; 4-8 p.m.
- San Francisco, CA - Thursday, December 4, 2014; 4-8 p.m.
- Tucson, AZ - Thursday, December 4, 2014; 4-8 p.m.
- Kansas City, MO - Tuesday, December 9, 2014; 4-8 p.m.
- New Orleans, LA - Thursday, December 11, 2014; 5-9 p.m.
- New York, NY- Monday, December 15, 2014; 4-8 p.m.

The Scoping Summary Report may be found in Appendix B. The following major items were identified during the scoping comment period and in public meetings:

- Potential impacts of the NPSBN on sensitive natural resources;
- Concerns regarding the impacts of tower placement on culturally and ecologically sensitive areas, such as Tumamoc Hill in Tucson, AZ; and
- The impact of the NPSBN on existing public safety communications infrastructure and operations.

FirstNet continued to accept comments after the close of the formal scoping period in order to allow the public as many opportunities as possible to provide input. Additional comments were received on the topics mentioned above, as well as on the topic of potential impacts of radio frequency (RF) emissions.

1.7.3. Draft PEIS Comment Period

The Draft PEIS for the East Region was released on May 6, 2016 for a 60-day public comment period, via an announcement in the Federal Register (81 FR § 27409 27410). During that period, FirstNet held a series of public meetings to provide the general public and interested stakeholders with an opportunity to learn about the PEIS, ask questions, and provide comments. Meetings were held in the following locations:

- Washington, D.C.: May 16, 2016, from 4:00 p.m. to 8:00 p.m.
- Annapolis, MD: May 19, 2016, from 4:00 p.m. to 8:00 p.m.
- Bangor, ME: May 24, 2016, from 4:00 p.m. to 8:00 p.m.
- New York City, NY: May 24, 2016, from 4:00 p.m. to 8:00 p.m.
- Boston, MA: May 25, 2016, from 4:00 p.m. to 8:00 p.m.
- New Haven, CT: May 25, 2016, from 4:00 p.m. to 8:00 p.m.
- Providence, RI: May 26, 2016, from 4:00 p.m. to 8:00 p.m.
- Albany, NY: May 26, 2016, from 4:00 p.m. to 8:00 p.m.
- Richmond, VA: May 31, 2016, from 4:00 p.m. to 8:00 p.m.
- Burlington, VT: May 31, 2016, from 4:00 p.m. to 8:00 p.m.
- Manchester, NH: June 1, 2016, from 4:00 p.m. to 8:00 p.m.
- Charleston, WV: June 2, 2016, from 4:00 p.m. to 8:00 p.m.
- Harrisburg, PA: June 14, 2016, from 4:00 p.m. to 8:00 p.m.

- Trenton, NJ: June 15, 2016, from 4:00 p.m. to 8:00 p.m.
- Dover, DE: June 16, 2016, from 4:00 p.m. to 8:00 p.m.

Comments received focused primarily on issues such as potential impacts of radio frequency (RF) emissions, best management practices (BMPs), climate change impact assessment guidelines, vibration impacts, requests for consultation, and legal questions surrounding FirstNet's network deployment procedures and future environmental compliance requirements. Appendix F contains the comments received by FirstNet during the public comment period for the East Draft PEIS, as well as responses.

1.8. Overview of Relevant Federal Laws and Executive Orders

This section will provide a brief explanation of major federal laws and Executive Orders (EOs) that are relevant to this Proposed Action. Given the expected nature and extent of the proposed NPSBN, it is likely that a wide range of diverse resources could be potentially impacted to varying degrees, including wetlands, coastal areas, farmland, wildlife, marine areas, migratory birds, and social or cultural resources, among others. Therefore, there are multiple laws and EOs that FirstNet is obliged to consider as part of this analysis. This is not intended to be a comprehensive list of all applicable laws and EOs, instead it provides context with regard to those laws and EOs that are most likely to be directly triggered by the Proposed Action. Appendix C provides a comprehensive list of applicable laws and regulations that were considered as part of the Proposed Action.

1.8.1. National Environmental Policy Act

NEPA (42 U.S.C. *§* 4321 *et seq*.) requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their Proposed Actions and reasonable alternatives to those actions. NEPA also established CEQ. As part of the Executive Office of the President, CEQ coordinates federal environmental efforts and is responsible for advising the president on environmental policy matters. CEQ has also promulgated regulations implementing NEPA, which are binding on all federal agencies. These regulations address the procedural provisions of NEPA and the administration of the NEPA process, including preparation of EISs.

NEPA is applicable to all "major" federal actions affecting the quality of the human environment. A major federal action is an action with effects that may be major and which are potentially subject to federal control and responsibility. These actions may include new and continuing activities, including projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by federal agencies; new or revised agency rules, regulations, plans, policies, or procedures; and legislative proposals. FirstNet has determined that the deployment/construction, operation, and maintenance of the NPSBN qualifies as a major federal action under these criteria and therefore requires a review under NEPA.

1.8.2. National Historic Preservation Act

The goal of the NHPA (formerly 16 U.S.C. § 470 *et seq*., now 54 U.S.C. § 100101 et seq.) is to empower federal agencies to act as responsible stewards of cultural resources when agency actions affect historic properties. The NHPA established the Advisory Council on Historic Preservation (ACHP), an independent federal agency that promotes the preservation, enhancement, and productive use of our nation's historic resources, and advises the President and Congress on national historic preservation policy. The NHPA also authorizes the Secretary of the Interior to expand and maintain a National Register of Historic Places composed of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, engineering, and culture.

Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. In carrying out their responsibilities under Section 106, the NHPA requires that federal agencies consult with federally-recognized American Indian tribes and Native Hawaiian Organizations that attach traditional religious and cultural significance to eligible or listed historic properties that could potentially be affected by the agency's actions. The intent of the consultation is to identify historic properties potentially affected by the undertaking and to seek ways to avoid, minimize, or mitigate any adverse effects on those properties.

The NHPA details a 4-step process for Section 106 consultation that requires each federal agency to: 1) initiate a review process to evaluate any proposed action; 2) identify historic properties that could be affected by the proposed federal, or federally-licensed, permitted or funded, action; 3) assess whether the action has the potential to affect properties that are listed in or are eligible for listing in the National Register of Historic Places; and, 4) resolve the adverse effects. FirstNet has determined that the deployment/construction, operation, and maintenance of the NPSBN qualifies as an undertaking under Section 106, and will, therefore, require analysis under NHPA.

1.8.3. Endangered Species Act

The ESA (16 U.S.C. § 1531 et seq.) was established to conserve and protect threatened and endangered species. Under most circumstances, the ESA prohibits take.[5] Section 2 of the ESA sets forth the purposes and policy, which include providing a means to conserve endangered and threatened species' ecosystems and providing programs for the conservation of such species. The ESA requires federal agencies to conserve threatened and endangered species, and use their authorities to further the purposes of the ESA.

Accordingly, Section 7 of the ESA requires each federal agency to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of critical

[5] *Take* is defined differently by various federal and state regulations, but the most commonly accepted definition is that of the U.S. Endangered Species Act that defines take as "to harass, harm, pursue, hunt, shoot, wound, trap, capture, collect or attempt to engage in any such conduct."

habitat for such species. Federal agencies are further required to consult with the appropriate federal agency, either the USFWS or the National Marine Fisheries Service (NMFS), for federal actions that "may affect" a listed species or adversely modify critical habitat. Federal agencies must use the best available scientific and commercial data available when making an effect determination relating to the impact of their actions. Given the likely extent of the NPSBN, FirstNet has determined consultation under the ESA is required to determine whether there are any expected impacts to endangered and threatened species or their critical habitat.

1.8.4. Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. § 1801 *et seq.*) is the primary law governing fisheries management in U.S. federal waters. The MSA is intended to foster long-term biological and economic sustainability of U.S. marine fisheries through the prevention of overfishing, the rebuilding of overfished stocks, and increasing long-term economic and social benefits to ensure a safe and sustainable supply of seafood. The MSA extended U.S. jurisdiction from 12 nautical miles to 200 nautical miles and established eight regional fisheries management councils to develop Fishery Management Plans (FMPs), which must comply with conservation and management standards to promote sustainable fisheries management. The FMPs also define essential fish habitat (EFH), which is the aquatic habitat where fish spawn, breed, feed, and grow through various life stages; this habitat includes marine waters, wetlands, coral reefs, seagrasses, and rivers. The FMPs further define habitat areas of particular concern (HAPCs), which are high priority areas that are rare, particularly sensitive, or critical to overall ecosystem functions. FirstNet may encounter marine resources in the deployment/construction and operation of the NPSBN, particularly for those parts of the network intended to provide coverage and service to coastal areas.

1.8.5. Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) (16 U.S.C. § 1361 *et seq*.) prohibits takes of all marine mammals in the U.S. (including territorial seas) with few exceptions. Permits for scientific research on marine mammals and permits to enhance the survival or recovery of a species, issued under Section 104 of the MMPA, are two such exceptions, neither of which would likely be pursued by FirstNet as part of the Proposed Action. For threatened and endangered marine mammals, any activities that may affect ESA-listed species must be consistent with the ESA as well. Deployment/construction, operation, and maintenance of the NPSBN may include activities that occur in or adjacent to marine areas for those parts of the network intended to provide coverage to coastal areas, including mainland and island coastlines.

1.8.6. Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. § 703-712) was enacted to ensure protection of migratory bird resources that are shared among the U.S., Canada, Mexico, Japan, and Russia. The MBTA prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase, or barter, of any migratory bird, their eggs, parts, and nests, except as authorized under a valid permit. The responsibilities of federal agencies to protect migratory

birds are set forth in EO 13186 (see below).[6] USFWS is the lead agency for migratory birds. The USFWS issues permits for takes of migratory birds for activities such as scientific research, education, and depredation control, but does not issue permits for incidental take[7] of migratory birds. FirstNet activities, such as tower construction, would have the potential to impact migratory bird species; therefore, FirstNet is obliged under the MBTA and EO 13186 to analyze the potential impacts of such actions.

1.8.7. Clean Water Act

The Federal Water Pollution Control Act, commonly referred to as the Clean Water Act (CWA) (33 U.S.C. § 1251 *et seq*.), establishes the basic structure for regulating discharges of pollutants into the waters of the U.S. and regulating quality standards for surface waters. The CWA defines waters of the U.S. to include all interstate waters, lakes, rivers, streams, territorial seas, tributaries to navigable waters, interstate wetlands, wetlands that could affect interstate or foreign commerce, and wetlands adjacent to other waters of the U.S. The CWA made it unlawful to discharge any pollutant from a point source into navigable waters, without a permit. Under Sections 303 and 305 of the CWA, states must review all "existing and readily available" state surface water quality data to compare against their water quality standards and determine whether water bodies will be classified as higher quality (Category 1 or 2) or lower quality (Categories 3, 4, or 5). A water pollution reduction plan, or total maximum daily load (TMDL), may be required for water bodies that are classified as lower quality. The TMDL defines the upper threshold of a given pollutant that a waterbody can contain and still meet water quality standards.

Under Section 401 of the CWA, discharges of pollutants, such as storm water from point or nonpoint sources[8] into waters of the U.S. are authorized through the National Pollutant Discharge Elimination System (NPDES) permitting program. The U.S. Environmental Protection Agency (USEPA) and delegated states and territories administer the NPDES permitting program. As part of this program, general NPDES permits are required to regulate storm water discharges associated with construction activities that disturb one or more acres of land. Section 404 of the CWA established a program to regulate the discharge of dredged or fill material into waters of the United States. Under the CWA, if FirstNet intends to carry out ground disturbing activity in or adjacent to waters of the United States, then permits and analyses may be required.

[6] See https://www.federalregister.gov/articles/2001/01/17/01-1387/responsibilities-of-federal-agencies-to-protect-migratory-birds.
[7] Section 704 of the Migratory Bird Treaty Act describes a take as "hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any such bird, or any part, nest, or egg thereof."
[8] Section 502 (14) of the CWA defines point source pollution as pollution that comes from "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged." Nonpoint source pollution is defined as any source of water pollution that does not meet the legal definition of "point source", and includes runoff from rain or snowmelt that picks up natural and manmade pollutants, such as fertilizers, oils, salt, bacteria, and others that are eventually deposited into lakes, rivers, streams, wetlands, coastal water, and groundwater.

1.8.8. Coastal Zone Management Act

Congress enacted the Coastal Zone Management Act (CZMA) (16 U.S.C. § 1451 *et seq*.) to protect the coastal environment from growing demands associated with residential, recreational, commercial and industrial uses (such as, state and federal offshore oil and gas development). Coastal states with an approved Coastal Zone Management Plan, which defines permissible land and water use within the state's coastal zone, can review federal actions (such as deployment/construction, operation, and maintenance of the Proposed Action), licenses, or permits for federal consistency. Federal consistency is the requirement that those federal permits and licenses likely to affect any land/water use or natural resources of the coastal zone be consistent with the state program's enforceable policies. Deployment/construction of the NPSBN is likely to occur in coastal areas; therefore, consistency determinations under CZMA may be required.

1.8.9. Occupational Safety and Health Act

The Occupational Safety and Health Act of 1970 (OSH Act) (29 U.S.C. § 658) created the Occupational Safety and Health Administration (OSHA) for the purpose of ensuring safe and healthful working conditions. OSHA pursues this mission by setting and enforcing standards in the workplace to create an environment free from hazards that include exposure to toxic substances, excessive noise, unsanitary conditions, and other physical hazards such as mechanical dangers and heat or cold stress. The OSH Act covers most private sector, and some public sector, employers and their workers either directly at the federal level, through OSHA, or through an OSHA-approved state plan that defines and implements state-level worker health and safety programs and enforcement standards. Currently, 22 states and territories have OSHA-approved state plans. Deployment/construction, operation, and maintenance activities required for the deployment of the NPSBN would be required to comply with OSHA standards, or OSHA-approved state plans.

1.8.10. Executive Order 11988 (as Amended by EO 13690) – Floodplain Management

EO 11988 requires federal agencies to avoid, to the extent possible, the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.[9] Furthermore, federal agencies must either avoid funding or permitting critical facilities in the 500-year floodplain, or must provide protection to mitigate the flood risk to those facilities. Critical facilities are those facilities for which even a small risk of flooding is too great, and include public safety infrastructure (FEMA, 2016). In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural

[9] See http://www.ar chives.gov/federal-register/codification/executive-order/11988.html.

and beneficial values served by floodplains in carrying out its responsibilities" for the following actions:

- Acquiring, managing, and disposing of federal lands and facilities;
- Providing federally undertaken, financed, or assisted construction and improvements; and
- Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

Aspects of EO 11988 have been updated in EO 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input* (FEMA, 2015). The purpose of EO 13690 is to implement the Federal Flood Risk Management Standard as part of a national policy on resilience and risk reduction, consistent with the President's Climate Action Plan. The EO emphasizes consideration by agencies of ecosystem-based alternatives and long-term resilience and risk reduction when managing flood risks. The order further establishes a process for further solicitation and consideration of public input and a climate science-based approach to defining floodplains and flood hazard areas. Guidelines for implementing EO 11988, published by the Federal Emergency Management Agency, describe an 8-step process that agencies should carry out as part of their decision-making on projects that have potential impacts to or within the floodplain (FEMA, 2015). This 8-step process can be addressed as part of the NEPA compliance process if an EA or EIS, such as this PEIS, is developed.

1.8.11. Executive Order 11990 – Protection of Wetlands

The purpose of EO 11990 is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands."[10] To meet these objectives, federal agencies are required, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. The EO applies to the following:

- Acquisition, management, and disposition of federal lands and facilities construction and improvement projects that are undertaken, financed or assisted by federal agencies; and
- Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.

The procedures require the determination of whether or not the proposed project would be in, or would affect, wetlands. If so, a wetlands assessment must be prepared that describes the alternatives considered. The procedures include a requirement for public review of assessments. The evaluation process follows the same eight steps as for EO 11988, Floodplain Management. As with EO 11988, this 8-step process can be addressed as part of the NEPA compliance process if an EA or EIS, such as this PEIS, is developed.

[10] See http://www.archives.gov/federal-register/codification/executive-order/11990.html.

1.8.12. Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

The purpose of EO 12898 is to ensure that federal agencies avoid taking actions that have a disproportionately high and adverse impact on low-income populations or minority populations.[11] Each federal agency must make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health, environmental, economic, and social effects of its programs, policies, and activities on minority and low-income populations, particularly when such analysis is required by NEPA. The EO emphasizes the importance of NEPA's public participation process, directing that each federal agency shall provide opportunities for community input in the NEPA process. Agencies are further directed to identify potential effects, as well as BMPs and mitigation measures in consultation with affected communities.

1.8.13. Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds

The purpose of EO 13186 is to direct federal agencies to take certain actions to further implement the MBTA. Several international, bilateral conventions on migratory birds, of which the U.S. is a co-signatory, impose substantive obligations on the U.S. for the conservation of migratory birds and their habitats. Through the MBTA, the U.S. has implemented these migratory bird conventions with respect to this country. The EO directs each federal agency whose actions are likely to create a measurable, negative effect on migratory bird populations to enter into a Memorandum of Understanding (MOU) with the USFWS to promote the conservation and mitigation of impacts to migratory birds. Furthermore, the EO established the interagency Council for the Conservation of Migratory Birds to enhance coordination and communication among federal agencies regarding their responsibilities under the four bilateral treaties on the conservation of migratory birds.

1.8.14. Executive Order 13693 – Planning for Federal Sustainability in the Next Decade

The purpose of EO 13693 is to maintain federal leadership in sustainability and greenhouse gas emission reductions by continuing a policy for federal agencies to increase efficiency and improve their environmental performance. This order outlines goals for federal agencies related to climate change, energy, water use, vehicle fleets, construction, and acquisition. It establishes targets for greenhouse gas emissions, water use and efficiency, and clean energy use for federal operations by 2025, relative to various baselines (depending on resource reduction or improvement).

[11] See https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice.

1.9. PEIS ORGANIZATION

This Final PEIS includes descriptions of the affected environment, potential impacts, and alternatives of the Proposed Action, including cumulative impacts, in each of the 14 states and the district that make up the East region. The structure and contents of this document have been developed consistent with NEPA requirements. The main organization of this document is as follows:

- Chapter 1: Introduction;
- Chapter 2: Description of the Proposed Action and Alternatives;
- Chapters 3 through 16: Each chapter contains a state-by-state analysis of the affected environment (including descriptions of the portions of the environment that could be affected by the Proposed Action), environmental consequences (including descriptions of the potential environmental, social, historic, and cultural impacts of the Proposed Action and alternatives, and references;
- Chapter 17: Best Management Practices and Mitigation Measures;
- Chapter 18: Comparison of Alternatives;
- Chapter 19: Cumulative Impacts;
- Chapter 20: Other Required Analysis;
- Chapter 21: List of Preparers and Contributors;
- Chapter 22: Distribution List;
- Chapter 23: Glossary; and
- Appendices.

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First Responder Network Authority

Nationwide Public Safety Broadband Network

Final Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 1 - CHAPTER 2

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U.S. Department of Commerce—National Telecommunications and Information Administration
U.S. Department of Defense—Department of the Air Force
U.S. Department of Energy
U.S. Department of Homeland Security

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2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

In accordance with the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), FirstNet must examine a range of reasonable alternatives to design, construct, and operate the nationwide public safety broadband network (NPSBN). These alternatives must be reasonable ways in which FirstNet could meet the purpose and need for the Proposed Action. In addition to the range of reasonable alternatives, this document also describes those alternatives considered but not carried forward for analysis. Alternatives not carried forward were initially considered but found to not reasonably meet the purpose and need. FirstNet is also required to include the alternative of no action as part of the alternatives analysis in the PEIS. The "No Action Alternative" describes what would happen if FirstNet did not construct the NPSBN, and is used as a baseline against which the potential impacts of the action alternatives can be compared.

2.1. PROPOSED ACTION

The Proposed Action would encompass the design, deployment/construction, operation, and maintenance of the NPSBN by FirstNet or a partner organization(s)[1] through a comprehensive network procurement process, currently underway. FirstNet anticipates a competitive process to procure a comprehensive technical and business solution to meet its stated mission and objectives. By statute, the network must have several characteristics, including security, resiliency, backwards compatibility with existing commercial networks, integration with public safety answering points (PSAPs)[2] or their equivalents, substantial rural coverage; it must be built to open, non-proprietary, commercially available standards; and it must use existing infrastructure to the maximum extent economically desirable. The FirstNet network would have two components, the core network, and the radio access network (RAN). The core network is a key component for ensuring that users have a single interoperable platform nationwide, and would consist of a wide range of telecommunications infrastructure including fiber optic cable, towers, data centers, microwave technology, and others. The core is envisioned to have six primary functions: it switches data, processes and reformats information, stores and maintains data, and keeps it secure. The core network would interface with local, tribal, state, and federal networks, including 911 and the internet, thereby serving as the backbone connecting the 50 states, 5 territories, and the District of Columbia. The core network would be constructed and maintained to the most up-to-date technological standards, comprised of all standard Evolved Packet Core (EPC) elements under the 3rd Generation Partnership Project (3GPP). The EPC is the collection of systems that manages the connection of all voice calls, data sessions, messaging, and video services in a wireless network. Since the EPC is responsible for the management of all services, it is the central "brain" of the network. The RAN would consist of all radio base station infrastructure that would connect user devices. This infrastructure would include communication towers, cell site equipment, antennas, deployable mobile hotspots, and

[1] FirstNet's partner organization(s) would assist in providing resources as necessary to deploy and operate the NPSBN.
[2] Public safety answering points (PSAPs) are call centers responsible for answering calls to an emergency telephone number for police, fire, and emergency medical services.

backhaul equipment required to enable wireless communications with devices using the public safety broadband spectrum. Finally, the Act states that FirstNet must continue to maintain and improve the NPSBN to account for new and evolving technologies.

FirstNet may enter into Spectrum Manager Lease Agreements (SMLAs) with states that opt-out of the FirstNet network. However, as NEPA applies equally to opt-in and opt-out states, the range of methods that would be employed by states to connect their RAN to the FirstNet core network are expected to include methods described and analyzed in the various alternatives listed below.

2.1.1. Characteristics of the NPSBN

The Act specifies that the FirstNet network would be based on the minimum technical requirements on the commercial standards for Long Term Evolution (LTE) service. LTE is a proven upgradeable technology, now in its fourth generation (4G). Improvements in speed and function are achieved with each subsequent generation, and 4G LTE standards are continuing to evolve. FirstNet is involved in the research and development of new standards and is working closely with the public safety community as part of this process, with the goal of ensuring that the unique needs of public safety can be met.

As stated above, the core network is envisioned to have six primary functions: it would switch data, process and reformat information, store and maintain data, and keep that data secure. Other functions, such as applications, services, and operational and business support systems would also be part of the core network. The backhaul, or intermediate links that carry user traffic, including voice, data, and video, and signaling from radio base stations to the core network, would likely be accomplished through fiber optic and microwave technology, with an emphasis on redundancy to allow the network to continue to function in events of extreme demand.

The RAN would place an emphasis on reliability, prioritizing physical hardening and security. Redundant power backup, redundant backhaul capabilities, structural hardening, and security measures would be implemented as appropriate to provide a resilient and reliable radio base station infrastructure.

2.1.2. Proposed Action Infrastructure

There is currently a wide range of technologies that FirstNet may use to implement and deploy the NPSBN, ranging from fixed assets to mobile, deployable infrastructure. The following are general descriptions of the types of wired, wireless, and deployable projects that FirstNet may consider.

2.1.2.1. Wired Projects

New Build – Buried Fiber Optic Plant

The installation of fiber optic cable would generally consist of plowing or trenching cable alongside the road usually within a utility corridor or within public road right-of-way (ROW), where possible. Utility ROWs could also include other easements and may be public or private.

This could involve either burying both conduit and cable inside the conduit or only direct buried cable. Installation may involve plowing, trenching (including vibratory plowing), or directional boring, and may involve the construction of points of presence (POPs),[3] huts, or other facilities to house outside plant equipment or hand-holes to access the fiber.

Use of Existing Conduit – New Buried Fiber Optic Plant

The installation of new fiber optic cable in existing conduit typically requires blowing or pulling new fiber optic cable into existing, buried conduit. In this project scenario, any ground disturbance would usually be limited to the entry and exit points of the existing conduit.

New Build – Aerial Fiber Optic Plant

Construction of new aerial fiber optic cable would generally consist of installing new poles and hanging cables in previously disturbed or new (undisturbed) ROWs or easements, or installing replacement poles in previously disturbed ROWs or easements. Installation of new poles and fiber may involve construction of access roads, depending on the availability of ROWs. This type of activity may also involve the constructions of POPs, huts, or other facilities to house outside plant equipment.

Collocation on Existing Aerial Fiber Optic Plant

Installation of new fiber on existing poles may require structural hardening or reinforcement to improve disaster resistance and resiliency. It may also require pole replacement to accommodate an increased load from new users. All replacement poles must be placed in the exact same hole in order for the action to qualify as "collocation."

Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable

This project type would involve lighting up dark fiber owned by and leased from various providers. Dark fiber is fiber that has been installed without a transmitter and receiver, typically to provide capacity for future growth.

New Build – Submarine Fiber Optic Plant

Deployment of new submarine cable, if implemented, would involve the installation of specially sealed cables in limited near-shore or inland bodies of water, and construction of landings / facilities on the shore to accept a cable, which is typically buried close to shore. Transoceanic submarine cables are not anticipated to be used as part of the Proposed Action; therefore, submarine repeaters and large marine vessels for installation or repairs would not be used. However, small marine vessels could be required for installation and repairs of smaller, non-transoceanic cables in limited near-shore or inland bodies of water.

[3] Points of Presence are connections or access points between two different networks, or different components of one network.

Installation of Optical Transmission or Centralized Transmission Equipment

All fiber installation activities may require additional installation of equipment to enhance the digital signals travelling through the fiber, depending on the network configuration. FirstNet may also install transmission equipment as part of the core network construction. This equipment is usually installed in small boxes or huts in the ROW of the utility corridor, and may involve construction of access road, depending on the availability of public ROW.

2.1.2.2. Wireless Projects

New Wireless Communication Towers

FirstNet may undertake the construction of new towers of various heights and configurations (e.g., monopoles, lattice, and guy-wired) to support wireless infrastructure, such as antennas and microwave dishes. Tower construction may also include associated structures including generators, equipment sheds, fencing, security lighting, aviation lighting, electrical feeds, and concrete foundations and pads. This type of project may require the construction of access roads, depending on the availability of public ROW.

Collocation on Existing Wireless Tower, Structure, or Building

Collocation projects would involve mounting or installation of equipment such as antennas or microwave dishes on an existing tower to transmit and/or receive signals, or provide backhaul. Installation of power units, such as an uninterruptible power supply could be added. Existing towers, structures, or buildings may require structural hardening or increased physical security measures.

2.1.2.3. Deployable Technologies

As part of the Proposed Action, there may be areas where permanent, fixed infrastructure cannot be erected due to a variety of factors. Deployable technologies may provide an option to either provide coverage in such areas, or they may be used to supplement existing coverage during a large-scale planned or emergency event. In addition, deployable technologies could also be used in areas where potential permanent impacts to significant sensitive resources/receptors cannot be avoided or mitigated. In general, some limited construction could be associated with the implementation of deployable technologies, such as land clearing or paving for parking or staging areas.

Cell on Wheels

The Cell on Wheels (COW) deployable technology consists of a cellular base station on a trailer with an expandable antenna mast, typically between 15 feet and 40 feet in height, and usually a microwave or satellite link back to the main controller. COWs typically contain a small generator and may also connect to utility power cables. This type of technology is designed to be part of a cellular network and augment existing capacity.

Cell on Light Truck

The Cell on Light Truck (COLT) deployable technology consists of a cellular base station on a light truck platform with an expandable antenna mast, typically between 15 feet and 40 feet in height, and usually a microwave or satellite link back to the main controller. COLTs typically contain a small generator and may also connect to utility power cables. This type of technology is designed to be part of a cellular network and augment existing capacity.

System on Wheels

The System on Wheels (SOW) deployable technology consists of a full base station and controller on a large towable trailer or truck. A SOW is a fully self-contained cellular system that can provide an island system with no need for satellite/microwave link back. SOWs typically contain a power generator and a larger antenna mast (ranging from approximately 50 feet to 120 feet in height), suitable to address larger localized coverage or capacity shortages in the event of planned or unplanned incidents.

Deployable Aerial Communications Architecture

Deployable Aerial Communications Architecture (DACA) consists of aerial vehicles, including, but not limited to, drones, balloons, blimps, and piloted aircraft, which would be deployed at a variety of altitudes and are capable of providing wide-area coverage, although with relatively low capacity/throughput. DACAs would be used for addressing wide scale loss of coverage after a major catastrophic event, which would have the network down for a significant period.

2.1.2.4. Satellites and Other Technologies

Satellite-Enabled Devices and Equipment

FirstNet may install permanent equipment on existing structures or support the use of portable devices that use satellite technology, such as satellite phones or video cameras.

Deployment of Satellites

FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes and may work with other federal agencies or commercial entities that engage in satellite launches to use Global Positioning System satellites to support devices requiring location information.

2.2. DESCRIPTION OF ALTERNATIVES

In accordance with NEPA, FirstNet has considered a variety of alternatives to ensure the building, deployment/construction, operation, and maintenance of the NPSBN. CEQ has defined reasonable alternatives as those that are economically and technically feasible ways to meet the purpose and need. NEPA also requires the analysis of the No Action Alternative, which provides a baseline against which the potential impacts of the Action Alternatives may be compared. FirstNet is carrying two alternatives plus the No Action Alternative forward for

analysis. Furthermore, FirstNet has considered three additional alternatives and dismissed them from further consideration.

2.2.1. Preferred Alternative

Under the Preferred Alternative, FirstNet and its partner(s) would construct a nationwide broadband LTE network using a combination of the wired, wireless, deployable, and satellite technologies. This may include, but is not limited to, the following methods: collocation of the network equipment on existing towers, poles and structures; construction of new communication towers, poles and associated structures to include generators, equipment sheds, fencing, and concrete pads; use of existing fiber facilities, including lighting up dark fiber and installation of new fiber on existing poles and in existing conduit; installation of new conduit and fiber using trenching (including vibratory plowing) or directional boring (including horizontal directional drilling); deployment of satellite phones and other portable satellite technology; launching of satellites; installation of microwave facilities for cell-site backhaul communication; and the utilization of deployable technologies.

2.2.2. Deployable Technologies Alternative

Under the Deployable Technologies Alternative, FirstNet would procure, deploy, and maintain a nationwide fleet of mobile communications systems, including ground-based and aerial deployable technologies, to provide temporary coverage in areas not covered by existing, usable infrastructure, as there would be no collocation of equipment or new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Generally, these units would be deployed at times of an incident to the affected area for either planned or unplanned incidents or events. Equipment would be stationed in every state and territory, often at multiple locations in each state or territory, to facilitate suitable response. These mobile communication units would be temporarily installed and may use existing satellite, microwave, or radio systems for backhaul. In general, some limited construction could be associated with the implementation of deployable technologies, such as land clearing or paving for parking or staging areas. However, these construction activities would be minimal in comparison to the combination of project types associated with the Preferred Alternative as described above.

2.2.3. No Action Alternative

Under the No Action Alternative, the NPSBN would not be constructed; there would be no nationwide, coordinated system dedicated to public safety interoperable communications. The existing multiplicity of communications networks would remain in place, as would the current, known limitations and problems of existing communication networks during times of emergency or disaster. This alternative would require an act of Congress to revise the Act, which currently requires the NPSBN.

2.3. ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

During the course of the development of the Proposed Action, several additional alternatives to implement the Proposed Action were considered. Each of these alternatives was found deficient in some way, and did not meet the purpose and need for the Proposed Action as discussed below.

2.3.1. New Construction Only Alternative

Under the New Construction Only Alternative, FirstNet would construct a nationwide network using all new construction and installation of fiber optic cable, conduit, utility poles, communication towers, and installed equipment. This alternative has been dismissed from further consideration because it is counter to FirstNet's legislative mandate to leverage existing infrastructure. Furthermore, new construction of the entire network would be cost-prohibitive and the construction timeline would cause unnecessary delays in network implementation as a result of the need for building an entirely new NPSBN from the ground up, which would not meet the agency's legislative purpose and the needs of the Proposed Action.

2.3.2. New Satellite Alternative

Under the New Satellite Alternative, FirstNet would construct a nationwide network using new and existing satellite technology only. Generally, satellite technology is not cost effective due to limited spectrum, and technical issues such as limited in-building coverage and performance. This alternative has been dismissed from further consideration because it is counter to FirstNet's mandate to use standards-based LTE technology to provide coverage, and its performance capabilities would not meet the purpose and need of the Proposed Action.

2.3.3. Collocation-Only Alternative

Under the Collocation-Only Alternative, FirstNet would construct the NPSBN using existing infrastructure only, by collocating equipment exclusively on existing towers, buildings, or other structures. This alternative has been dismissed from further consideration because suitable infrastructure does not exist to provide nationwide broadband coverage using only existing infrastructure. Many areas of the country, particularly rural areas, would have little to no service options from FirstNet if existing infrastructure alone were required to build the network. Therefore, this alternative would not meet the purpose and need of the Proposed Action.

2.4. RADIOFREQUENCY (RF) EMISSIONS

2.4.1. Introduction

General interest in the topic of the safety of radiofrequency electromagnetic field emissions (RF emissions),[4] a form of radiation, from communication towers and their relationship to human health and the environment has increased with the number of devices being used and the degree

[4] RF emissions refer to RF radiation emitted by devices. OSHA defines RF radiation as "electromagnetic radiation in the frequency ranges 3 kilohertz (kHz) - 300 Megahertz (MHz), and 300 MHz - 300 gigahertz (GHz), respectively" (Occupational Health and Safety Administration, 2015)

of connectivity needed for people to go about their daily lives. This interest has been demonstrated in the comments received by FirstNet during the scoping and public comment periods for its Programmatic Environmental Impact Statement (PEIS) for the nationwide public safety broadband network (NPSBN), other telecommunications projects, as well as active discussions within the human health and environmental science communities, and among the general public. Accordingly, FirstNet has determined it is important to analyze the potential human and environmental effects in the PEISs.

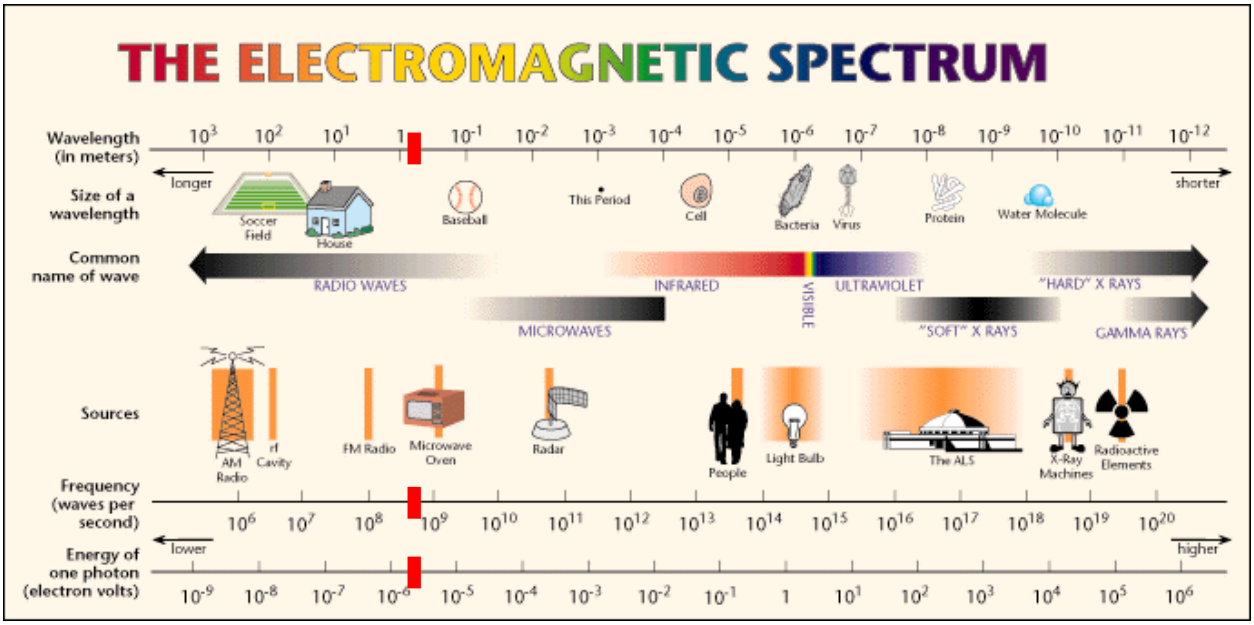
This document provides a general overview regarding (RF) emissions, the existing regulatory framework for limiting RF exposures, the general discussions on the current state of research for potential effects on humans, as well as information on animal and plant species, and some of the general conclusions on data gaps and the paths forward. While this document is not intended to be a complete analysis of all aspects of RF emissions and their potential effects, it does provide a general discussion of some of the credible scientific literature and information that relates to RF emissions and potential effects to human health and other species.

In general, radiation is the product of a wide range of energies that form the electromagnetic spectrum. A number of radiation sources exist in nature—such as the radon emitted from the breakdown of certain minerals in the ground or the radiation from energy in space) and others are artificial (such as RF emissions created by broadcasting, radio, and cellular equipment).

The electromagnetic spectrum is divided into two main classes: non-ionizing radiation (NIR) and ionizing radiation (IR):

- **Non-ionizing radiation**. NIR is as the low end of the electromagnetic spectrum. Visible Light, AM/FM radio, cellular, and microwaves are all classified as NIR. The FirstNet system would operate in the 700 MHz frequency band, which means that it would emit NIR in the microwave spectrum (Zamanian and Hardiman, 2005).
- **Ionizing radiation**. IR can produce charged particles (ions) in matter and is produced by unstable atoms that have an excess of energy or mass or both. Gamma radiation and x-rays are examples of IR. FirstNet equipment would not produce any IR (Zamanian and Hardiman, 2005).

This review focuses on NIR related to cellular systems (e.g., tower and building-mounted equipment) and, specifically, the 700 MHz Long Term Evolution (LTE) spectrum band licensed for use by FirstNet. Figure 2.4.1-1 details the full electromagnetic spectrum (U.S. Department of Energy, 2009). The red band on each line of Figure 2.4.1-1 indicates the 700 MHz frequency band, portions of which are already being used for both commercial wireless and public safety communications.



Source: (U.S. Department of Energy, 2009)

Note: The red band on each line indicates the 700 MHz frequency band licensed for use by FirstNet.

Figure 2.4.1-1: The Electromagnetic Spectrum

Radiation is frequently presented in the terms of *power intensity* or *irradiance*. The power intensity is the radiant flux[5] received by a specific surface area. The units for irradiance are watts per meters squared (W/m^2). Frequently, RF emissions and exposure standards are defined in terms of power density. Some standards are explicitly defined while others are a function of the frequency of the radiation. Table 2.4.1-1 summarizes the current Federal Communications Commission (FCC) standards for RF emissions for occupational/controlled exposure, as well as uncontrolled exposure.

[5] The radiant flux is the amount of energy per unit time radiated from a source.

Table 2.4.1-1: FCC Regulatory Levels

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) ($\mu W/cm^2$)	Averaging Time $(E)^2$, $(H)^2$, or S (minutes)
Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	(100) [a]	6
3.0-30	1842/f	4.89/f	($900/f^2$) [a]	6
30-300	61.4	0.163	1.0	6
300-1500 [b]	--	--	f/300	6
1500-100,000	--	--	5	6
Limits for Occupational/Controlled Exposure				
0.3-1.34	614	1.63	(100) [a]	30
1.34-30	842/f	2.19/f	($180/f^2$) [a]	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

Source: (FCC, 1996)

f=frequency in MHz
[a] Plane-wave equivalent power density
[b] Frequency range within which FirstNet would operate

Since FirstNet is licensed to operate in the 700 MHz range,[6] the FCC regulations establishing exposure limits would govern FirstNet operations and (power density) would be between 2.33 mW/cm^2 and 2.66 mW/cm^2 for occupational or controlled exposure for frequencies of 700 and 799 MHz, respectively.[7] For these same frequencies and general population/uncontrolled exposure, the FCC standard exposure limits are 0.47 mW/cm^2 to 0.53 mW/cm^2. This analysis is intended to outline some preliminary information on the topic to describe the state of current research, science, and the unsettled issues surrounding RF emissions.

2.4.2. RF Emissions and Humans

For 20 years, the regulatory levels for human exposure to RF emissions have been established by the FCC as a means of protecting both workers and the general public from any potential effects.[8] Concerns about RF emissions have been raised for a number of years by various nongovernmental stakeholder groups about whether the FCC's exposure levels—and similar standards established by other developed nations—are protective enough based upon the current science on the potential health effects.

The FCC's standards were first established in 1996 based upon the guidelines formulated by the National Council on Radiation Protection and Measurements (NCRP), a Congressionally-chartered nonprofit corporation that prepares recommendations on matters of radiation protection, as well as those promoted by two independent nonprofit organizations, the Institute of

[6] FirstNet holds a single 700 MHz Public Safety Broadband Nationwide License, under Call Sign WQQE234.
[7] See 47 U.S.C. § 1421(a).
[8] See 47 Code of Federal Regulations (CFR) 1.1307(b), 1.1310, 2.1091, 2.1093. (To search for and locate CFR records, see the Electronic Code of Federal Regulations (e-CFR): www.ecfr.gov).

Electrical and Electronic Engineers (IEEE) and the American National Standards Institute (ANSI), both of whom have helped set industry standards for decades (FCC, 2013) (FCC, 2014).

These standards set effective radiated power (ERP) of no more than 500 watts per channel (WPC), depending on tower height and the total number of radio channels (transmitters) authorized at a specific site, so that the RF power transmitting at any particular location will vary, with most urban and suburban sites operating at an ERP of less than 100 WPC. According to the FCC and depending upon the type of antenna being used, the typical cell site emits an ERP of 100 WPC, which corresponds to an actual radiated power of 5 to 10 watts (FCC, 2014).

The power of RF emissions rapidly decreases as the distance from the transmitter increases. As a result, measurements taken of typical ground-level exposures are usually well below the FCC exposure standards. Those standards recommend a maximum permissible exposure level to the general public of approximately 580 microwatts per square centimeter for cellular and Personal Communications Service (PCS) cell site transmitters. The RF levels typically found near the bases of cellular or PCS cell site towers or in the vicinity of other, lower-powered cell site transmitters are many times less than this limit (FCC, 2014).

Demonstrating cause and effect in humans from low-level[9] environmental exposures is considered to generally require multiple studies over many years before consensus is reached and a clear cause and effect can be established (Webb, P. and C. Bain, 2011). In order to respond to a request by Congress to study the potential health effects of electric and magnetic fields on humans and other living organisms, the Department of Energy entered into an agreement with the National Research Council (NRC) for the National Academy of Science to prepare a study.

That report, in looking at routine exposures to electric and magnetic fields found in homes and communities as the cause of disease and abnormalities, stated, "There is no widely accepted understanding of how extremely low-frequency electric and magnetic fields, such as those associated with the distribution and use of electric power, could cause a disease or whether it causes a disease. Considerable research has been conducted in this area, and numerous research data can be found on the subject, but given the lack of a specific disease end point to track or a well-accepted theory of how the fields might affect biologic systems, the data are discordant; they have been gathered using different exposure conditions and have resulted in conflicting observations of different effects or no effects" (National Research Council, 1997). Hence, the investigations into RF have not yet achieved scientific consensus on cause and effect.

Some of the major problems with demonstrating cause and effect for RF are listed below:

- No consistent measures of exposure. Exposure is changing with the proliferation of cell phone use, and there is no real unexposed or "control" population (Ahlbom et al., 2004) (Khurana et al., 2010);
- No scientifically agreed upon biological mechanism for harm. The lack of a clear biological mechanism increases uncertainty into whether the health end point that the study examined is the correct endpoint to try and measure (Hauri et al., 2014) (Ahlbom et al., 2004); and,

[9] For the purposes of this review, "low-level" is a qualitative description of the small amount of energy contained in these emissions.

- Some potential effects of major concern are rare, such as brain cancer and acoustic neuroma, both of which have been potentially linked to RF exposure. If the health outcome is rare, it is even harder to demonstrate cause and effect (Ahlbom et al., 2004).

However, there is an active scientific research effort worldwide concerning the potential health effects of RF emissions, with new studies being published frequently. This research environment reflects the public interest in the topic, the increased level of interest within the scientific community and the desire by governments and health organizations to determine conclusively whether there are any potential effects from RF emissions to either people or the environment.

2.4.2.1. Regulatory Framework for RF Emissions

As indicated above, RF emissions have been identified by the FCC as a potential environmental factor to be weighed in evaluating a transmitter's effect on the human environment. Currently, the FCC implements and enforces both occupational and public exposure limits to RF electromagnetic fields through its authorization and licensing process. In order for a facility operation or transmitter to be authorized or licensed, FCC requires licensees to be in compliance with its regulations relating to RF emissions.

In 1996, as a consequence of the authority granted by Congress to the FCC in the Telecommunications Act of 1996 (TCA) to "prescribe and make effective rules regarding the environmental effects of radio frequency emissions" (TCA, 104 Pub. L. 104), the agency adopted new guidelines and procedures reflected in its revised Office of Engineering and Technology (OET) Bulletin 65, *Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields,* originally issued in 1985 (FCC, 1997). The revised guidelines include limits for Maximum Permissible Exposure (MPE) for transmitters operating between 300k Hz and 100 GHz which are averaged over a specified time-interval. The limits are different based on whether an occupational setting or a general population exposure setting is being evaluated. These standards have been challenged in federal courts and have been upheld (*See*, for example, *Cellular Phone Taskforce et al. v. FCC,* 205 F.3d 82 [2nd Cir. 2000]).

The FCC has updated its standards for evaluating mobile or personal communication devices "localized absorption" as well. The FCC's MPE "localized absorption" limits are based on recommendations from the National Council on Radiation Protection and Measurements (NCRP) and the Institute of Electrical and Electronics Engineers, Inc. (IEEE)[10] and were adopted by the American National Standards institute (ANSI) to replace the earlier ANSI guidelines of 1982. These limits are based on thermal effects (i.e., the amount of RF energy required to heat tissue). According to the FCC, the established limits are well below levels that are considered to have adverse health effects. These levels are shown in Table 2.4.1-1. Additionally, the IEEE's Committee on Man and Radiation (COMAR) states that the amount of RF emissions in buildings

[10] Outside of the United States, many countries (including most of Europe) use exposure guidelines developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The ICNIRP safety limits are similar to those of the NCRP and IEEE (Classic, K., 2015).

"will be lower than outside, since a substantial fraction of the signal is absorbed when it passes through most building materials" (IEEE COMAR, 2000).

COMAR cites a study (Health Physics Society, 1997) that measured the power density of radiation on the top floors of buildings with roof-mounted antennas (IEEE COMAR, 2000). The study found that radiation emissions on these floors "were less than 0.0004 mW/cm^2 per 100 W Effective Radiated Power (ERP) per channel." For purposes of reference, this indicates that it is 1,000 times less than the FCC standard for general population exposure and 5,000 times less than the FCC standard for occupational workers.

COMAR also found that "roof-mounted base station antennas are normally designed to radiate energy in the horizontal direction away from the building, and they radiate very little energy into the building itself. Therefore, exposure to residents inside a building with roof-mounted base station antennas is invariably very low" (IEEE COMAR, 2000).

In March of 2013, the FCC voted to review current RF rules and regulations and put forth a *Notice of Inquiry.* The *Inquiry* was intended to open discussion around whether the existing RF exposure limits and policies need to be reassessed. Through this process, the FCC has gathered input from industry, scientific experts, and members of the public to help the agency to determine whether current policies and rules need to be changed (FCC, 2013).

2.4.2.2. Overview of Research for Potential Non-Thermal Effects to Humans

A few organizations have provided research that is useful as a framework for the state of the research on RF and the basis of some of the concerns. For example, several studies of the potential non-thermal health effects cited below have focused on cancer outcomes (primarily childhood leukemia and brain cancers); however, reproductive/neonatal problems, neurological and neurobehavioral issues, and genotoxicity have also been studied. In addition to these studies, one group (the International Association of Fire Fighters) has raised concerns about potential non-thermal effects resulting from RF emissions coming from telecommunications equipment (International Association of Fire Fighters, 2015).

As with any source, RF emissions from the FirstNet system would be dependent on the location, type, and power of antennas used. There are three basic forms of antennas: omnidirectional, narrow horizontal gain (focused beam), and panel.

The most common type of antenna is a panel antenna, as these are easily mounted on towers or rooftops and provide approximately 60 degrees of horizontal and vertical coverage. Omnidirectional antennas are frequently used for things such as Wi-Fi where a widespread area needs to be covered by a signal. Directional beam antennas are used to propagate a strong, focused beam to a specific location which is ideal for sending a stronger signal for greater distances without affecting areas outside the target. Thus, the omnidirectional and beam antennas are generally not suitable for deploying a cellular network.

Panel antennas do not produce a significant amount of radiation outside of the primary lobe, making them an ideal candidate for providing widespread coverage while maintaining control of

the radiation beam. Figure 2.4.2-1 shows a typical lattice cell tower with multiple panel antennas arranged radially.

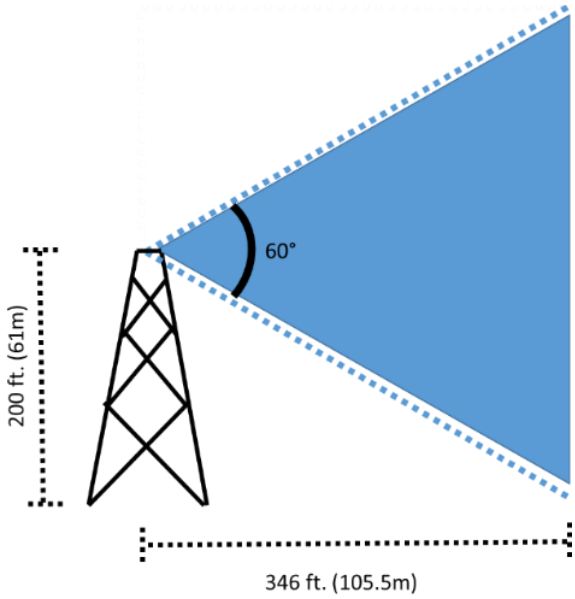
Source: (The Fiber Optic Association, Inc., 2014)

Figure 2.4.2-1: Monopole Cell Tower with Multiple Panel Antennas

Using the power intensity formula described above and assuming an antenna fixed to a base station transmits 60 watts (W) of power:

- The power density 0.30 m (1 ft.) from the base station would be 4.77 W/m^2;
- The power density 0.61 m (2 ft.) from the base station drops to 1.2 W/m^2; and
- At 100 m, the power intensity drops to 0.000477 W/m^2, a 99.99% reduction.

Figure 2.4.2-2 depicts the radiation beam from a panel antenna on a 200 ft. (61 m) tower. Assuming a 60-degree vertical spread and no vertical tilt, the primary lobe of the radiation beam (shaded blue) would not reach the ground until 346 ft. (106 m) from the tower. At the point where the beam reaches the ground (approximately 346 ft. [106 m] from the base), there is a 99.99% reduction in power density compared to the power intensity 0.30 ft. (1 m) from the panel.



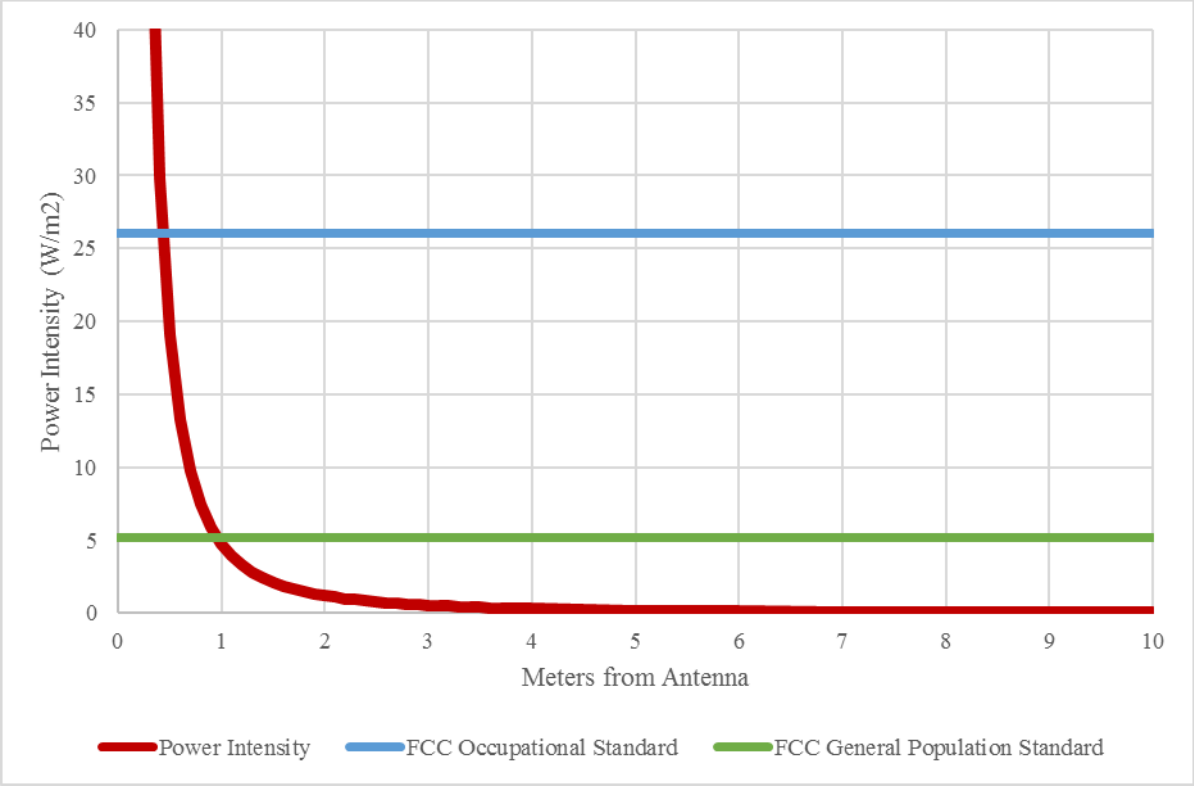
Source: (FCC, 1997)

Figure 2.4.2-2: Depiction of Primary Radiation Lobe of a Panel Antenna Attached to a 200 ft. (61 m) Cell Tower

Correspondingly in Figure 2.4.2-2, the zone outside of the blue-shaded area is not within the primary radiation lobe of the antenna, and thus, would receive very little radiation (<0.01% of the density 0.30 m [1 ft.] in front of the antenna). This means that buildings and people under the tower would receive little RF emissions from those antennas, assuming none of the antennas are tilted downward.

Figure 2.4.2-3 depicts the decrease of power intensity from a 60W antenna as a function of distance from the antenna and displays the FCC standards for 780 MHz frequency. The 780 MHz frequency is used for these calculations since it splits the two operating frequency bands at which the FirstNet system would operate (i.e., 758-769 MHz and 788-799 MHz). While the FirstNet system would not operate specifically at 780 MHz, this frequency best represents all of the possible frequencies at which the system would operate.

Figure 2.4.2-3 further demonstrates that the FCC occupational standard is met at 0.42 m while the standard for the general public is met at 0.96 m. While these distances may seem small and insignificant, this chart only represents one 60W antenna. Generally speaking, there may be three or more antennas serving one area (one transmitter, two receivers). Assuming there are three antennas operating at a power of 60W at 780 MHz each, the standards are then met at 0.72 m and 1.66 m, respectively using the formulas in Table 2.4.1-1.



Source: (FCC, 1997)

Note: This figure is a simple representation of the power intensity versus distance from a 60W antenna. There are many other factors that may affect the power intensity at a specific location, which are not accounted for in this graph. Some factors include positive or negative interference with other electromagnetic waves, absorption by building materials or other items, and varying power outputs dependent on signal demand.

Figure 2.4.2-3: 60W Antenna (780MHz) - Power Intensity vs Distance with Respect to FCC Guidelines for Limiting Thermal Radiation

As previously described, radiation can elicit both thermal and non-thermal effects in humans and other biological organisms. Given that thermal effects are only elicited when exposed to intense amounts of radiation, this section summaries the available credible scientific information about potential non-thermal effects of RF emissions, particularly at low power intensities.

Among the research organizations studying RF emissions, the World Health Organization (WHO)—as an agency of the United Nations—is the most prominent. According to the WHO, there have been tens of thousands of papers published on RF, extremely low frequency (ELF) and potentially related health effects over the last 30 years. A recent (May 2015) statement on the WHO website states:

> "The heating effect of radio waves forms the underlying basis for current guidelines. Scientists are also investigating the possibility that effects below the threshold level for body heating occur as a result of long-term exposure. To date, no adverse health effects from low level, long-term exposure to radiofrequency or power frequency fields have been confirmed, but scientists are actively continuing to research this area" (World Health Organization, 2015).

In 2011, based upon the inconclusive data and in an abundance of caution, WHO classified RF exposures due to cell phone use as a 2B carcinogen—indicating that it was possibly carcinogenic to humans—based upon some studies that found a potential increased risk of glioma (a type of brain cancer) associated with cell phone use (International Agency for Research on Cancer, 2011). However, WHO's International Agency for Research on Cancer (IARC) noted that the evidence for carcinogenicity for occupational and environmental exposures (exposures to emissions from cell towers would fall into the "environmental" category) was inadequate to draw conclusions regarding carcinogenic potential.

The conclusions made by the IARC specifically identify RF emissions from wireless phones as the source for positive associations with negative health effects. Many of the studies examined by the IARC for fixed transmitter emissions sued that living close to fixed transmitters increased the risk of developing either brain cancer, leukemia, or lymphoma; nonetheless, the IARC identified several shortcomings of these studies, including:

- Not accounting for mobile phone use or exposure to RF emissions from other sources (ambient RF emissions levels or confounding factors);
- Not accounting for buildings or other geographic features which impact the strength of the radiation;
- Small population size;
- Lack of controls;
- Poor exposure assessment (no individual data);
- Non-differential disease misclassification; and
- Lack of cumulative measure of exposure to RF emissions (take into account individual's place of residence between birth and diagnosis of cancer/disease) (International Agency for Research on Cancer, 2013).

While some of the studies indicated a negative (inverse) correlation between distance from transmitters and risk of cancer, the caveats identified by the IARC indicate general lack of scientific rigor of previous research projects. Furthermore, most of the studies reviewed by the IARC focus on cellular telephone use rather than low-level, background radiation emitted from fixed transmitter sites. Overall, these studies do not indicate a clear trend, reproducible with regard to the effects of fixed transmitter radiation.

WHO is currently undertaking a health risk assessment of radiofrequency electromagnetic fields, to be published as a monograph in the Environmental Health Criteria Series. WHO scientists themselves began conducting research on RF emissions, and electromagnetic fields more broadly, when it established the International EMF Project in 1996 (Repacholi, M., 2001). However, recent studies on behalf of WHO have concluded that "there is insufficient data to draw firm conclusions about health effects from long-term low-level exposure [to RF electromagnetic fields] typically occurring in the everyday environment" (Röösli et al., 2010).

In contrast to the WHO's statement on health effects, a public advocacy group of scientists, known as the BioInitiative Working Group (BWG), published the BioInitiative Report, first in 2007 and followed by a revised version in 2012 (Carpenter & Sage, 2012) that found substantial evidence of adverse health effects associated with RF and ELF exposures. However, the BWG

itself has been criticized by other scientific, professional and governmental bodies for ignoring conflicting, inconsistent or other credible evidence that clashed with its report (e.g., (Dolan, M. and J. Rowley, 2009)).

The BWG report concluded that there was evidence to support adverse health effects resulting from sustained low-intensity electromagnetic radiation on decreased male fertility, fetal and neonatal effects, brain tumors, childhood leukemia, genotoxicity, and several other effects. The BioInitiative Report noted further that health effects due to emissions from cell towers were cited in a number of studies that possibly linked headaches/sleep disturbance/concentration issues in children, adolescents, and adults at levels in the range of 0.003 to 0.05 $\mu gW/cm^2$, much lower than current regulatory standards shown on Table 2.4.1-1. BWG recommends lower standards be established and that cell phone towers not be built within certain distances of sensitive receptors, such as schools, daycare centers, and hospitals (Carpenter & Sage, 2012).

These two positions illustrate the scientific and philosophical divide. First, there is some evidence of adverse health effects at levels below the current standards in a number of studies, but as is the case with other epidemiological studies attempting to prove causality, these studies are subject to a variety of uncertainties inherent in the epidemiological process.[11] Consequently, it appears that the preponderance of the evidence to date does not definitively demonstrate that there are adverse health effects caused by RF emissions and there is still no single, plausible biological mechanism to indicate adverse effects. Second, although there is some scientific data in certain studies to warrant further investigation, some researchers urge that precautions should apply to reduce exposures as much as possible (Carpenter & Sage, 2012).

2.4.2.3. Conclusions on RF Emissions and Humans

Based on the analysis above, there is insufficient and inconclusive data to make a definitive determination of effect of RF emissions on humans. Although there is some evidence of adverse health effects at levels below the current standards in a number of studies, these studies are subject to a variety of uncertainties inherent in the epidemiological process. The preponderance of the evidence to date does not definitively demonstrate that there are adverse health effects caused by RF emissions and there is still no single, plausible biological mechanism to indicate adverse effects.

2.4.3. RF Emissions and Non-Human Species

Unlike those established for human exposure, no federal regulatory levels have been set for non-human species exposure to RF emissions.

Under NEPA, an environmental analysis is required to be conducted by the lead federal agency prior to undertaking any major federal action. This analysis requires the federal agency to consider any and all types of environmental impacts associated with the project and make qualitative decisions concerning the likelihood and severity of the potential effects and give

[11] It is difficult to attribute causation when other effects cannot be ruled out. The complexity of health conditions also makes it difficult to imply causation. Epidemiological studies can never provide proof or 100% certainty of an effect (Webb, P. and C. Bain, 2011).

potential environmental effects due consideration in making engineering and economic decisions.

As is the case with considering the potential effects of RF emissions on humans, demonstrating cause and effect in animal and plant species from low-level environmental exposures is challenging and it too requires multiple studies over many years and across many species. Although there is some research that shows that there could be potential effects on some animal and plant species associated with RF emissions, here too there is no clear or definitive scientific research and literature, especially for animals or plants in North America, to achieve scientific consensus on whether there exists demonstrable cause and effect.

Undoubtedly, there is considerable public interest into the potential effects of RF emissions on both humans and other species. Research is continuing with a number of scientific and academic centers, although there is still no consensus within the larger scientific community. Consequently, there is still the need for more targeted information, research, and studies on RF emissions and human, plant and animal life. This means that we should expect that additional research will likely both continue and increase over the coming years.

2.4.3.1. Research on the Potential Effects to Animal and Plant Species

Since the 1980s, numerous studies have been conducted that focus on the potential effects of RF emissions on animal and plant species. Mirroring the findings indicated by the growing body of scientific research, the United States (U.S.) Fish and Wildlife Service (USFWS) has indicated in reports and agency memoranda that RF emissions could be potentially harmful to migratory birds, even at levels too low to cause thermal effects (Manville, 2007) (Manville, 2009) (Manville, 2014).[12] Further, a comment letter on the Draft PEIS for the Western U.S. presented by Dr. Albert Manville, former USFWS agency lead on avian-structural impacts, summarizes the state of scientific knowledge of the potential effects of RF on wildlife, particularly migratory birds; the comment letter is presented in its entirety in Appendix G, *Radio Frequency Emissions Comments Received* Such studies and scientific knowledge generally agree that exposure to RF may result in adverse impacts on wildlife, although a distinct causal relationship between RF exposure and responses in wild animal populations has not been established. Further, important questions regarding the mechanisms of impact, the exposure levels that trigger adverse effects, and the importance of confounding factors in the manifestation of effects, among other questions, remain unanswered (Manville, 2016) (see Appendix G, *Radio Frequency Emissions Comments Received*).

Research conducted to date under controlled laboratory conditions has identified a wide range of physiological and behavioral changes in avian and mammalian subjects, including embryonic mortality in bird eggs, genetic abnormalities, cellular defects, tumor growth, and reproductive and other behavioral changes in adult birds and rodents (Wyde, 2016) (Levitt & Lai, 2010) (DiCarlo, White, Guo, & Litovitz, 2002) (Grigor'ev, 2003) (Panagopoulos & Margaritis, 2008).

[12] Although discussions of RF emissions generally involve "biological effects," meaning terrestrial and avian species, the research and environmental community have focused largely on bird species, especially migratory. Some studies have also indicated the potential for adverse effects to vegetation from RF emissions.

Laboratory studies conducted with domestic chicken embryos have shown that emissions at the same frequency and intensity as that used in cellular telephones have appeared to result in embryonic mortality (DiCarlo, White, Guo, & Litovitz, 2002) (Manville, 2007). These studies suggest that RF emissions at low levels (far below the existing exposure guidelines for humans) (see Section 2.4.2, RF Emissions and Humans) may be harmful to wild birds; however, given the controlled nature of the studies and potential exposure differences in the wild, it is unclear how this exposure would affect organisms in the wild. A number of other studies link RF exposure and the disruption of biological processes that are fundamental to plant and animal growth and health, including but not limited to behavior, deoxyribonucleic acid damage, immune deficiencies, reproductive system effects, hormone dysregulation, degraded cognition and sleep, and desynchronization of neural activity (Carpenter & Sage, 2007) (Carpenter & Sage, 2012) (Balmori, 2015).

Few studies of the effects of RF exposure on wild animal populations have been conducted due to the difficulty of performing controlled studies on wild subjects. Those that have been conducted are observational in nature (i.e., documenting reproductive success and behavior in birds near RF-emitting facilities). These studies lack controls on exposure levels or other potentially confounding factors. Nevertheless, findings from these studies indicate reduced survivorship at all life stages; physiological problems related to locomotion and foraging success; and behavioral changes that resulted in delayed or unsuccessful mating in several species of nesting birds (Balmori, 2005) (Balmori, 2009) (Balmori & Hallberg, 2007) (Manville, 2016) (see Appendix G, *Radio Frequency Emissions Comments Received*).

For example, research conducted by Balmori (2005) (2009), Balmori and Hallberg (2007), and Di Carlo *et al.* (2002) suggests that the presence of electromagnetic fields in the microwave range may be a consideration in the decline of some urban bird populations. Research in Balmori (2005) focused on several species of wild birds in relation to cellular tower sites in Spain and indicated negative correlations between levels of RF emissions and bird breeding, nesting, and roosting. Also, nest and site abandonment, plumage deterioration, locomotion issues, and even death were noted for some house sparrows, white storks, rock doves, magpies, collared doves, and other species where roosting and nesting in close proximity to cellular antennas. The research suggested that these symptoms were not observed prior to construction of the cellular towers, although studies were not conducted prior to the cellular tower installation. Balmori (2005) documented these effects as far as 1,000 feet from the RF source.

Balmori and Hallberg (2007) reported that declines of urban house sparrows in Spain increased as electromagnetic field strength increased. Everaert and Bauwens (2007) also found negative correlations between the amount of RF emissions present and the presence of male house sparrows and concluded that long-term exposure to higher emission levels may be affecting bird abundance or bird behavior in this species.

Similarly, Bhattacharya and Roy (2014) looked at bird and nest occurrence in relation to tower proximity and electromagnetic fields in India. The study examined bird species within proximity to towers and used the point count method to identify the presence of birds and nests at various distances in all four cardinal directions from towers. This study found that bird occurrence was

lowest within 20 meters of towers, which is the zone where power density was at peak values. Also, it was found that within this zone food sources were readily available and avoided. Additionally, no nests were identified within this zone and the closest nest was well outside this zone (approximately 80 meters or 263 feet).

It has also been suggested that RF emissions may act as an attractant to certain species of birds. Magnetite is a mineral found in high concentrations in bird eye, beak, and brain tissues and is used by birds for navigation. Since magnetite is highly sensitive to the electromagnetic frequencies, it has been suggested that RF emissions could lead to increased bird strikes and/or direct exposure to high levels of RF emissions due to the attractant quality of materials used in some equipment (Ritz, Thalau, Phillips, Wiltschko, & Wiltschko, 2004) (Balmori, 2015).

Along these same lines, Balmori (2015) has noted that other flying species that use magnetic fields for navigation purposes have been found to be affected by RF emissions, primarily honeybees and butterflies. After several studies were published regarding the effects of cell phones on bees, the author of one of the studies, Stefan Kimmel, "emailed The Associated Press to say that there is 'no link between our tiny little study and the Colony Collapse Disorder (CCD)-phenomenon…anything else said or written is a lie" (U.S. Department of Agriculture, 2015). Other, less defensible studies have purported to find that RF emissions from cell towers affect bees' behavior and could be responsible for colony collapse disorder. In general, these studies are not published in peer-reviewed and in credible journals, such as some well-known honeybee studies either published in predatory open access journals[13] or that are informal in nature.

2.4.3.2. Conclusions on RF Emissions and Animal/Plant Species

The amount of research related to determining whether there are identifiable effects from RF emissions to animal species and, to a lesser degree, plant species is fairly extensive and growing. Experts in this field generally agree that exposure to RF might adversely affect wildlife species, particularly birds and bats, although a clear case of cause and effect between RF exposure and impacts to wild animal populations has not been established and many questions remain unanswered, including but not limited to the thresholds at which impacts may occur and the implications of impacts at the population level. The widespread conclusion of nearly every study or expert/agency assessment of the issue is that more research is essential to better understand the patterns of cause and effect, variations among species, and the potential sensitivities and severity of impacts to such species.

The common practice for NEPA documents related to cellular towers is to cite FCC standards and point to the fact that they would be built and operated according to allowable FCC RF emission limits. Some NEPA documents that have more directly addressed the RF emissions potential largely point to the existing literature and suggest that although there is evidence that RF emissions could potentially affect some species, the evidence is insufficient to support a

[13] Predatory journals are issued by publishers that "are characterized by various levels of deception and lack of transparency in their operations…they may claim a stringent peer-review where none really exists" (Elliott, 2012). Open access journals are available online and require no fee or membership; they are accessible to anyone who has access to the internet.

finding of adverse impacts on these species due to RF emissions (Ballistic Missile Defense Organization, 2000) (FCC, 2012).

2.4.4. Summary

FirstNet is a licensee of the FCC and FirstNet's operations in the 700 MHz range are governed by FCC regulations establishing exposure limits for RF emissions. Federal law authorizes the FCC to establish regulatory levels for human exposure to RF emissions. Over the years, the FCC has revised its standards and guidelines for protecting both workers and the general public—including limits for Maximum Permissible Exposure (MPE) for transmitters covering the 700MHz range and localized absorption limits for mobile devices—and these have been upheld by the federal courts.

Scientific investigations into RF emissions and the possible effects of exposure on humans, animals, and plants are inconclusive. These studies do not indicate any clearly reproducible trend and, consequently, there is insufficient and inconclusive data to make a definitive determination of effect of RF emissions on humans.

The studies cited in this PEIS do not indicate any clearly reproducible trend and, consequently, there is insufficient and inconclusive data to make a definitive determination of effect of RF emissions on humans. As explained above, scientific investigations into RF emissions and the possible effects of exposure on wildlife and plants are inconclusive. However, as there is a body of evidence that suggests potential impacts to wildlife, FirstNet concurs with recommendations from Dr. Manville and the U.S. DOI that further studies should be performed that are designed to determine thermal and non-thermal impacts from RF emission on birds and other wildlife.

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First Responder Network Authority

Nationwide Public Safety Broadband Network

Final Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 1 - CHAPTER 3

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Federal Communications Commission
General Services Administration
U.S. Department of Agriculture—Rural Utilities Service
U.S. Department of Agriculture—U.S. Forest Service
U.S. Department of Agriculture—Natural Resource Conservation Service
U.S. Department of Commerce—National Telecommunications and Information Administration
U.S. Department of Defense—Department of the Air Force
U.S. Department of Energy
U.S. Department of Homeland Security

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3. CONNECTICUT

English Puritans from neighboring Massachusetts were the first people to found a permanent European settlement in Connecticut, though the Dutch first explored the state. Connecticut participated in the Revolutionary War as one of the original 13 states (State of Connecticut, 2015a). Located in the northeastern region of the United States, Connecticut is bordered by New York to the west, Rhode Island to the east, Massachusetts to the north, and by Long Island Sound to the south. This chapter provides details about the existing environment of Connecticut as it relates to the Proposed Action.

General facts about Connecticut are provided below.

- **State Nickname:** The Constitution State
- **Area:** 4,842 square miles; **U.S. Rank:** 48 (U.S. Census Bureau, 2010a) (U.S. Census Bureau, 2015a)
- **Capital:** Hartford
- **Counties:** 8 (State of Connecticut, 2015a)
- **Estimated Population:** Over 3.5 million people; **U.S. Rank:** 29 (U.S. Census Bureau, 2015b) (U.S. Census Bureau, 2015c)
- **Most Populated Cites:** Bridgeport, New Haven, Hartford, Stamford, and Waterbury (State of Connecticut, 2015a)
- **Main Rivers:** Connecticut River, Thames River, Housatonic River, and Farmington River
- **Bordering Waterbodies:** Long Island Sound
- **Mountain Ranges:** Berkshire Mountains, Taconic Mountains, and a portion of the Appalachian Mountains
- **Highest Point:** Mt. Frissell (2,380 ft.) (U.S. Geological Survey, 2015)

3.1. AFFECTED ENVIRONMENT

3.1.1. Infrastructure

3.1.1.1. Definition of the Resource

This section provides information on key Connecticut infrastructure resources that could potentially be affected by FirstNet projects. Infrastructure consists of the systems and physical structures that enable a population in a specified area to function. Infrastructure is entirely manmade with a high correlation between the type and extent of infrastructure and the degree to which an area is characterized as "developed." Infrastructure includes a broad array of facilities such as utility systems, streets and highways, railroads, airports, buildings and structures, ports, harbors, and other manmade facilities. Individuals, businesses, government entities, and virtually all relationships between these groups depend on infrastructure for their most basic needs, as well as for critical and advanced needs (e.g., emergency response, health care, and telecommunications).

Section 0 provides an overview of Connecticut's traffic and transportation infrastructure, including road and rail networks and waterway facilities. Connecticut's public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in the Act, including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by the Act. Public safety services in Connecticut are presented in more detail in Section 3.1.1.4. Section 3.1.1.5 describes Connecticut's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of Connecticut's utilities, such as power, water, and sewer, is presented in Section 3.1.1.6.

3.1.1.2. Specific Regulatory Considerations

Multiple Connecticut laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 3.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state's applicable statutes and administrative rules referenced in column one. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

[1] The term "public safety entity" means an entity that provides public safety services (7 U.S. Code [U.S.C.] § 140126).

Table 3.1.1-1: Relevant Connecticut Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
General Statutes of Connecticut: Title 16a, Planning and Energy Policy; Connecticut eRegulations System: Title 16a, Planning and Energy Policy	Department of Energy and Environmental Protection (DEEP); Public Utilities Regulatory Authority; Office of Policy and Management; Department of Emergency Services and Public Protection; Department of Transportation	Coordinates all state and local government programs for the allocation, rationing, conservation, distribution, and consumption of energy resources including conventional, renewable, and emerging energy technologies (including atomic development); oversees generating and distribution facilities with respect to energy efficiency, load management, and demand; administers the state's energy emergency planning and preparedness activities.
General Statutes of Connecticut: Title 4a, Administrative Services; Title 4b, State Real Property; Title 22a, Environmental Protection; Title 23, Parks, Forests and Public Shade Trees; Title 25, Water Resources, Flood and Erosion Control; Title 26, Fisheries and Game; Connecticut eRegulations System: Title 22a, Environmental Protection; Title 23, Parks, Forests and Public Shade Trees; Title 25, Water Resources, Flood and Erosion Control; Title 26, Fisheries and Game	DEEP; Department of Public Health; Department of Agriculture; Department of Transportation; Department of Administrative Services; Council on Environmental Quality; State Properties Review Board; Connecticut Siting Council; Governor's Steering Committee on Climate Change; Interstate Environmental District; New England Interstate Water Pollution Control Commission; Water Planning Council; Council for Soil and Water Conservation; Connecticut Emergency Response Commission	General Statutes of Connecticut: Title 4a, Administrative Services; Title 4b, State Real Property; Title 22a, Environmental Protection; Title 23, Parks, Forests and Public Shade Trees; Title 25, Water Resources, Flood and Erosion Control; Title 26, Fisheries and Game; Connecticut eRegulations System: Title 22a, Environmental Protection; Title 23, Parks, Forests and Public Shade Trees; Title 25, Water Resources, Flood and Erosion Control; Title 26, Fisheries and Game.
General Statutes of Connecticut: Title 10, Education and Culture; Connecticut eRegulations System: Title 10, Education and Culture	Department of Economic and Community Development; Historic Preservation Council; State Historic Preservation Board	Investigates structures and landmarks for educational, recreational, and historical significance; encourages the development, preservation, and marking of historic structures; establishes state standards and administers the National Register of Historic Places Program; maintains a program of historical, architectural, and archaeological research and development including surveys, excavation, scientific recording, interpretation, and publication of the state's historical, architectural, archaeological, and cultural resources; formulates standards and criteria to guide municipalities in the evaluation, delineation, and establishment of historic districts.
General Statutes of Connecticut: Title 4b, State Real Property; Title 19a, Public Health and Well-Being; Title 28, Civil Preparedness and Emergency Services; CGS Title 29, Public Safety and State Police; Connecticut	CT Department of Emergency Services and Public Protection including Division of State Police, Division of Emergency Management and Homeland Security, Office of State-Wide Emergency Telecommunications;	Oversees statewide emergency management and homeland security through a collaborative program of prevention, planning, preparedness, response, recovery, mitigation, and public education including strategic and operational planning, training, grants, and disaster relief; develops, maintains, and implements the state-wide emergency service telecommunications plan and implementation including a public safety data

State Law/Regulation	Regulatory Agency	Applicability
eRegulations System: Title 19a, Public Health and Well-Being; Title 28, Civil Preparedness and Emergency Services; Title 29, Public Safety and State Police	Department of Administrative Services including Division of Information Technology; State-Wide Security Management Council; Office of Policy and Management; Connecticut Emergency Response Commission	network that allows for the exchange of information among public safety and criminal justice entities.
General Statutes of Connecticut: Title 16, Public Service Companies; Connecticut eRegulations System: Title 16, Public Service Companies	Public Utilities Regulatory Authority within the CT DEEP; Nuclear Energy Advisory Council; Connecticut Siting Council	Regulates electric, gas, telephone, pipeline, sewage, water, and community antenna television companies with respect to rates and charges, services, accounting practices, safety, and operations; oversees standards for power systems using cogeneration technology and renewable fuel resources; regulates the safety and operation of the nuclear power generating facilities; promotes the sharing of towers wherever technically, legally, environmentally, and economically feasible.
General Statutes of Connecticut: Title 13a, Highways and Bridges; Title 13b, Transportation; Title 15, Navigation and Aeronautics; Title 16, Public Service Companies; Connecticut eRegulations System: Title 13a, Highways and Bridges; Title 13b, Transportation; Title 15, Navigation and Aeronautics; Title 16, Public Service Companies	Connecticut Department of Transportation (ConnDOT); Connecticut Public Transportation Commission; DEEP; Department of Economic and Community Development; Department of Administrative Services; State Properties Review Board; Connecticut Transportation Authority; Connecticut Airport Authority; Tweed-New Haven Airport Authority; Connecticut Maritime Commission; State Maritime Office; Connecticut Pilot Commission; Connecticut Transportation Strategy Board; Connecticut Commuter Rail Council	Oversees the development and operation of the state's highway, mass transit, marine, and aviation facilities and services including the planning, alteration, repair, or expansion of any real asset; ensures the development and maintenance of adequate rail, bus, and motor carrier facilities and services including the adequacy of such services for elderly and disabled users; licenses airports, heliports, restricted landing areas, and other air navigation facilities; regulates operators' licenses; oversees maritime polices and operations including ports, harbors, and navigable waterways and the construction of bridges over the navigable waters of the state.
General Statutes of Connecticut: Title 25, Water Resources, Flood and Erosion Control; Connecticut eRegulations System: Title 25, Water Resources, Flood and Erosion Control	Department of Public Health; DEEP; Public Utilities Regulatory Authority; Water Planning Council	Oversees water supplies and water companies, treatment plants, and water distribution systems; regulates the purity and adequacy of the public drinking water supply including all springs, streams, watercourses, brooks, rivers, lakes, ponds, wells, or underground waters from which water is taken; the safety of any distributing plant and system; and the adequacy of methods used to assure water purity; issues permits for the use of water company land to allow for telecommunications antennas and towers used in the provision of personal wireless services.

Source: (CGA, 2017a)

3.1.1.3. Transportation

This section describes the transportation infrastructure in Connecticut, including specific information related to the road networks, airport facilities, rail networks, harbors, and ports. (This PEIS defines "harbor" as a body of water deep enough to allow anchorage of a ship or boat.) The movement of vehicles is commonly referred to as traffic, as well as the circulation along roads. Roadways can range from multilane road networks with asphalt surfaces to unpaved gravel or private roads. The information regarding existing transportation systems in Connecticut are based on a review of maps, aerial photography, and federal and state data sources.

The Connecticut Department of Transportation (ConnDOT) has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state; local counties have jurisdiction for local streets and roads. The mission of the ConnDOT is "to provide a safe and efficient intermodal transportation network that improves the quality of life and promotes economic vitality for the state and the region." (ConnDOT, 2015a)

Connecticut has an extensive and complex transportation system across the entire state. The state's transportation network includes:

- 21,390 miles of highways and 5,266 bridges (ConnDOT, 2012a);
- Over 628 miles of passenger and freight rail network (ConnDOT, 2012b);
- 114 aviation facilities, including airstrips and heliports (FAA, 2015a);
- 43 harbors (FHWA, 2015a); and
- 2 major ports (ConnDOT, 2012a).

Road Networks

As identified in Figure 3.1.1-1, the major urban centers in Connecticut are Hartford-West Hartford in the middle third of the state, and New Haven-Bridgeport in the western portion of the state (U.S. Census Bureau, 2013). Connecticut has three major interstates connecting its major metropolitan areas to one another, as well as to other states. Travel to local towns is conducted mainly via state and county routes (ConnDOT, 2012a). Table 3.1.1-2 lists the interstates and their start/end points in Connecticut. Per the national standard, even numbered interstates run from west to east with the lowest numbers beginning in the south; odd numbered interstates run from north to south with the lowest numbers beginning in the west (FHWA, 2015a).

Table 3.1.1-2: Connecticut Interstates

Interstate	Southern or Western Terminus in Connecticut	Northern or Eastern Terminus in Connecticut
I-84	NY line near Danbury	MA line near Union
I-91	I-95 at New Haven	MA line at North Thompsonville
I-95	NY line near Greenwich	RI line near North Stonington

Sources: (FHWA, 2015a)

In addition to the Interstate System, Connecticut has both National Scenic Byways and State Scenic Roads. Both National Scenic Byways and State Scenic Roads are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic

qualities. Figure 3.1.1-1 illustrates the major transportation networks, including roadways in Connecticut. Section 3.1.8, Visual Resources, describes the National Byways and State Scenic Roads found in Connecticut from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the U.S. Department of Transportation's (DOT) Federal Highway Administration designates and manages these byways. Connecticut has two National Scenic Byways, Connecticut State Route 169 and Merritt Parkway (ConnDOT, 2010).

Connecticut Scenic Roads are roads with statewide interest; Scenic Roads are designated and managed by the ConnDOT. Connecticut has 63 State Scenic Byways (ConnDOT, 2010), as presented in Table 3.1.1-3.

Airports

A number of nearby major international airports, including John F. Kennedy International Airport and LaGuardia Airport in New York City, NY, and Logan International Airport in Boston, MA, provide air service to the state. Bradley International Airport (BDL), outside Hartford, is the state's only commercial service airport. In 2013, BDL had 5.4 million passengers, which is a 1 percent total growth compared to 2012 (Connecticut Airport Authority, 2014a).

In 2011, the state created the Connecticut Airport Authority (CAA), which is "an independent, quasi-public agency" that owns, operates, and develops BDL, as well as the state's five general aviation airports (ConnDOT, 2015b) (Connecticut Airport Authority, 2014b). Figure 3.1.1-1 illustrates Connecticut's major transportation networks, including BDL's location. Section 3.1.7, Land Use, Recreation, and Airspace provides additional detail on Connecticut airports and airspace.

Rail Networks

Connecticut is connected to an extensive network of passenger rail (Metro-North Railroad and Amtrak), public transportation (commuter rail), and freight rail. Metro-North Railroad and Amtrak operate under contract with ConnDOT. Connecticut has 628.5 miles of railroad tracks: 246.2 miles are privately owned and 382.3 miles are publically owned (ConnDOT, 2012b). "On an annual basis, the rail system moves 3.6 million gross tons of freight over 10 freight railroads that operate in the state, 3.5 million intercity rail passengers over the NEC [Northeast Corridor] lines owned and operated by Amtrak, and 20 million commuter rail passengers over the NHL [New Haven Line] and SLE [Shore Line East] services" (ConnDOT, 2012b). Several commuter lines traverse Connecticut, including the New Haven Line (operated by Metro-North Railroad), Shore Line East, and New Haven Line (ConnDOT, 2015c). Figure 3.1.1-1 illustrates the major transportation networks, including rail lines, in Connecticut.

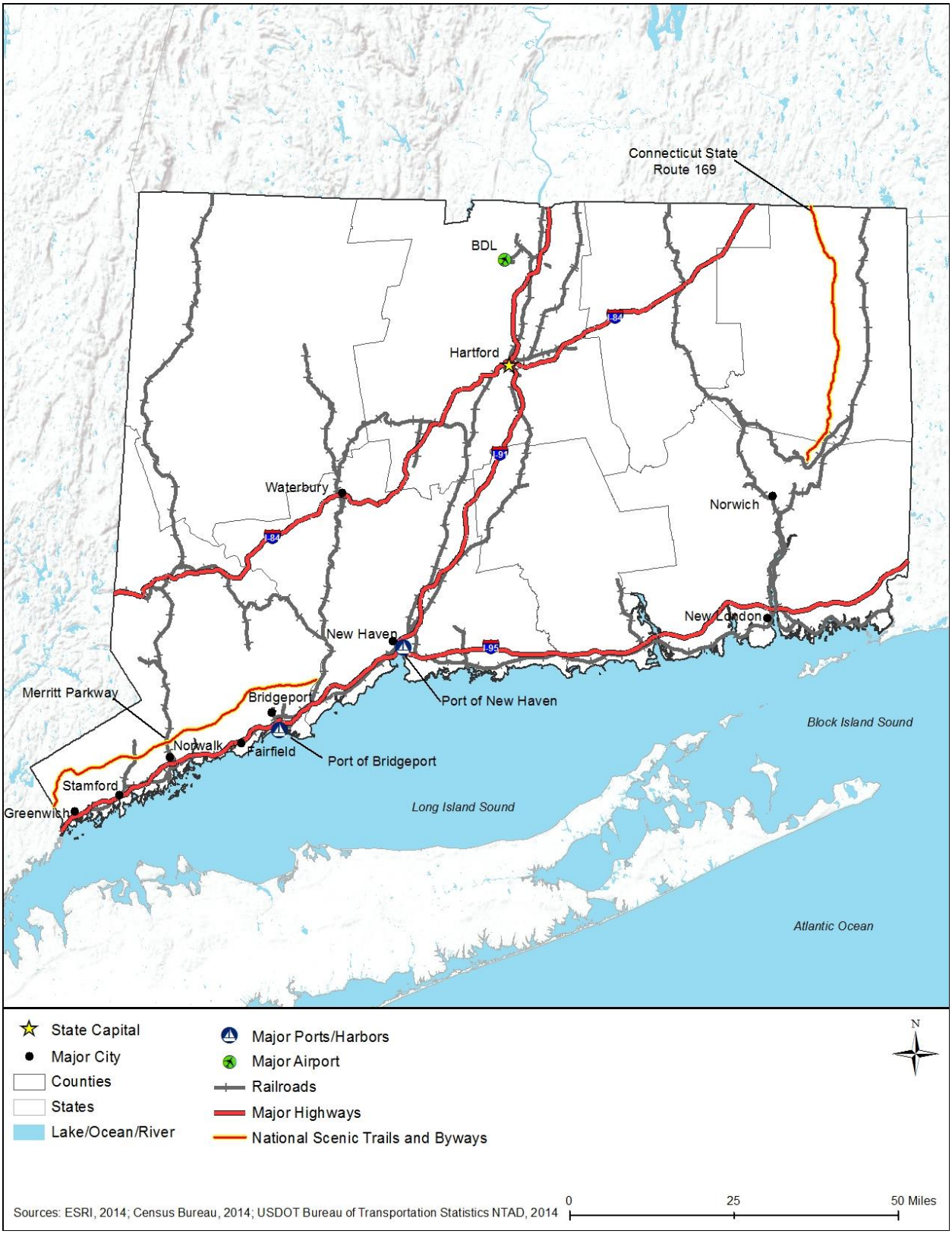


Figure 3.1.1-1: Connecticut Transportation Networks

Table 3.1.1-3: Connecticut State Scenic Roads

Route	Town	Miles	Location
1	Madison	2.3	From Neck Road #2 north to Lovers Lane
4	Sharon	3.10	From Route 7 west to Dunbar Road
4	Sharon	0.80	From Dunbar Road west to Old Sharon Road
4 118	Harwinton	1.60 0.10	From Cooks Dam west to Route 118. From Route 4 west to Cemetery Road
7	Sharon	4.29	From the Cornwall Bridge crossing of the Housatonic River north to Route 128 at the covered bridge
7	Kent	10.50	From the New Milford town line north to the Cornwall town line
7	Cornwall	3.56	From the Kent town line north to Route 4
7	Sharon, Salisbury, Canaan	10.26	From Route 128 north to the North Canaan town line
10	Farmington	1.0	From Route 4 south to Tunxis Street
14	Windham, Scotland	4.40	From the Windham Center School to 0.3 mi. east of Scotland Center
14A	Sterling	0.70	From Route 49 east to Porter Pond Road
17	Durham	1.40	From Route 77 north to 125 feet north of Talcott Lane
27	Stonington, Groton	0.83	From 0.25 miles north of Jerry Browne Road, north to Route 184
33	Wilton	4.90	From the Wilton/Ridgefield town line south to the intersection with Old Ridgewood Road #1
41	Sharon	4.00	From Boland Road north to Cole Road
41	Sharon	2.20	From Cole Road north to the Sharon/Salisbury town line
41	Sharon	2.20	From Boland Road south to the New York state line
41	Salisbury	8.01	From the Sharon/Salisbury town line north to the Massachusetts state line
44	Salisbury	8.83	From the New York state line east to the Salisbury/North Canaan town line
45	Washington	0.5	From the intersection with Route 202, northerly to the southern limit of the section noted below
45 SR 478	Washington Warren	6.90	From the Washington/Kent town line on SR 478, east to Route 45, north on Route 45 to the northern junction of SR 478, and west on SR 478 to the Warren/Kent town line
SR 478	Kent	1.0	From the Washington/Kent town line north to the Warren/Kent town line
49	North Stonington	10.90	From Route 184 north to 0.10 miles before Route 165
49	Voluntown	7.90	From the Boat Launch area north to Route 14A
53	Redding	2.03	From the Redding/Weston town line north to the southern junction of Route 107
58	Easton	3.14	From the Fairfield/Easton town line north to Freeborn Road
63	Litchfield	3.37	From the Morris town line north to Sarcka Lane
67	Roxbury	0.87	From Ranny Hill Road south to 0.30 miles south of Route 317
67	Roxbury	2.90	From the Roxbury/Bridgewater town line east to Ranny Hill Road
75	Suffield	4.30	From the southern end of the bridge over Stony Brook north to the Massachusetts state line
77	Guilford	11.56	From Route 146 north to the Durham/Guilford town line
77	Durham	2.3	From the Durham/Guilford town line north to Route 17.
80	Madison	2.0	From the Killingworth town line, westerly to Squire's Road
82	Haddam E. Haddam	0.29	From the Haddam shoreline of the Connecticut River east to Route 149 (includes the swing bridge
97	Pomfret	4.50	From Route 44 north to Route 169

Route	Town	Miles	Location
118	Litchfield	2.77	From Clark Road west to Route 63
146	Branford, Guilford	12.20	From Eades Street, Branford to U.S. Route 1, Guilford
148	Chester	1.60	From the Chester shoreline, easterly via the Chester-Hadlyme Ferry to its intersection with Route 82 in Lyme
149	East Haddam	2.31	From Route 82 north to Creek Row
151	East Hampton	1.51	From 1.0 mile north of SSR439/Hurd Park Road north to Route 66
154	Haddam	9.16	From the Chester/Haddam town line north to the Haddam/Middletown town line
154	Old Saybrook	6.10	From Route 1, north to Old Boston Post Road
156	East Haddam	6.24	From Route 82 in East Haddam easterly to the Lyme/Old Lyme town line
160	Glastonbury	1.06	From the Roaring Brook Bridge west to the Connecticut River
164	Preston	2.58	From Old Shetucket Turnpike north to the Preston/Griswold town line
179	Canton	0.30	From the Burlington/Canton town line to the junction with SR 565
181	Barkhamsted	1.10	From Route 44 north to Route 318
183	Colebrook	3.10	From Route 182 north to Church Hill Road
202	New Hartford	5.10	From the Canton/New Hartford town line west to the Bakersville Methodist Church
202	Litchfield	0.47	From Route 118 west to Russell Street
202	Washington	2.8	From Rabbit Hill Road, southerly to Route 45
203	Windham	1.70	From Route 32 northerly to Route 14, Windham Center Green
219	Barkhamsted	2.60	From Route 318 south to the end of Lake McDonnough Dam
219	New Hartford	0.70	From the Lake McDonnough Dam southerly to the south side of the "Green Bridge" (Br. No. 1561)
234	Stonington	3.16	From North Main Street west to Route 27
244	Pomfret	3.10	From Route 97 westerly to Ragged Hill Road
254	Litchfield	3.98	From Camp Hill Road in Northfield west to Route 118
272	Norfolk	11.00	From the Norfolk/Goshen town line north to the Massachusetts state line
317	Roxbury	0.40	From Painter Hill Road west to Route 67
318	Barkhamsted	2.60	From Route 181 to Route 219
SSR 431	Lyme	0.26	From its intersection with Route 148 in Lyme northerly to the Lyme/East Haddam town line
SSR 431	East Haddam	0.54	From the Lyme/East Haddam town line northerly to the entrance to Gillette Castle State Park
565	Canton	0.70	From Route 179 northeast to Allen Place

Source: (ConnDOT, 2010)

Amtrak runs several lines through Connecticut, including the Acela Express and Northeast Regional, which is a popular line, with routes running from Washington, DC to Boston in 6 hours 40 minutes and 7 hours 50 minutes, respectively (Amtrak, 2015a) (Amtrak, 2015b). Table 3.1.1-4 provides a complete list of Amtrak lines that run through Connecticut.

According to the New York State Department of Transportation, with close to 82 million passengers reported in 2011, Metro-North railroad is the nation's busiest commuter railroad. Metro-North's three lines radiate out from its hub in Manhattan, Grand Central Station. One of those lines runs into Connecticut: the New Haven line runs northeast from Grand Central to New Haven, with select extensions to New Canaan, Danbury, and Waterbury. In addition, Amtrak has a contract with Connecticut to provide a daily commuter service called the Shore Line East Commuter. The Shore Line East Commuter rail runs along the shoreline of the Long

Island Sound from New Haven to New London (ConnDOT, 2012b). The New Haven Line and Shore Line East Commuter serve approximately 20 million commuter rail passengers annually (ConnDOT, 2012b).

Connecticut has 10 privately owned freight railroad companies operating in the state. These 10 companies own most of the freight rail infrastructure in Connecticut (ConnDOT, 2012b).

Table 3.1.1-4: Amtrak Train Routes Serving Connecticut

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in Connecticut
Acela Express	Boston, MA	Washington, DC	6 hours 40 minutes	New Haven (2 hours 10 minutes), Stamford (2 hours 45 minutes)
Northeast Regional	Boston, MA	Virginia Beach, VA	12 hours 30 minutes	New Haven (2 hours 45 minutes), Stamford (3 hours 30 minutes)
Vermonter	St. Albans, VT	Washington, DC	13 hours 30 minutes	Hartford (7 hours), New Haven (7 hours 50 minutes), Stamford (9 hours)

Sources: (Amtrak, 2015a) (Amtrak, 2015b)

Harbors and Ports

The Bureau of Public Transportation of ConnDOT supervises the ports and ferries in the state of Connecticut. Connecticut has 43 harbors and 2 major ports on Long Island Sound: Port of Bridgeport and Port of New Haven (ConnDOT, 2015d). As shown in Figure 3.1.1-1, the Port of Bridgeport in the western Long Island Sound and the Port of New Haven is in Central Long Island Sound. Two commercial ferry services connect Connecticut to New York. The Cross Sound Ferry runs between New London, CT and Orient Point, NY. The Bridgeport-Port Jefferson Ferry operates between Bridgeport, CT and Port Jefferson, NY (ConnDOT, 2013a). ConnDOT operates two seasonal ferry services that cross the Connecticut River, between Rocky Hill and Glastonbury and between Chester and Hadlyme (ConnDOT, 2014).

The Port of Bridgeport is accessible via I-95, which runs parallel to the Connecticut shoreline. The port has 20 acres of outdoor storage space, 130,000 square feet of indoor dry storage, and 85,000 square feet of refrigerated warehouse storage (ConnDOT, 2005a). In 2013, the Port of Bridgeport imported 222.3 thousand tons of cargo worth $12.1 million (M) and exported less than $0.5 M in goods (U.S. Census Bureau, 2015d).

The Port of New Haven is also along I-95, and is served by the Providence and Worcester Railroad, which connects to Conrail and New England Railroad, Canadian National Railway, and Canadian Pacific rail lines. Port of New Haven facilities include 400,000 square feet of indoor storage and 50 acres of outdoor storage (ConnDOT, 2005b). According to U.S. Census data from 2013, the Port of New Haven imported 2 million tons of cargo worth $2.27 billion (B) and exported 461 thousand tons of cargo worth $148.6 M (U.S. Census Bureau, 2015d).

The U.S. Census Bureau also lists Hartford and New London as handling small amounts of cargo in 2013. The City of Harford imported less than half a million dollars in cargo and exported approximately $37 M. The city of New London imported $102 M and exported less than half a million dollar in cargo. (U.S. Census Bureau, 2015d)

3.1.1.4. Public Safety Services

Connecticut public safety services generally consist of public safety infrastructure and first responder personnel throughout the state. The general abundance and distribution of public safety services may roughly follow key state demographic indicators. Table 3.1.1-5 presents Connecticut's key demographics including estimated population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 3.1.9, Socioeconomics.

Table 3.1.1-5: Key Connecticut Indicators

Connecticut Indicators	
Estimated Population (2014)	3,596,677
Land Area (square miles) (2010)	4,842.36
Population Density (persons per sq. mile) (2014)	743
Municipal Governments (2013)	30
Cities and Towns (2007)	169

Sources: (U.S. Census Bureau, 2015c) (State of Connecticut, 2015b) (National League of Cities, 2007)

Table 3.1.1-6 presents Connecticut's public safety infrastructure, including fire and police stations. Table 3.1.1-7 identifies first responder personnel, including dispatch, fire and rescue, and law enforcement, and emergency medical personnel in the state.

Table 3.1.1-6: Public Safety Infrastructure in Connecticut by Type

Infrastructure Type	Number
Fire and Rescue Stations	793
Law Enforcement Agencies	120
Fire Departments	542

Source: (U.S Fire Administration, 2015)

Table 3.1.1-7: First Responder Personnel in Connecticut by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers	1,460
Fire and Rescue Personnel	14,834
Law Enforcement Personnel	21,982
Emergency Medical Technicians and Paramedics	3,240

Sources: (U.S Fire Administration, 2015) (BLS, 2015a)

3.1.1.5. Telecommunications Resources

Telecommunication resources in Connecticut can be divided into two primary categories: specific public safety communications infrastructure and commercial telecommunications infrastructure (FCC, 2015a) (BLS, 2016). There is no central repository of information for either category; therefore, the following information and data are combined from a variety of sources, as referenced.

In general, the deployment of telecommunications resources in Connecticut is widespread and similar to other states in the United States. Communications throughout the state are based on a variety of publicly and commercially owned technologies, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems providing voice, data, and video services (BLS, 2016).

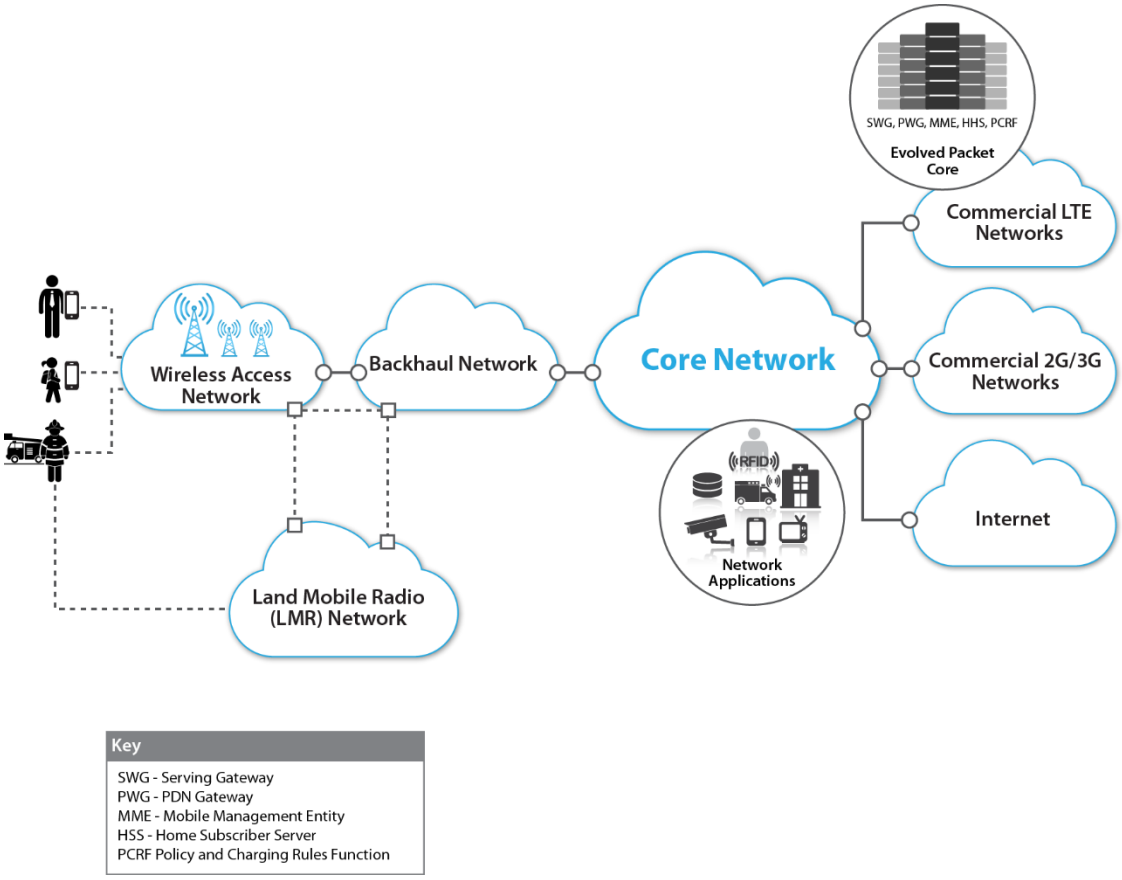
Figure 3.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including an LTE evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as long term evolution (LTE) (see Section 2.1.1), has the potential to provide users with better coverage, while offering additional capacity and enabling the use of new applications that would likely make their work safer and more efficient. Designing such a network presents several challenges due to the uniqueness of the deployment, the requirements, and the nationwide scale (NIST, 2015). Historically, there have been many challenges and impediments to timely and effective sharing of information, including jurisdictional challenges, funding challenges, the pace of technology evolution, and communication interoperability. Communication interoperability has been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (National Task Force on Interoperability, 2005). This has caused a fragmented approach to communications implementation among states, including in Connecticut. There are five key reasons why public safety agencies often cannot connect through existing communications (National Task Force on Interoperability, 2005):

- Incompatible and aging communications equipment;
- Limited and fragmented funding;
- Limited and fragmented planning;
- A lack of coordination and cooperation; and
- Limited and fragmented radio spectrum.

To help enable the public safety community to incorporate disparate Land Mobile Radio (LMR) networks into a nationwide public safety LTE broadband network, in 2015, the U.S. Department of Commerce (DOC) Public Safety Communications Research (PSCR) – Boulder Laboratories, prepared a locations-based services (LBS) research and development roadmap to: (1) examine the current state of location-based technologies, (2) forecast the evolution of LBS capabilities and gaps, and (3) identify potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years (PSCR, 2015).



Prepared by: Booz Allen Hamilton

Figure 3.1.1-2: Wireless Network Configuration

Public safety communications in Connecticut are similar to those in other states and consist of a mix of older analog[2] and digital[3] narrowband networks supplemented by newer wireless digital capabilities as well as the deployment of upgraded microwave and fiber tower interconnection and aggregation network capacity. These assets support the introduction of new data, video, and multimedia services on a larger scale than in the past. Public safety wireless networks in Connecticut can be categorized as statewide, regional, or local/city-specific with uses spanning police, fire, health/EMS, emergency communications incident response, and mutual aid applications.

Connecticut's public safety and emergency communications networks operate across a diverse set of channels and licensed wireless frequencies including: Very High Frequency (VHF),[4] Ultra High Frequency (UHF),[5] 700 Megahertz (MHz), and 800 MHz (Connecticut Division of Emergency Management and Homeland Security, 2007). To support the planning and

[2] Analog networks are those based on circuit-switching, which establishes a connection and then maintains it through the whole communication. Although now digitized, the nation's original telephone system is an example of an analog network.
[3] Digital networks are those that allow for simultaneous digital transmission of voice, data, video, and other network services over the traditional public-switched telephone network, or over new 3G, 4G, or LTE wireless networks.
[4] VHF band covers frequencies ranging from 30 MHz to 300 MHz (NTIA, 2005).
[5] UHF band covers frequencies ranging from 300 MHz to 3000 MHz (NTIA, 2005).

implementation of its Statewide Public Safety Tactical Interoperable Communications Plans and its State Communications Interoperability Plan (Connecticut Division of Emergency Management and Homeland Security, 2007), Connecticut is organized around five geographically distinct regions, presented in Figure 3.1.1-3.

In 2010, Connecticut's Department of Information Technology was awarded a Broadband Technology Opportunity Program (BTOP) grant which resulted in the connection of 875 Public Safety Community Anchor Institutions (CAI) and connected 26 additional wireless towers with fiber (CT DEEP, 2013a). Figure 3.1.1-4, below, presents the public safety locations served as a result of the BTOP infrastructure grant, by county and by type, including: Department of Emergency Services and Public Protection, Public Safety Answering Points (PSAP), Police, Fire, and Tribal Police Departments.

The state initiated a pilot of Next-Generation 9-1-1 (NG 9-1-1) in 10 locations in 2015 to support Internet Protocol (IP)-based[6] text, wireless, and new communications calling services. It is estimated that 70 percent of 9-1-1 calls are from wireless phones (FCC, 2014a).

Statewide Networks

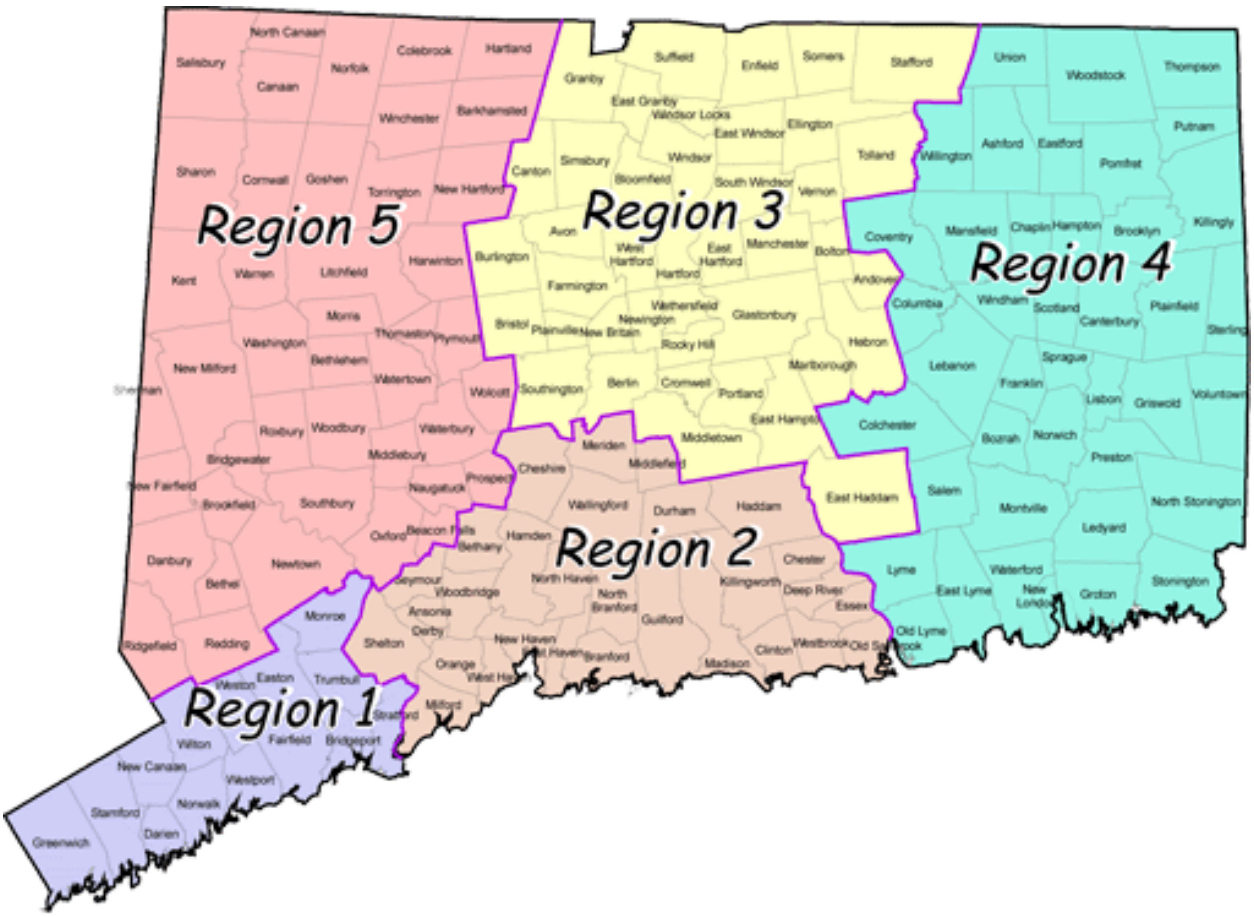
Connecticut's statewide radio system's digital Project 25 (P-25) network operational responsibility is under the Department of Public Safety's Connecticut Telecommunications System (CTS) organization, which designs, operates, and maintains the 108 MHz-700/800 MHz frequency network. The P-25 network contains 640 trunked base stations,[7] 189 Convention Channel Gateways,[8] 152 generators, and supports 12,000+ subscriber units. This radio system provides communications for nearly all Connecticut state agencies, municipal agencies, multiple federal agencies, and interoperability to 110 PSAPs (Connecticut Division of Emergency Management and Homeland Security, 2007).

The Connecticut State Police (CSP), via the CTS, operates a P-25 exclusively using Association of Public-Safety Communications Officials (APCO) 25/ Improved Multiband Excitation (IMBE) voice. The CTS organization upgraded the network controller equipment in of 2010 to enable the digital P-25 features. The Connecticut Statewide Police Emergency Network (CSPERN) is an 800 MHz statewide simulcast system controlled by the Connecticut State Police, which supports interagency emergency communications (Connecticut Division of Emergency Management and Homeland Security, 2007).

[6] The Internet Protocol (IP) "is designed for use in interconnected systems of packet-switched computer communications networks and provides for transmitting blocks of data called datagrams from sources to destinations" (FCC, 2015b).

[7] "Trunked single-site or multisite systems can be shared among a mix of users, with each type of user having an appropriate set of talk groups and priorities" (NTIA, 2015).

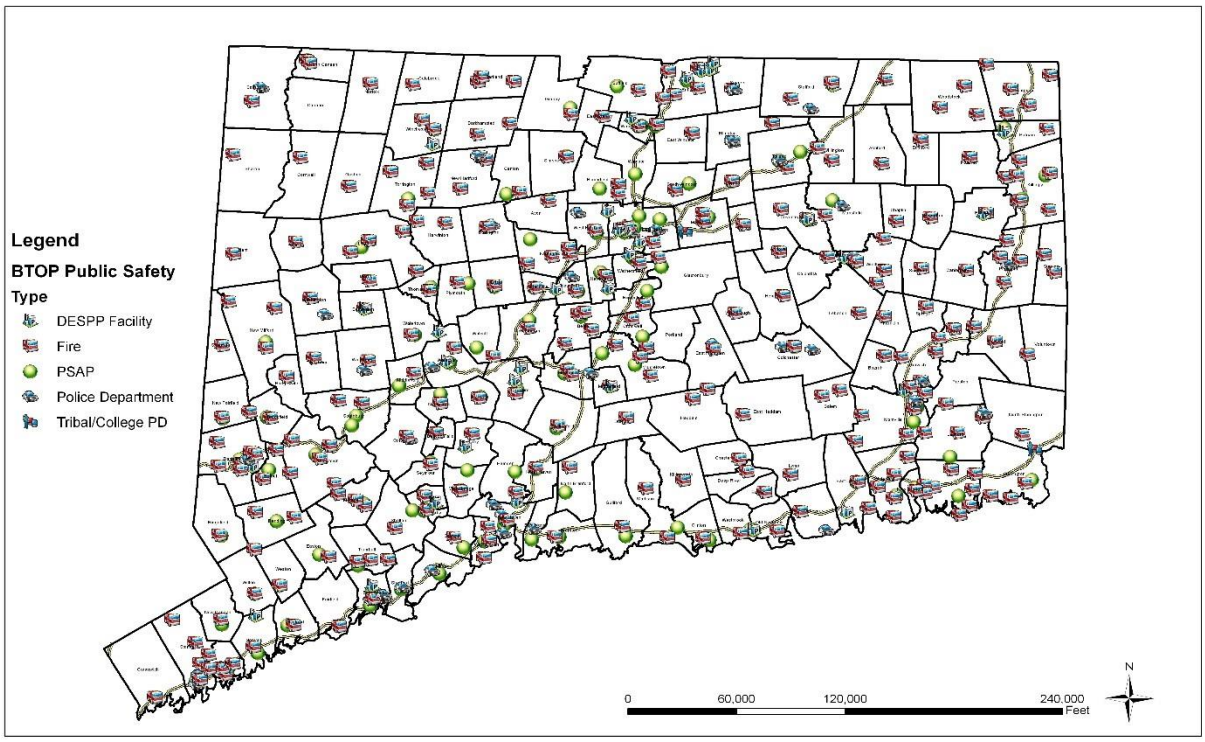
[8] Allows trunked system users to integrate analog conventional channels into dispatch systems without additional hardware or channels.



Source: (Connecticut Division of Emergency Management and Homeland Security, 2007)

Figure 3.1.1-3: Connecticut Geographical Regions

The Coordinated Medical Emergency Dispatch system (CMED) is a statewide network consisting of 13 regional EMS Communications systems using common channels operating on 10 UHF (450-512) MHz. CMED facilitates communications between EMS/ambulance and hospital/healthcare facilities (Connecticut Division of Emergency Management and Homeland Security, 2007). The Medical Network (MEDNET) System is statewide network designed to be a survivable two-way radio system to provide for communications between the states 13 CMED Centers. MEDNET utilizes the VHF frequency 155.340 MHz (Connecticut Division of Emergency Management and Homeland Security, 2007). The Statewide Low Band Mobile Fire Radio Network uses the common channel of 33.78 MHz, which allows interoperability between fire and rescue units that normally do not operate on a common frequency or to supplement primary network channels (Connecticut Division of Emergency Management and Homeland Security, 2007).



Source: (Connecticut Department of Administrative Services, 2012)

Figure 3.1.1-4: Public Safety Locations by Type Served by BTOP Grants

Regional Networks

The Regional Area Law Enforcement System consists of a series UHF and 800 MHz base stations configured as cross channel repeaters throughout the Region. Regional Area Law Enforcement System provides seamless communications between police department units, currently funded and operated under the auspices of the Capital Region Chiefs of Police Association and direct dispatch center to dispatch center communications (Connecticut Division of Emergency Management and Homeland Security, 2007).

The Northeastern Connecticut/Massachusetts/Rhode Island Local Police Network, a High Band VHF (150-160 MHz) regional network, links the Connecticut State Police, local police departments in Region 4, and local police departments in Massachusetts and Rhode Island. It is operated and funded by local police departments and the Connecticut Department of Public Safety (Connecticut Division of Emergency Management and Homeland Security, 2007).

State Tactical On-Scene Channel System is a tactical network leveraging 5 channels via a Cross band repeater unit which allows VHF-Hi, 800 MHz, and UHF radio frequencies to behave as one interoperable service in tactical cross-agency/unit situations. The coverage is either regional, multiregional or statewide depending upon the channel used (Connecticut Division of Emergency Management and Homeland Security, 2007).

Specialized Networks

Within each of the state's five regions, specialized wireless networks such as city-specific health/EMS radio networks serve defined coverage areas and populations. An example of such a network is New Haven's Public Health Network. The 16 public health departments in Region 2, serving the New Haven area, have developed a point-to-point UHF (450-512 MHz) radio network, utilizing a UHF channel operated by the City of New Haven Health Department. This network consists of a control station in each Health Department Command Center, which will allow point-to-point communications between them in the event of failure of the public switched telephone network. This installation also supports the regional CMED networks which allow direct radio communications between the regions health departments/districts and Region 2 hospitals and emergency health care facilities (Connecticut Division of Emergency Management and Homeland Security, 2007).

In addition to the statewide and regional mutual aid wireless networks in Connecticut cities and towns, fire, police, and health care facilities operate mutual aid and specialized wireless networks that support emergency communications and dispatch needs in localized service areas. Examples of such mutual aid networks include: (1) the Fairfield County Fire Radio System established as a common mutual aid radio system using the low band frequency 33.86 MHz in the 1960s (this legacy system is used less than in the past as fire departments have migrated to 150 MHz, 450 MHz and 800 MHz systems for their day-to-day operations), and (2) the Tolland County Mutual Aid Communications System, which is a combination of Low Band VHF and UHF transmitters linked to provide daily common voice communications for Fire and EMS service within its service area (Connecticut Division of Emergency Management and Homeland Security, 2007).

Commercial Telecommunications Infrastructure

Connecticut's commercial telecommunications industry and infrastructure is robust with multiple service providers, offering products and services via the full spectrum of telecommunications technologies (FCC 2014a and 2014b). The following sub-sections present information on Connecticut's commercial telecommunications infrastructure, including information on the number of carriers and technologies deployed; geographic coverage; voice, Internet access, and wireless subscribers; and the quantity and location of telecommunications towers, fiber optic plant, and data centers.

Carriers, Coverage, and Subscribers

Connecticut's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems as well as cable submarine systems for international connectivity. Table 3.1.1-8 presents the

number of providers of switched access[9] lines, Internet access,[10] and mobile wireless services including coverage.

Table 3.1.1-8: Telecommunications Access Providers and Coverage in Connecticut as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage
Switched access lines	123	98% of households
Internet access	36	68% of households
Mobile wireless	4	97% of population

Sources: (FCC, 2014c) (FCC, 2014b) (NTIA, 2014)

Table 3.1.1-9 shows the wireless providers in Connecticut along with their geographic coverage. The following two maps, Figures Figure 3.1.1-5 and Figure 3.1.1-6, show the combined coverage for the top two providers, AT&T and Verizon Wireless, and Sprint's and T-Mobile's coverage, respectively.

Table 3.1.1-9: Wireless Telecommunications Coverage by Providers in Connecticut

Wireless Telecommunications Providers	Coverage
AT&T Mobility	99.81%
Verizon Wireless	98.28%
Sprint	79.85%
T-Mobile	53.58%

Source*:* (NTIA, 2014)

[9] "A service connection between an end user and the local telephone company's switch; the basis of plain old telephone services (POTS)" (FCC, 2014b).
[10] Internet access includes DSL, cable modem, fiber, satellite, and fixed wireless providers.

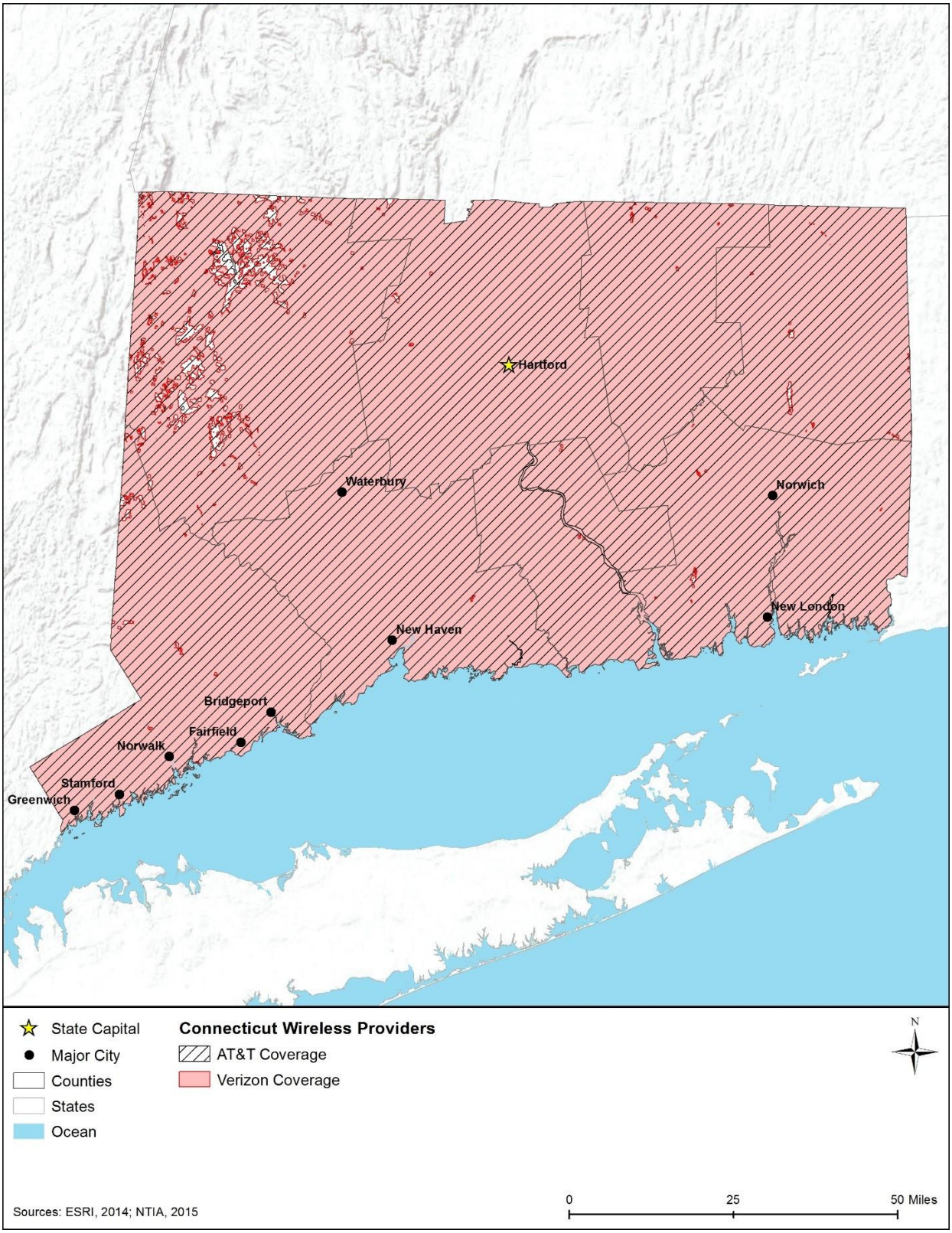


Figure 3.1.1-5: AT&T and Verizon Wireless Availability in Connecticut

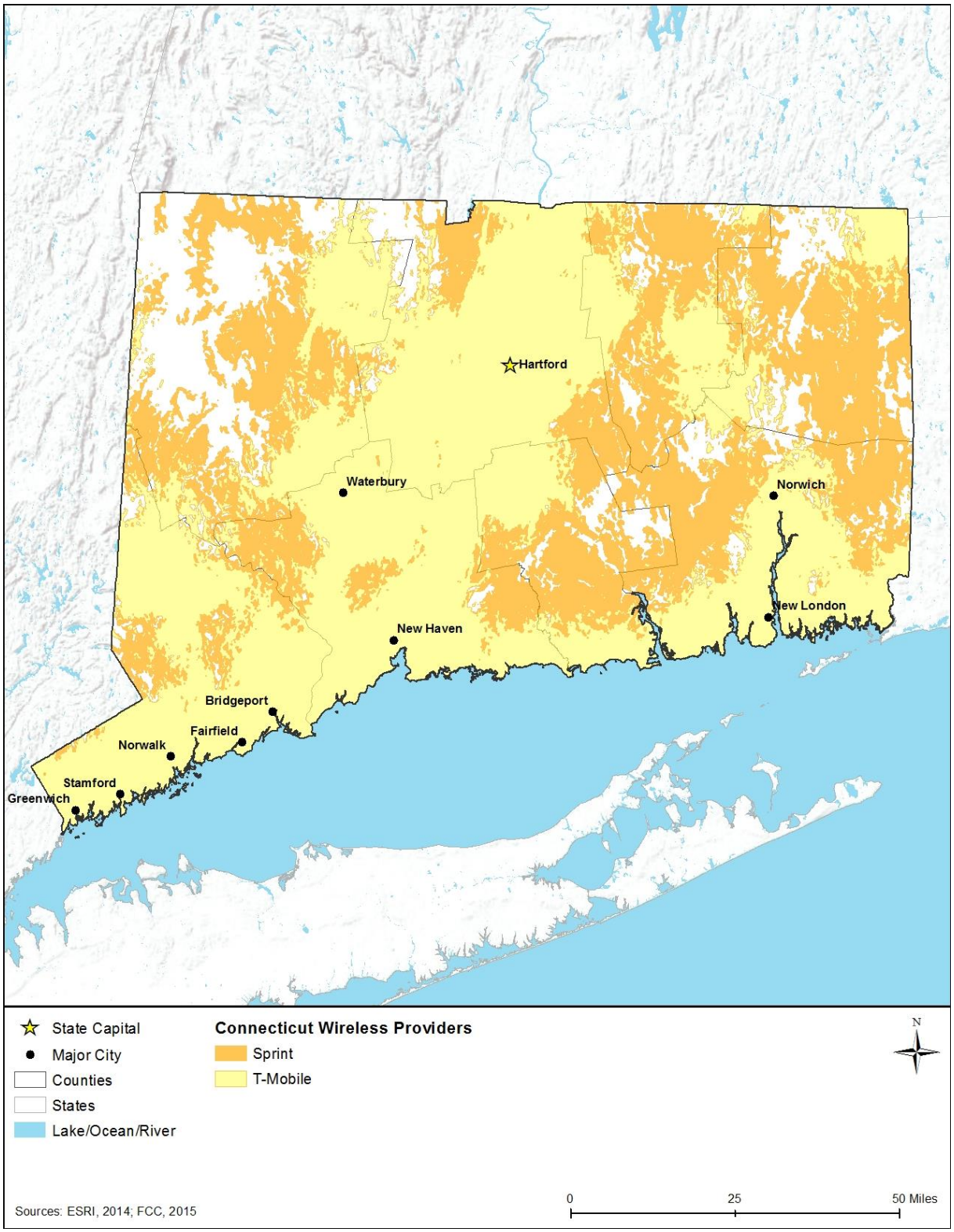


Figure 3.1.1-6: Sprint and T-Mobile Wireless Availability in Connecticut

Towers

There are many types of domestic towers employed today by the telecommunications industry, government agencies, and other owners. Towers are designed and used for a variety of purposes, and the height, location, and supporting structures and equipment are all designed, constructed, and operated according to the technical specifications of the spectrum used, the type of equipment mounted on the tower, geographic terrain, need for line-of-sight transmissions to other towers, radio frequency needs, and other technical specifications. There are three general categories of stand-alone towers: monopole, lattice, and guyed. Typically, monopole towers are the smallest, followed by lattice towers at a moderate height, and guyed towers at taller heights (with the guyed wires providing tension support for the taller heights) (CSC, 2007). In general, taller towers can provide communications coverage over larger geographic areas, but require more land for the actual tower site, whereas shorter towers provide less geographic coverage and require less land for the tower site (USFS, 2009a). Figure 3.1.1-7 presents representative examples of each of these categories or types of towers.

Monopole
100 – 200 feet
Source:
http://laps.noaa.gov/birk/laps_intranet/site_photos/Monarch/tower.jpg

Lattice
200 – 400 feet
Source: Personal Picture

Guyed
200 – 2,000 feet
Source:
http://www.esrl.noaa.gov/gmd/ccgg/insitu/

Figure 3.1.1-7: Types of Towers

Telecommunications tower infrastructure can be found throughout Connecticut, although tower infrastructure is concentrated in the higher and more densely populated areas of Hartford, New Haven, Waterbury, and New London. Owners of towers and some types of antennas are required to register those infrastructure assets with the Federal Communications Commission (FCC) (FCC, 2016b).[11] Table 3.1.1-10 shows the number of towers (including broadcast towers)

[11] An antenna structure must be registered with the FCC if the antenna structure is taller than 200 feet above ground level or may interfere with the flight path of a nearby airport (FCC, 2016b).

registered with the FCC in Connecticut. Figure 3.1.1-8 shows the location of those 339 structures, as of June 2015.

Table 3.1.1-10: Number of Commercial Towers in Connecticut by Type

Constructed[a] Towers[b]		**Constructed Monopole Towers**	
100ft and over	24	100ft and over	0
75ft – 100ft	32	75ft – 100ft	0
50ft – 75ft	93	50ft – 75ft	2
25ft – 50ft	124	25ft – 50ft	19
25ft and below	10	25ft and below	0
Subtotal	**283**	**Subtotal**	**21**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	1	100ft and over	0
75ft – 100ft	4	75ft – 100ft	2
50ft – 75ft	2	50ft – 75ft	2
25ft – 50ft	0	25ft – 50ft	1
25ft and below	0	25ft and below	1
Subtotal	**7**	**Subtotal**	**6**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	1	100ft and over	2
75ft – 100ft	3	75ft – 100ft	0
50ft – 75ft	3	50ft – 75ft	2
25ft – 50ft	6	25ft – 50ft	2
25ft and below	2	25ft and below	0
Subtotal	**15**	**Subtotal**	**6**
Constructed Tanks[d]			
Tanks	1		
Subtotal	**1**		
Total All Tower Structures		**339**	

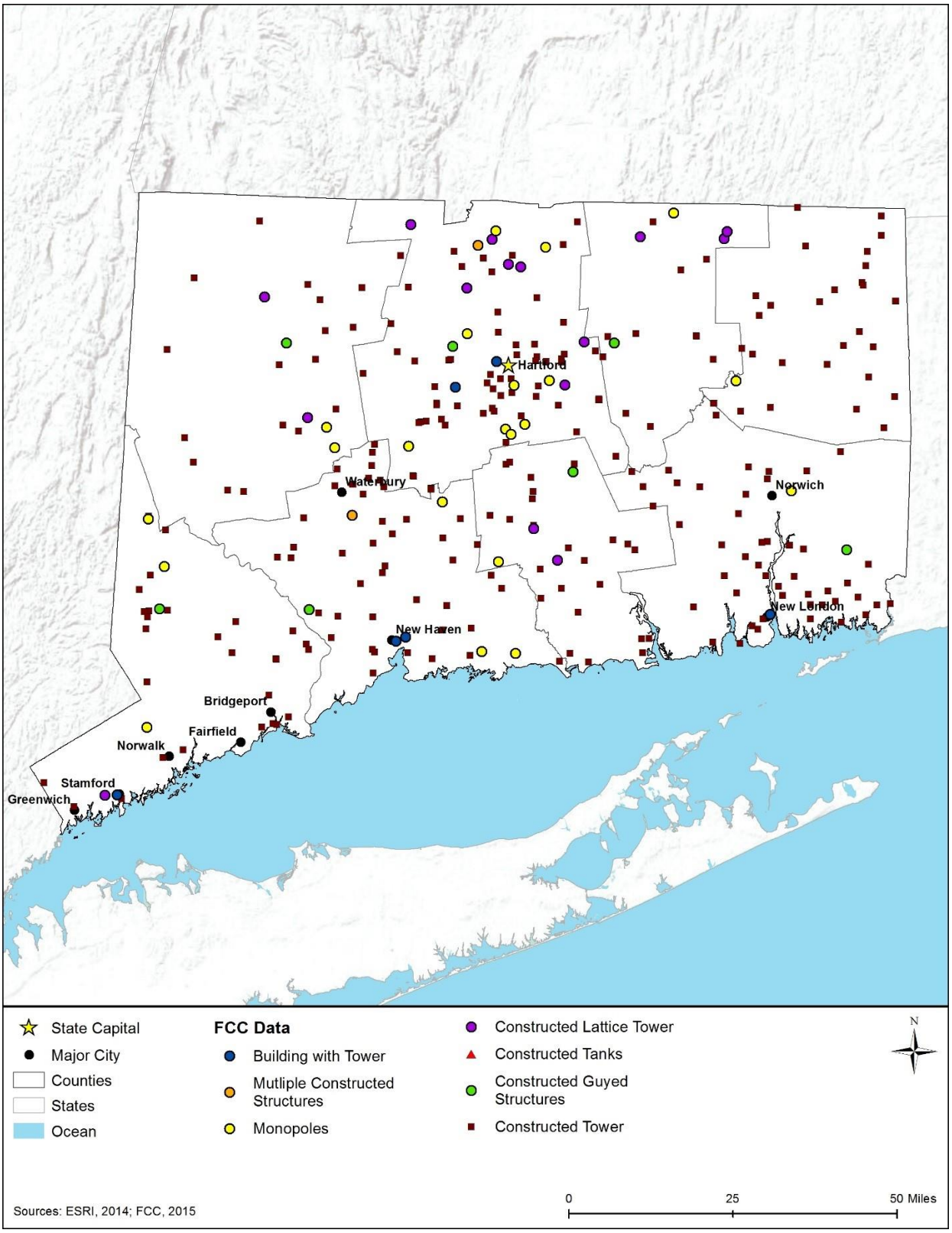
Source: (FCC, 2015c)

[a] Planned construction or modification has been completed. Results will return only those antenna structures that the FCC has been notified are physically built or planned modifications/alterations to a structure have been completed (FCC, 2015c)

[b] Free standing or guyed structure used for communication purposes (FCC, 2012)

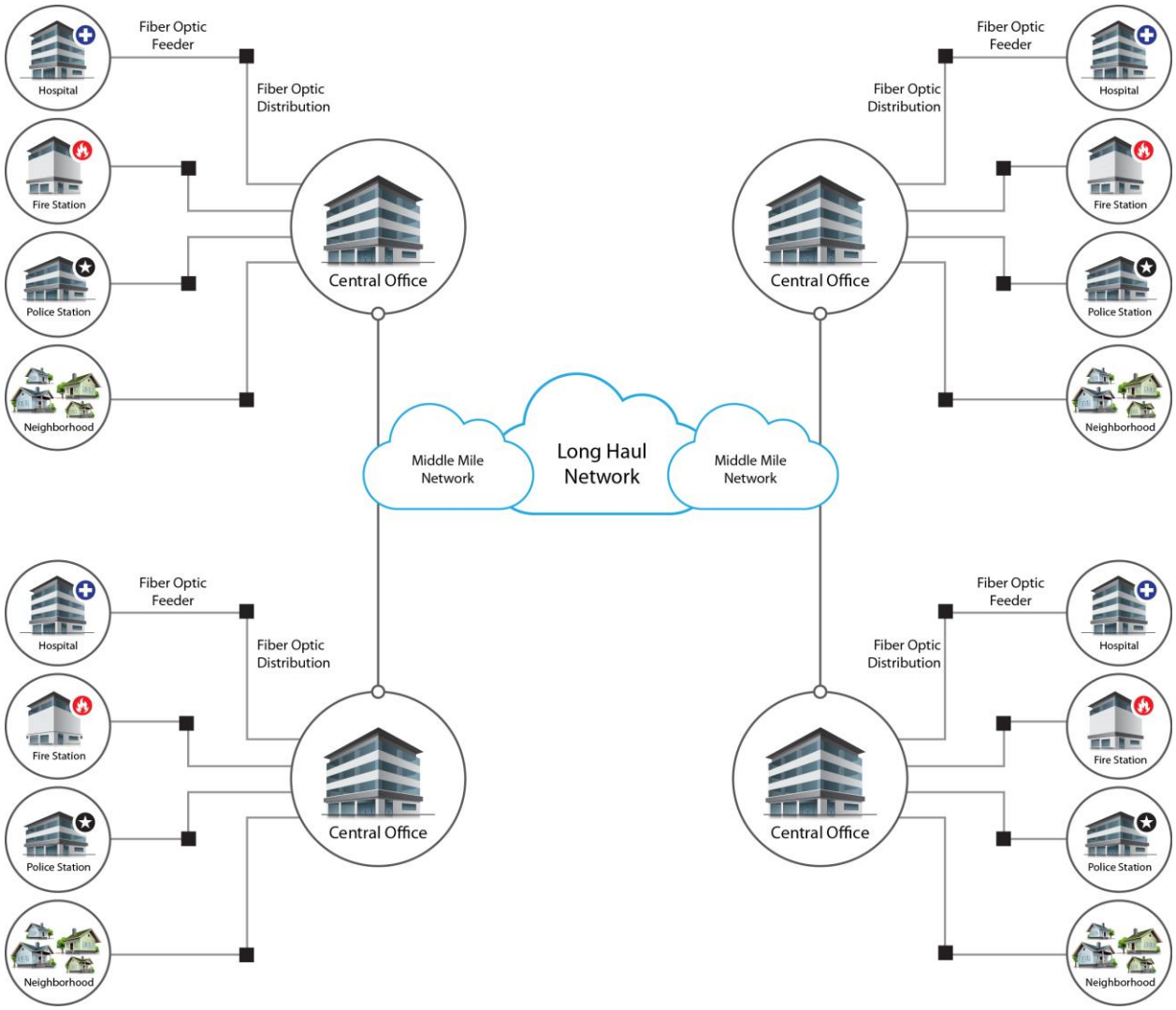
[c] Multiple constructed structures per antenna registration (FCC, 2016c)

[d] Any type of tank – water, gas, etc. with a constructed antenna (FCC, 2016c)



Source: (FCC, 2015c)

Figure 3.1.1-8: FCC Tower Structure Locations in Connecticut



Prepared by: Booz Allen Hamilton

Figure 3.1.1-9: Typical Fiber Optic Network in Connecticut

Fiber Optic Plant (Cables)

Fiber optic plant, or cables, can be buried directly in the ground; pulled, blown, or floated into ducts, conduits, or innerduct (flexible plastic protective sleeves or tubes); placed under water; or installed aerially between poles, typically on utility rights-of-way (ROW). A fiber optic network includes an access network consisting of a central office, distribution and feeder plant (cables of various sizes directly leaving a central office and splitting to connect users to the network), and a user location, as shown in Figure 3.1.1-9. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).

Last Mile Fiber Assets

In Connecticut, fiber access networks are concentrated in the highest population centers as shown in the figures below. Sixteen fiber providers offer service in Connecticut (Table 3.1.1-11). Figure 3.1.1-10 shows coverage for AT&T East and Comcast; Figure 3.1.1-11 shows coverage for Fibertech, Charter Communications Inc., and MegaPath Corporation; Figure 3.1.1-12 shows coverage for Cablevision, Cox Communications, and MetroCast Communications of Connecticut LLC; and Figure 3.1.1-13 shows coverage for all providers with less than five percentage coverage area, respectively.

Table 3.1.1-11: Fiber Provider Coverage

Fiber Provider	Coverage
AT&T East	78.09%
Comcast	37.70%
Fibertech	32.74%
Charter Communications Inc.	23.18%
MegaPath Corporation	19.60%
Cablevision	14.46%
Cox Communications	9.48%
MetroCast Communications of CT, LLC	5.50%
Other[a]	3.85%

Source: (NTIA, 2014)

[a] Provider with less than 5% coverage area: Thames Valley Communications; Level 3 Communications, LLC; Verizon New York Inc.; Lightpath; Connecticut Education Network; Broadview Networks, Inc.; XO Communications Services, Inc. (Affiliated Entity); Cogent Communications, Inc.; Zayo Group, LLC

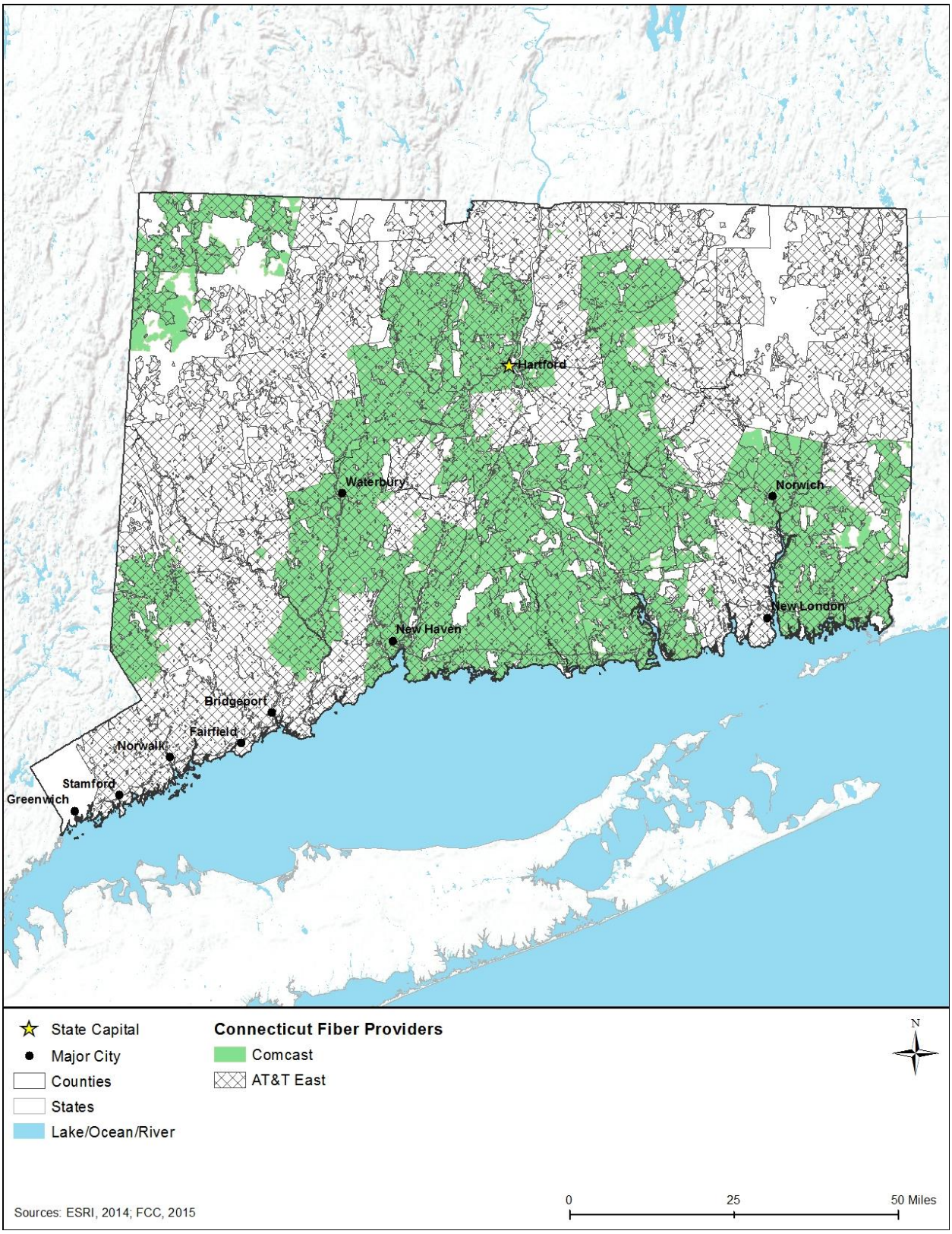


Figure 3.1.1-10: Fiber Availability in Connecticut for AT&T and Comcast

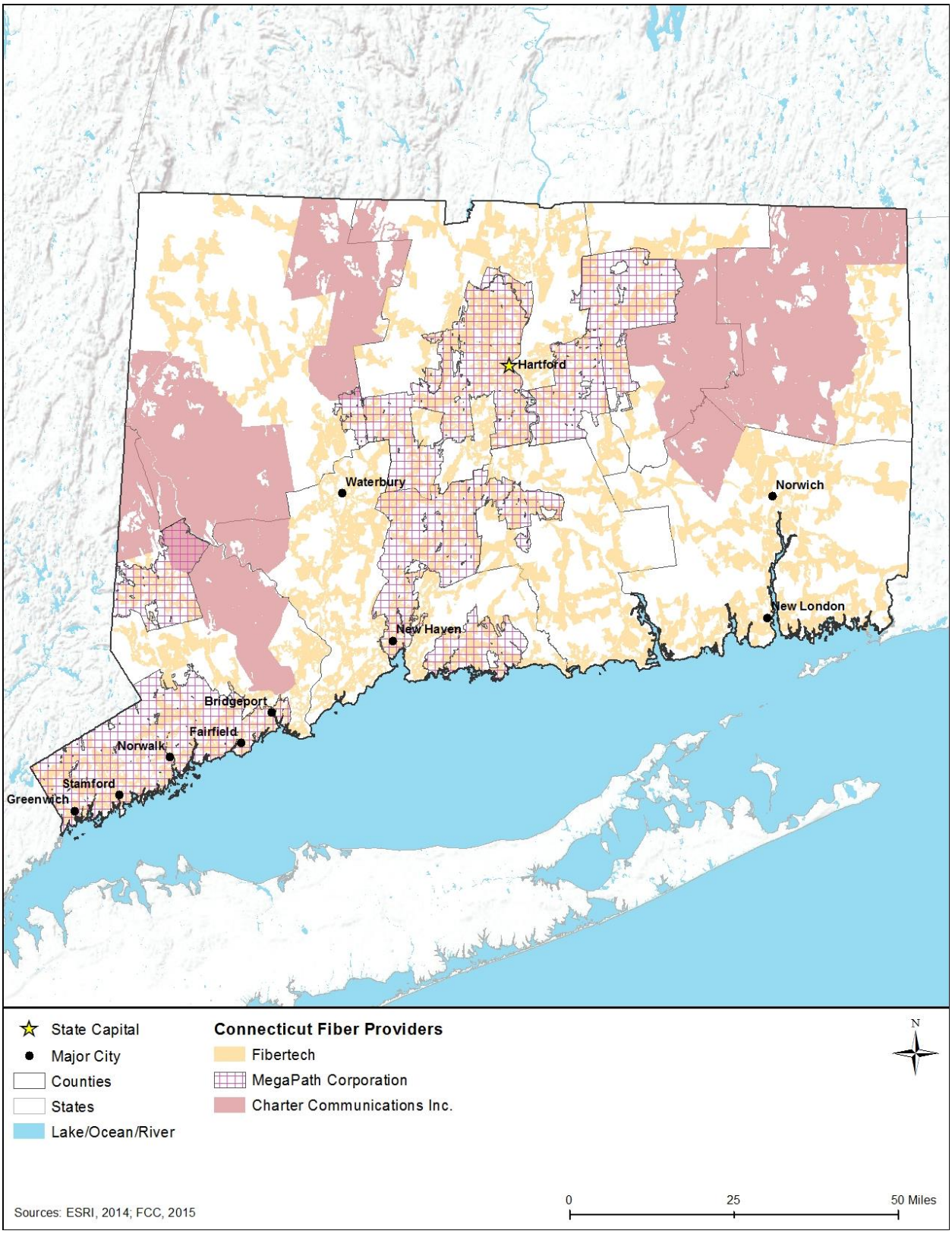
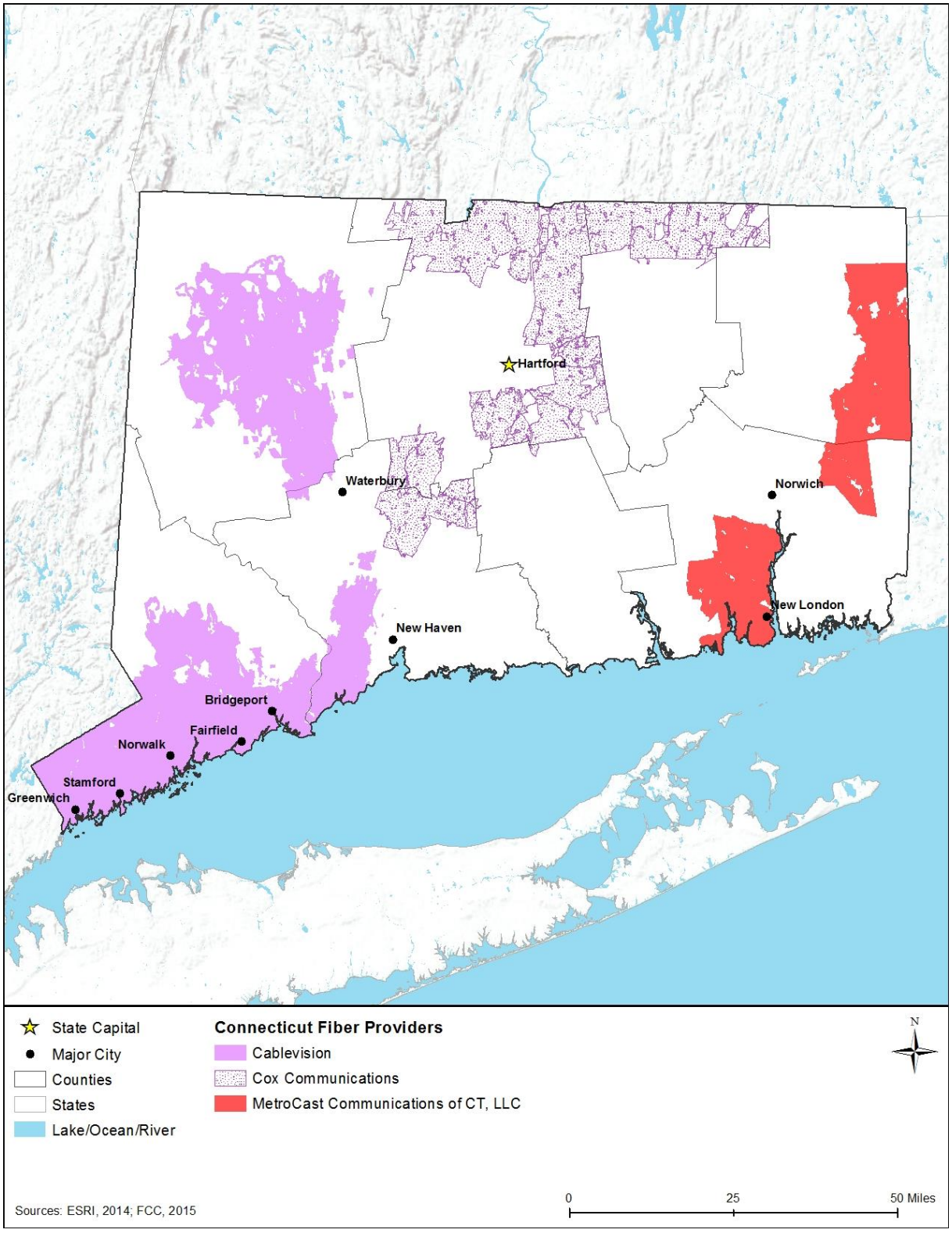
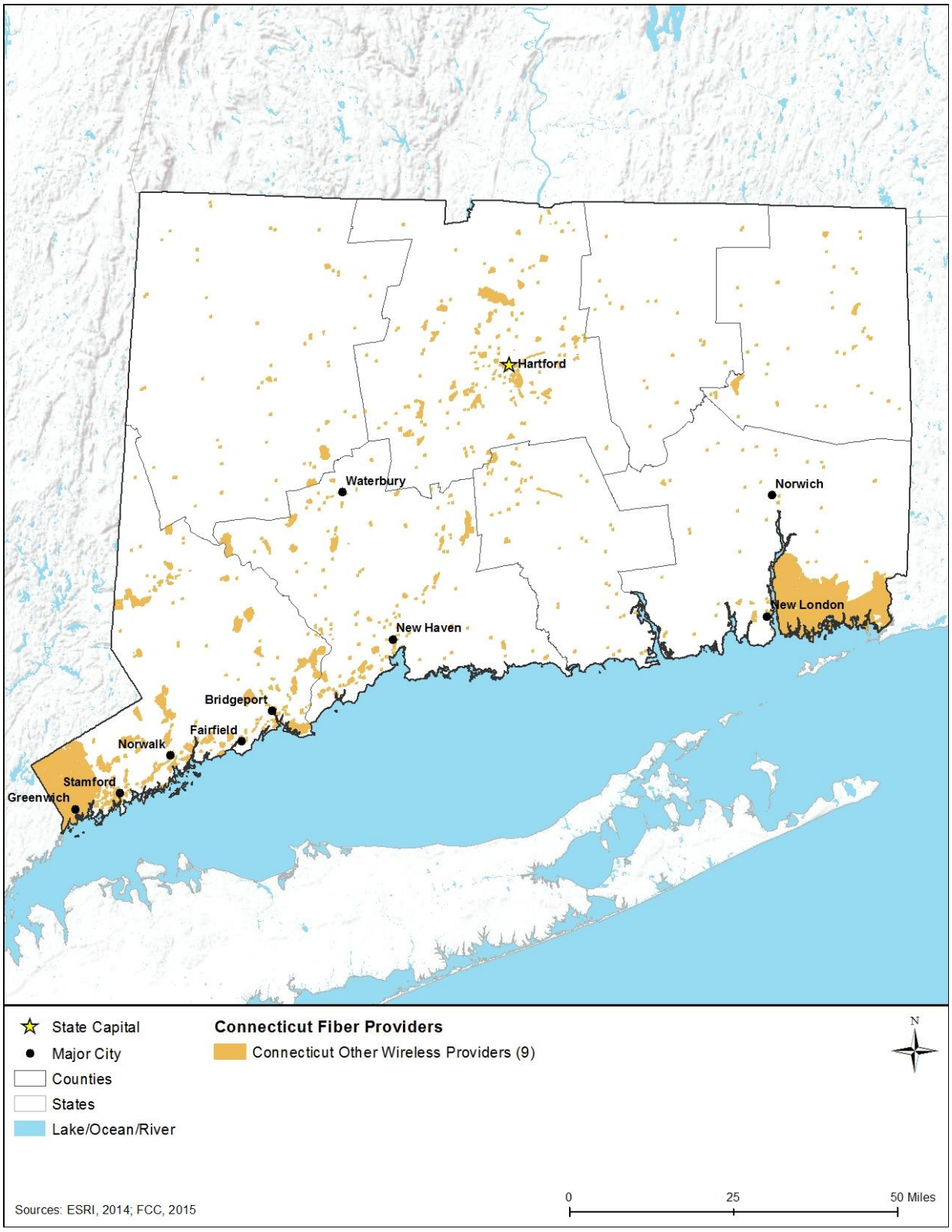


Figure 3.1.1-11: Fibertech, MegaPath, and Charter Communications Inc. Fiber Availability in Connecticut



Source: (NTIA, 2014)

Figure 3.1.1-12: Cablevision, Cox Communications, and MetroCast Communications of CT LLC Fiber Availability in Connecticut



Source: (NTIA, 2014)

Figure 3.1.1-13: Other Provider Fiber Availability in Connecticut

Data Centers

Data centers (also known as network access points, collocation facilities, hosting centers, carrier hotels, and Internet exchanges) are large telecommunications facilities that house routers, switches, servers, storage, and other telecommunications equipment. These data centers facilitate efficient network connectivity among and between telecommunications carriers, and between carriers and their largest customers. These facilities also provide racks and cages for equipment, power and cooling, cabling, physical security, and 24x7 monitoring (CIO Council, 2015; GAO, 2013).

3.1.1.6. Utilities

Utilities are the essential systems that support daily operations in a community and cover a broad array of public services, such as electricity, water, wastewater, and sewage. Section 3.1.4, Water Resources, describes the potable water sources in the state.

Electricity

Two distribution companies produce electricity in Connecticut: Eversource (formerly Connecticut Light and Power Company) and United Illuminating Company. These companies supply electricity to the distribution companies: Bozrah Light and Power, Groton Utilities, Norwich Public Utilities, South Norwalk Electric Works, and Wallingford DPU (CT DEEP PURA, 2015a). The Connecticut Public Utilities Regulatory Authority (PURA), who addresses issues in distribution, transmission rates, efficiency, cost, and other related areas, oversees all these companies. PURA falls under the umbrella of the CT DEEP (CT DEEP PURA, 2013). In 2016, an estimated 36,455 thousand megawatthours (MWh) of electricity was produced by the state of Connecticut.[12] Of this, 17,808 thousand MWh came from nuclear electric power and the remaining 3,771 thousand MWh came from other renewable sources (EIA, 2017a). By 2020, Connecticut plans to have 23 percent of the state's electricity come from renewable sources, a large increase from the 3.5 percent produced from renewable sources in 2014 (EIA, 2015). As of February 2017, Connecticut had the third highest average residential electricity price in the country (EIA, 2017b).

Water

The CT DEEP PURA has a Water Unit that regulates water and wastewater facilities in the state (CT DEEP PURA, 2009). There are ten investor owned water utility companies that fall under the Water Unit's oversight, including eight that make over $500,000 a year and two that make less than $100,000 (CT DEEP PURA, 2015b). The Department of Public Health's Drinking Water Division regulates the quality of Connecticut's drinking water. Approximately 76 percent of Connecticut's citizens get their drinking water through companies that use both ground and surface water sources. The remaining population obtains their water from private drinking wells.

[12] A megawatt hour is defined as "One thousand kilowatt-hours or 1million watt-hours," where a watthour is "the electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hou.r" (EIA, 2016)

These wells are not regulated by the federal Safe Drinking Water Act, but Connecticut holds them to the same potability standards as are used for public water sources (CT DEEP, 2015a).

Wastewater

The CT DEEP also oversees interactions with municipal wastewater treatment operators (CT DEEP, 2015b). Treatment facility operators are required to have multiple years of experience in the operation of these plants, or take a number of training courses to satisfy requirements, as well as passing a CT DEEP sponsored exam (CT DEEP 2013a). CT DEEP also regulates the discharge of industrial wastewater, which may contain harmful chemicals or heavy metals and should be treated more rigorously than other wastewater (CT DEEP 2014a). Connecticut still has a number of combined sewers leftover from earlier eras. These are designed to carry both stormwater and wastewater. While this can be a benefit, allowing all water to be treated at once, it can also cause problems when heavy rains cause untreated wastewater and stormwater to back up and discharge at an overflow location before treatment. In the last 40 years, approximately $1.2 B has been spent on separating combined sewers, with overflow locations remaining in six Connecticut communities. An estimated $3 B more will be required to deal with the remaining combined sewer overflows in an environmentally conscious manner (CT DEEP 2013b).

Solid Waste Management

Solid waste management in Connecticut is governed by the Solid Waste Management Plan, which will aid in decision making until 2024.[13] This plan is overseen by a Solid Waste Management Advisory Committee and aims to boost waste reduction at its source, as well as recycling and composting (CT DEEP, 2015c). This plan was last updated in 2006 and includes efforts to move away from a system based in waste disposal, to one based in management of resources (CT DEEP 2014b). In 2011, the state burned 64.53 percent of its municipal solid waste and recycled 24.82 percent. Out of state disposal accounted for 9.87 percent, with only 0.78 percent being disposed of in landfills (CT DEEP 2014c). Connecticut is home to 21 active landfills that handle a mixture of municipal, bulk, industrial or special waste such as sludge ash (CT DEEP, 2015d). There are also seven facilities permitted as Resource Recovery Facilities. These are facilities were municipal solid waste is combusted to produce electricity. Scattered across the state, these facilities range in capacity from those that burn 300 tons/day to those that can handle 2,849 tons/day (CT DEEP, 2015e).

3.1.2. Soils

3.1.2.1. Definition of the Resource

The Soil Science Society of America defines soil as:

(i) "The unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants." (NRCS, 2015a)

[13] Connecticut Solid Waste Management Plan is reviewed and revised every 10 years.

(ii) "The unconsolidated mineral or organic matter on the surface of the Earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics." (NRCS, 2015a)

Five primary factors account for soil development patterns. A combination of the following variables contributes to the soil type in a particular area (University of Minnesota, 2001):

- *Parent Material*: The original geologic source material from the soil formed affects soil aspects, including color, texture, and ability to hold water.
- *Climate*: Chemical changes in parent material occur slowly in low temperatures. However, hot temperatures evaporate moisture, which also facilitates chemical reactions within soils. The highest degree of reaction within soils occurs in temperate, moist climates.
- *Topography*: Steeper slopes produce increased runoff, and, therefore, downslope movement of soils. Slope orientation also dictates the microclimate to which soils are exposed, because different slope faces receive more sunlight than others.
- *Biology*: The presence/absence of vegetation in soils affects the quantity of organic content of the soil.
- *Time*: Soil properties are dependent on the period over which other processes act on them.

3.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply for Soils, such as the Farmland Protection Policy Act of 1981, are presented in Appendix C. A list of applicable state laws and regulations is included in Table 3.1.2-1 below.

Table 3.1.2-1: Relevant Connecticut Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CGs §§ 22a-325 through 22a-329, Soil Erosion and Sediment Control Act	CT DEEP	Requires soil erosion and sediment control standards in municipal planning and zoning regulations, as well as CT DEEP permits associated with land development.

Source: (Justia, 2017a)

3.1.2.3. Environmental Setting

Connecticut is composed of one Land Resource Region (LRR),[14] as defined by the National Resources Conservation Service (NRCS), the Northeastern Forage and Forest Region (NRCS, 2006). Within and among Connecticut's single LRR are three Major Land Resource Areas

[14] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (NRCS, 2006).

(MLRA),[15] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (NRCS, 2006) . The locations and characteristics of Connecticut's MLRAs are presented in Figure 3.1.2-1 and Table 3.1.2-2, respectively.

Soil characteristics are an important consideration for FirstNet insomuch as soil properties could influence the suitability of sites for network deployment. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, elevation, and position on the landscape; biota[16] such as bacteria, fungi, biological crusts, vegetation, and animals; and climatic variables, such as precipitation and temperature. For example, expansive soils[17] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky, & Rogers, 2004). Soils can also be affected by a variety of surface uses that loosen topsoil and damage or remove vegetation or other groundcover, which may result in accelerated erosion, compaction, and rutting[18] (discussed further in the subsections below).

Table 3.1.2-2: Characteristics of Major Land Resource Areas in Connecticut

MLRA Name	Region of State	Soil Characteristics
Connecticut Valley	Central Connecticut	Entisols[19] and Inceptisols[20] are the dominant soil orders in this area, and the soils in this area are generally very deep, excessively drained to poorly drained, and clayey, loamy, or sandy.
New England and Eastern New York Upland, Northern Part	Northwestern Connecticut	Dominant soil orders in this MLRA are Inceptisols and Spodosols,[21] and the soils in this area are shallow to very deep, are generally excessively drained to poorly drained, and sandy or loamy.
New England and Eastern New York Upland, Southern Part	Western and Eastern Connecticut	Dominant soil orders in this MLRA include Entisols, Histosols,[22] and Inceptisols, and the soils are generally very deep, somewhat excessively drained to poorly drained, and loamy or sandy.

Source: (NRCS, 2006)

[15] Major Land Resource Area: "A geographic area, usually several thousand acres in extent, that is characterized by a particular pattern of soils, climate, water resources, land uses, and type of farming" (NRCS, 2006).
[16] Plants and animals in an environment (Agency for Toxic Substances and Disease Registry, 2016).
[17] Expansive soils are characterized by "the presence of swelling clay materials" that absorb water molecules when wet and expand in size or shrink when dry leaving "voids in the soil" (Rogers, Olshansky, & Rogers, 2004).
[18] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).
[19] Entisols: "Soils that show little to no pedogenic horizon development. They occur in areas of recently deposited parent materials or in dunes, steep slopes, or flood plains where erosion or deposition rates are faster than rate of soil development. They make up nearly 16% of the world's ice-free land surface" (NRCS, 2015b).
[20] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates, and make up nearly 17% of the world's ice-free land surface" (NRCS, 2015b).
[21] Spodosols: "Soils formed from weathering processes that strip organic matter combined with aluminum from the surface layer and deposit them in subsoil. They commonly occur in areas of coarse-textured deposits under forests of humid regions, tend to be acid and infertile, and make up nearly 4% of the world's ice-free land surface" (NRCS, 2015b).
[22] Histosols: "Soils that have a high content of organic matter and no permafrost. Also known as bogs, moors, peats, or mucks, these soils are saturated year round and form in decomposed plant remains. If exposed to air and drained, the microbes will decompose and the soils can subside dramatically. They make up nearly 1% of the world's ice-free land surface" (NRCS, 2015b).

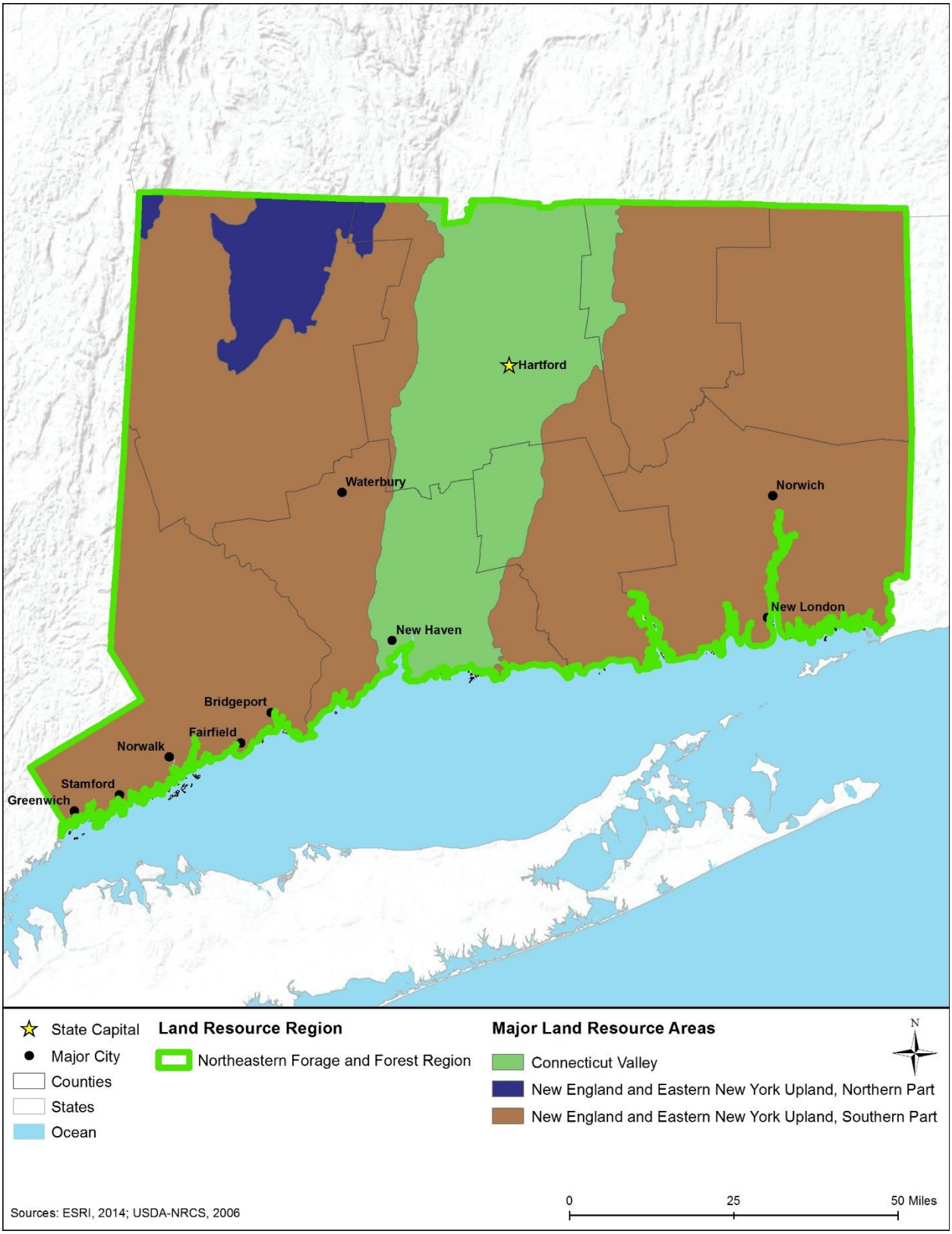


Figure 3.1.2-1: Locations of Major Land Resource Areas in Connecticut

3.1.2.4. Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy;[23] there are 12 soil orders in the world and they are characterized by both observed and inferred[24] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (NRCS, 2015c). FirstNet used the STATSGO2 database to obtain soils information at the programmatic level to ensure consistency across all the states and territories. This regional information provides a sufficient level of detail for a programmatic analysis. The best available soils data and information, including the use of the more detailed SSURGO database, will be used, as appropriate, during subsequent site-specific assessments. The STATSGO2[25] soil database identifies four different soil suborders in Connecticut (NRCS, 2015d). Figure 3.1.2-2 depicts the distribution of the soil suborders, and Table 3.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found in the state.

3.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[26] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 3.1.2-3 provides a summary of the runoff potential for each soil suborder in Connecticut.

Group A. Sand, loamy sand or sandy loam soils. This group of soils has "low runoff potential and high infiltration rates[27] even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission" (Purdue University, 2015). Orthents, Psamments, and Udepts fall into this category in Connecticut.

Group B. Silt loam or loam soils. This group of soils has a "moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures" (Purdue University, 2015). This group has medium runoff potential. Udepts fall into this category in Connecticut.

Group C. Sandy clay loam soils. This group of soils has "low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure" (Purdue

[23] Taxonomy: A formal representation of relationships between items in a hierarchical structure (USEPA, 2013a).
[24] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)" (NRCS, 2015c).
[25] STATS2GO is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map is composed of general soil association units and is maintained and distributed as a spatial and tabular dataset.
[26] Classifying soils is highly generalized and it is challenging to differentiate orders as soil properties can change with distance or physical properties. The soil suborders are at a high level, therefore soil groups may be found in multiple hydrologic groups within a state, as composition, topography, etc. varies in different areas.
[27] Infiltration Rate: "The rate at which a soil under specified conditions absorbs falling rain, melting snow, or surface water expressed in depth of water per unit time" (FEMA, 2010).

University, 2015). This group has medium runoff potential. Aquepts and Udepts fall into this category in Connecticut.

Group D. Clay loam, silty clay loam, sandy clay, silty clay, or clay soils. This group of soils "has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material" (Purdue University, 2015). Aquepts and Udepts fall into this category in Connecticut.

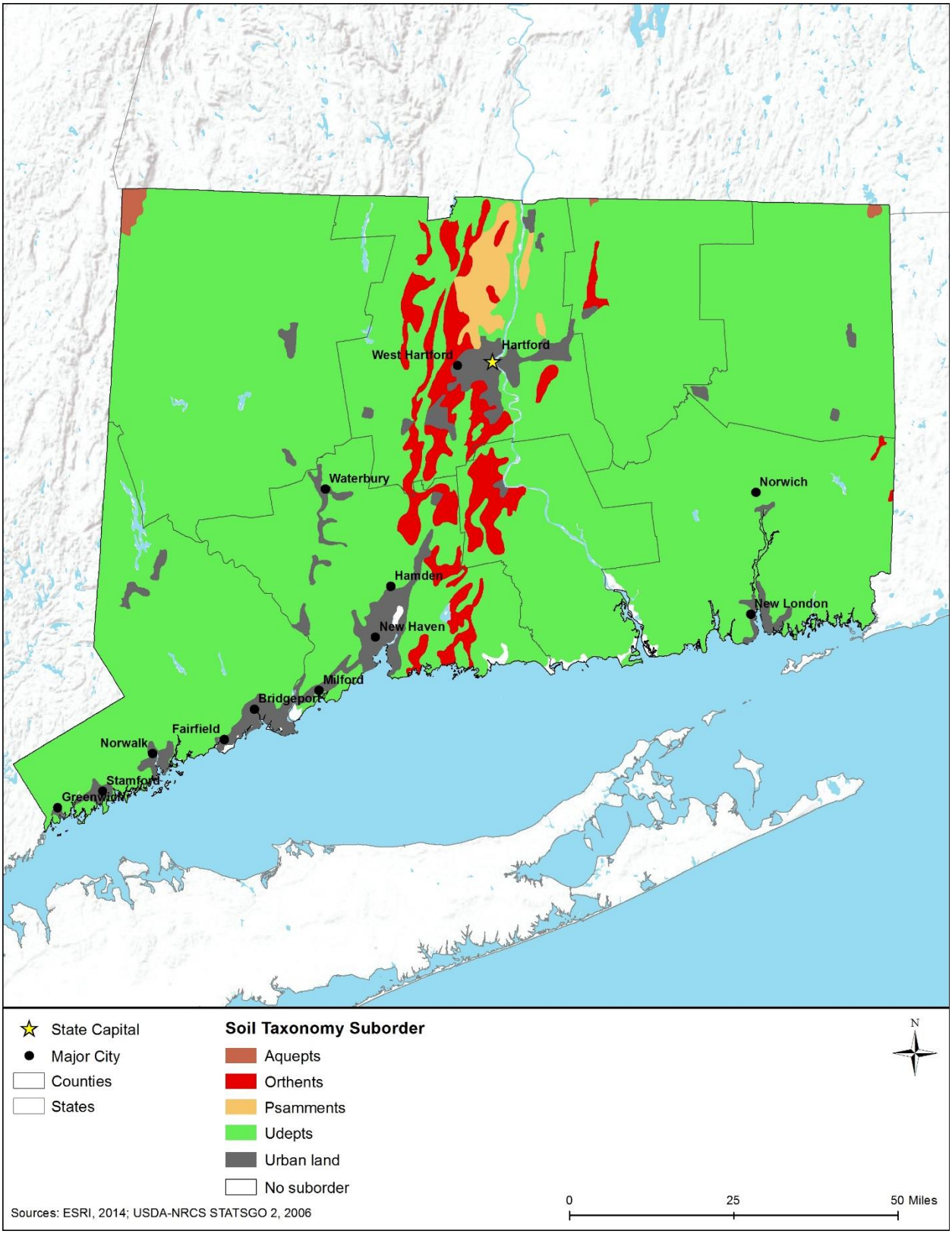


Figure 3.1.2-2: Connecticut Soil Taxonomy Suborders

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Table 3.1.2-3: Major Characteristics of Soil Suborders Found in Connecticut, as depicted in Figure 3.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[28]	Hydrologic Group	Runoff Potential	Permeability[29]	Erosion Potential	Compaction and Rutting Potential
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage. If these soils have not been artificially drained, groundwater is at or near the soil surface at some time during normal years (although not usually in all seasons). They are used primarily for pasture, cropland, forest, or wildlife habitat. Many Aquepts have formed under forest vegetation, but they can have almost any kind of vegetation.	Silt loam	0-8	Very poorly drained to poorly drained	Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Fine sandy loam, gravelly loamy sand, loamy fine sand	0-25	Excessively drained	No	A	Low	High	Low	Low
Entisols	Psamments	Psamments are sandy in all layers. In some arid and semi-arid climates, they are among the most productive rangeland soils, and are primarily used as rangeland, pasture, or wildlife habitat. Those Psamments that are nearly bare are subject to wind erosion and drifting, and do provide good support for wheeled vehicles.	Loamy sand	3-8	Excessively drained	No	A	Low	High	Low	Low
Inceptisols	Udepts	Udepts have an udic or perudic (i.e., saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the Northwest and mixed or hardwood forest in the East. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture.	Channery silt loam, fine sandy loam, gravelly fine sandy loam, gravelly loam, gravelly sandy loam, loam, sandy loam, stratified very gravelly coarse sand to loamy fine sand, unweathered bedrock, very fine sandy loam	0-35	Somewhat excessively drained to well drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low

Source: (NRCS, 2015d) (NRCS, 1999)

[28] Hydric Soil: "A soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (NRCS, 2015e).
[29] Based on Runoff Potential, described in Section 3.5.3.2

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3.1.2.6. Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015f). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public safety hazard (NRCS, 1996a). Table 3.1.2-3 provides a summary of the erosion potential for each soil suborder in Connecticut. Soils with the highest erosion potential in Connecticut include those in the Aquepts and Udepts suborders, which are found throughout most of the state (Figure 3.1.2-2).

3.1.2.7. Soil Compaction and Rutting

Soil compaction and rutting occurs when soil layers are compressed by machinery or animals, which decreases both open spaces in the soil, as well as water infiltration rates (NRCS, 1996b). Moist soils with high soil water content are most susceptible to compaction and rutting, as they lack the strength to resist deformation caused by pressure. When rutting occurs, channels form and result in downslope erosion (USFS, 2009c). Other characteristics that factor into compaction and rutting risk include soil composition (i.e., low organic soil is at increased risk of compaction), amount of pressure exerted on the soil, and repeatability (i.e., the number of times the pressure is exerted on the soil). Machinery and vehicles that have axle loads greater than 10 tons can cause soil compaction of greater than 12 inches depth (NRCS, 1996b), (NRCS, 2003).

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS, 1996b). Table 3.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Connecticut. Soils with the highest potential for compaction and rutting in Connecticut include those in the Aquepts suborder, which are found in the far northwest and northeast corners of the state (Figure 3.1.2-2).

3.1.3. Geology

3.1.3.1. Definition of the Resource

The U.S. Geological Survey (USGS) is the primary government organization responsible for the nation's geological resources. USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and ground-water availability. Several of these elements are discussed in other sections of this PEIS, including Water Resources (Section 3.1.4), Climate Change (Section 3.1.14), and Human Health and Safety (Section 3.1.15).

This section covers the six aspects of geology most relevant to the Proposed Action and Alternatives:

- Section 3.1.3.3 Major Physiographic Regions and Provinces;[30, 31]
- Section 3.1.3.4 Surface Geology;
- Section 3.1.3.5 Bedrock Geology;[32]
- Section 3.1.3.6 Paleontological Resources;[33]
- Section 3.1.3.7 Fossil Fuel and Mineral Resources; and
- Section 3.1.3.8 Potential Geologic Hazards.[34]

3.1.3.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Geology, such as the National Historic Preservation Act and the Clean Water Act, are detailed in Appendix C. A list of applicable state laws and regulations is included in Table 3.1.3-1 below.

Table 3.1.3-1: Relevant Connecticut Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CT Building Codes (2016)	Connecticut Department of Administrative Services	Guidelines for seismic design

Source: (CT DAS, 2017)

3.1.3.3. Environmental Setting: Physiographic Regions and Provinces

Geologist Nevin Fenneman, as a way to describe areas of the United States based on common landforms (i.e., not climate or vegetation), created the concept of physiographic regions in 1916. Physiographic regions are areas of distinctive topography, geography, and geology. "Important physiographic differences between adjacent areas are, in a large proportion of cases, due to differences in the nature or structure of the underlying rocks." There are eight distinct physiographic regions in the continental United States: 1) Atlantic Plain, 2) Appalachian Highlands, 3) Interior Plains, 4) Interior Highlands, 5) Laurentian Upland, 6) Rocky Mountain System, 7) Intermontane Plateaus, and 8) Pacific Mountain System. Regions are further sub-divided into physiographic provinces based on differences observed on a more local scale. (Fenneman, 1916)

[30] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology (Fenneman, 1916).
[31] Physiographic provinces: Subsets within physiographic regions (Fenneman, 1916).
[32] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015a).
[33] Paleontology: "Study of life in past geologic time based on fossil plants and animals" (USGS, 2015b).
[34] Geologic Hazards: "Any geological or hydrological process that poses a threat to people and/or their property, which includes but is not limited to volcanic eruptions, earthquakes, landslides, sinkholes, mudflows, flooding, and shoreline movements" (NPS, 2013).

Connecticut is entirely within the Appalachian Highlands Physiographic Region and the New England Province (NPS, 2017a) (Figure 3.1.3-1). To characterize differences in physiography across the state and to better support PEIS tiering, the physiographic sections of the New England Province in Connecticut are summarized below.

Appalachian Highlands Region

The Appalachian Highlands Region extends from Canada to Alabama. This region is composed of layers of folded sedimentary rock,[35] created when the North American plates collided with the Eurasian and African plates more than 500 million years ago (MYA). Once similar in height to the present-day Rocky Mountains,[36] the Appalachian Highlands have eroded considerably (USGS, 2016a). The current Appalachian Highlands Region is characterized by prime and unique farmlands and is rich in mineral resources. (QAB, 1968)

As reported above, the Appalachian Highlands Region within Connecticut is comprised of one physiographic province: the New England Province (USGS, 2003a).

New England Province – The New England Province spans between Canada and New Jersey. The predominant topography of the province is a broad plateau interspersed with narrow valleys. The New England Province can be further sub-divided into two sections within Connecticut: the Taconic Section and New England Upland Section (USFWS, 2015a). Within Connecticut, the Taconic Section includes the state's highest point, Mount Frissell (2,380 feet), which is in the northwestern portion of the state (Summit Post, 2011). Hills and mountains of the New England Uplands Section generally slope toward the southeast from more than 2,200 feet in northwestern Connecticut to sea level along the coast (USFWS, 2015a).

[35] Sedimentary Rock: "Rocks that formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding" (USGS, 2014a).
[36] The Rocky Mountains exceed 14,000 feet above sea level (NPS, 2004).

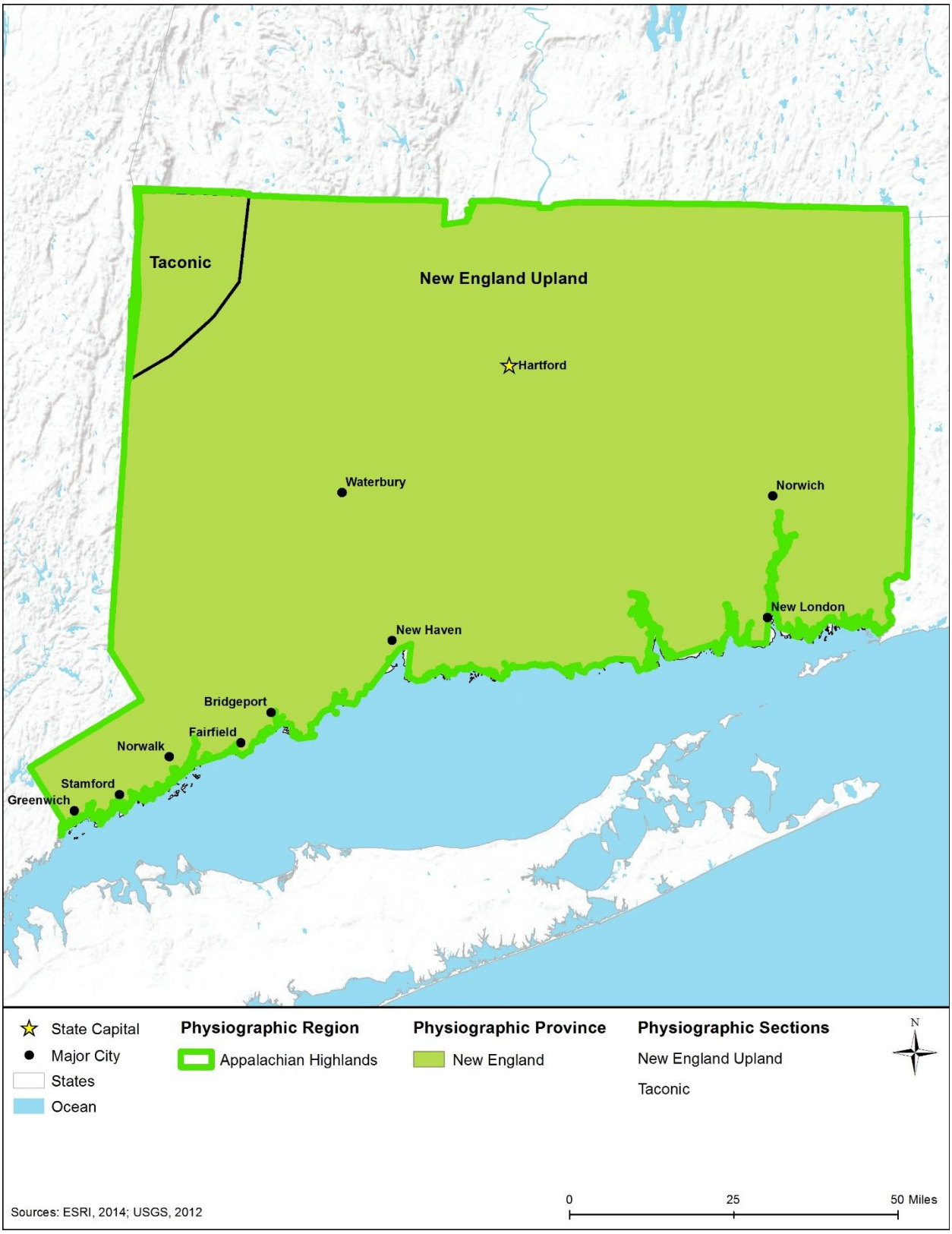


Figure 3.1.3-1: Physiographic Regions, Provinces, and Sections of Connecticut

3.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[37] sand and gravel, or clays that overlie bedrock. The surface terrain, which can include bedrock outcrops, provides information on the rock compositions and structural characteristics of the underlying geology. Because surface materials are exposed, they are subject to physical and chemical changes due to weathering from precipitation (rain and snow), wind and other weather events, and human-caused interference. Depending on the structural characteristics and chemical compositions of the surface materials, heavy precipitation can cause slope failures,[38] subsidence,[39] and erosion. (Thompson, 2015)

Most of the surficial materials in Connecticut are from deposits attributed to two glaciations within the last 150,000 years. The Illinoian glaciation, which took place between 150,000 and 130,000 years ago, removed rocks that had weathered during the previous 270 million years (following the Alleghenian Orogeny[40]). More recently, the Wisconsinan glaciation affected Connecticut between 26,000 and 15,500 years ago. This glacier was more than 6,000 feet thick and migrated as far south as the middle of Long Island (NY), before receding over a 3,500-year period. During both the Illinoian and Wisconsinan glaciations, hills were rounded and valleys were widened and deepened as the glaciers flowed from north to south across the state. Any pre-existing surface deposits were removed. The topography of the present-day Connecticut coast and surficial landscape reflects the impacts of these relatively recent glaciation periods. Figure 3.1.3-2 depicts a generalized illustration of the surface geology for Connecticut. (LISRC, 2013)

[37] Till: "An unsorted and unstratified accumulation of glacial sediment, deposited directly by glacier ice. Till is a heterogeneous mixture of different sized material deposited by moving ice (lodgement till) or by the melting in-place of stagnant ice (ablation till). After deposition, some tills are reworked by water" (USGS, 2013a).
[38] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses.
[39] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000).
[40] Orogeny: "The process of the formation of mountains" (USGS, 2005).

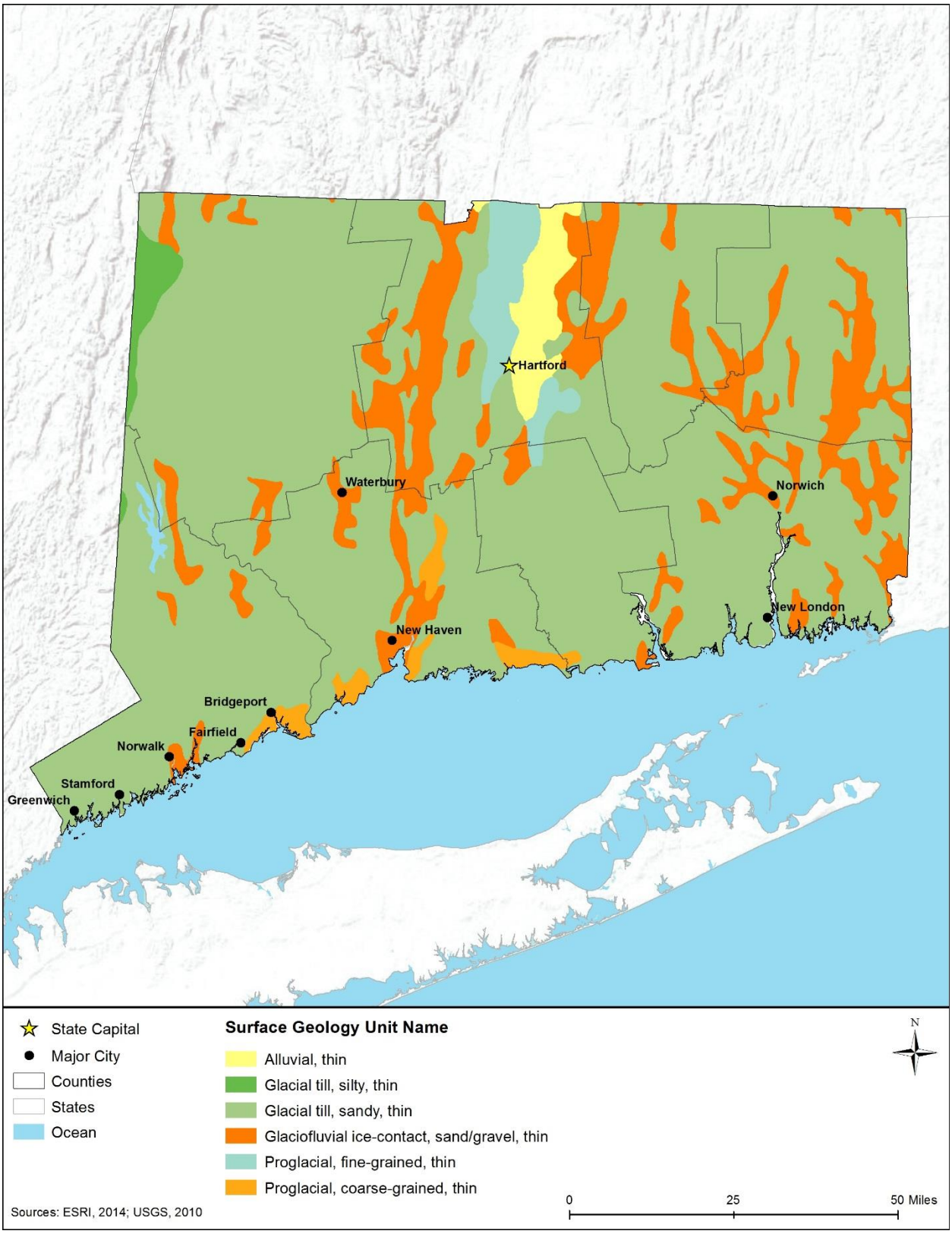


Figure 3.1.3-2: Generalized Surface Geology for Connecticut

3.1.3.5. Bedrock Geology

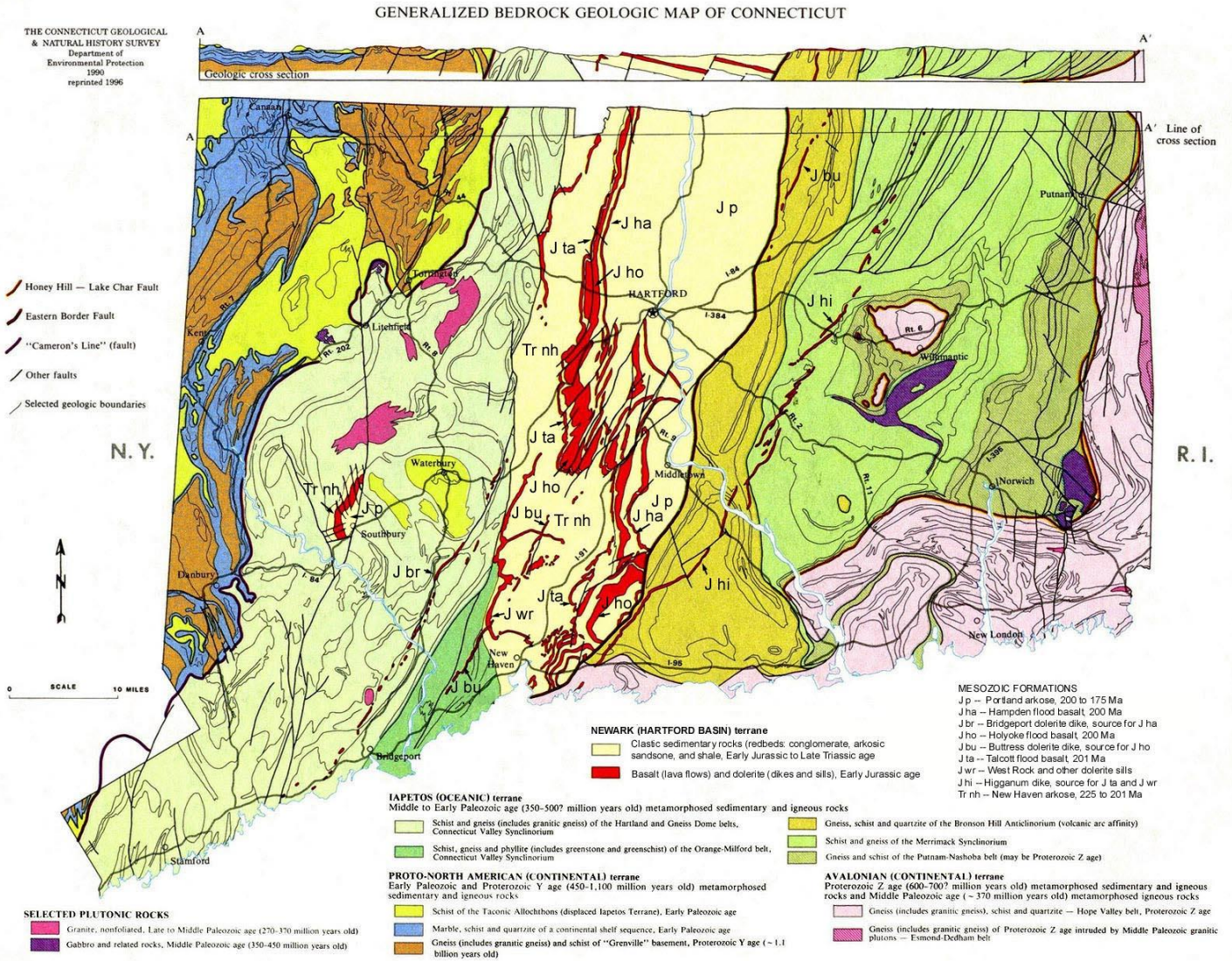
Bedrock geology analysis, and the study of "distribution, position, shape, and internal structure of rocks" (USGS, 2015c) reveals important information about a region's surface and subsurface characteristics (i.e., 3-dimensional geometry), including dip (slope of the formation),[41] rock composition, and regional tectonism.[42] These structural aspects of bedrock geology are often indicative of regional stability, as it relates to geologic hazards such as landslides, subsidence, earthquakes, and erosion (New Hampshire Department of Environmental Services, 2014).

Connecticut's modern-day landscape was shaped by events that occurred approximately 500 MYA. Several orogenies[43] occurred between 460 and 270 MYA, which built the igneous[44] and metamorphic-based mountains of Connecticut's Western and Eastern Uplands; these events included the Taconic (460 to 440 MYA), Acadian (440 to 350 MYA), and Alleghenian (350 to 270 MYA) orogenies associated with the formation of the supercontinent Pangaea. (LISRC, 2013)

Around 200 MYA, the mountain building events that had contributed to the growth of Connecticut's highlands ceased and tensional stresses began to pull the landscape apart. This resulted in the formation of the Hartford Rift Basin, which contains numerous faults and fractures of Mesozoic age (251 to 66 MYA). Folds,[45] faults,[46] and fractures[47] throughout bedrock result in differential erosion of weathered rock units. Valleys and lowlands dominate the landscape that is underlain by weak bedrock, whereas topographic ridges persist where the bedrock is stronger. (LISRC, 2013)

Figure 3.1.3-3 displays the general bedrock geology for Connecticut. For more site-specific information, other sources from the Connecticut Geological Survey should be consulted (e.g., http://www.ct.gov/deep/cwp/view.asp?a=2701&q=519804&deepNav_GID=1641 (CT DEEP, 2014a)

[41] Dip: "A measure of the angle between the flat horizon and the slope of a sedimentary layer, fault plane, metamorphic foliation, or other geologic structure" (NPS, 2000).
[42] Tectonicisms: "Structure forces affecting the deformation, uplift, and movement of the earth's crust" (USGS, 2015d).
[43] Orogeny: "The process of the formation of mountains." (USGS, 2005)
[44] Igneous Rock: "Rocks that solidified from molten or partly molten material, such as magma" (USGS, 2005).
[45] Fold: "A bend or flexure in a rock" (USGS, 2005).
[46] Fault: "A surface along which a rock body has broken and been displaced" (USGS, 2005).
[47] Fracture: "A crack in a rock. Also includes joints and faults" (USGS, 2005).



Source: (Wesleyan University 1990)

Figure 3.1.3-3: Generalized Bedrock Geology for Connecticut

3.1.3.6. Paleontological Resources

Fossils from the Triassic Period (251 to 200 MYA) have been recorded in the central portion of Connecticut throughout sedimentary rocks in the Ancient Connecticut River Valley, which extends from Connecticut north into Canada (Figure 3.1.3-4) (Paleontology Portal, 2015). A fossil-bearing layer of black bituminous shale underlies the Connecticut River Valley. Plant and fish fossils are well preserved because they were quickly buried prior to decomposition (Richard Swann Lull, 1923). Jurassic Period (200 to 146 MYA) sedimentary rocks from the Connecticut River Valley have yielded vertebrate fossils and dinosaur tracks (Paleontology Portal, 2015); some of the world's best-preserved sets of dinosaur tracks are found in Rocky Hill, CT (Figure 3.1.3-4) (State of Connecticut, 2015c). Additionally, marine and intertidal fossils from the Quaternary Period (2.6 MYA to present) are found in the northwest part of the state, and along the Long Island Sound (Paleontology Portal, 2015).

Fossils from the Triassic and Jurassic Periods in the sediments of the Ancient Connecticut River Valley include fossils of fish, mollusks, insects, as well as footprints and bones of dinosaurs and reptiles (Paleontology Portal, 2015). However, the number of fossil impressions or footprints far outnumber fossilized animals and plants (Colbert, 1970). Dinosaur footprints found in Connecticut number in the tens of thousands, whereas fossil plants and fish "are numbered by the hundreds, , and reptile fossils number "are counted by the dozens" (Colbert, 1970).

Source: (State of Connecticut, 2015d)

Connecticut State Fossil
***Eubrontes giganteus* track**

Four dinosaur species' footprints have been found in the Ancient Connecticut River Valley: the genera *Anchisaurus, Yaleosaurus, Coelophysis*, and *Ammosaurus* (Galton, 1976). Two other types of tracks have been found (*grallator* and *otozoum)*, but have not yet been connected to a specific genera of dinosaur (WU, 2017). The Connecticut state fossil is Eubrontes (*Eubrontes giganteus*), a large Jurassic Era three-toed track found in abundance in the Ancient Connecticut River Valley. Skeletal remains of the track-making individual have never been found, but based on the shape, size, and stride of the Eubrontes, these tracks likely belong to a genus of dinosaur similar to the *Dilophosaurus* (State of Connecticut, 2015c), a dinosaur that was 8 feet in height with "strong hind legs, forelimbs with hand that was flexible, and an opposable thumb" , "" (Berkley, 2017). In 1966, 2,000 Eubrontes tracks were discovered in Rocky Hill, CT, and consequently, Dinosaur State Park, a Registered Natural Landmark, was created to preserve and study these tracks (Figure 3.1.3-4) (State of Connecticut, 2015c). Other fossils found in Connecticut from the Quaternary Period include those from crustaceans, clams, oysters, snails, bryozoans, sponges, insects, and both intertidal and marine organisms (Paleontology Portal, 2015).

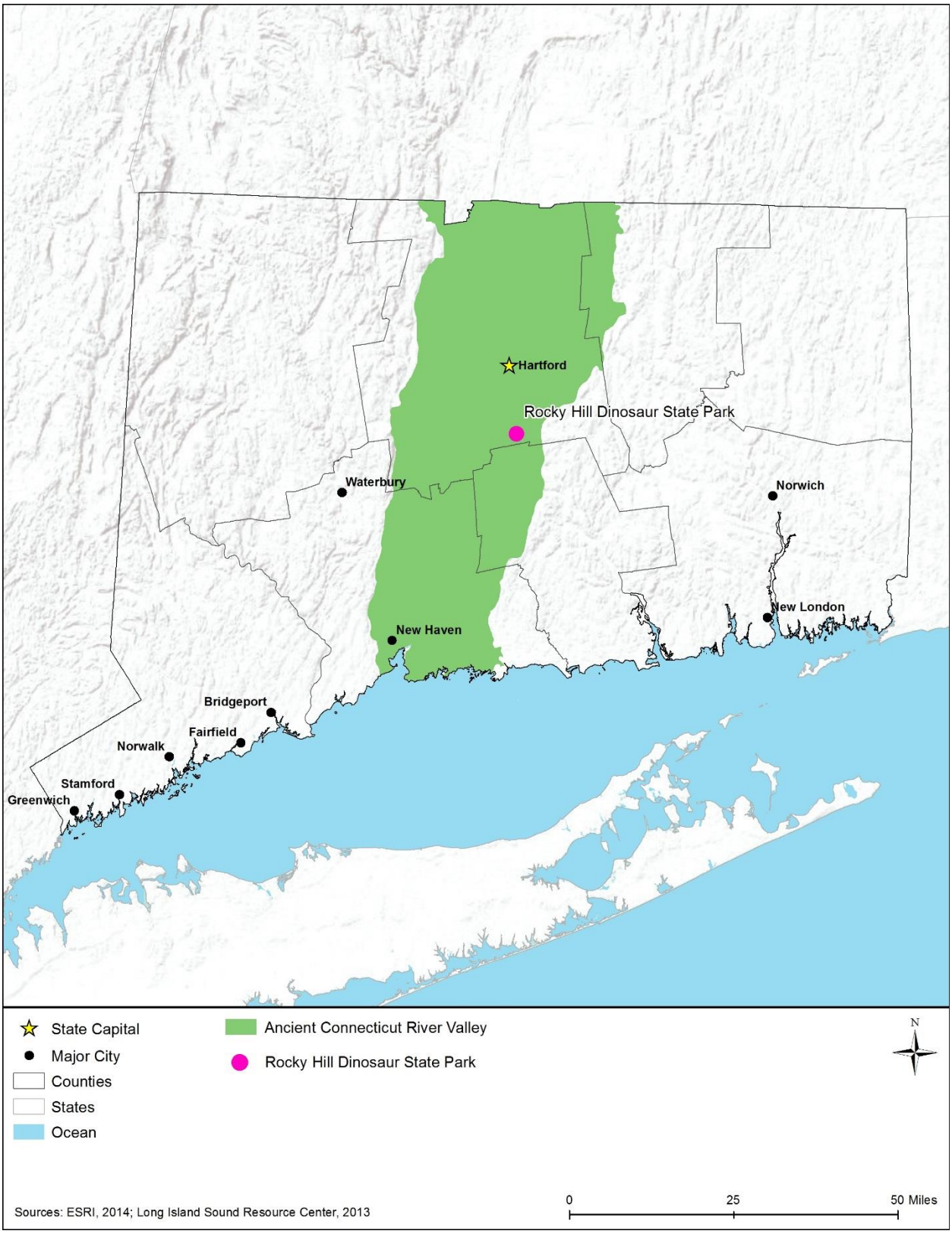


Figure 3.1.3-4: Ancient Connecticut River Valley

3.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

Connecticut does not produce or refine petroleum or natural gas. Connecticut receives petroleum from other states via coastal ports, and natural gas is received from pipelines networked through New York (EIA, 2014a). For additional information on Connecticut's infrastructure, refer to section 3.1.1.

Minerals

As of 2016, Connecticut's total nonfuel mineral production was valued at $352M, ranking 41st nationwide (in terms of dollar value), less than 1 percent of the country's total nonfuel mineral production (USGS, 2017). in 2012 ans 2013 (the most recent year the data was readily available) crushed stone was the leading nonfuel mineral produced in the state, followed by construction sand and gravel. Other minerals produced in Connecticut in 2012 and 2013 include common clays, dimension stone,[48] and gemstones. Dimension stone was only produced intermittently from small producers (USGS, 2017).

3.1.3.8. Geologic Hazards

The three major geologic hazards of concern in Connecticut are earthquakes, landslides, and subsidence. Volcanoes do not occur in Connecticut and therefore do not present a hazard to the state (USGS, 2015e). The subsections below summarize current geologic hazards in Connecticut.

Earthquakes

Between 1980 and 2015, there were seven earthquakes of a magnitude 2.5 (on the Richter scale[49]) or greater in Connecticut (although considerably more that were felt in Connecticut but originated in nearby states) (Earthquake Track, 2017). Earthquakes are the result of large masses of rock moving against each other along fractures called faults. Earthquakes occur when landmasses on opposite sides of a fault suddenly slip past each other; the grinding motion of each landmass sends out shock waves. The vibrations travel through the Earth and, if they are strong enough, they can damage manmade and natural structures on the surface (USGS, 2016b).

The shaking due to earthquakes can be significant many miles from its point of origin depending on the type of earthquake and the type of rock and soils beneath a given location. Crustal earthquakes, the most common, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale. Subduction zone earthquakes happen where tectonic plates converge. "When these plates collide, one plate slides (subducts) beneath the other, where it is reabsorbed into the mantle of the earth" (Oregon

[48] Dimension stone: "Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape" (USGS, 2015f)
[49] The Richter scale is a numerical scale for expressing the magnitude of an earthquake on the basis of seismograph oscillations. The more destructive earthquakes typically have magnitudes between about 5.5 and 8.9; the scale is logarithmic and a difference of one represents an approximate thirtyfold difference in magnitude (USGS, 2014b).

Department of Geology, 2015). Subduction zones are found off the coast of Washington, Oregon, and Alaska and therefore do not affect Connecticut (USGS, 2014c). Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale (Oregon Department of Geology, 2015).[50] Connecticut is in the middle of a tectonic plate, far from convergence boundaries, and therefore experiences relatively low seismic activity (YU, 1995).

Figure 3.1.3-5 depicts the seismic risk throughout Connecticut. The map indicates levels of horizontal shaking (measured in Peak Ground Acceleration) that have a 2 percent chance of being exceeded in a 50-year period. Units on the map are measured in terms of acceleration due to gravity (% g). Most pre-1965 buildings are likely to experience damage with exceedances of 10% g.[51] (USGS, 2010) Areas of greatest seismicity in Connecticut are concentrated in the southwest portions of the state. Portions of Connecticut are among the most seismically active areas in New England (Resor & deBoer, 2005).

Notable Connecticut Earthquakes

The largest measured earthquake in Connecticut's history occurred in May 1791 and measured seven on the Mercalli intensity scale (equivalent to 5.0 to 5.9 on the Richter scale). The epicenter of the earthquake was central Connecticut near the town of Moodus (Middlesex County), where many stonewalls and chimney tops collapsed. Tremors were felt as far away as New York City and Boston. (Devestating Disasters, 2016)

Landslides

The potential for landslides in most areas of Connecticut is minimal. However, areas along the Connecticut River are susceptible to slope failure where clay soils dominate (USGS, 1982).

"The term 'landslide' describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides and other ground failures" (USGS, 2003b). Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale. (USGS, 2003b)

Landslides can be triggered by a single severe storm or earthquake, causing widespread damage in a short period. Most landslide events are triggered by water infiltration that decomposes and loosens rock and soil, lubricates frictional surfaces, adds weight to an incipient landslide, and imparts buoyancy to the individual particles. Intense rainfall, rapid snowmelt, freeze/thaw cycles, earthquakes, volcanic eruptions, and human alterations to the natural landscape can trigger mass land movements. Large landslides can dam rivers or streams, and cause both upstream and downstream flooding. (USGS, 2003b)

In recent times, Connecticut has experienced major landslides during heavy precipitation events, including Tropical Storm Irene in 2011 (USGS, 2012a). Figure 3.1.3-6 shows landslide incidence and susceptibility throughout Connecticut.

[50] Mercalli Scale: "[An] Arbitrary ranking [system for earthquakes] based on observed effects" (USGS, 2015g).
[51] Post-1985 buildings (built to California earthquake standards) have experienced only minor damage with shaking of 60% g (USGS, 2010).

Land Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." Land subsidence is not a widespread problem throughout Connecticut, though it has been observed in the communities of New Haven and Cheshire (Miller, 2013). The main triggers of land subsidence can be aquifer compaction, drainage of organic soils, mining, sinkholes, and thawing permafrost (although permafrost does not occur in Connecticut). More than 80 percent of subsidence in the United States is due to over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If layers of silt or clay, which do not transport groundwater, confine an aquifer the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the lowering of the land surface elevation, which is permanent (USGS, 2000).

Land subsidence can result in altered stream elevations and slopes; detrimental effects to infrastructure and buildings; and collapse of wells due to compaction of aquifer sediments. Subsided areas can become more susceptible to inundation, both during storm events and non-events. Lowered terrain is more susceptible to inundation during high tides. Changes in ground-surface elevation not only affect the integrity and operation of existing infrastructure, but also complicate vegetation and best management of land use. (USGS, 2013b)

In Connecticut, the main causes of land subsidence are "subsurface soil loss after heavy precipitation events and abandoned mine collapse" (Miller, 2013). Abandoned mines are at risk of collapse due to the destabilization of wooden support beams and tunnel collapse during flooding. There are approximately 23 mines with tunnels in Connecticut; the safety status of many of these mines is unknown. (Miller, 2013)

Land subsidence due to the collapse of abandoned mines is of concern in the town of Cheshire, CT, as a result of nineteenth century barite mining. Some housing in Cheshire overlies abandoned mine shafts and tunnels that are several miles long and up to 1,000 feet deep. Several abandoned barite mines in the Cheshire area have collapsed in recent years, resulting in subsidence and damage to two residential backyards and one residential street (Miller, 2013).

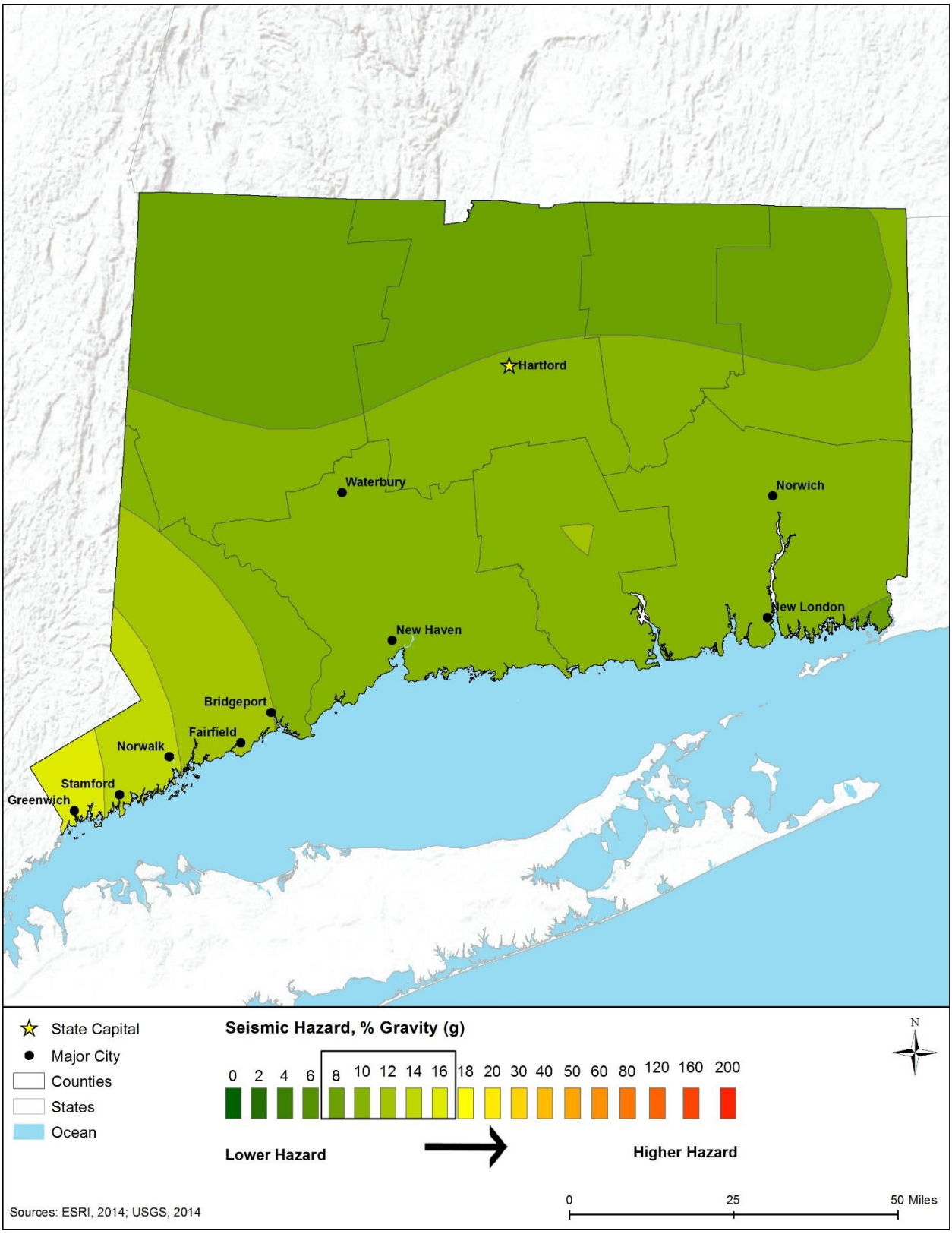


Figure 3.1.3-5: Connecticut 2014 Seismic Hazard Map

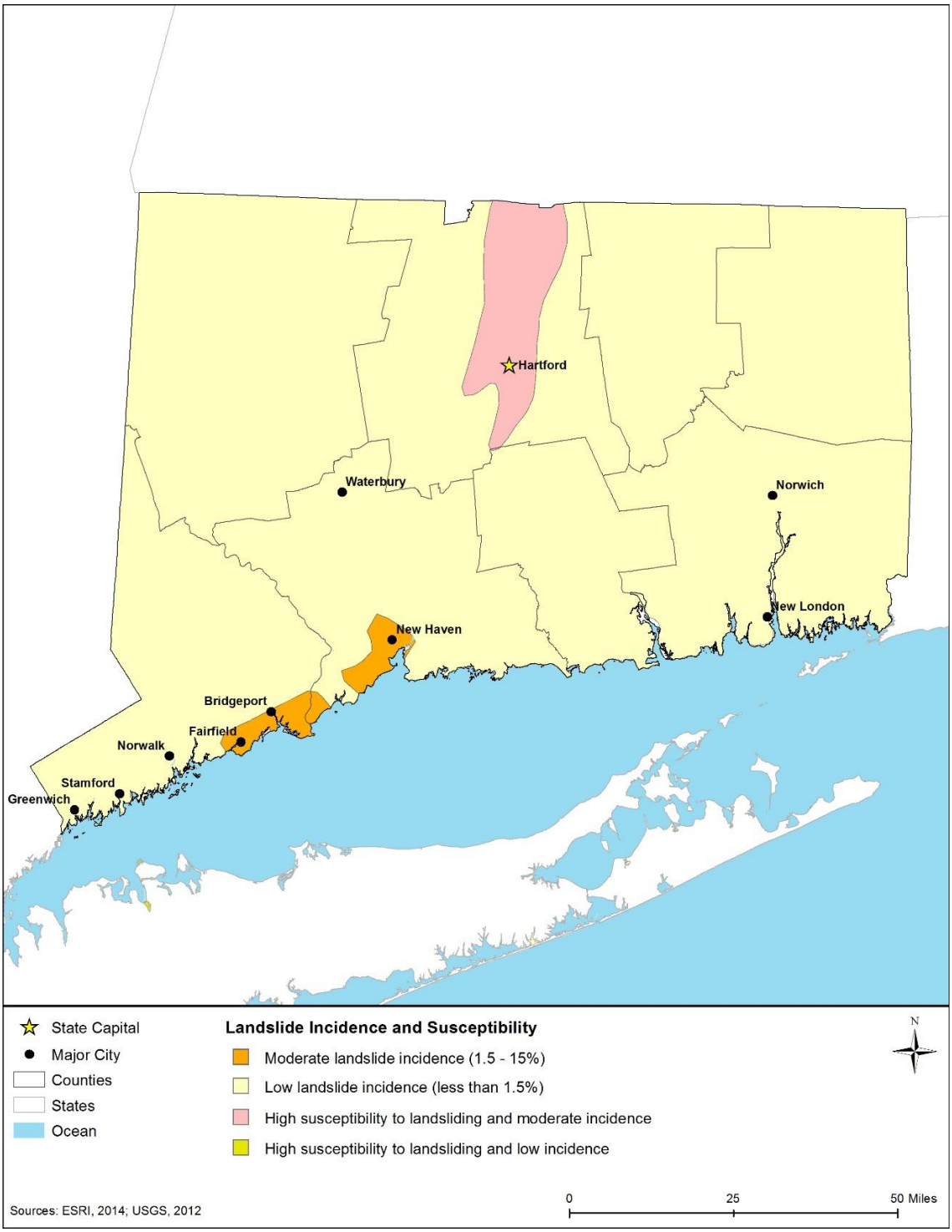


Figure 3.1.3-6: Connecticut Landslide Incidence and Susceptibility Hazard Map[52]

[52] Susceptibility hazards not indicated in Figure 3.1.3-6 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated (USGS, 2014d).

3.1.4. Water Resources

3.1.4.1. Definition of the Resource

Water resources are defined as all surface waterbodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine waters, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 3.1.5). These resources can be grouped into watersheds, which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for available water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human health, economic wellbeing, and ecological health. (USGS, 2014e)

3.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C. Table 3.1.4-1 summarizes the major Connecticut laws and permits requirements relevant to the state's water resources.

Table 3.1.4-1: Relevant Connecticut Water Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CGS Title 22a-36 et seq.	CT DEEP Inland Water Resources Division	Regulates "operations within or use of a wetland or watercourse involving the removal or deposition of material, or any obstruction, construction, alteration or pollution of such wetlands or watercourses."
CGS Title 22a-361	CT DEEP Office of Long Island Sound Programs	Regulates activities being conducting "waterward of the Coastal Jurisdiction Line in tidal, coastal, or navigable waters of the state, including dredging and the placement of structures or fill material."
Section 404 of CWA	United States Army Corps of Engineers (USACE), New England District	Regulates "fill or dredge activities in waters of the United States." The New England District has issued regional general permits for certain activities with no more than minimal *adverse effects* on the aquatic environment.
CT Water Quality Standards (33 U.S.C. 1341)	CT DEEP Inland Water Resources Division	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the United States require a Water Quality Certification from CT DEEP indicating that the proposed activity will not violate water quality standards.
CGS Title 22a, 430b	CT DEEP	"Permit applies to all discharges of stormwater and dewatering wastewater from construction activities which result from the disturbance of *one or more* total acres of land area on a site."
CGS Title 22a, 354a-354bb	CT DEEP	Regulates activities within Aquifer Protection Areas.

Sources: (CT DEEP, 2014b), (USACE New England District, 2016), (CT DEEP, 2014c)

3.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams, as well as estuarine[53] and coastal waters. Connecticut has "approximately 6,000 miles of streams and rivers, over 2,000 lakes and reservoirs, and 600 square miles of estuarine water in Long Island Sound" (CT DEEP, 2014d). These surface waters supply drinking water, provide flood control, transportation corridors, and aquatic habitat, and support power generation, recreation, tourism, agriculture, and fishing across the state (CT DEEP, 2014e).

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains streams and rainfall to a common outlet (e.g., reservoir, bay). Connecticut's waters (lakes, rivers, and streams) are divided into eight major watersheds, or drainage basins (Figure 3.1.4-2). Connecticut Appendix A, Table A-1, provide detailed information on the state's major watersheds, as defined by CT DEEP. The CT DEEP website (www.ct.gov/deep/watershed/) provides additional information and maps about the states' watershed location, size, and water quality. (CT DEEP, 2015f)

The Connecticut, Housatonic, and Thames watersheds cover three-fourths of the state and drain south into Long Island Sound. Three coastal watersheds and portions of the Hudson River and Pawcatuck River watersheds encompass the remainder of the state. The two smaller Hudson and Pawcatuck watersheds are in the southwestern and southeastern corners, respectively. The Hudson Watershed is predominantly in New York and drains into the Hudson River Estuary. For more information on the Hudson Watershed, see Section 11.1.4.3, New York watersheds. The Pawcatuck Watershed extends into Rhode Island and drains into the Pawcatuck River Estuary. For more information on the Pawcatuck Watershed, see Section 13.1.4.3, Rhode Island watersheds. The three coastal watersheds include the South Central, Southwest, and Southeast watersheds that drain into Long Island Sound. These watersheds include only a small portion of the state's land surface, but are densely populated resulting in water quality impacts from point and non-point pollution sources. (CT DEEP, 2015f)

Freshwater

As shown in Figure 3.1.4-2, there are 11 major rivers in Connecticut: Connecticut, Farmington, Housatonic, Naugatuck, Quinebaug, Quinnipiac, Scantic, Shepaug, Shetucket, Thames, and Willimantic. All of the rivers in the state drain south into Long Island Sound, which flows into the North Atlantic Ocean (CT DEEP, 2017a). For example, the Connecticut River flows approximately 410 miles from the Connecticut Lakes in northern New Hampshire into Long Island Sound and is the longest and widest river in New England. It is also the major source of freshwater to the Long Island Sound Estuary. (Pirrotta, 2012)

[53] Estuarine: related to an estuary, or a "partially enclosed body of water where fresh water from rivers and streams mixes with saltwater from the ocean. It is an area of transition from land to sea" (USEPA, 2015a).

Connecticut also contains more than 2,200 lakes and reservoirs. Some of the state's large lakes and dammed reservoirs provide flood control, hydropower generation, and drinking water sources (CT DEEP, 2017b). For instance, Candlewood Lake, in the western portion of the state, is Connecticut's largest lake (covering more than 5,000 acres), and provides hydropower to five nearby communities, as well as recreational activities (CT DEEP, 2006a).

Estuarine and Coastal Waters

Estuaries (including bays and tidal rivers) are bodies of water that provide transition zones between fresh river water and saline ocean water. Barrier islands, sand bars, and other landmasses protect estuaries, including those in Connecticut, from ocean waves and storms. Connecticut's estuarine environments support a variety of habitats, including tidal wetlands, mudflats, sandy beaches, and submerged aquatic vegetation, and are a critical part of the lifecycle of many different plant and animal species. (USEPA, 2012a) (Pirrotta, 2012)

Connecticut's total estuarine environment encompasses approximately 600 miles, including the lower reaches of the Connecticut River, Housatonic River, Quinnipiac River, and Thames River, and Long Island Sound. Estuarine waters provide recreational areas for boating, swimming, hiking, bird watching, and other activities. (CT DEEP, 2013b)

Connecticut has three major estuaries in the southern portion of the state (Figure 3.1.4-3).

- The **Connecticut River Estuary** encompasses the lower 60 miles from Windsor Locks near the Connecticut-Massachusetts border to Long Island Sound. The estuary provides essential habitat for many wildlife species and anadromous fish (fish that live in the ocean and return to estuaries and rivers to spawn) such as Atlantic salmon (*Salmo salar*), American shad (*Alosa sapidissima*), shortnose sturgeon (*Acipenser brevirostrum*), and striped bass (*Morone saxatilis*) (NMFS, 2012). The Connecticut River estuary and tidal wetlands complex Figure 3.1.4-1) has been designated as a "wetland of international importance," as defined by the Ramsar Convention,[54] due to its rich biological resources. In addition, a state-local "Gateway Commission" was established in 1973 by the Connecticut General Assembly to protect the lower portion of the Connecticut River (approximately 30,000 acres and 30 miles up the river from Long Island Sound). The purpose of the commission was to promote conservation through easements, acquisition of development rights, and local zoning ordinances that would "protect the scenic, historic, and environmental resources of the lower river." (Connecticut River Estuary Regional Planning Agency, 2004) More information about the Connecticut River Estuary is available at www.ct.gov/deep/lib/deep/long_island_sound/coastal_management/gatewaycommissionmission.pdf.

[54] Ramsar Convention: the "oldest of the modern global intergovernmental environmental agreements. The treaty was negotiated through the 1960s by countries and non-governmental organizations concerned about the increasing loss and degradation of wetland habitat for migratory waterbirds" (Ramsar Convention, 2014).

Source: (NMFS, 2012).

Figure 3.1.4-1. Connecticut River Estuary, Old Saybrook, CT

- The **Housatonic River Estuary** extends 149 miles upstream from the mouth of the river at Long Island Sound to the Merritt Parkway and includes two of the last remaining tidal marsh and barrier beach systems in the state: Wheeler Marsh and Milford Point. The Housatonic River Estuary provides valuable oyster habitat and is the state's leading producer of seed oysters, one of the largest north of Chesapeake Bay (Housatonic Valley Association, 2015). The Housatonic Valley Association website (www.hvatoday.org/) provides more information about the estuary.
- The **Long Island Sound** watershed covers 1,320-square miles with 600 miles of coastline in one of the most densely populated areas in the United States, within the jurisdictions of both New York and Connecticut (NYSDEC, 2015). The estuary provides habitat to "more than 1,200 species of invertebrates, 170 species of fish, and dozens of species of migratory birds live at least part of the year" (Long Island Sound Study, 2015a). In 1988, the U.S. Environmental Protection Agency's (USEPA) National Estuary Program (NEP) identified Long Island Sound as an Estuary of National Significance. In cooperation with USEPA and NEP, the Long Island Sound released a Comprehensive Conservation and Management Plan (CCMP) in 1994 to guide restoration and management actions in the estuary. Key issues identified in the CCMP include hypoxia (low dissolved oxygen), toxic substances, pathogens, floatable debris, land use and development, and management and conservation of living resources and their habitats within the estuary (Long Island Sound Study, 2015b). More information on the Long Island Sound estuary and the Long Island Sound Study and Management Plan is available at http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2.

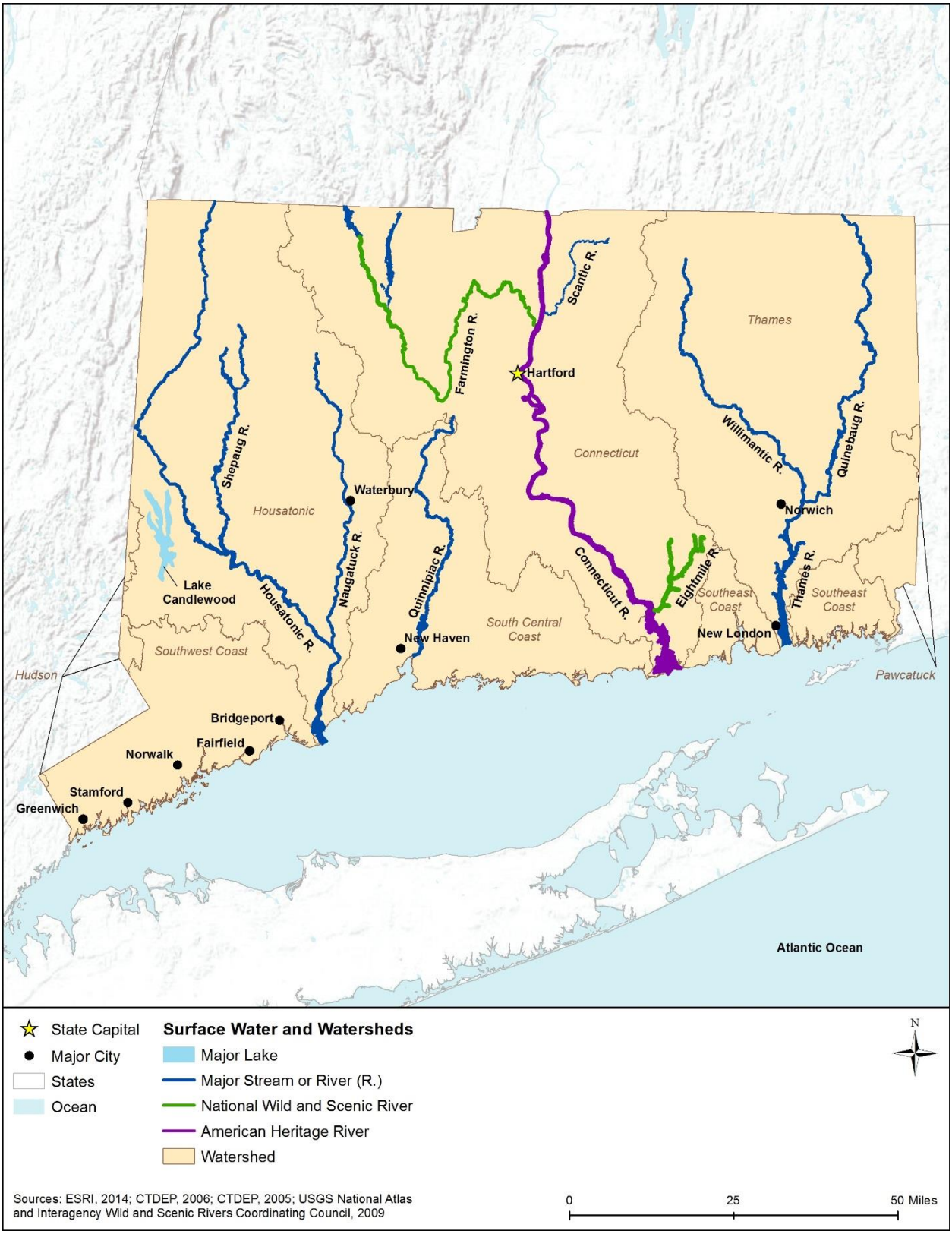


Figure 3.1.4-2: Major Connecticut Watersheds and Surface Waterbodies, defined by CT DEEP

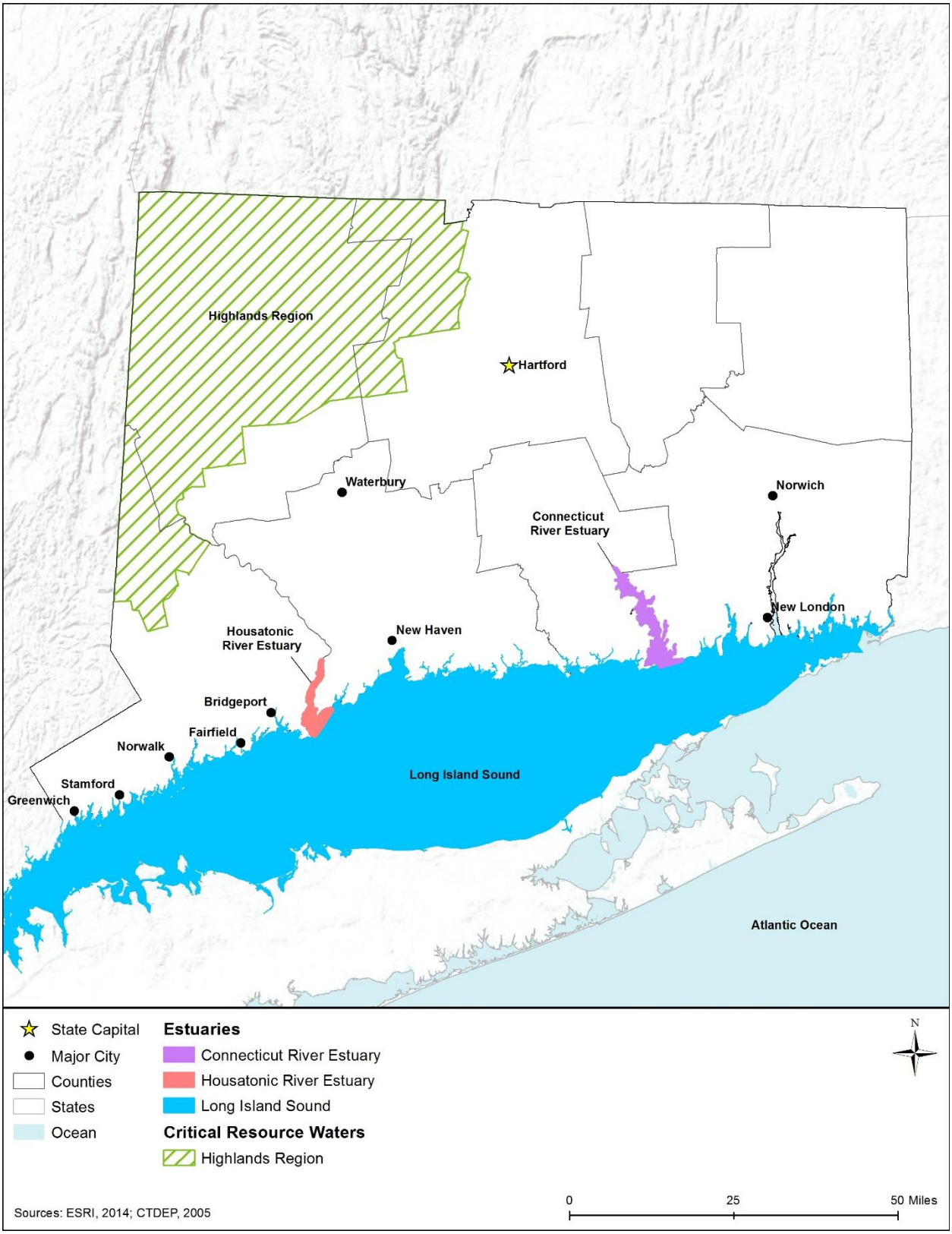


Figure 3.1.4-3: Connecticut's Estuaries and Critical Resource Waters

3.1.4.4. Sensitive or Protected Waterbodies

Wild and Scenic Rivers

Two river segments in Connecticut have been designated as a National Wild and Scenic River: approximately 25 miles along the Eightmile River, and 14 miles along the Farmington River. These are the only federally designated rivers or river segments in the state (Figure 3.1.4-2) (National Wild and Scenic Rivers System 2015).

The Eightmile River stretches 150 miles, through 60 square miles of predominantly rural land in the southern portion of the state. The river's relatively undisturbed watershed makes it an important habitat for rare and significant plant and animal species, as well as "scenic vistas, high water quality, unimpeded stream flow, and significant cultural features" (NPS, 2009). The Farmington River is in the northwestern portion of the state and is bordered by state forests and historic settlements. The river provides important habitat for wildlife, including trout and river otter, and is the only nesting site for bald eagles in the state. (NPS, 2006)

Additionally, in 2006, the Lower Farmington River, beginning at Canton and extending downstream to Windsor (where the Farmington River meets the Connecticut River), and its tributary Salmon Brook, were designated as a Wild and Scenic Study River[55]. This river segment and tributary provide habitat to diverse plant, wildlife, and fish species and passes by archaeological sites, historic towns, and scenic views (NPS, 2011a). The Wild and Scenic Rivers Act provides Study Rivers the same level of protection as wild and scenic rivers (USFS, 2004).

In 1998, the President of the United States declared the Connecticut River (Figure 3.1.4-2) an American Heritage River.[56] The Connecticut River has played a key historic role in New England and flows by 99 New England communities from the Canadian border to Long Island Sound. The river provides valuable habitat for a variety of birds and wildlife. Through a Community Action Plan, restoration efforts have been made to improve water quality and re-establish Atlantic salmon runs within the river and its tributaries. (White House: Clinton Administration, 1998)

[55] Under Section 5(a)(1), "Congress authorizes the study of select rivers and directs one of four federal river-administering agencies to conduct the study, as outlined in Sections 4(a) and 5(c) of the Wild & Scenic Rivers Act." To date, studies have led to 48 Wild & Scenic River designations. Public Law 109-370 initiated the Lower Farmington River and Salmon Brook NPS study in 2007 (USFWS, 2015b).

[56] "The American Heritage Rivers initiative, announced by the President Clinton in his 1997 State of the Union address, recognizes and rewards voluntary community-based efforts to restore and protect the environmental, economic, cultural, and historic values of our rivers. It encourages communities to come together around their rivers and develop strategies to preserve them for future generations" (White House: Clinton Administration, 1998).

State Designated Critical Resource Waters[57]

The Highlands region, in the metropolitan area of Connecticut, New York, New Jersey, and Pennsylvania, is a critical watershed, providing drinking water to the region, and has been designated an area of national significance. In 2004, Congress passed the Highlands Conservation Act with the purpose of recognizing the "importance of the water, forest, agricultural, wildlife, recreational, and cultural resources of the Highlands Region." This act is designed to "assist Connecticut, New Jersey, New York, and Pennsylvania in conserving land and natural resources in this region through federal assistance for land conservation projects." (Hochhozer, 2010)

3.1.4.5. Impaired Waterbodies

Several elements, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, observations of aquatic wildlife communities, and sampling of fish tissue, are used to evaluate water quality. Under Section 303(d) of the Clean Water Act, states are required to assess water quality and report a listing of impaired waters,[58] the causes of impairment, and probable sources. Table 3.1.4-2 summarizes the water quality of Connecticut's major waterbodies that have been assessed by category, percent impaired, designated use,[59] cause, and probable sources. Figure 3.1.4-4 shows the Section 303(d) waters in Connecticut as of 2012.

As shown in Table 3.1.4-2, various sources affect Connecticut's waterbodies, causing impairments. For example, from 1932 to 1977 industrial manufacturing and improper disposal of electrical transformers lead to extensive polychlorinated biphenyls (PCBs) contamination of the Housatonic River, extending from Pittsfield, MA, through Connecticut into Long Island Sound (USEPA, 2014a). Approximately 70 percent of Connecticut's estuaries and bays are impaired, with the overall condition of Long Island Sound rated as being poor.

[57] Critical Resource Waters include NOAA-designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for Federally listed threatened and endangered species, coral reefs, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment (U.S. Government Printing Office, 2012).
[58] Impaired waters: waterways that do not meet state water quality standards. Under the CWA, Section 303(d), states, territories, and authorized tribes are required to develop prioritized lists of impaired waters (USEPA, 2015a).
[59] Designated Use: an appropriate intended use by human beings and/or aquatic life for a waterbody. Designated uses may include recreation, shellfishing, or drinking water supply (USEPA, 2015a).

Table 3.1.4-2. Section 303(d) Impaired Waters of Connecticut, 2012

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	43%	41%	drinking water, aquatic life, recreation, and fishing	pathogens[c], polychlorinated biphenyls (PCBs), and flow and habitat alterations	urban stormwater, municipal point source discharges, industrial point sources, and sewer overflows
Lakes, Reservoirs, and Ponds	47%	20%	drinking water, aquatic life, recreation, and fishing	nutrients, algal growth, PCBs, trash, mercury, and pathogens	industrial, historic pollutants, urban runoff/storm sewers, and municipal discharges/sewage
Estuaries and Bays	100%	69%	aquatic life, recreation, fishing, and shellfish habitat	oxygen depletion, pathogens, and nutrients such as nitrogen and phosphorus	urban runoff/storm sewers, atmospheric deposition[d], municipal discharges/sewage, and industrial

Source: (USEPA, 2015b)

[a] Some waters may be considered for more than one water type.
[b] Connecticut has not assessed all waterbodies within the state.
[c] Pathogen: a bacterium, virus, or other microorganism that can cause disease (USEPA, 2015a).
[d] Atmospheric deposition: the process by which airborne pollutants settle onto to the earth's surface and pollutants travel from the air into the water through rain and snow ("wet deposition"), falling particles ("dry deposition"), and absorption of the gas form of the pollutants into the water (USEPA, 2015a).

Designated uses of the impaired estuaries and bays include aquatic life, fishing, recreation, and shellfish harvesting. Legacy discharges of PCBs have resulted in fish consumption advisories on striped bass and bluefish for all estuaries, as well as consumption advisories for all freshwater fish, except trout, due to atmospheric deposition of mercury (CT DEEP, 2012a).

In order to protect and restore water quality and conserve and manage water resources in the state, the CT DEEP Watershed Management Program has assisted in developing comprehensive watershed management plans with municipalities throughout the state. Development activities can affect the quality of water and other natural resources within a watershed. Watershed management helps to identify sources of pollution in the watershed and provide solutions on how to reduce or eliminate those sources. The CT DEEP Watershed Management Plans and Documents website contains lists of the approved watershed management plans (http://www.ct.gov/deep/cwp/view.asp?a=2719&q=379296&deepNav_GID=1654) (CT DEEP, 2014f).

3.1.4.6. Floodplains

Floodplains are lowlands along inland or coastal waters, including flood-prone areas of offshore islands. The Federal Emergency Management Agency (FEMA) defines a floodplain or flood-prone area as "any land area susceptible to being inundated by water from any source" (44 CFR 59.1) (FEMA 2000). Through FEMA's flood hazard mapping program, the agency identifies flood hazards and risks associated with the 100-year flood, which is defined as "a flood that has a

1 percent chance of occurring in any given year," to allow communities to prepare and protect against flood events (FEMA, 2013).

Floodplains provide suitable and sometimes unique habitat for a wide variety of plants and animals and are typically more biologically diverse than upland areas due to the combination of both terrestrial and aquatic ecosystems. Vegetation along stream banks provide shading, which helps to regulate water temperature for aquatic species. During flood events, sediment and debris settle out and collect on the floodplain, enriching the soil with additional nutrients. Pollutants from floodwater runoff are also filtered by floodplain vegetation and soils; thereby improving water quality. Furthermore, floodplains protect natural and built infrastructure by providing floodwater storage, erosion control, water quality maintenance, and groundwater recharge. Historically floodplains have been favorable locations for agriculture, aquaculture, and forest production due to the relatively flat topography and nearby water supply. Floodplains can also offer recreational activities, such as boating, swimming, and fishing, as well as hiking and camping. (FEMA, 2014a)

Floodplains in Connecticut include the following:

- **Riverine floodplains:** occur along rivers and streams where overbank flooding may occur, inundating adjacent land areas. In steep river valleys found in hilly areas, floodwaters can build and recede quickly, with fast moving and deep water. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters. Whereas, flatter floodplains may remain inundated for days or weeks, covered by slow-moving and shallow water (FEMA 2014b). Hartford County, which includes the Connecticut River, has the highest risk of riverine flooding within the state (CT DEEP 2014f).
- **Coastal floodplains:** In coastal floodplains, flooding resulting from storm surge is the primary concern. Storm surge can occur from both winter storms and tropical storms. Additionally, heavy rain events and overflowing upland waterbodies can also cause flooding in coastal floodplains (Johnson, 2010). The highest risk of coastal flooding in the state occurs in coastal floodplains bordering Long Island Sound and include the coastal counties of Fairfield, Middlesex, New Haven, and New London (CT DEEP 2014f).

Flooding is the leading cause for disaster declaration by the President in the United States and is the most frequently occurring natural hazard in the state (NOAA, 2015a). The main causes of flooding in Connecticut include river flooding, flash flooding, and coastal flooding (CT DEEP 2012b).

The towns of Fairfield (on the coast) and Litchfield (inland) have had the highest number of reported flood events, followed by Hartford (inland) and New London (on the coast). Since 1954, Connecticut has had 14 major disaster declarations due to severe flooding. Of these disaster declarations, three have occurred in the past five years (since 2010). From January 1993 to December 2012, there have been close to 600 flood events in the state, resulting in approximately $56 million in estimated property damages, as well as 10 deaths and 3 injuries. (CT DEEP 2014f)

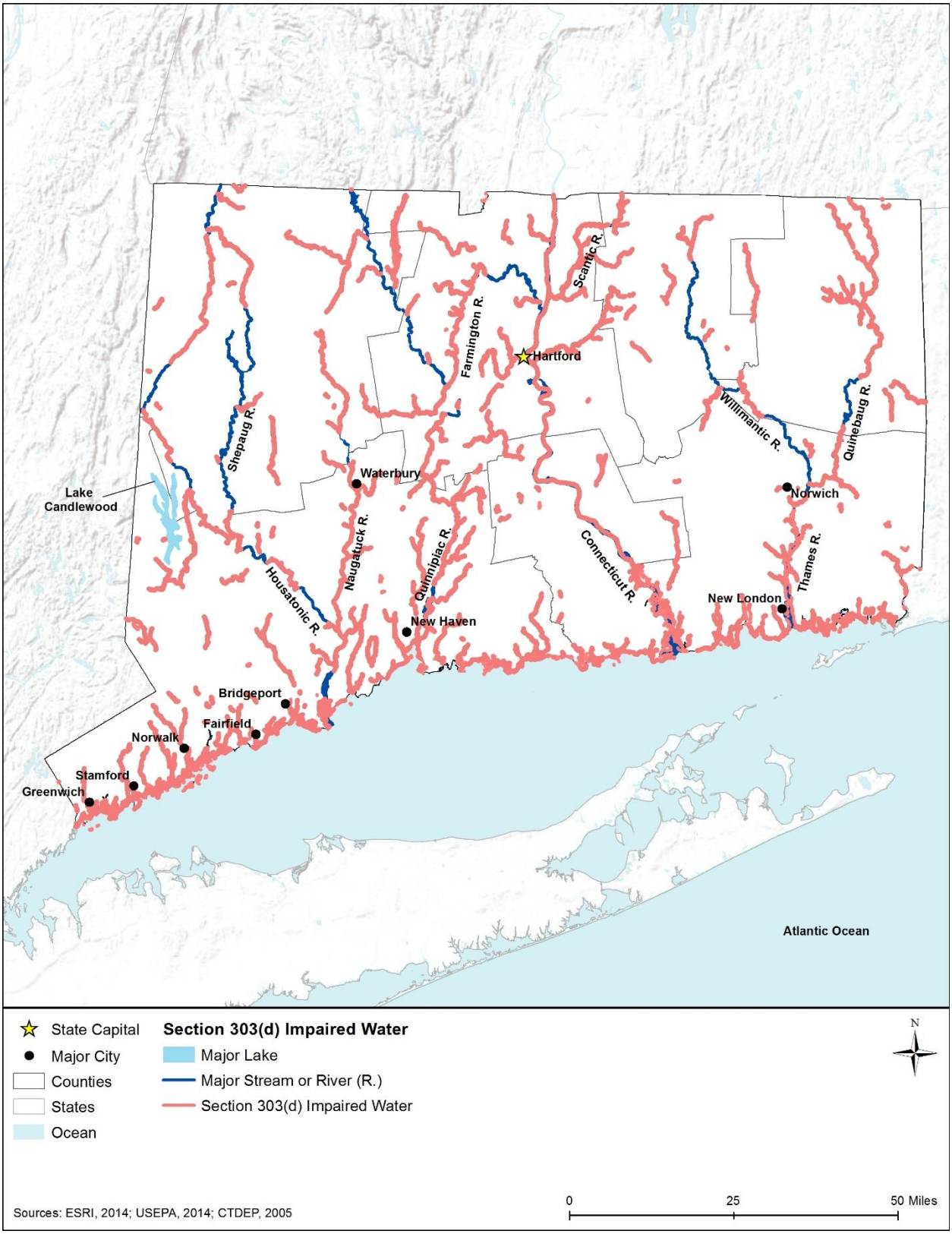


Figure 3.1.4-4: Section 303(d) Impaired Waters of Connecticut, 2012

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. As of April 30, 2013, there are 177 National Flood Insurance Program (NFIP)-participating communities in Connecticut (CT DEEP 2014f). Established to reduce the economic and social cost of flood damage, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, Connecticut had 13 communities participating in the CRS (FEMA, 2014b).[60]

3.1.4.7. Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and includes underground water that occupies pore spaces between sand, clay, or rock particles. An aquifer is a permeable geological formation that stores or transmits water, such as to wells and springs. Groundwater is contained in either confined (bound by clays or nonporous bedrock) or unconfined (no layer to restrict the vertical movement of groundwater) aquifers. (USGS, 1999) When the water table reaches the ground surface, groundwater will reappear as either streams, surface bodies of water, or wetlands. This exchange between surface water and groundwater is an important feature of the hydrologic (water) cycle.

Connecticut's principal aquifers consist of bedrock-till formations (carbonate-rock[61], crystalline-rock) which underlie the entire state and sand and gravel aquifers of alluvial and glacial origin[62] found in river valleys. Generally, the water quality of Connecticut's aquifers is suitable for drinking and most uses. Statewide, the most serious threats to groundwater quality include pesticide applications, improper handling and disposal of solvents from commercial or industrial activities, discharge from solid waste sites and industrial contamination, leaking underground storage tanks, septic tank failure, and improper storage of road salt. (CT DEEP, 2015g) Table 3.1.4-3 provides details on aquifer characteristics in the state.

[60] A list of these 13 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (www.fema.gov/media-library-data/1398878892102-cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

[61] Carbonate-rock aquifers typically consist of limestone with highly variable water-yielding properties (some yield almost no water and others are highly productive aquifers) (Olcott, 1995).

[62] Sand and gravel aquifers of alluvial (sand, silt, or gravel materials left by river waters) and glacial origin are highly productive aquifers in the northern part of the country, consisting of mostly sand and gravel deposits formed by melting glaciers (USGS, 1995).

Table 3.1.4-3: Description of Connecticut's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
New York and New England Carbonate-Rock Consolidated bedrock of limestone, dolomite, and marble and are generally soluble.	Occurs in western part of the state	The water is hard and saltwater is present in places, especially at shallow depths. Overall, the water is suitable for most uses, though carbonate can make groundwater acidic. Where exposed, carbonate-rock aquifers are susceptible to contamination from the land surface because of their permeability. Groundwater is the principal source of water for small businesses or homes in this region.
Early Mesozoic Basin Consolidated bedrock made up of sedimentary and crystalline (non-carbonate) rock	Center of the state	Generally good to excellent water quality. Groundwater is suitable for drinking and most uses. Although these aquifers are the least productive of the principal aquifers, they are important sources of domestic water supplies in areas where the surficial and aquifer system is not present.
Aquifers of Alluvial or Glacier Origin These aquifers consist of layered deposits of sand, gravel, silt, and clay eroded by glaciers.	Found beneath major river and stream valleys or lake plains and terraces, throughout the state.	Suitable for most uses. Generally good to excellent water quality. Most productive aquifers in state and primary source of groundwater for public supply and large industrial or commercial uses. Stratified-drift aquifers are more susceptible to contamination than bedrock aquifers. Because stratified drift aquifers exist mainly in major river valleys, where many cities and large industries occur, they are susceptible to contamination.

Source: (CT DEEP, 2009a), (Moody, Carr, Chase, & Paulson, 1986), (Olcott, 1995a), (USGS, 1995)

Approximately one-third of Connecticut's three million residents use groundwater as their primary source for their drinking water. "Approximately one-half of those residents draw groundwater from private well, and the other one-half from community wells" (CT DEEP, 2015h). Most of the wells in Connecticut are less than 300 feet deep and there is limited data on groundwater quality at depths greater than 300 feet. (Moody, Carr, Chase, & Paulson, 1986)

Connecticut's Aquifer Protection Area Program protects major public water supply wells that serve more than 1,000 people in sand and gravel aquifers to safeguard public drinking water supply around the state. Currently, there are 127 active wells designated in 80 towns around the state with land use restrictions to minimize potential contamination. CT DEEP, municipalities, and the water companies jointly manage the Program. (CT DEEP, 2014g)

Sole Source Aquifers

The USEPA defines a sole source aquifer (SSA) as one that "supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and are areas with no other drinking water sources (USEPA, 2015c). There are two SSAs in Connecticut: Pawcatuck River aquifer basin on the Connecticut and Rhode Island border, and the Pootatuck aquifer in the southeastern corner of the state (as shown in Figure 3.1.4-5) (USEPA, 2014b). Designating a groundwater resource as a SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized (USEPA, 2015c). Figure 3.1.4-5 shows Connecticut's principal and sole source aquifers.

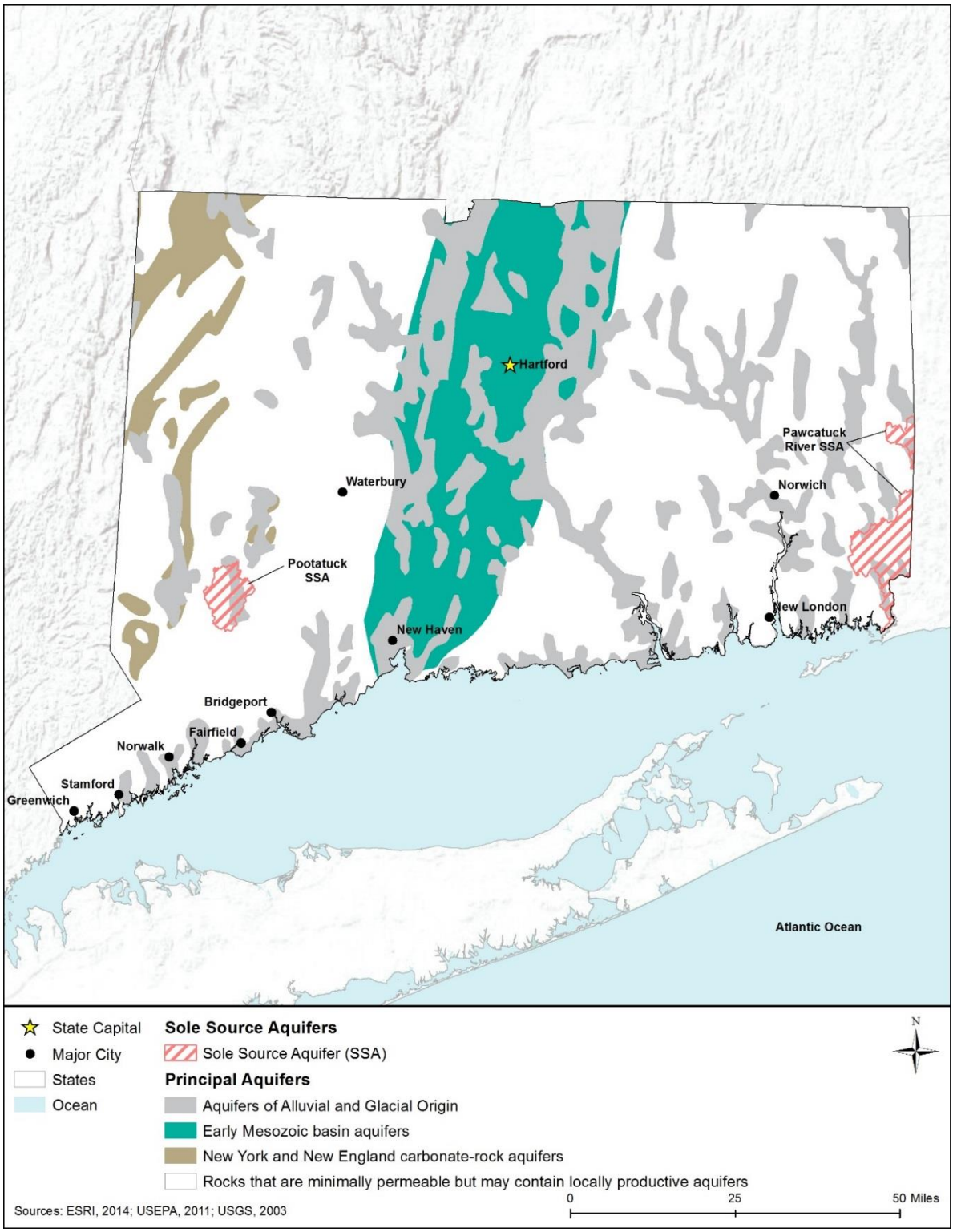


Figure 3.1.4-5: Principal and Sole Source Aquifers of Connecticut

3.1.5. Wetlands

3.1.5.1. Definition of the Resource

The Clean Water Act (CWA) defines wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (U.S. Government Printing Office, 1993).

The Environmental Protection Agency estimates that "more than one-third of the United States' threatened and endangered species live only in wetlands, and nearly half [of such species] use wetlands at some point in their lives" (USEPA, 2017a). In addition to providing habitat for many plants and animals, wetlands also provide benefits to human communities. Wetlands store water during flood events, improve water quality by filtering polluted runoff, help control erosion by slowing water velocity and filtering sediments, serve as points of groundwater recharge, and help maintain base flow in streams and rivers. Additionally, wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography. (USEPA, 2017a)

3.1.5.2. Specific Regulatory Considerations

Appendix C explains the pertinent federal laws to protecting wetlands in detail. Table 3.1.5-1 summarizes major Connecticut state laws and permitting requirements for the state's wetlands.

Table 3.1.5-1: Relevant Connecticut Wetlands Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CWA Section 404 permit, CT regional requirements	USACE, New England District	Activities in waters of the U.S. that have "minimal individual and cumulative impacts on the aquatic environment" within Connecticut and lands within the exterior boundaries of an Indian reservation are permitted.
Tidal Wetlands Act	CT DEEP Office of Long Island Sound Programs	Regulated activities in the wetlands of the state, adjoining coastal and tidal resources, navigation, recreation, erosion, sedimentation, water quality and circulation, fisheries, shellfisheries, wildlife, flooding and other natural disasters and water dependent use opportunities require a permit.
Inland Wetlands and Watercourses Act	CT DEEP Inlands Water Resources Program and State Municipality Inland Wetlands Agencies	Regulated activities in state inland wetlands and watercourse including rivers, streams, brooks, waterways, lakes, ponds, marshes, swamps, bogs[a], and all other waterbodies require a permit. In accordance with CWA Section 401, activities that may result in a discharge into the navigable waters, including all wetlands, watercourses, and natural and manmade ponds of the U.S. require a Water Quality Certificate from CT DEEP indicating that the proposed activity will not violate water quality standards.

Sources: (USACE 2015) (CT DEEP, 2014h) (CT DEEP, 2014i) (CT DEEP, 2014j)

[a] "Bogs, unlike marshes and swamps, are most often located in glacial kettle holes. Water pools in these depressions forming an acidic environment where many unique forms of vegetation grow. The most characteristic plant in a bog is Sphagnum moss. Sphagnum forms mats along the bog surface. New layers grow on top of the old which subsequently become compacted with other plant debris to form peat. The depth of peat accumulation can exceed 40 feet" (CT DEEP, 2012b).

3.1.5.3. Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard (WCS) that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined in (Cowardin, Carter, Golet, & LaRoe, 1979) and (FGDC, 2013). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine (as detailed in Table 3.1.5-2). The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats.

- The Marine System consists of open ocean, continental shelf, including beaches, rocky shores, lagoons, and shallow coral reefs. Normal marine salinity (saltiness) to hypersaline (more than 35 percent salty) water chemistry; minimal influence from rivers or estuaries. Where wave energy is low, mangroves, or mudflats may be present.
- The Estuarine System consists of deepwater tidal habitats and adjacent tidal habitats that usually semi enclosed by land but have open, partly obstructed, or sporadic access to the open ocean and the ocean water is at least occasionally diluted by freshwater runoff from the land.
- Riverine System includes all wetlands and deepwater habitats contained within a channel with two exceptions (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts of 0.5 ppt or greater.
- Lacustrine System includes inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30 percent vegetation cover, and occupy at least 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc.
- Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergent plants, or emergent mosses or lichens, and all wetlands that occur in tidal areas where the salinity is below 5 percent. The Lacustrine System is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types) (Cowardin, Carter, Golet, & LaRoe, 1979) (FGDC, 2013).

Table 3.1.5-2 uses 2014 NWI data to characterize and map Connecticut's wetlands on a broad-scale. The data is not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. The map codes and colorings in Table 3.1.5-2 correspond to the wetland types in the figures. Figure 3.1.5-1 visually depicts the distribution of wetlands across Connecticut by wetland type.

Table 3.1.5-2: Connecticut Wetland Types, Descriptions, Location, and Amount, 2014

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Palustrine forested wetland	PFO	PFO wetlands contain woody vegetation that are at least 20 feet tall. Floodplain forests, hardwood swamps, and silver maple-ash swamps are examples of PFO wetlands.	Throughout the state, along rivers and streams, lake floodplains and bordering salt marshes in coastal areas	146,037
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.	Throughout the state, often on river and lake floodplains	
Palustrine emergent wetlands	PEM	PEM wetlands have erect, rooted, green-stemmed, annual, water-loving plants, excluding mosses and lichens present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens[c], prairie potholes, and sloughs.	Throughout the state, along rivers and streams and bordering salt marshes in coastal areas	24,584
Palustrine unconsolidated bottom	PUB	PUB and PAB wetlands are commonly known as freshwater ponds, and includes all wetlands with at least 25% cover of particles smaller than stones and a vegetative cover less than 30%.	Throughout the state	22,133
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Other Palustrine wetland	Misc. Types	Farmed wetland, saline seep[d], and other miscellaneous wetlands are included in this group.	Throughout the state	54
Riverine wetlands	R	Riverine systems include rivers, creeks, and streams. They are contained in natural or artificial channels periodically or continuously containing flowing water.	Throughout the state along rivers	187
Lacustrine wetland	L2	Lacustrine systems are lakes or shallow reservoir basins generally consisting of ponded waters in depressions or dammed river channels, with sparse or lacking persistent emergent vegetation, including any areas with abundant submerged or floating-leaved aquatic vegetation. These wetlands are generally less than 8.2 feet deep.	Throughout the state in shallow portions of lakes	2,005
Estuarine intertidal and Marine intertidal wetland	E2/M2	These intertidal[e] wetlands include the areas between the highest tide level and the lowest tide level. Semidiurnal tides (two high tides and two low tides per day) periodically expose and flood the substrate. Wetland examples include vegetated and non-vegetated brackish (mix of fresh and saltwater), and saltwater marshes, shrubs, beaches, sandbars, or flats.	Along the shores of the Long Island Sound and lower reaches of the tidal rivers	13,956

Sources: (Cowardin, Carter, Golet, & LaRoe, 1979), (USFWS, 2015c), (FGDC, 2013)

[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin, et.al, 1979, some data has been revised based on the latest scientific advances. The USFWS uses these standards as the minimum guidelines for wetlands mapping. (FGDC, 2013)

[b] All acreages are rounded to the nearest whole number. The maps are prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. (USFWS, 2015d)
[c] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water. (Edinger, et al., 2014)
[d] Saline seep is an area where saline groundwater discharges at the soil surface. Saline soils and salt tolerant plants characterize these wetland types. (City of Lincoln, 2015)
[e] Intertidal wetlands are wetlands found along a shoreline that are exposed to air at low tide and submerged by water at high tide.

Palustrine Wetlands

In Connecticut, the majority of wetlands are vegetated palustrine wetlands (freshwater swamps, marshes, wet meadows, bogs, ponds, and shallow water zones of lakes and rivers). Palustrine forested wetlands (PFO) are the most abundant and widely distributed type in Connecticut, with large portions in northwest Litchfield County and southeast New London County (Tiner, Ralph W., 2013). The majority of PFO lie along rivers and streams and in upland depressions, while some border salt marshes in coastal areas (Metzler & Tiner, 1992). Common types of PFO wetlands in Connecticut are red maple swamps intermixed with yellow birches, American elm, black ash, and conifers like Easter hemlock and Eastern white pine (Metzler & Tiner, 1992). PFO form on organic soils (peats and mucks), loamy and clayey soils, and sandy soils.

Scrub-shrub wetlands (PSS) occur throughout Connecticut, usually on the floodplains of rivers and streams. The vegetation in these wetlands is diverse and includes dominant shrubs such as alder and willow thickets in the north; red maples, arrow-wood, and highbush blueberry along the coast; and buttonbush in the wettest areas of northcentral Connecticut (Metzler & Tiner, 1992). Palustrine emergent wetlands (PEM), or freshwater marshes and wet meadows, are most abundant along the Connecticut River and are dominated by herbaceous and grass-like vegetation that support diverse animal populations. Marshes occur in shallow water or in areas subjected to extended periods of flooding. Common marsh plants in Connecticut include cattails (*Typha latifolia*), bur-reeds (*Sparganium* sp.), and arrowheads (*Sagittaria* sp.). Emergent wetlands in the calcareous[63] valleys of western Connecticut are different from most marshes found in the state due to their alkalinity.[64] Common vegetation adapted to the alkaline-rich waters include Muhlenbergia (*Muhlenbergia* sp.), bulrush (*Scirpus* sp.), capillary beak-rush (*Rhynchospora capillacea*), and golden sedge (*Carex aurea*) (Metzler & Tiner, 1992).

Palustrine wetlands also include the shallow water zone of lakes, rivers, and ponds and aquatic beds formed by free-floating plants such as bullhead lily (*Nuphar variegata*) and pickerelweed (*Pontederia cordata*) (Metzler & Tiner, 1992). These wetlands are found throughout the state.

In 2009, the most common freshwater wetland type was PFO/PSS (74 percent), followed by PUB/PAB (19 percent), and PEM (7 percent) (Tiner, 2010). Based on the USFWS NWI 2014 analysis, PFO/PSS remains the dominant wetland type (75 percent), but ratios have changed slightly with PEM (14 percent) exceeding PUB/PAB (11 percent) (USFWS, 2014a). As of 2014, there are about 200,840 acres of freshwater wetlands in the state (USFWS, 2014a).

[63] Calcareous: of or containing calcium carbonate, calcium, or limestone (USEPA, 2013a).
[64] Alkalinity: a measure of the capacity of water to neutralize acids (USEPA, 2013a).

In 1972, the Connecticut State Legislature passed The Inland Wetlands and Watercourses Act (IWWA) to preserve and protect freshwater (palustrine) wetlands from "random, unnecessary, undesirable and unregulated uses, disturbance or destruction for the health, welfare and safety of the citizens of the state" (CGA, 1972). The IWWA was amended in 1987 to declare it is the "public policy of the state" to require municipal regulation of these activities (CT DEEP, 2015i). Main threats to palustrine wetlands in Connecticut include agricultural conversion and urbanization (Tiner, McGuckin, & Herman, 2013).

Estuarine and Marine Wetlands

In Connecticut, major estuarine or tidal fringe wetland, include submerged aquatic beds, intertidal beaches and rocky shores, and intertidal flats. These wetlands can be vegetated (marshes) or unvegetated (mud and sand flats), and are most extensive along the south central coast of the Long Island Sound and in the lower reaches of major tidal rivers, such as the Housatonic and Connecticut Rivers, and extend upstream to freshwater. Mud and sand flats are often found between intertidal marshes and protected deep-water bays and coves in Connecticut. (Metzler & Tiner, 1992)

Filling and dredging have caused the permanent loss of approximately 30 percent of Connecticut's tidal wetlands. As a result, the state has taken a proactive approach to preserve the remaining wetlands with the passage of the Tidal Wetlands Act in 1969 to regulate dredging and filling activities and the Coastal Management Act in 1980 to create policy for restoration efforts of affected estuarine wetlands. Restoration efforts by CT DEEP have prevented large losses of estuarine wetlands and restored more than "1,700 acres of estuarine wetlands at approximately 40 sites from Greenwich to Stonington." (CT DEEP, 2014k)

Lacustrine and Riverine Wetlands

Lacustrine and riverine wetlands comprise approximately one percent of all Connecticut wetlands, mostly occurring along the shores of rivers and in the shallow portions of lakes. Since they represent such a small portion of the state's total wetlands, they are not discussed in detail.

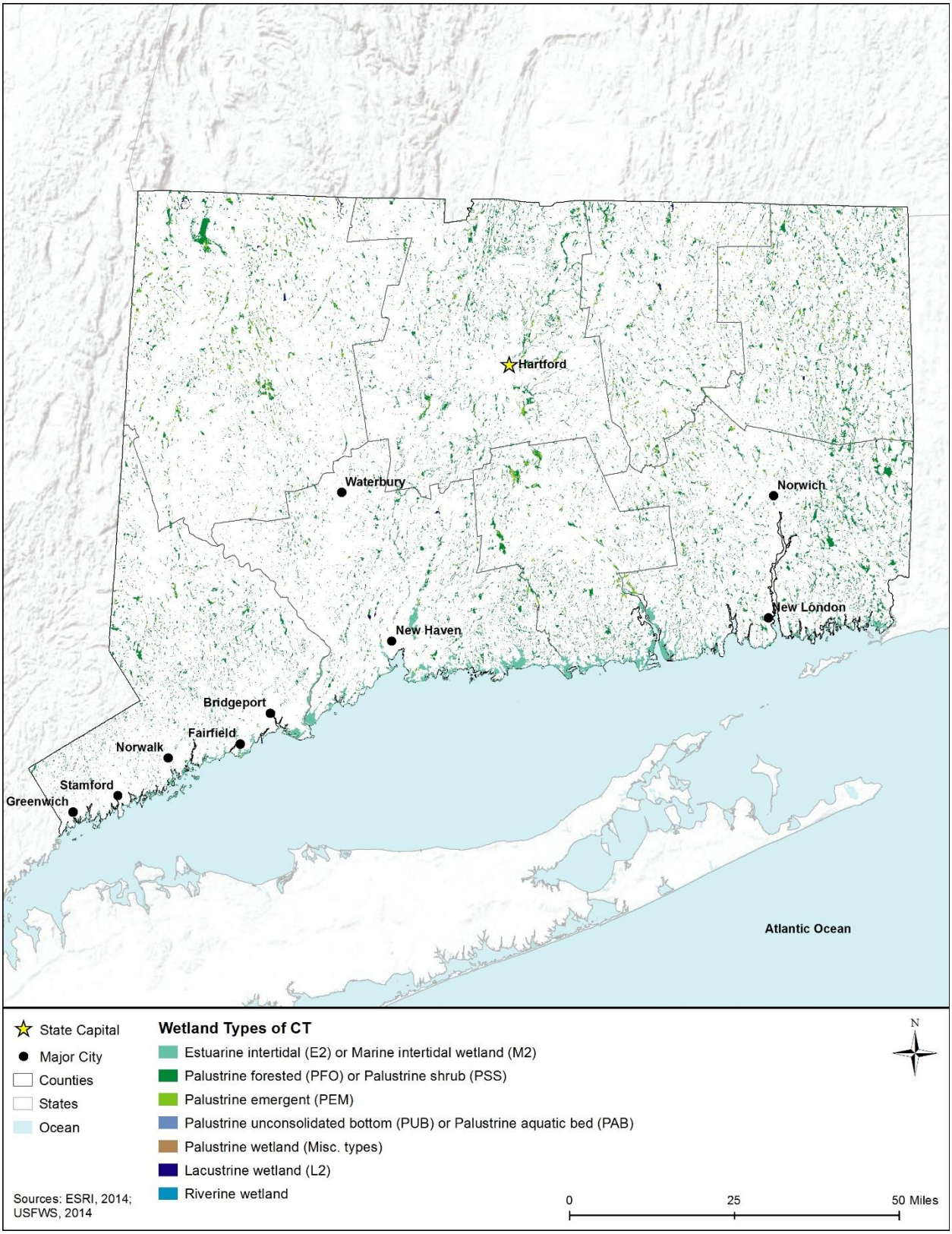


Figure 3.1.5-1: Wetlands by Type, in Connecticut, 2014

3.1.5.4. Wetlands of Special Concern or Value

In addition to protections under the state's IWWA and national CWA, Connecticut considers certain wetland communities as areas of special value due to their global or regional scarcity, "unusual local importance," or habitat they support. These include vernal pools, as described below, and the wetlands associated with the Lower Connecticut River.

Source: (CT DEEP, 2015j)

Figure 3.1.5-2*:* Vernal Pool, Connecticut

Vernal Pools

Under Connecticut's IWWA, "natural or artificial, vernal or intermittent" bodies of water are considered watercourses (CT DEEP, 2013c). One example is the vernal pool, a unique vernal watercourse containing a specific ecology. Vernal pools are seasonal wetlands in confined depressions or basins that lack a permanent outlet stream. They are typically filled with water during the winter and spring months, and appear dry by late summer and early fall. Connecticut's vernal pools vary in size from small mud puddles to shallow lakes, and are generally at low spots in forests or meadows, as shown in Figure 3.1.4-3. Vernal pools are often difficult to identify as climatic changes during each season dramatically alter their appearance. Due to their temporary nature, vernal pools lack fish populations but are able to provide ideal breeding grounds for amphibian or invertebrate species. These species include the spotted salamander (*Ambystoma maculatum*), Jefferson salamander (*Ambystoma jeffersonianum*), marbled salamander (*Ambystoma opacum*), wood frog (*Lithobates sylvaticus*), and fairy shrimp (*Anostraca* sp.) (USDA, 2015a). In response to long-term decline in certain vernal pool wildlife species, Connecticut municipalities have developed conservation management practices to preserve habitats.

Lower Connecticut River

The Lower Connecticut River is home to many ecologically sensitive tidal marsh communities. The tidal marshes have been designated as Wetlands of International Importance under the Ramsar Convention.[65] The area offers habitat for a "multitude of creatures, including six kinds

[65] The Ramsar Convention is the "oldest of the modern global intergovernmental environmental agreements. The treaty was negotiated through the 1960s by countries and non-governmental organizations concerned about the increasing loss and degradation of wetland habitat for migratory waterbirds" (Ramsar Convention, 2014).

of plants and animals that are rare or endangered worldwide" (The Nature Conservancy, 2015a). The Nature Conservancy has protected more than 4,000 acres in this region since 1960 and is currently conducting a marsh restoration program with CT DEEP to restore habitats in the region. Local communities collaborate with The Nature Conservancy to focus protection efforts on wetlands along the river, such as the freshwater tidal marshes of Hamburg Cove. These marshes are an important foraging and resting site for waterfowl and provide a viable spawning area for fish such as river herring (USNRC, 2004). The lower portion of the Eightmile River, a tributary of the Connecticut River, includes an expansive freshwater tidal marsh that is recognized by the USFWS as a Special Focus Area. The tidal marsh "harbors rare species, important fisheries, waterbirds, and unusual habitats" and "provides important winter habitat for Bald Eagles" (The Nature Conservancy, 2015b).

Other Important Wetland Sites

Other important wetland sites in Connecticut include:

- Wetland Nature Centers are open to the public and all are state-protected because of their ecological importance (CT DEEP, 2014l). *More information on the centers is available at* www.ct.gov/deep/cwp/view.asp?a=2716&q=325086&deepNav_GID=1650.
- Wildlife Management Areas (WMAs) are designated for outdoor recreation; these public lands include wetlands. (CT DEEP, 2015k) To learn more about state WMAs, visit www.ct.gov/deep/cwp/view.asp?a=2723&q=329520&deepNav_GID=1719.
- National Natural Landmarks range in size from 10 acres to more than 1,500 acres, and are owned by CT DEEP, The Nature Conservancy, municipalities, and other private conservation organizations and individuals. (NPS, 2012a) Visit www.nature.nps.gov/nnl/state.cfm?State=CT to learn more about state National Natural Landmarks.
- Additionally, natural resource groups such as state land trusts, CT DEEP, Connecticut Department of Agriculture, McLean Game Refuge, National Audubon Society, and The Nature Conservancy manage wetland conservation easements or lands that contain important wetland habitat within Connecticut, according to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/reports/easements). (National Conservation Easement Database, 2015)

For more information on Connecticut's WMAs, National Natural Landmarks, conservation programs, and easements, see Section 3.1.8, Visual Resources, and Section 3.1.7, Land Use, Airspace, and Recreation.

3.1.6. Biological Resources

3.1.6.1. Definition of the Resource

This chapter describes the biological resources of Connecticut. Biological resources include vegetation, wildlife, fisheries and aquatic habitats[66], threatened[67] and endangered[68] species as well as communities and species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Because of the significant topographic variation from the western to eastern portions of the state, and its location along the Atlantic Coast, Connecticut supports a wide diversity[69] of biological resources ranging from marine[70] settings along the coastal lowlands of Long Island Sound, to western hardwood, oak-hickory, and oak-pine forests in the hills and upland regions of the northwest. Each of these topics is discussed in more detail below.

3.1.6.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of biological resources in Connecticut are summarized in Appendix C. Table 3.1.6-1 summarizes the state laws relevant to the state's biological resources and the Proposed Action.

Table 3.1.6-1: Relevant Connecticut Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CT Chapter 446 § 22a-381c	CT DEEP	Provides a list of all invasive and potentially invasive plants prohibited in Connecticut.
CGS Chapter 495 § 26-303, Connecticut Endangered Species Act (ESA)	CT DEEP	Protection of threatened, endangered, and special concern species in Connecticut. Currently, CT DEEP lists 14 mammals, 50 birds, 14 reptiles, 8 amphibians, 13 fish, 174 insects, 20 other invertebrates, and 331 plants. The USFWS lists 14 federally listed species including 2 mammals, 2 birds, 5 reptiles, 1 fish, 2 invertebrates, and 2 plants.

Sources: (CGA, 2017b), (CT DEEP, 2015l), (USFWS, 2015e)

3.1.6.3. Vegetation

As the third smallest state in the nation, Connecticut's vegetation is diverse given the geographic size of the state is only 5,090 square miles (CT DEEP, 2005a). There are approximately 1,114 plant species included in the University of Connecticut (UCONN) Plant Database and, and each

[66] Habitat: "The environment in which an organism or population of plants or animals lives; the normal kind of location inhabited by a plant or animal" (USEPA, 2015d).
[67] Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C §1532(20)) (USEPA, 2015d).
[68] Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C §1532(6)) (USEPA, 2015d).
[69] Diversity: "An ecological measure of the variety of organisms present in a habitat" (USEPA, 2015d).
[70] Marine: "Any marine environment, from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment" (USEPA, 2015d).

species is considered to be part of the flora[71] of Connecticut (UCONN, 2016a). The distribution of vegetation (i.e., flora) within the state is a function of the geology[72], soils, climate, and water of a given geographic area and correlates to distinct areas identified as ecoregions[73]. Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions, and represent ecosystems contained within a region. Ecoregion boundaries are not fixed, but rather depict a general area with similar ecosystem types, functions, and qualities (National Wildlife Federation, 2015) (USDA, 2015b) (World Wildlife Fund, 2015). Ecoregion boundaries often coincide with physiographic[74] regions of a state. The ecoregions mapped by the USEPA are the most commonly referenced, although individual states and organizations have defined ecoregions that may differ slightly. The USEPA Level I ecoregion is the coarsest level, dividing the United States into 15 ecological regions. Level II further divides the country into 50 regions. The continental U.S. contains 104 Level III ecoregions and the contiguous lower 48 states has 84 Level III ecoregions. This section presents a discussion of biological resources for Connecticut at USEPA Level III (Griffith, et al., 2009).

As shown in Figure 3.1.6-1, the USEPA divides Connecticut into two Level III ecoregions, each supporting a variety of different plant communities, all predicated on their general location within the state. Communities range from hardwood and floodplain forest communities in the Connecticut River Valley to oak-pine, American chestnut (*Castanea dentata*), hickory (*Carya* sp.), and pine forest communities in the southern portions. Areas adjacent to the coastal regions of Long Island Sound are influenced by milder climates and are characterized by coastal hardwood forests, thickets of vines and shrubs, and some pitch pine near the coastal dunes. (Griffith, et al., 2009) Table 3.1.6-2 provides a summary of the general abiotic[75] characteristics, vegetative communities, and the typical vegetation found within each of the two Connecticut ecoregions.

[71] Vegetation within an area.
[72] "Geology is the study of the planet earth- the materials it is made of, the processes that act on those materials, the products formed, and the history of the planet and its life forms since its origin" (USEPA, 2015d).
[73] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables" (USEPA, 2015d).
[74] Physiographic: "The natural, physical form of the landscape" (USEPA, 2015d).
[75] Abiotic: "Nonliving characteristic of the environment; the physical and chemical components that relate to the state of ecological resources" (USEPA, 2015d).

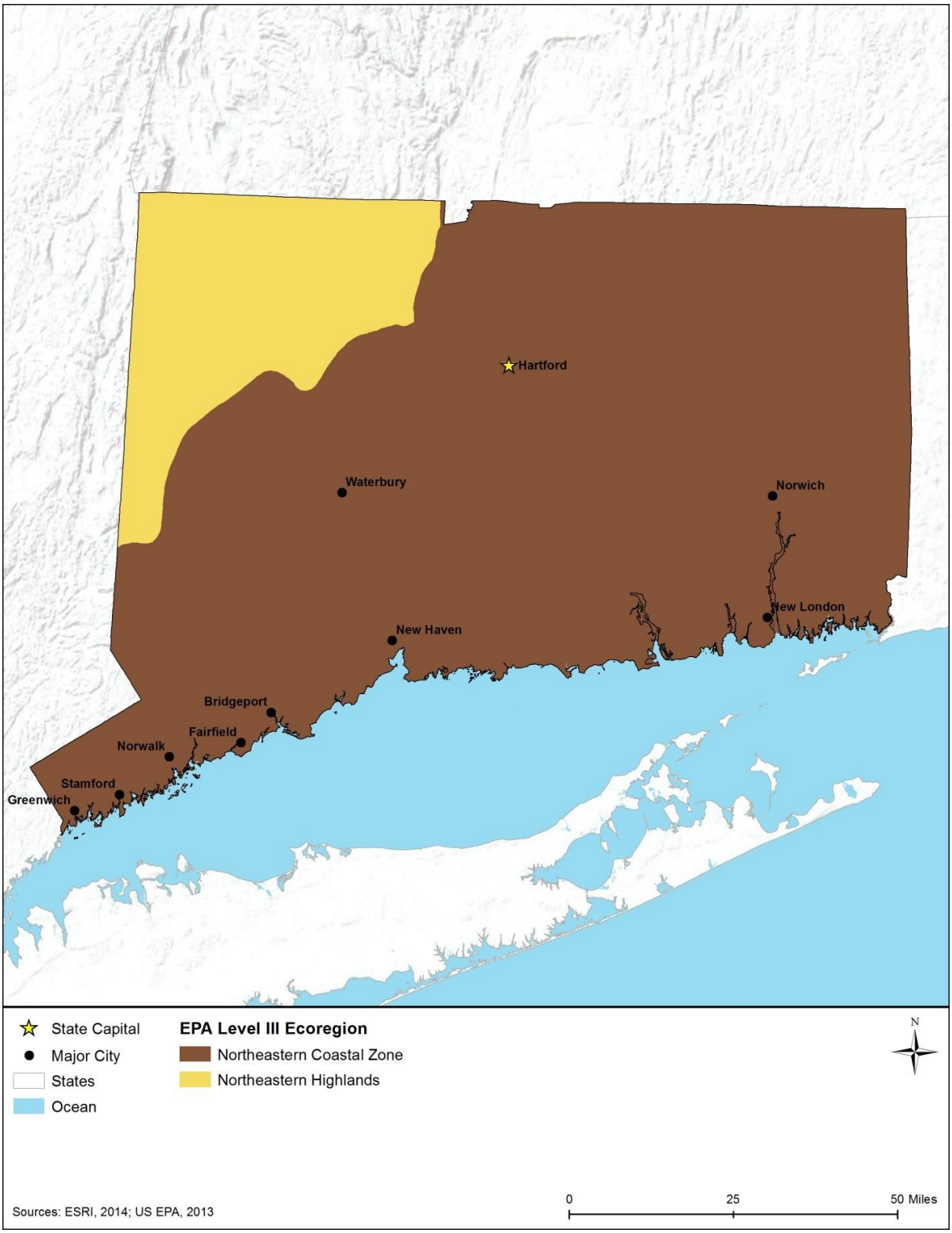


Figure 3.1.6-1: Level III Ecoregions of Connecticut

Table 3.1.6-2: Characteristics of Level III Ecoregions in Connecticut

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
Geographic Region: Western New England, Marble Valley, Berkshires				
58	Northeastern Highlands	Composed mostly of forested hills and mountains on nutrient poor soils, with numerous high-gradient streams and glacial[76] lakes	Maple-Beech-Birch; Spruce-Fir; Oak-Hickory	**Hardwood Trees** – Maples (*Acer sp.*); Oaks (*Quercus sp.*); Bitternut hickory (*Carya cordiformis*); American beech (*Fagus grandifolia*); Birches (*Fagus* sp.); White walnut (*Juglans cinerea*); Spruces (*Picea* spp.); Eastern hemlock (*Tsuga canadensis*) **Conifer Trees** – Balsam fir (*Abies balsamea*); White pine (*Pinus strobus*) **Shrubs** – Highbush blueberry (*Vaccinium corymbosum*); Mountain laurel (*Kalmia latifolia*)
Geographic Region: Southern New England, Connecticut Valley, Long Island Sound				
59	Northeastern Coastal Zone	Composed of irregular plains and plains with high hills, on nutrient poor soils with numerous glacial lakes	Appalachian Oak Forest and Northeastern Oak-Pine Forest	**Hardwood Trees** – Oaks; Sweetgum (*Liquidambar styraciflua*); Persimmon (*Diospyros virginiana*); Red maple (*Acer rubrum*); Black birch (*Betula lenta*); American chestnut (*Castanea dentate*); Hickories **Conifer Trees –** White pine (*Pinus strobus*); Pitch pine (*Pinus rigida*) **Shrubs** – American holly (*Ilex opaca*); Eastern dogwood (*Cornus florida*)

Sources: (Griffith, et al., 2009) (USEPA, 2015e)

[76] Glacial: "Of or pertaining to distinctive processes and features produced by or derived from glaciers and ice sheets" (USEPA, 2015d).

Communities of Concern

Connecticut contains several vegetative communities of concern that include rare natural plant communities, plant communities with greater vulnerability or sensitivity to disturbance, and communities that provide habitat for both rare plant and wildlife species. The CT DEEP's Natural Diversity Database includes federal and state-listed species and significant natural communities known to occur, or that have historically occurred, in the state (CT DEEP, 2015m). The historical occurrences are important for assessing previously undocumented occurrences or re-occurrences of previously documented species; significant natural communities are also mapped. The Greatest Conservation Need (GCN) plant list includes plants listed as globally rare (e.g. G-1 to G3) by NatureServe[77], species with restricted geographic ranges, and species that serve as important host plants for GCN invertebrate species. Connecticut also implements the 2005 Comprehensive Wildlife Conservation Strategy (CWCS), known as the Connecticut Wildlife Action Plan (WAP). CT DEEP updates the strategy every 10 years to create a blueprint for the conservation of wildlife in the state.

Connecticut's 2005 WAP presents the species of greatest conservation need (GCN), their key habitats, threats, research needs, and conservation actions. The 2005 WAP also outlines how CT DEEP will monitor the effectiveness of the strategy, coordinate with conservation partners to periodically review and update the strategy, and engage the public (CT DEEP, 2005a). Given the last update was completed more than a decade ago, CT DEEP is now in the process of updating the original WAP for the next decade (2015 through 2025). This effort involves revising the state's list of species of GCN and adding new information on climate change and its impacts to wildlife conservation. The effort also includes updating resource maps, refining conservation threats, and incorporating information gained through the implementation of the first WAP. While final drafts of the 2015 Revision of the WAP[78] have been circulated to the public, because the plan has not been adopted by the state, the original 2005 CWCS, or WAP is summarized here to describe the state's vegetative communities of concern.

According to the 2005 WAP and continued in the 2015 WAP, the state used three standardized classification systems to describe Connecticut's vegetated landscape. CT DEEP used each system to develop the state's key wildlife habitats. The first vegetation classification system includes the National Vegetation Classification Standard, established in 1997 as the standard vegetation classification system for federal agencies. The second system is a vegetation classification system developed by NatureServe, which was derived from a consortium of state natural heritage programs and conservation agencies. Two graduate researchers in ecology and evolutionary biology, Metzler and Barrett, developed the third classification system specifically for Connecticut; it uses regional landscape approaches, but is tailored more to the localized

[77] NatureServe is a non-profit organization that provides high-quality scientific expertise for conservation projects with over 1,000 conservation professionals from the United States, Canada, and Latin America (www.natureserve.org).
[78] The 2015 WAP incorporates climate change data and potential impacts to wildlife conservation, updates maps, refines conservation threats, identifies new and revised conservation actions, and adds best practices and information from the 2005 WAP implementation.

influences of Connecticut's topography, surface features, and major drainage patterns on vegetation communities (CT DEEP, 2005a).

Based on an iterative ranking process, a database was created to store and sort species into 12 key habitats. The 12 key habitats developed to protect GCN species include: upland forest, upland woodland and shrub, upland herbaceous, forested inland wetland, shrub inland wetland, herbaceous inland wetland, sparsely vegetation inland wetland, tidal wetland, freshwater aquatic, estuarine aquatic, unique and manmade habitats, and intensively managed habitat.

The 12 key habitats in Connecticut represent the most common to most unique habitats in the state. Table 3.1.6-3 summarizes the 12 key habitats identified in Connecticut, as defined in the 2005 WAP.

Table 3.1.6-3: Key Habitats in Connecticut[79]

Habitat Type	Sub-Habitats	Description	Distribution
Upland Forest	Dry Oak Forests, Calcareous Forests, Coniferous Forests, Old Growth Forests	Characterized by deciduous trees, evergreen trees, or mixed evergreen-deciduous trees with overlapping crowns forming between the canopy cover.	Predominant vegetation type in Connecticut; dominated by trees in the 80 to 100 year class.
Upland Woodland and Shrub	Red Cedar Glades, Pitch Pine/Scrub Oak Woodlands, Coastal Shrublands	Open forests where tree crowns do not touch (between 25-65% canopy cover). Woodlands are dominated by evergreen or deciduous trees with a variety of shrubs, herbs, and non-vascular plants in the understory.	Overall status and distribution of this habitat is not well known; sparsely spread across the state.
Upland Herbaceous	Coastal Dunes, Grassy Glades and Balds, Sandplain and Other Warm Season Grasslands, Sparsely Vegetated Sand and Gravel	Herbaceous plants, such as grasses, herbs, and ferns that form 25% or more of the ground cover. Also includes areas with scattered trees, shrubs, and dwarf-shrubs, as long as they provide less than 25% cover.	Scarce and declining in Connecticut; 3 of the sub-habitats are included among the 13 most imperiled ecosystems in the state (Metzler & Wagner, 1998).
Forested Inland Wetland	Atlantic White Cedar Swamps, Red/Black Spruce Swamps, Northern White Cedar Swamps, and Floodplain Forests	Characterized by wetland soils, and dominated by evergreen or deciduous trees with crowns forming 60-100% cover.	Approximately 100,000 acres of forested inland wetlands in the state, with red maple forest being most common.
Shrub Inland Wetland	None	Dominated by wetland soils and woody vegetation greater than 1.5 feet and less than 20 feet in height, arranged individually, or clumped. The shrub layer generally forms more than 25% of the canopy cover. Habitat includes shrub thickets, bogs, and fens.	Status and distribution in the state are not well known; most of Connecticut's bogs have escaped serious degradation. Nutrient input from development and beaver impoundments threatens the habitat.

[79] Wetland communities are described in Section 3.1.5.

Habitat Type	Sub-Habitats	Description	Distribution
Herbaceous Inland Wetland	Calcareous Spring Fens, Freshwater Marshes	Dominated by herbaceous layer of grasses, forbs, and ferns, and includes less than 25% of scattered tree, shrub, and dwarf-shrub cover.	Condition of the habitat is poor and declining; Calcareous Spring Fens are 1 of the 13 most imperiled ecosystems in the state (Metzler & Wagner, 1998).
Sparsely Vegetated Inland Wetland	Surface Springs, Vernal Pools	Open water or open mineral substrates with scattered, if any, plants.	Status is not well known; some habitat is mapped by town, because of increased residential development.
Tidal Wetland	Tidal Wetlands, Intertidal Beaches and Shores	Diurnally flooded areas, typically dominated by herbaceous plants, however some areas may have trees or shrubs or be sparsely vegetated.	Reduced by approximately 50% since 1900s through filling, dredging, and ditching activities; today there are approx. 17,500 acres of tidal wetlands remaining.
Freshwater Aquatic	Large Rivers and Streams and Associated Riparian Zones, Unrestricted Free-flowing streams, Cold water streams, Head-of-Tide, Lakes and Shorelines, Coastal Plain Ponds	Encompass a variety of bodies of water, including large rivers, streams, lakes, and ponds. Include both vegetated shorelines and non-vegetated habitats. Vegetation may be emergent or submerged.	15,000 miles of rivers and streams, and 6,000 lakes and ponds in Connecticut; current water quality data are available.
Estuarine Aquatic	Coastal Rivers, Coves, and Embayments; Vegetation Beds; Hard Bottoms; Sponge Beds; Shellfish Reefs and Beds; Sedimentary Bottoms; Open Water	Include coastal and tidal waters of varying salinity and substrates that are associated with Long Island Sound. All transitional zones from the Sound to upstream areas are included; estuaries are migration corridors for diadromous fish, as well as nursery areas for many diadromous, estuarine, and marine fish.	Long Island Sound forms approximately 235 miles of coastline along Connecticut's southern border. Habitat extends from pelagic (open water) areas of the Sound, to the various submerged substrates, to the intertidal coves and embayments, to the heads-of-tide that reach the major rivers flowing in the Sound.

Habitat Type	Sub-Habitats	Description	Distribution
Unique and Manmade Habitats	Taprock Ridges, Offshore Islands, Coastal Bluffs and Headlands, Caves and Subterranean Habitats, Urban Habitat	Taprock ridges range from dense forest to open rocky summits and cliff faces; Offshore Islands are similar habitats as coastal and estuarine aquatic habitats (include Falkner Island, Menunketesuck Island, Charles Island, Great Captain's Island, and others); Coastal bluffs and headlands include cliffs and escarpments that border Long Island Sound; Caves and Subterranean Habitats include natural limestone caves found in the Marble Valley; and Urban Habitats include the areas in and around cities and towns with impervious surfaces.	Distribution varies by sub-habitat: Taprock ridges are in good condition; Offshore islands are limited geographically and vulnerable to rising sea levels; Coastal bluffs and headlands have been altered, but natural areas still exist; Cave and subterranean habitat is limited; and Urban habitat varies as features such as parks and riverways through cities can provide habitat; whereas other building features degrade habitat.
Intensively Managed Habitats	Early Successional Shrublands and Forests, Cool Season Grasslands, Wet Meadows	Early successional shrublands and forests are characterized by shorter shhrubs (generally less than 2 feet tall) with a shrub canopy of more than 25% and a tree canopy of less than 25%. Cool seasonal grasslands include hayfields and other managed grasslands that tend to be primarily composed of non-native species. Wet meadows include temporarily flooded grasslands that can contain a variety of grasses and sedges.	These habitats occur throughout the state.

Sources: (USEPA, 2015e) (CT DEEP, 2017c)

Nuisance and Invasive Plants

Nuisance and invasive plants are a broad category that includes a large number of undesirable plant species that are non-native to areas and have the potential to spread causing harm to the environment, local economy, and human health. Noxious weeds[80] are typically non-native species that have been introduced into an ecosystem inadvertently; however, on occasion native species can be considered a noxious weed. Noxious weeds greatly affect agricultural areas, forest management, natural, and other open areas (GPO, 2017).

Connecticut maintains an invasive plant list and regulates invasive plants by prohibiting the importation, movement, sale, purchase, transplanting, cultivation, and distribution of invasive plants and potentially invasive plants in accordance with state law (CGS § 22a through 381b) (Connecticut Invasive Plant Council, 2014). The Connecticut Invasive Plant list (http://cipwg.uconn.edu/invasive_plant_list/) currently contains 102 invasive plant species, which including aquatic, grass, herbaceous, shrub, tree, and woody vine species (Connecticut

[80] Noxious weeds: "any living stage (e.g., seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the United States or the public health" (Federal Noxious Weed Act of 1974).

Invasive Plant Council, 2014). Additionally, the U.S. government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S.C. 7701 et seq.). As of September 2014, 112 federally recognized noxious weed species have been catalogued in the United States, 88 of which are terrestrial, 19 aquatic, and 5 parasitic (USDA, 2014). According to the USDA PLANTS database, at least three of these noxious weed species are known to occur within Connecticut including three aquatic species, Hydrilla (*Hydrilla verticillata*,) Giant salvinia (*Salvinia molesta*) and Giant hogweed (*Heracleum mantegazzianum*) (USDA, 2015c).

3.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Connecticut, divided among mammals, birds, reptiles and amphibians, and invertebrates. Terrestrial wildlife are those species of animals, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals and furbearers,[81] non-game animals, and game birds and waterfowl and their habitats that may be found in Connecticut. A discussion of non-native or invasive wildlife species is also included. As identified in the Connecticut Comprehensive Wildlife Conservation Strategy, there are 84 mammal species considered by CT DEEP to be part of the fauna[82] of the state, "335 species of birds, 49 species of reptiles and amphibians, and an estimated 20,000 species of invertebrates" (http://www.ct.gov/deep/lib/deep/wildlife/pdf_files/nongame/ctwap/2005cwcs/CWCSCh1.pdf) (CT DEEP, 2015n). Of these species, the state recognized several important state species of concern, including 27 mammal species, 148 species of resident and migratory birds, 30 reptile and amphibian species, and 196 invertebrates (CT DEEP, 2015o).

Mammals

Of the 84 mammal species present in Connecticut, many are common or widely distributed throughout the state. Regionally, Connecticut supports several species that reside at the northern or southern limits of their habitat ranges. The coastal portion of Connecticut includes the northern distribution limit for southern Piedmont species, such as the least shrew (*Cryptotis parva*). In addition, moose (*Alces alces*) have been found in Connecticut in the last few decades (CT DEEP, 2015n).

Other large mammal species commonly found throughout Connecticut include furbearers, such as the black bear (*Ursus americanus*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana)*, skunk (*Mephitis mephitis)*, and muskrat (*Ondatra zibethicus)*. Most of these species occur throughout Connecticut, however, some species, such as beaver (*Castor canadensis*) and river otter (*Lontra canadensis*) prefer forested wetlands. Other species that occur in Connecticut include red fox (*Vulpes vulpes*) and gray fox (*Urocyon cinereoargenteus*), although their populations have likely declined from historic levels due to a decline in early successional stage habitats and competition with coyotes (*Canis latrans*). Coyotes are a non-native species to the state, but during the past few decades the

[81] A furbearer species is any animal whose fur is considered commercially valued or of a high quality.
[82] Animals within an area.

population has rapidly increased and the species is now common. Fisher (*Martes pennanti)*, a member of the weasel family, also occur in Connecticut and are often found statewide, although they appear to be more abundant in eastern Connecticut (CT DEEP, 2015n).

Small mammals commonly found throughout Connecticut consist of small rodents and shrews, including southern red-backed vole (*Clethrionomys gapperi)*, woodland vole (*Microtus pinetorum)*, meadow jumping mouse (*Zapus hudsonius)*, and woodland jumping mouse (*Napaeozapus insignis)*. Several of these species have been surveyed and mapped by CT DEEP. In 2010, the state placed more than 5,000 traps and recorded subsequent captures. Outcomes of the survey identified long-term stability for two population areas of the meadow jumping mouse, and the need to continue to ensure careful management of the endangered least shrew (CT DEEP, 2015n). Small game mammals in Connecticut consist of eastern cottontail (*Sylvilagus floridanus)*, New England cottontail (*Sylvilagus transitionalis)*, gray squirrel (*Sciurus carolinensis)*, woodchuck (*Marmota monax)*, snowshoe hare *(Lepus americanus)*, and European hare *(Lepus europaeus)*. The state also monitors abundance and distribution of these small game species.

Of the 84 mammal species in Connecticut listed in the 2015 Connecticut WAG (http://www.ct.gov/deep/lib/wildlife/pdf_files/nongame/ctwap/CTWAP-Chapter1.pdf), 45 mammal species have been designated as Regional Species of Greatest Conservation Need (RSGCN) based on the species' conservation status, listings in other SWAPs, and the percentage of species' range that occurs in the Northeast (CT DEEP, 2015n). One of the mammal species is federally listed as threatened; 11 of the species include state-listed endangered or threatened species.

Connecticut has identified 28 mammals as Greatest Conservation Need (GCN) species. Eight mammal species were considered to be regional responsibility, or of "high" or "very high" regional concern. These species were also listed in a majority of other northeastern WAPs, but only three of these species occur in Connecticut: eastern small-footed myotis (*Myotis leibii*), New England cottontail (*Sylvilagus transitionalis*), and American water shrew (*Sorex palustris*). Connecticut also identified 12 mammals as the "most important" category of GCN species, 6 as "very important," and 10 as "important." (CT DEEP, 2015n)

The Connecticut GCN list consists of at-risk species that are rare or declining, and can receive funding from State Wildlife Grants for efforts to reduce their potential for listing as endangered. Although these species have been targeted for conservation they are not currently under legal protection. The state GCN list is updated periodically and used by the state to focus their conservation efforts and to implement their SWAP.

Table 3.1.6-4 presents a breakdown of mammals by taxonomic order and by species richness.

Table 3.1.6-4: Summary of Regulated Mammal Species in Connecticut

Mammal Species Conservation Categories	Number of Species
Total Number of Species in Connecticut	84
Federally Listed Species	4
RSGCN	45
High Regional Responsibility and Concern	8
State-listed Species	11
G1 & G2 Ranked	1
GCN Most Important	12
GCN Very Important	6
GCN Important	10

Source: (CT DEEP, 2015n)

Note: Marine mammals are described in further detail in Section 3.1.6.5, Fisheries and Aquatic habitats.

As shown in Table 3.1.6-4, the majority of the mammal species in Connecticut are protected either as a state GCN species, or as a federal and/or state listed endangered or threatened species. Section 3.1.6.6, Threatened and Endangered Species, identifies these protected species.

The following five species of small game mammals may be legally hunted in the state: gray squirrel, eastern cottontail rabbit (*Sylvilagus floridanus*), European Hare (*Lepus europaeus*), snowshoe hare (*Lepus americanus*), and woodchuck (*Marmota monax*). The state also allows the following five species of furbearers to be legally hunted in the state: raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), and coyote (*Canis latrans*) (CT DEEP, 2015p).

Birds

The number of native bird species documented in Connecticut varies according to the timing of the data collection effort, changes in bird taxonomy[83], and the reporting organization's method for categorizing occurrence and determining native versus non-native status. This section begins with a summary of native bird species found in Connecticut. The variety of ecological communities (i.e., coastal areas, valleys and plains, large rivers and lakes, hills, etc.) in Connecticut in turn supports a large variety of bird species.

Connecticut recognizes and manages various types of bird species including grassland birds, shrubland birds, night birds, migratory landbirds, raptors, upland gamebirds, forest interior birds, waterbirds, and marsh birds. Several recent reports, including the *2014 National State of the Birds* (NABCI, 2017) report and the *Conservation Status Assessment* (Nature Serve, 2017), indicate there has been decades of persistent population declines. Some of the grassland birds experience such declines include: Eastern meadowlark (*Sturnella magna)*, field sparrow (*Spizella pusilla)*, Northern bobwhite (*Colinus virginianus)*, ring-necked pheasant (*Phasianus colchicus)*, brown thrasher (*Toxostoma rufum)*, song sparrow (*Melospiza melodia)*, common yellowthroat (*Geothlypis trichas)*, grasshopper sparrow (*Ammodramus savannarum)*, and red-winged blackbird (*Agelaius phoeniceus)*, among many others. One of the threats to these grassland

[83] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2015d).

species' habitat has been a loss of grasslands due to agricultural abandonment (CT DEEP, 2015n).

Based on historical survey efforts between 1966 and 2006, shrubland birds, such as blue-winged warbler (*Vermivora cyanoptera)*, eastern towhee (*Eastern towhee)*, prairie warbler (*Setophaga discolor)*, and field sparrow (*Spizella pusilla*) are declining across the state. These surveys continue to monitor the abundance, distribution, and habitat preference for these species to track the species' response to habitat management efforts. CT DEEP also regularly monitors night birds including Eastern whip-poor-wills (*Antrostomus vociferus)* and various owl species. The state also regularly surveys migratory landbirds[84] and has cooperated with other Northeast states to identify important migratory landbird stopover sites throughout the region. Additionally, Connecticut monitors several raptor species, including bald eagles (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), broad-winged hawk (*Buteo platypterus*), sharp-shinned hawk *(Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), and Northern Goshawk (*Accipiter gentilis*). Since surveying for raptors, CT DEEP has documented record high bald eagle sightings indicating their presence in the state is steadily rising. Similarly, while osprey numbers declined in the 1970s and 1980s due to the effects of pesticide use such as DDT[85], populations near the Connecticut River have begun to recover and expand to coastal and inland habitats. (CT DEEP, 2015n)

Other common bird species in Connecticut include upland gamebirds, such as eastern wild turkey (*Meleagris gallopavo)*, ruffed grouse (*Bonasa umbellus)*, northern bobwhite quail (*Colinus virginianus)*, and American woodcock (*Scolopax minor)*. The state also tracks and monitors forest interior birds, such as cerulean warbler (*Setophaga cerulean)*, black-throated blue warbler (*Setophaga caerulescens)*, black-throated green warbler (*Setophaga virens)*, and the worm-eating warbler (*Helmitheros vermivorus)*; and waterbirds, such as the American black duck (*Anas rubripes)*, a "very important" GCN species in Connecticut (CT DEEP, 2015n). Marshes are another important wildlife habitat in Connecticut, particularly for marsh birds, such as saltmarsh sparrows (*Ammodramus caudacutus)* and eastern Black Rail (*Laterallus jamaicensis)*, two species with declining populations primarily due to marshes getting wetter due to climate change (CT DEEP, 2015n). As a result, the Saltmarsh Habitat and Avian Research Program, was founded by a group of academic, governmental, and non-governmental organizations and provides important information on the conservation of the birds' tidal marsh habitat.

According to the Connecticut WAP, 335 birds are found in Connecticut. The Connecticut Ornithological Association develops an annual list, the *Checklist of the Birds of Connecticut.* The list includes 438 species; some of these species occur infrequently in the state, and others occur mainly during migration (Connecticut Ornithological Association, 2017). Among the 335 extant[86] species in Connecticut more than 50 percent are protected: 3 are federally listed species,

[84] Landbirds are birds with predominantly terrestrial lifecycles, such as hawks, eagles, grouse, quail, pigeons, etc.
[85] DDT: "dichloro-diphenyl-trichloroethane was developed as the first modern synthetic insecticide in the 1940s. It was initially used to combat malaria, typhus, and the other insect-borne human diseases among both military and civilian populations. It was also effective for insect control in crop and livestock production, institutions, homes, and gardens" (USEPA, 2015d).
[86] Extant: "A species that is currently in existence (the opposite of extinct)" (USEPA, 2015d).

110 are RSGCN species in the northeast, 50 are state-listed species, and 95 are listed by the state as GCN species (CT DEEP, 2015n). Connecticut lists 22 bird species in the "most important" category of GCN species, 38 are listed as "very important," and 35 are listed as "important" (CT DEEP, 2015n). Table 3.1.6-5 presents a breakdown of these bird species numbers by level of species protection.

Table 3.1.6-5: Summary of Regulated Native Bird Species in Connecticut

Bird Species Conservation Categories	Number of Species
Total Number of Species in Connecticut	335
Federally Listed Species	3
Regional Species of Greatest Conservation Need (RSGCN)	110
High Regional Responsibility and Concern	0
State-listed Species	50
G1 & G2 Ranked	0
GCN Most Important	22
GCN Very Important	38
GCN Important	35

Source: (CT DEEP, 2015n)

A number of threatened and endangered birds are in Connecticut. Section 3.1.6.6, *Threatened and Endangered Species*, lists and briefly describes these protected species.

Connecticut is within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. It is the most densely human-populated of the four waterfowl migration flyways in North America (Atlantic, Mississippi, Central, and Pacific) (Ducks Unlimited, 2015). Large numbers of waterfowl and non-waterfowl birds utilize this flyway and other migration corridors and pathways throughout the state during their annual migrations northward in the spring and southward in the fall. Despite the dense human population and development, the coastal areas near Long Island Sound are an important ecological resource for migrating birds (National Audubon Society, 2015a). Stewart B. McKinney National Wildlife Refuge (NWR) encompasses more than 1,000 acres and stretches along 70 miles of Connecticut's coastline. Located in the Atlantic Flyway, it provides nesting and feeding habitat for many wading birds, shorebirds, songbirds, and terns (CT DEEP, 2015n). Major rivers in the state are also important stopover areas for migratory birds (CT DEEP, 2015q).

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act. Bald eagles are found sporadically near large rivers and lakes in the entire state throughout the year, with a higher amount during winter months (eBird, 2015a). Golden eagles are found in Connecticut during the fall migration period and in the Connecticut River Valley in the winter months (eBird, 2015b; The Connecticut Audubon Society, 2016).

In 1995, the National Audubon Society initiated the Important Bird Area (IBA) program in the United States, which was modeled after a similar program initiated in Europe in the 1980s by BirdLife International (National Audubon Society, 2015b). IBAs provide essential habitat for one or more species of birds and are typically unique sites that are different from the surrounding

landscape. IBAs assist in achieving local conservation priorities to provide important habitat for native bird populations during breeding[87], migratory stops, feeding, and over-wintering areas. A variety of habitats are designated as IBAs, including forests, scrub/shrub, grasslands, freshwater and saltwater wetlands, and bodies of water (National Audubon Society, 2015b).

Connecticut has 27 recognized IBAs that encompass approximately 19,550 acres (National Audubon Society, 2015a). The IBAs are widely distributed throughout the state with clusters of IBAs in the eastern, central, and western portions.[88] In the eastern portion of the state, near the coastline, there is an IBA at Charles Island and Silver Sands State Park. Within the north central portion of the state, there is an IBA at Northwest Park, north of Hartford. Within the western portion of the state, there are several IBAs including Topsmead State Forest, Good Hills Farm Preserve, and Bent of the River Sanctuary (National Audubon Society, 2015a).

A total of 27 recognized IBAs have been identified in the following Connecticut counties:

- Fairfield: Stratford Great Meadows Unit of the Stewart B. McKinney National Wildlife Refuge, Audubon Center in Greenwich, Cove Island Park, Great Captains Island, Greenwich Point Park and nearby islands, The Nature Conservancy – Devil's Den
- Hartford: Northwest Park, Station 43 Marsh/Sanctuary
- Litchfield: White Memorial Foundation, Good Hill Farm Preserve, Topsmead State Forest, Woodbury Chimney Swift Roosts
- Middlesex: Salt Meadow Unit of Stewart B. McKinney NWR, Menunketesuck and Duck Islands and surrounding tidal flats
- New Haven: Hammonasset Beach State Park, Milford Point/Wheeler Marsh/Mouth of the Housatonic River, Quinnipiac River Tidal Marsh, Sandy Point, Bent of the River Sanctuary, Charles Island and Silver Sands State Park, East Rock Park, Falkner Island Unit of Stewart B. McKinney NWR, Lighthouse Point Park, Naugatuck State Forest
- New London: Barn Island Wildlife Management Area, Connecticut College Arboretum, Mamacoke Island and Adjacent Coves
- Windham: Bafflin Sanctuary Complex (National Audubon Society, 2015a)

Reptiles and Amphibians

According to CT DEEP, 50 native reptile and amphibian species occur in Connecticut. Among these species, 16 reptiles and 15 amphibians are considered GCN species. The Northeast RSGCN list, which includes species that are found outside of the state of Connecticut, consists of 29 reptile species, including 14 turtles, 2 lizards, and 13 snakes. The RSGCN lists 35 amphibian species, including 28 salamanders, 5 frogs, and 2 toads. (CT DEEP, 2015n)

Of the total 50 reptile and amphibian species recognized by the CT DEEP as occurring in the state, five are federally listed endangered or threatened species, and 22 are state-listed endangered, threatened, or species of concern. Connecticut further lists 6 reptiles and amphibians in the "most important" category of the GCN species, 13 in the "very important"

[87] Breeding areas: "The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared" (USEPA, 2015d).
[88] There is no statewide map available of Connecticut's Important Bird Areas (http://netapp.audubon.org/IBA/State/US-CT).

category, and 12 in the "important" category of GCN species. Among these species, Connecticut considers the wood turtle (*Glyptemys insculpta*), Northern diamondback terrapin (*Malaclemys terrapin)*, and Northern black racer (*Coluber constrictor constrictor)* as species of high regional responsibility due to habitat loss and fragmentation, water pollution, illegal harvest, and habitat conversion impacts (CT DEEP, 2015n).

Reptile and amphibian species are widely distributed throughout Connecticut, but most amphibians occur in Connecticut's wetlands and the surrounding uplands. Evidence also indicates widespread declines in amphibian populations, with historical changes in land use likely having the most significant impact, particularly those species dependent on specific habitat types. The common mudpuppy (*Necturus maculosus)* is one example of a state species of special concern and an "important" GCN species that is uncommon, as it only occurs in two riverine systems in Connecticut (CT DEEP, 2015n). Another common, but sensitive, salamander species in the state is the Jefferson salamander (*Ambystoma jeffersonianum)*, which occurs west of the Connecticut River where it is localized in the upland areas. The blue-spotted salamander (*Ambystoma laterale)* also occurs near the Connecticut River where it is associated with riparian red maple swamps. Other mole salamander species include the blue-spotted salamander (*Ambystoma laterale),* spotted salamander (*Ambystoma maculatum),* and marbled salamander (*Ambystoma opacum).* Other lungless salamander species include the northern dusky salamander (*Desmognathus fuscus),* northern two-lined salamander *(Eurycea bislineata)*, northern spring salamander (*Gyrinophilus porphyriticus)*, four-toed salamander (*Hemidactylium scutatum),* northern red-backed salamander (*Plethodon cinereus),* and the northern slimy salamander (*Plethodon glutinosus)* (CT DEEP, 2016a). The red-spotted newt (*Notophthalmus viridescens),* a widespread newt species occurring in many sections of Connecticut is abundant on the forest floors of the northwestern highlands during damp weather (CT DEEP, 2017d).

Toads and tree frogs that occur in Connecticut include the eastern American toad (*Bufo americanus),* Fowler's toad (*Bufo fowleri),* and the eastern spadefoot (*Scaphiopus holbrookii),* as well as the gray tree frog (*Hyla versicolor)* and northern spring peeper (*Pseudacris crucifer).* True frog species, also known as common frogs, consist of bullfrog (*Rana catesbeiana), g*reen frog (*Rana clamitans melanota),* pickerel frog (*Rana palustris),* northern leopard frog (*Rana pipiens),* and wood frog (*Rana sylvatica)* (CT DEEP, 2017e). Turtles include painted turtle (*Chrysemys picta),* spotted turtle (*Clemmys guttata),* wood turtle (*Clemmys insculpta),* bog turtle (*Clemmys muhlenbergii)*, eastern box turtle (*Terrapene carolina),* and common musk turtle (*Sternotherus odoratus)* (CT DEEP, 2017f). Reptile species, such as lizard and snake species include the five-lined skink (*Eumeces fasciatus)* and the eastern worm snake (*Carphophis amoenus),* northern ringneck snake (*Diadophis punctatus edwardsii),* and black rat snake (*Elaphe obsoleta obsoleta).* Some snake species, such as the timber rattlesnake (*Crotalus horridus)* and eastern ribbon snake (*Thamnophis sauritus sauritus)* are venomous (CT DEEP, 2017g).

Three threatened and endangered reptiles are found in Connecticut. Section 3.1.6.6, Threatened and Endangered Species, lists and briefly describes these protected species.

Invertebrates

Connecticut is home to over 20,000 invertebrate species, including freshwater mussels; gastropods; crustaceans; arthropods; including dragonflies, damselflies, butterflies, moths, bees, wasps, and flies, and spiders, mites, crustaceans, and nematodes. These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates.

At least 20,000 invertebrate species exist in Connecticut (CT DEEP, 2015n). CT DEEP lists 194 species as endangered, threatened, or species of concern. Thirty-six species are listed in the "most important" category of GCN species, 58 are listed as "most important," and 148 are listed as "important" (CT DEEP, 2015n). The RSGCN invertebrate list includes federally listed species and representatives of two major invertebrate taxa. Because baseline information on invertebrates is relatively unknown, the state has initiated various regional projects to focus conservation actions into management plans, protect rare species, and expand the data available on species. To better understand the distribution of freshwater benthic invertebrates, CT DEEP's Bureau of Water Management has been surveying macroinvertebrates. The presence of three sensitive macroinvertebrates: *Ephemeroptera* (mayflies), *Plecoptera* (stoneflies), and *Trichoptera* (caddisflies) has provided the state information on important water quality data (CT DEEP, 2017h). Similarly, CT DEEP's Inland Fisheries Division conducts assessments on the status and distribution of native crayfish. These surveys have helped the state determine the most commonly distributed species; the surveys also determined that one previously listed species was more abundant then initially reported, thereby removing it from the list of Connecticut's GCN species (CT DEEP, 2015n).

More than 1,000 species of moths have been documented in southern New England, including *Papaipema* moths and *Lepidoptera* moths, such as sphinx or hawk moths, and giant silkworm moths. Two common butterfly families that occur in the state include skippers and the blues, coppers, and elfins. While these families are common, several species, such as the Karner blue butterfly (*Lycaeides melissa samuelis)* are less common because they are weak fliers and have specific host plant requirements (i.e., cranberry, wild lupine and indigo, and bearberry), or exhibit narrow ecological specializations, such as associations with specific vegetation communities (CT DEEP, 2015n). As a result, Connecticut manages and implements several conservation projects for moth and butterfly species. The state currently manages a mapping project through the Connecticut Butterfly Atlas project. This mapping project and other federally funded project have helped the state focus on habitat restoration efforts for the northern metalmark butterfly (*Calephelis borealis)* and the monarch butterfly *(Danaus plexippus)* (YU, 2017) .

Over the past decade, increasing concern has developed regarding the conservation of native bee pollinators, as scientific evidence indicates that these bee species have been declining in North America. Evidence also suggests that reduced bee populations could result in decreased pollination of plant species that require the process for fertilization and reproduction, thereby threatening certain plant populations dependent on pollination. CT DEEP and UCONN have been collecting and inventorying data on Connecticut bees since 2005. As a result, both entities have generated a database documenting more than 16,000 records of bees. This effort has

allowed the state to identify the highest risk bee species in the state, which lead to the addition of four state-listed bee species in 2010: yellow-banded bumblebee (*Bombus terricola*), rusty-patched bumblebee (*Bombus affinis*), Ashton's cuckoo bumblebee (*Bombus ashtoni*), and fringed loosestrife oil-bee (*Macropis ciliata*). (CT DEEP, 2015n)

Other important invertebrate species in Connecticut include tiger beetles (i.e. genus *Cicindela)* and cicadas. Fourteen tiger beetle species have been documented in Connecticut, but only 10 of these species likely still remain in the state, and only three species are considered secure, as most other populations are localized or their populations have declined as their specialized habitats have been removed. The RSGCN list consists of 11 tiger beetle taxa, including the federally listed and regionally endemic Puritan tiger beetle *(Cicindela puritan)*, which is found along the Connecticut River and Chesapeake Bay. The northeastern beach tiger beetle (*Cicindela dorsalis dorsalis)* is the other federally listed species in the region; it was last recorded in Connecticut in 1950. The largest cicada species in North America, the northern dusk-singing cicada (*Neotibicen auletes),* occurs in Connecticut and is listed as a species of special concern. (CT DEEP, 2015n)

Two threatened and endangered invertebrates are in Connecticut. Section 3.1.6.6, Threatened and Endangered Species, identifies these protected species.

Invasive Wildlife Species

A range of non-native wildlife species have been introduced to Connecticut. To protect native species and the habitats in which they occur, CT DEEP has taken measures to control and remove invasive species on state land and assist private landowners seeking to manage invasive species on their properties (CT DEEP, 2015n). While the state has adopted regulations that prohibit certain invasive plant species, it does not specifically regulate any wildlife species. Connecticut does manage two invasive insects: Emerald ash borer (*Agrilus planipennis),* and Asian long-horned beetle (*Anoplophora glabripennis)*. (CT DEEP, 2015r)

3.1.6.5. Fisheries and Aquatic Habitats

This section discusses the aquatic wildlife species in Connecticut, including fish, invertebrates, marine mammals, sea turtles, and their habitats. A summary of non-native and invasive aquatic species is also presented in this section. Fish are divided into freshwater and saltwater species, although many of Connecticut's fish are diadromous (i.e., anadromous[89] and catadromous[90]), reflecting the state's location along the Atlantic coast and the variety of aquatic habitats that it provides. A distinctive feature of the Connecticut's landscape with regard to aquatic wildlife is the coastal habitat within the Long Island Sound. The Long Island Sound is an estuary that is home to more than 1,200 species of invertebrates and 170 species of fish (Long Island Sound Study, 2015c). An Ecological Assessment of the Long Island Sound was recently completed by the Nature Conservancy and Ecological Marine Units (EMUs) were defined within the sound. EMUs include geographic areas with sustained levels of marine diversity, geographic areas of diverse and complex bottom habitat types, geographic areas that perform or serve notable

[89] Anadromous: "Referring to the lifecycle of fishes, such as salmon, in which adults travel upriver from the sea to breed, usually returning to the area where they were born" (USEPA, 2015d).
[90] Catadromous: "An organism which lives in fresh water and goes to the sea to spawn, such as some eels" (USEPA, 2015d).

ecological functions (e.g. seagrass), and geographic areas with special status species and/or habitats (The Nature Conservancy, 2015c).

Freshwater Fish

Connecticut is home to more than 70 species of freshwater fish, ranging in size from small darters and minnows to large species such as salmon and sturgeon (U.S. Fish Finder, 2013). These species are grouped into several families including: true bass, catfishes, true perch, common prey fish, salmon, sturgeons, sunfish, and trout. Many of these fish families include diadromous species, such as the anadromous American shad (*Alosa sapidissima*), striped bass (*Morone saxatilis*), and Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and the catadromous American eel (*Anguilla rostrata*) (CT DEEP, 2015n).

Saltwater Fish

Connecticut's nearshore marine waters are home to a large number of fish species. Many saltwater fish species are known for their recreational and commercial fishing value. Finfish are important fish species for both recreational anglers and the commercial fishing industry. Populations of many fish species vary dramatically from season to season. Common species include the winter flounder, blackfish, killifish, sticklebacks, Atlantic silversides, sea ravens, sculpins, cunner, sand lance, whiting, tomcod, herrings, dogfish sandbar sharks, Atlantic salmon, windowpane flounder, and skates (UCONN, 2001) (CT DEEP, 2015n).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act identifies and protects those fish habitats that are necessary for spawning, breeding, feeding, or growth to maturity. These habitats are termed "Essential Fish Habitat" or EFH. NOAA provides an online mapping application[91] and website[92] to provide the public a means to obtain illustrative representations of EFH. This tool can be used to identify the existing conditions for a project location to identify sensitive resources. Table 3.1.6-6 presents a summary of EFH offshore of Connecticut/within Long Island Sound.

[91] http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html.
[92] http://www.greateratlantic.fisheries.noaa.gov/hcd/list.htm.

Table 3.1.6-6: Essential Fish Habitat of Connecticut

Common Name	Eggs	Larvae/YOY [a]	Juveniles	Adults
Atlantic herring	Not designated in immediate vicinity	Not designated in immediate vicinity	Long Island Sound	Long Island Sound
Little skate	Long Island Sound	No larval life stage exists for this species	Long Island Sound	Long Island Sound
Ocean pout	Not designated in immediate vicinity	Not designated in immediate vicinity	Not designated in immediate vicinity	Long Island Sound (in part)
Pollock	Not designated in immediate vicinity	Not designated in immediate vicinity	Long Island Sound	Long Island Sound
Red hake	Long Island Sound	Long Island Sound	Long Island Sound	Long Island Sound
Silver hake	Not designated in immediate vicinity	Not designated in immediate vicinity	Not designated in immediate vicinity	Long Island Sound (in part)
Windowpane flounder	Long Island Sound	Long Island Sound	Long Island Sound	Long Island Sound
Winter flounder	Long Island Sound	Long Island Sound	Long Island Sound	Long Island Sound
Winter skate	Long Island Sound	No larval life stage exists for this species	Long Island Sound	Long Island Sound
Yellowtail flounder	New York Bight	New York Bight	Southeastern shore of Long Island	Southeastern shore of Long Island
Yellowfin tuna	NA	NA	Eastern end of Long Island	NA

Sources: (USEPA, 2013a) (NMFS, 2015a) (NMFS, 2015b)

[a] YOY (Young of the year): "All of the fish of a species that were born in the past year, from transformation to juvenile until January 1"

NA = Not Applicable

Shellfish and Other Invertebrates

Connecticut is home to both freshwater and marine shellfish. Familiar freshwater bivalve[93] species include a variety of mussel species, such as the eastern elliptio mussel (*Elliptio complanata*), eastern pearlshell mussel (*Margaritifera margaritifera*), lampmussels, and floater mussels. A multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.) and other Connecticut freshwater invertebrates can be observed regularly throughout the state (CT DEEP, 2015n).

Long Island Sound is home to more than 545 benthic species including 111 species of arthropods (e.g., crabs, lobsters, shrimp, and barnacles); 80 species of mollusks (e.g., clams, scallops, squid, limpets, sea slugs, and snails); 147 species of annelids (sea worms); 12 species of echinoderms (e.g., sea stars, sea urchins, sea cucumbers, and sand dollars); and 4 species of cnidarians (corals, anemones, jellyfish). (The Nature Conservancy, 2015c)

[93] Bivalve: "An aquatic mollusk whose compressed body is enclosed within a hinged shell" (USEPA, 2015d).

Marine Mammals

This section briefly introduces the marine mammal species found in Connecticut waters. Whale species observed within Long Island Sound include the beluga whale, (*Delphinapterus leucas*), minke whale (*Balaenoptera acutorostrata*), humpback whale (*Megaptera novaeangliae*). Until 2015, many marine mammals including whale species had not been seen off the coast of Connecticut for nearly two decades. A few whale species exhibit distinctive behaviors. For example, in contrast to migratory patterns displayed by other whale species, minke whales breed during the summer months in the northern hemisphere; however, they spend very little time at the surface and are therefore rarely seen (CT DEEP, 2015n).

Regional seals that make the Long Island Sound their home from September through June, sometimes never leaving at all include the harbor seal and gray seal. In addition, the harp seal and hooded seal can be found in the sound from January to early May (Long Island Sound Study, 2009). Harbor porpoises have also been observed in the Long Island Sound (UCONN, 2001).

Sea Turtles

Three species of sea turtles occur in Connecticut's waters, including the green sea turtle (*Chelonia mydas*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), and leatherback sea turtle (*Dermochelys coriacea*) (CT DEEP, 2015n). For more information on these protected sea turtles, refer to Section 3.1.6.6, Threatened and Endangered Species.

Invasive Aquatic Species

Some of the more troublesome invasive aquatic animals in the state are listed below. In addition, 18 invasive plant species are regulated in the Connecticut (CT DEEP, 2015s).

- **Animals** – Asian clam (*Corbicula fluminea*), Chinese mitten crab (*Eriocheir sinensis*), New Zealand mud snail (*Potamopyrgus antipodarum*), quagga mussel (*Dreissena bugensis*), rusty crayfish (*Orconectes rusticus*), and zebra mussel (*Dreissena polymorpha*).
- **Plants** – American water lotus *(Nelumbo lutea),* brittle water-nymph (*Najas minor),* common reed *(Phragmites australis),* curly leaved pondweed *(Potamogeton crispus),* Eurasian water milfoil *(Myriophyllum spicatum),* Egeria *(Egeria densa),* fanwort *(Cabomba caroliniana),* giant salvinia *(Salvinia molesta),* hydrilla *(Hydrilla verticillata),* one-row yellowcress *(Rorippa microphylla),* parrotfeather *(Myriophyllum aquaticum),* purple-loosestrife *(Lythrum salicaria),* pond water-starwort *(Callitriche stagnalis),* variable water milfoil *(myriophyllum heterophyllum),* water chesnut *(Trapa natans),* watercress *(Rorippa nasturtium-aquaticum*), yellow floating heart *(Nymphoides peltata),* and yellow iris *(Iris pseudacorus)*. http://www.ct.gov/deep/cwp/view.asp? a=2696&q=322690&deepNav_GID=1630

3.1.6.6. Threatened and Endangered Species

The USFWS is responsible for administering the ESA (16 U.S.C. §1531 *et seq*.) in Connecticut. The USFWS has identified seven federally endangered and six threatened species known to occur in Connecticut (USFWS, 2015e). Of these, none have designated critical habitat within Connecticut[94] (USFWS, 2015f). The federally listed species include two mammals, three birds, four reptiles, two invertebrates, and two plants (USFWS, 2015e), and are discussed in detail under the following sections.

Mammals

Two federally protected mammals are known to occur in Connecticut. Details on this species are presented in detail below and summarized in Table 3.1.6-7. Northern long-eared bats (*Myotis septentrionalis*) are found throughout the state and the Indiana bat (*Myotis sodalist)* was only recently discovered in Conncticut. Information on the habitat, distribution, and threats to the survival and recovery of this species in Connecticut is provided below.

Table 3.1.6-7: Federally Listed Mammal Species of Connecticut

Common Name	Scientific Name	Federal Status	Critical Habitat	Habitat Description
Northern Long-eared Bat	*Myotis septentrionalis*	Threatened	No	Trees and snags, caves, and abandoned mines; found in eight counties in Connecticut
Indiana Bat	*Myotis sodalis*	Endangered	No	Occurs in abandoned mines, tunnels, limestone caves during the winter and in riparian[a] floodplain forests for foraging. Medium-sized caves with large shallow passageways is preferred.

Sources: (USFWS, 2014b)

[a] Riparian: "Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands" (USEPA, 2015c).

Northern Long-eared Bat. The northern long-eared bat is a medium-sized (3 to 3.7 inches in length), brown furred, insectivorous bat with long ears, relative to other members of the genus *Myotis*. The numbers of northern long-eared bats in hibernacula has decreased by 99 percent in the northeast U.S. (NWHC, 2015). It was listed as threatened in 2015 (80 FR 17973 18033, April 2, 2015). In the U.S., its range includes most of the eastern and north central states (USFWS, 2015g). In Connecticut, known hibernacula are found in nine counties with no known maternity roots trees (CT DEEP, 2016b).

This species hibernates in caves and mines that exhibit constant temperatures, high humidity, and no air currents. In the summer, they roost singly or in colonies beneath bark, or in crevices or cracks of both live and dead trees. Although mating occurs in the fall, fertilization occurs

[94] Critical habitat includes "the specific areas (i) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species" (16 U.S.C §1532(5)(A)).

following hibernation. Pregnant females then migrate to summer areas where they roost in small colonies (USFWS, 2015g).

White Nose Syndrome is the leading cause for the decline of this species. The numbers of northern long-eared bats in hibernacula has decreased by 99 percent in the northeast U.S. Other threats include temperature or air flow impacts to their hibernating habitat, forest management practices that are incompatible with this species' habitat needs, habitat fragmentation, and wind farm operations (USFWS, 2015g).

Indiana Bat. The endangered Indiana bat is a small, insectivorous[95] mammal measuring approximately 1.5 to 2 inches long with dull grayish chestnut fur and strongly resembles the more common little brown bat (*Myotis lucifugus*) (USFWS, 2015h). The Indiana bat was in danger of extinction" in 1967 and was classified as endangered under the ESA (32 Federal Register [FR] 4001, March 11, 1967). In 2009, only 387,000 Indiana bats were known to exist in its region, less than half of the population of 1967 (USFWS, 2015i). Regionally, this species is found in the central portion of the eastern U.S., from Vermont west to Wisconsin, Missouri, and Arkansas, and south and east to northwest Florida. In 2016, the Indiana Bat was discovered hibernating in Connecticut (CT DEEP, 2017i).

In the summer, Indiana bats roost[96] singly or in colonies beneath bark, or in crevices or cracks of both live and dead trees. Although mating occurs in the fall, fertilization occurs following hibernation[97]. Pregnant females then migrate to summer areas where they roost in small colonies. The species hibernates in caves and mines that exhibit constant temperatures, high humidity, and no air currents (USFWS, 2015h) (USFWS, 2015i).

First discovered in New York, White Nose Syndrome is the leading cause for the decline of this species, having spread throughout the region. Although all of the life stages of Indiana bat are vulnerable, adverse impacts related to changes in cave conditions or the spread of disease during hibernation could greatly affect bat colonies. Conservation efforts have focused on this vulnerable period (CWNJ, 2015). Other threats include the disturbance and intentional killing of hibernating and maternity colonies, temperature or air flow impacts to their hibernating habitat, forest management practices that are incompatible with this species' habitat needs, habitat fragmentation[98], and wind farm operations (NWHC, 2015) (USFWS, 2015h).

Birds

Two threatened and one endangered bird species are federally listed and known to occur in Connecticut, as summarized in Table 3.1.6-8. The piping plover (*Charadrius melodus*), and the roseate tern (*Sterna dougallii dougallii)* have habitat on the coast in southern Connecticut.

[95] Insectivorous: "An animal that feeds on insects" (USEPA, 2015c).
[96] Roost: "A place where a flying animal, usually a bird or bat, can sleep or rest, usually by perching or hanging" (USFWS, 2015g).
[97] Hibernation: "The act of passing the winter in a dormant state in which the metabolism is slowed to a tiny fraction of normal" (USFWS, 2015k).
[98] Fragmentation: "The breaking up of large and continuous ecosystems, communities, and habitats into smaller areas that are surrounded by altered or disturbed land or aquatic substrate" (USEPA, 2015c).

Information on the habitat, distribution, and threats to the survival and recovery of each species in Connecticut is provided below.

Table 3.1.6-8: Federally Listed Bird Species of Connecticut

Common Name	Scientific Name	Federal Status	Critical Habitat	Habitat Description
Piping Plover	*Charadrius melodus*	Threatened	No	Coastal areas of Connecticut
Red Knot	*Calidris canutus rufa*	Threatened	No	Coastal areas of Connecticut
Roseate Tern	*Sterna dougallii*	Endangered	No	Coastal areas of Connecticut

Source: (USFWS, 2015e)

Piping Plover. The piping plover is a small, pale-colored shorebird with a short beak and black band across the forehead, listed as endangered in 1985 for the Great Lakes watershed of both the United States and Canada. It was listed as threatened in the remainder of its range in the United States, which includes the Northern Great Plains, Atlantic and Gulf Coasts, Puerto Rico, and the Virgin Islands (50 FR 50726 50734, December 11, 1985) (USFWS, 2015j). Piping plovers breed in three geographic regions of North America, composed of two separate subspecies. Those breeding within Connecticut in the northeastern United States and Canada are of the subspecies *C. m. melodus*, whose range extends from the Atlantic to the Great Lakes (USFWS, 2001a). Piping plover subspecies (*C. m. melodus*) can be found on Connecticut's coastline and sandy beaches , including in Fairfield, Middlesex, New Haven, and New London Counties (USFWS, 2015k). Piping plovers arrive in Connecticut to nest in late March until early July (CT DEEP, 2015t).

Roseate tern Photo credit: USFWS

This species feeds in the intertidal zone of ocean beaches, ocean washover areas, mudflats, sandflats, wrack lines, and the shorelines of coastal ponds, lagoons, and salt marshes. They feed on worms, fly larvae, beetles, crustaceans, and other marine macroinvertebrates (USFWS, 2015j). Current threats to this species include habitat loss and habitat degradation, human disturbance, pets, predation[99], flooding from coastal storms, and environmental contaminants (CT DEEP, 2015t).

Red Knot. Federally listed as a threatened species in 2014 (79 FR 73705 73748, December 11, 2014) and protected under the Migratory Bird Treaty Act, the red knot is a large sandpiper that flies in large flocks along the Delaware Bay and the Atlantic coast each spring. Red knots spend their winters in the southern tip of South America, northern Brazil, the Caribbean, and the southeastern and Gulf Coasts of the U.S. and breed in the tundra of the central Canadian Arctic. Some have been documented to fly more than 9,300 miles from south to north every spring and return south in autumn (USFWS, 2015l) (USFWS, 2015m). In Connecticut, small numbers of red knots occur along the coast year round; however, these areas are also used as stopover habitats for migrating flocks. This species can be found in four coastal counties in Connecticut: Fairfield, Middlesex, New Haven, and New London (USFWS, 2016).

[99] Predation: "The act or practice of capturing another creature (prey) as a means for securing food" (USEPA, 2015d).

The red knot stops along the New England coast during the spawning season for the horseshoe crab eggs (*Limulus polyphemus*) and mussel beds which include snails, marine worms, and whole mussels and clams, which serve as important food sources to the species. Threats to the red knot include sea level rise; coastal development; shoreline stabilization; dredging; reduced food availability at migratory stopovers; and disturbance by humans, dogs, vehicles, and climate change (USFWS, 2015l) (USFWS, 2015m).

Roseate Tern. The roseate tern is approximately 16 inches in length with light-gray wings and a black cap. During breeding season, the roseate tern's white chest gains a rosy tinge on the chest, and its bill and legs turn from black to orange-red (USFWS, 2011). The tern was listed as endangered in 1987 in the Northeast region and threatened in the southeast region (52 FR 42064 42068, November 2,1987). Roseate terns nest in colonies on sand/gravel beaches or pebbly/rocky offshore islands along the Atlantic coast from Nova Scotia south to Long Island, New York, and on the southern tip of Florida. Roseates that nest in the northeastern United States appear to winter primarily in the waters off Trinidad and northern South America from the Pacific coast of Columbia to eastern Brazil (CT DEEP, 2015u). In Connecticut, populations of roseate tern may be found in coastal areas of New Haven and New London Counties (USFWS, 2015n). The third largest roseate tern colony in North America, containing up to 200 pairs of terns is off the coast of Connecticut on Falkner Island, which is part of the Stewart B McKinney National Wildlife Refuge (CT DEEP, 2015u).

The species is a marine bird that breeds along the coasts on salt marsh islands and beaches with sparse vegetation. Present threats include vegetation changes in breeding areas, disturbances from human activities in coastal areas, competition with gulls for suitable nest sites, and predation. (USFWS, 2011)

Reptiles

Three endangered and one threatened turtles are federally listed and known to occur in Connecticut, as summarized in Table 3.1.6-9. All three sea turtles occur off the coast, while the bog turtle (*Clemmys muhlenbergii*) is found primarily in western Connecticut. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Connecticut is provided below.

Table 3.1.6-9: Federally Listed Reptile Species of Connecticut

Common Name	Scientific Name	Federal Status	Critical Habitat	Habitat Description
Terrestrial Reptile				
Bog Turtle	*Clemmys muhlenbergii*	Threatened	No	Swamps and bogs of western Connecticut
Marine Reptiles				
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	Endangered	No	Muddy or sandy bottoms where prey items can be found, in waters rarely greater than 160 feet deep; found along the coast of Connecticut
Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered	No	Off the coast of Connecticut
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	No	Off the coast of Connecticut

Source: (USFWS, 2015e)

Terrestrial Reptiles

Bog Turtle. The threatened bog turtle is a very small turtle, averaging 3.1 to 4.5 inches in length and characterized by a light brown to ebony shell and bright yellow, orange, or red blotches on each side of the head (USFWS, 2001b). The USFWS proposed a final rule in 1997 to list the northern population of the bog turtle as threatened and southern population as threatened due to similarity of appearance, under provisions of the Endangered Species Act of 1973 (62 FR 59605 59623, November 4, 1997) (USFWS, 1977). Regionally, the northern population of the bog turtle occurs in localized distributions from western Massachusetts, New York, and Connecticut southward to Maryland. In Connecticut, the bog turtle is rare but populations have been documented in five towns between the Housatonic and Connecticut Rivers (CT DEEP, 2015v).

The bog turtles prefer habitats that are open wetlands, sedge meadows, and boggy areas with cool, shallow, slow-moving water, deep and soft muck soils, and with tussock-forming vegetation (clumpy grasses) (CT DEEP, 2015v) (USFWS, 2001b). For hibernation, the bog turtle generally retreats to densely vegetated areas. In Connecticut, bog turtles hibernate underwater in deep bogs and tend to emerge from hibernation in late March and April. Mating usually occurs in the spring or right after hibernation followed by nesting from June to July (CT DEEP, 2015v).

Current threats to this species are habitat loss and fragmentation from development. Additionally, this species is under threat of vegetation succession and invasion of nonnative plants, such as purple loosestrife (*Lythrum salicaria*), which out-complete native wetland plants that provided food or nesting sites for this species. The illegal collection of bog turtles has also been a major threat to the bog turtles throughout the species' range (CT DEEP, 2015v) (USFWS, 2001b).

Marine Reptiles

Kemp's Ridley Sea Turtle. The endangered Kemp's Ridley sea turtle is considered the smallest sea turtle species and the most endangered. These turtles grow up to two feet long and weigh up to 100 pounds (*NOAA 2015h*; *USFWS 2015q*). The Kemp's Ridley sea turtle was first federally listed in 1970 (*35 FR 18319-18322, December 2, 1970*) under the Endangered Species Conservation Act and grandfathered into the ESA in 1973 (Harrington, 1982) (USFWS, 2015o). Their range includes the Gulf of Mexico and the U.S. Atlantic seaboard, from Nova Scotia to Florida. They prefer nearshore habitats characterized by muddy or sandy bottoms where their prey items can be found, in waters rarely greater than 160 feet deep. They feed mostly on crabs, but also consume jellyfish, fish, and an array of mollusks (NOAA, 2015b).

Hawksbill Sea Turtle. The hawksbill sea turtle (*Eretmochelys imbricate*) is one of the smaller sea turtles with a dark brown upper shell with yellow streaks and a yellow under shell. It was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970) and was grandfathered into the ESA (Harrington, 1982). The species has overlapping plates that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events. Adults range in size from 30 to 36 inches and weigh an average of 175 pounds (NMFS, 2015c). The hawksbill is found throughout subtropical regions of the Atlantic, Pacific, and Indian Oceans and is widely found in the Caribbean and western Atlantic Ocean (USFWS, 2015p). Although in the Atlantic they range from the East Coast of the United States to northern Brazil, they are rarely found offshore of New England and the hawksbill sea turtle is a rare visitor to the northeast (NMFS, 2015c).

This species prefers warm, shallow, coastal waters of reefs, lagoons, inlets, and bays with submerged aquatic vegetation. It is an omnivore, feeding mostly sponges and is most often associated with the coral reef community. Nesting occurs on remote beaches in the Gulf of Mexico and the Caribbean Sea in two to three year cycles. Current threats to the hawksbill sea turtle include accidental capture in fishing lines, vessel strikes, contaminants, oil spills, disease, habitat loss of coral reef communities, and commercial exploitation (USFWS, 2015p). Outside of the United States, a current threat is the collection for meat, eggs, and parts, which was the historic threat to this species causing their decline (USFWS, 2013a).

Leatherback Sea Turtle. The leatherback sea turtle (*Dermochelys coriacea*) is the largest, most migratory, deepest-diving, and most wide-ranging sea turtle, found in all of the world's oceans. It was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970) (NMFS, 2015d) and was grandfathered into the ESA of 1973 (USFWS, 2017). The leatherback sea turtle is highly migratory and ranges as far north as the British Isles and as far south as Australia. The leatherback sea turtle may be found in concentrated numbers in the northeast, and turtles are frequently observed near Stonington and Block Island Sound during summer months (CT DEEP, 2015u).

Their diet consists of jellyfish and squid and while they may forage in coastal waters they prefer open sea environments (NMFS, 2015d). Female leatherback sea turtles nest at two to three-year intervals on beaches composed of coarse sand that are adjacent to deep water and subject to erosion (USFWS, 2015q). Major threats to the species include harvesting of their eggs, hunting,

their incidental capture in fishing gear, and consumption of plastics that were mistaken for jellyfish (NMFS, 2015d).

Invertebrates

The endangered dwarf wedgemussel (*Alasmidonta heterodon*) and the threatened Puritan tiger beetle (*Cicindela puritana*) are found in tributaries of the Connecticut River (Table 3.1.6-10). Information on the habitat, distribution, and threats to the survival and recovery of the species in Connecticut is provided below.

Table 3.1.6-10: Federally Listed Invertebrate Species of Connecticut

Common Name	Scientific Name	Federal Status	Critical Habitat	Habitat Description
Dwarf Wedgemussel	*Alasmidonta heterodon*	Endangered	No	Creek and river bottoms of the Connecticut River tributaries
Puritan Tiger Beetle	*Cicindela puritana*	Threatened	No	Sandy beaches and upper shoreline along the Connecticut River

Source: (USFWS, 2015e)

Dwarf Wedgemussel. The dwarf wedgemussel is a small (less than 1.5 inches in length), brown or yellowish-brown freshwater mussel. The dwarf wedgemussel was listed as endangered in 1990 (55 FR 9447 9451, March 14, 1990) (USFWS, 2015r). The range of the dwarf mussel is found within 15 watersheds along the Atlantic Coast from New Brunswick, Canada to North Carolina (USFWS, 2016). In Connecticut, the dwarf wedgemussel is limited to a few tributaries of the Connecticut River, although it is believed that they once inhabited the Quinnipiac River (CT DEEP, 2017j).

The dwarf wedgemussel inhabits creek and river areas with slow to moderate currents and a sand or mud bottom (USFWS, 2016). They are filter feeders feeding off suspended particles and algae, and spending most of their time buried in stream bottoms. They require a host species, either the bottom-dwelling tessellated darter (*Etheostoma olmstedi*) or the mottled sculpin (*Cottus bairdi*), to attach to the fish and complete their reproductive lifecycle. The dwarf wedgemussel lives for approximately 10 years. Threats to this species include pollution from agriculture and development projects, channelization, and habitat loss resulting from dams and impoundments (USFWS, 2016).

Puritan Tiger Beetle. The Puritan tiger beetle, measuring approximately .5 inches (CT DEEP, 2015w), was federally listed as threatened throughout its range in 1990 (55 FR 32088 32094, August 7, 1990) (USFWS, 2015s). The species is identified by its brownish bronze body with a metallic blue underside, covered with narrow white lines on each wing cover. Found in only two distinct regions separated by 600 miles, the Puritan tiger beetle has habitat along the Chesapeake Bay in Maryland and along the Connecticut River in New England. The total population in New England is less than 1,000, and more than 99 percent of the population is found in Connecticut. Their habitat is sandy beach regions along the upper shoreline of the Connecticut River (USFWS, 1990).

The Puritan tiger beetles burrow into sandy clay soils in areas with scattered vegetation. The tiger beetles mate in the summer months and females burrow into the sand one to two inches to lay eggs. The eggs hatch into larvae, which burrow further into the sand before emerging as adult beetles in June (CT DEEP, 2015w). Due to the very specific habitat requirements and limited range, this species is particularly vulnerable. Within Connecticut, major threats include habitat loss and degradation, primarily from shoreline development and bank stabilization, as well as flooding and changes in river flow from hydroelectric dams (CT DEEP, 2015w).

Plants

One endangered and one threatened plant species are federally listed and known to occur in Connecticut, as summarized in Table 3.1.6-11. These species occur in various counties and habitats throughout Connecticut. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Connecticut is provided below.

Table 3.1.6-11: Federally Listed Plant Species of Connecticut

Common Name	Scientific Name	Federal Status	Critical Habitat	Habitat Description
Sandplain Gerardia	*Agalinis acuta*	Endangered	No	Various coastal grasslands in the state of Connecticut
Small Whorled Pogonia	*Isotria medeoloides*	Threatened	No	Hardwood forests in New London and Litchfield Counties

Source: (USFWS, 2015e)

Sandplain Gerardia. Also known as Sandplain false foxglove (*Agalinis acuta*), this plant was federally listed as endangered in 1988 (53 FR 34701 34705, September 7, 1988), and is a light yellowish green annual plant with pink bell-shaped blossoms grows from four to eight inches in height. The species range in the northeast United States. In 2005, there were 23 known extant populations (USDA, 2016). The Sandplain gerardia may be found in Hartford County in central Connecticut and New London County in southern Connecticut (USFWS, 2015t).

Preferred habitats are sandy soils of grasslands and roadsides, in pine/oak scrubs, and on scattered patches of bare soils. Sandplain gerardia cannot survive on their own and are hemiparasites[100] requiring its roots to connect to little bluestem (*Schizachyrium scoparium*) as its host plant to obtain nutrients. Threats to this species include habitat loss from succession, fire suppression, land development, and invasive competitors. Periodic disturbances that create open grassland habitat are necessary for sandplain gerardias success (USDA, 2016).

Small Whorled Pogonia. The small whorled pogonia *(Isotria medeoloides)* is a member of the orchid family, which grows between 10 to 14 inches in height with greenish yellow flowers and bears fruit (USFWS, 2008). The small whorled pogonia was federally listed as endangered in 1982 (47 FR 39827 39831, September 9, 1982) and in 1994 was reclassified as threatened (59 FR 50852 50857, October 6, 1994) (USFWS, 2015u). Regionally, this species is known to occur sparsely distributed from Maine south to Georgia and eastern to Illinois, with populations of less

[100] Hemiparasites are plants that obtain most or some of their nutrients by parasitism.

than 20 plants (USFWS, 2008). Locally, the small whorled pogonia is a very rare species that may occur in Litchfield County in northern Connecticut and New London County in southern Connecticut (USFWS, 2015v).

The small whorled pogonia occurs in hardwood stands that have an open understory, preferring acidic soils along small streams that have a thick layer of litter (USFWS, 2008). Small whorled pogonias bloom in May to June, producing a single tiny yellowish or greenish flower that lasts for seven days . Current threats to small whorled pogonia include habitat loss due to urban expansion and forestry practices (USFWS, 2008) (USFWS, 1992).

3.1.7. Land Use, Recreation, and Airspace

3.1.7.1. Definition of the Resource

The following summarizes major land uses, recreational venues, and the airspace considerations in Connecticut, characterizing existing, baseline conditions for use in evaluating the potential environmental consequences resulting from implementing the Proposed Action or Alternatives.

Land Use and Recreation

Land use is defined as "the arrangements, activities, and inputs people undertake in a certain land cover type to produce, change, or maintain it" (FAO, 2017). A land use designation can include one or more pieces of land, and multiple land uses may occur on the same piece of land. Land use also includes the physical cover, observed on the ground or remote sensing and mapping, on the earth's surface; land cover includes vegetation and manmade development (Anderson, Hardy, Roach, & Witmer, 2003).

Recreational uses are activities in which residents and visitors participate. They include outdoor activities, such as hiking, fishing, boating, athletic events (e.g., golf), and other attractions (e.g., historic monuments and cultural sites) or indoor activities, such as museums and historic sites. Recreational resources can include trails, beaches, caves, lakes, forests, recreational facilities, museums, historic sites, and other areas/facilities (OECD, 2001). Federal, state, county, or local governments typically manage recreational resources.

Descriptions of land uses are presented in three primary categories: forest and woodlands, agricultural, and developed. Descriptions of land ownership are presented in four main categories: private, federal, state, and tribal. Descriptions of recreational opportunities are presented in a regional fashion.

Airspace

Airspace is generally defined as the space lying above the earth, above a certain area of land or water, or above a nation and the territories that it controls, including territorial waters (Merriam Webster Dictionary, 2015). Airspace is a finite resource that can be defined vertically and horizontally, as well as temporally, when discussing it in relation to aircraft activities. Airspace management addresses how and in what airspace aircraft fly. Air flight safety considers aircraft flight risks, such as aircraft mishaps and bird/animal-aircraft strikes. The Federal Aviation

Administration (FAA) is responsible for the safe and efficient use of the nation's airspace and has established criteria and limits to its use.

The FAA operates a network of airport towers, air route traffic control centers, and flight service stations. The FAA also develops air traffic rules, assigns use of airspace, and controls air traffic in U.S. airspace. "The Air Traffic Organization (ATO) is the operational arm of the FAA responsible for providing safe and efficient air navigation services to approximately 30.2 million square miles of airspace. This represents more than 17 percent of the world's airspace and includes all of the United States and large portions of the Atlantic and Pacific Oceans and the Gulf of Mexico" (FAA, 2014a). The ATO is composed of Service Units (organizations) that support the operational requirements.

The FAA Air Traffic Services Unit (the Unit) manages the National Airspace System (NAS) and international airspace assigned to U.S. control and is responsible for ensuring efficient use, security, and safety of the nation's airspace. FAA field and regional offices (e.g., Aircraft Certification Offices, Airports Regional Offices, Flight Standards District Offices [FSDOs], Regional Offices & Aeronautical Center, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (FAA, 2015b) (FAA, 2016a). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

3.1.7.2. Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, summarizes numerous federal environmental laws and regulations that, to one degree or another, may affect land use in Connecticut. However, most site-specific land use controls and requirements are governed by local county, city, and village laws and regulations. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities.

Land use in Connecticut is managed and regulated primarily at the local level by boards and commissions composed of local residents. Depending on the municipality, members of the boards and commissions are either elected or appointed. Each municipality in Connecticut is responsible for managing land use and development within its borders, through mechanisms established by the legislature (see Title 8, Chapter 126 of the Connecticut General Statutes) (CGA, 2017c). Generally, commissions within each municipality include a planning commission, zoning commission, and inland wetland and watercourses commission, which have the following responsibilities:

- The municipal planning commissions are responsible for regulating the division of parcels of land into multiple lots, which is controlled through the local subdivision regulations.
- The zoning commissions are responsible for developing and adopting the zoning regulations in accordance with statutory requirements.

- The local inland wetland and watercourses commissions are responsible for regulating activities that affect inland wetlands and watercourses. These commissions may be separate entities or part of the planning and zoning commissions.

In addition, local supporting entities play a major role in managing land use. Because local planning and zoning commissions often do not have the level of expertise necessary to fully understand the environmental, economic, and cultural issues associated with submitted applications, several other boards and commissions have land use advisory roles. These may include a conservation commission, water pollution control authority, economic development commission, and harbor management commission. Depending upon the municipality, there may be other advisory boards and commissions.

Because federal laws govern the nation's airspace, there are no specific Connecticut state laws that would alter the existing conditions relating to airspace for this PEIS.

3.1.7.3. Land Use and Ownership

For the purposes of this analysis, land use in Connecticut has been classified into three primary land use groups: forest and woodlands,[101] agricultural,[102] and developed.[103] Land ownership within Connecticut has been classified into four main categories: private, federal, state, and tribal.

Land Use

Forest and woodland are the largest portion of land use with 50.8 percent of Connecticut's total land occupied by this category (Table 3.1.7-1 and Figure 3.1.7-1). Developed land is the second largest area of land use with 20.6 percent of the land occupied for this use. The third largest land use is agricultural, accounting for approximately 7.9 percent of the total land area. The remaining percentage of land includes open water and wetlands, public land, and other land covers, shown in Figure 3.1.7-1, that are not associated with specific land uses. (USGS, 2012b)

Table 3.1.7-1: Major Land Uses in Connecticut

Land Use	Square Miles	Percent of Land
Forest and Woodland	2,456	50.8%
Developed Land	998	20.6%
Agricultural Land	383	7.9%
Open Water and Wetlands	969	20.0%
Other Land Covers	36	0.7%

Source: (USGS, 2012b)

[101] Forest and woodlands: Areas characterized by tree cover (natural or semi-natural woody vegetation, generally greater than 6 meters tall); tree canopy accounts for 25-100 percent of the cover (USGS, 2012b).
[102] Agricultural: Areas characterized by herbaceous vegetation that has been planted or is intensively managed for the production of food, feed, or fiber; or is maintained in developed settings for specific purposes. Herbaceous vegetation accounts for 75-100 percent of the cover (USGS, 2012b).
[103] Developed: Areas characterized by a high percentage (30 percent or greater) of constructed materials (e.g., asphalt, concrete, buildings, etc) (USGS, 2012b).

Forest and Woodland

Encompassing more than 50 percent of the land, forest and woodland areas occur throughout the state, many of them interspersed with and adjacent to, agricultural areas (Figure 3.1.7-1).

State Forests

Owned by the state and managed by the Division of Forestry within CT DEEP, state forests account for approximately 266 square miles of land. Organized into 32 state forest units, these areas are used for recreation, protection of endangered species, forest products, and the preservation of unique sites (Figure 3.1.7-2) (CT DEEP, 2015x).

Private Forest and Woodland

Private landowners own approximately 85 percent (2,088 square miles) of Connecticut's total forestland. Private forestlands provide many public benefits including forest products, wildlife habitat, jobs, scenic beauty, and outdoor recreation opportunities Scattered throughout the state, forests and woodlands on private lands often border agricultural fields, suburban neighborhoods, and state forests. For additional information regarding forests and woodlands, see Section 3.6, Biological Resources and Section 3.11, Visual Resources.

Agricultural Land

Agricultural land exists in every region of the state and occupies 442 square miles (see Figure 3.1.7-1) (USDA, 2012a). Some of the state's largest agricultural uses include dairy, floriculture,[104] sod, and tobacco. Most farms within the state are operated by small, family businesses with the majority (3,239 farms) under 50 acres. In 2012, there were 5,977 farms in Connecticut and nearly all were owned by families (USDA, 2012b). For more information by county, access the USDA Census of Agriculture website: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Connecticut/.

Developed Land

Developed land in Connecticut tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 3.1.7-1). As the second largest land use at 21 percent of all land within the state, developed land is utilized for residential, commercial, industrial, recreational, and government purposes. Table 3.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates; and Figure 3.1.7-1 shows where these areas are within the Developed category.

[104] Floriculture is to cultivate flowers.

Table 3.1.7-2: Top Five Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Hartford-West Hartford-East Hartford Metro Area	1,214,295
Bridgeport-Stamford-Norwalk Metro Area	945,438
New Haven-Milford Metro Area	861,277
Norwich-New London, Metro Area	273,676
Torrington, Metro Area	184,993
Total Estimated Population of Metropolitan Areas	**3,479,679**
Total Estimated Population (2014)	**3,596,677**[a]

Source: (U.S. Census Bureau, 2014) (U.S. Census Bureau, 2015e)

[a] The estimated population in 2016 was 3,576,452.

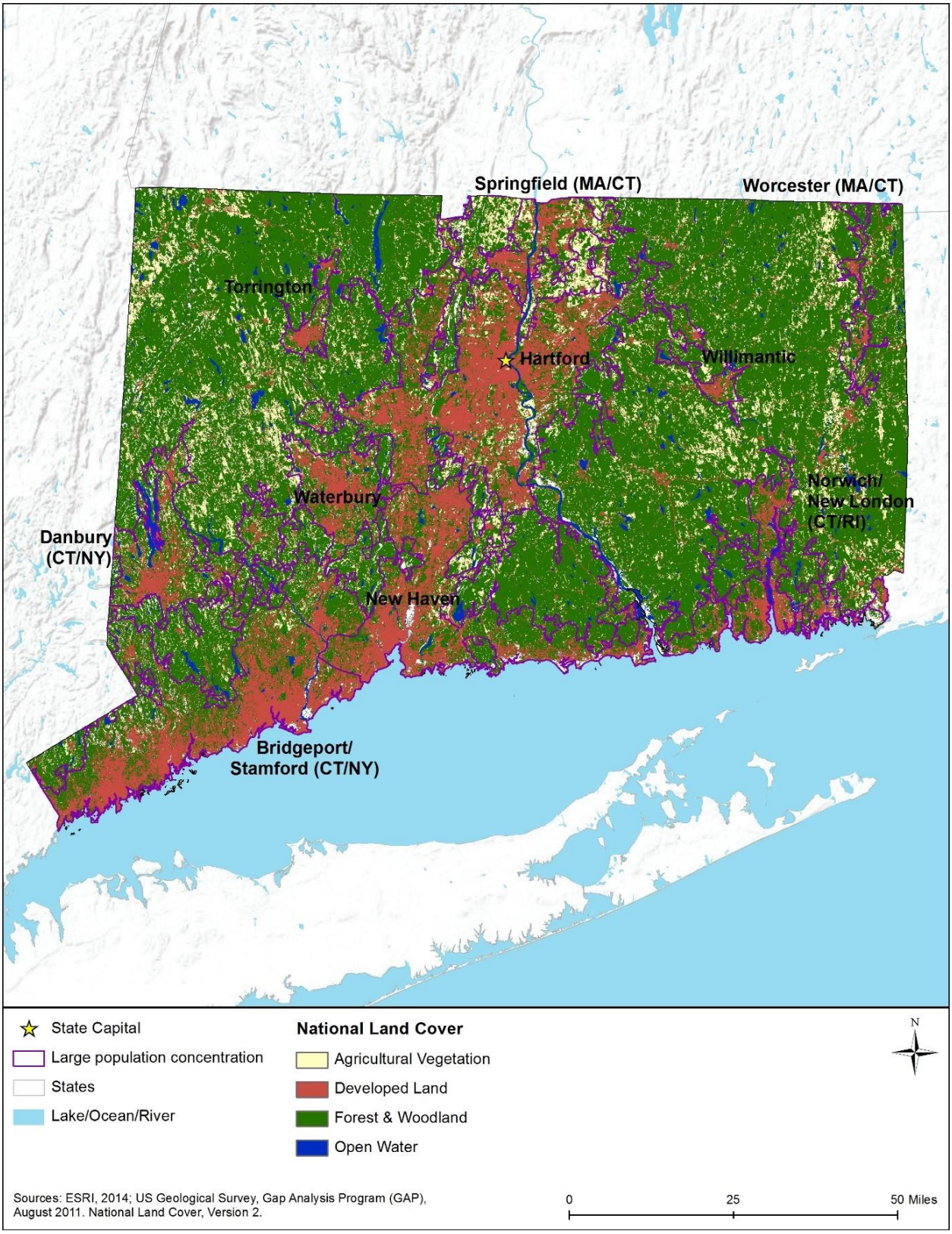


Figure 3.1.7-1: Land Use Distribution

Land Ownership

Land ownership within Connecticut has been classified into four main categories: private, federal, state, and tribal (Figure 3.1.7-2).

Private Land

The majority of land in Connecticut is privately owned, with most of this land falling under the land use categories of agricultural, forest and woodland, and developed (Figure 3.1.7-1). Highly developed, urban, metropolitan areas transition into suburban, agriculture, shrub, and woodland areas, which then transition into more wild and remote areas. Private land exists in all regions of the state.[105]

Federal Land

The U.S. federal government manages 28.89 square miles of Connecticut land with a variety of land types and uses (Figure 3.1.7-2). Three federal agencies manage federal lands within the state (Table 3.1.7-3). Additional information on lands managed by federal agencies is provided in Section 3.1.5, Wetlands, and Section 3.1.8, Visual Resources. Table 3.1.7-3 identifies the federal agencies managing federal lands throughout the state. Some federal agencies only have small areas of federal lands scattered throughout the state.[106]

Table 3.1.7-3: Federal Land in Connecticut

Agency[a]	Square Miles	Representative Type
Department of Defense (DoD)	19.00	New London Submarine Base
USFWS	0.50	Stewart B. McKinney National Wildlife Refuge
National Park Service (NPS)[b]	0.09	Weir Farm National Historic Site; various trails; various National Landmarks
USACE	9.30	Reservoirs for flooding control; recreation areas
Total	**28.89**	

Sources: (U.S. Navy, 2015) (NPS, 2011b) (USFWS, 2014c)

[a] Table identifies land wholly managed by the Agency; additional properties may be managed by or affiliated with the Agency.

[b] Additional trails and corridors pass through Connecticut that are part of the National Park System.

State Land

The Connecticut state government manages approximately 397 square miles of land composed of forests and woodlands, state parks, historic sites, state offices, schools, recreation areas, hospitals, and other facilities (Table 3.1.7-4) (Connecticut Office of Policy and Management, 2014).

[105] Total acreage of private land could not be obtained for the state.

[106] Not all Federal agency land is depicted in Figure 3.1.7-2 given the small size of some of the land acreage.

Table 3.1.7-4: State Land in Connecticut

Agency	Square Miles	Representative Type
CT DEEP	361.51	State forests, conservation easements, WMAs, state parks, state historical parks
Department of Education	8.96	Schools, universities
ConnDOT	8.35	Infrastructure
Department of Correction	4.72	Correctional facilities
Department of Public Health	4.69	Hospitals, clinics
Department of Consumer Protection	3.92	Offices, laboratories, other buildings
All Other	5.20	NA
Total	**397.35**	

Source: (Connecticut Office of Policy and Management, 2014)

NA = not applicable

- CT DEEP manages more than 90 percent of land owned by the state (Connecticut Office of Policy and Management, 2014).
- Connecticut has 65 state parks and 27 state forests (CT DEEP, 2016c).
- State WMAs are "areas of land and water having unique or outstanding wildlife qualities that are managed primarily for the conservation and enhancement of fish and wildlife and to provide opportunities for fish and wildlife-based recreation" (CT DEEP, 2012c). The Division of Wildlife manages WMAs. There are 105 WMAs covering 50 square miles scattered throughout the state, ranging in size from 1 to 2,000 acres (CT DEEP, 2012c). For additional information on wildlife refuges and management areas, see Section 3.1.6, Wildlife.

Tribal Land

The Bureau of Indian Affairs and two tribes manage 4.71 square miles of land within Connecticut. These lands are composed of two Indian Reservations: the Mashantucket Pequot Indian Reservation and the Mohegan Indian Reservation (Figure 3.1.7-2 and Table 3.1.7-5).

Table 3.1.7-5: Indian Reservations of Connecticut

Reservation Name	Square Miles
Mashantucket Pequot Indian Reservation	3.42
Mohegan Indian Reservation	1.29

Source: (USGS National Map, 2014)

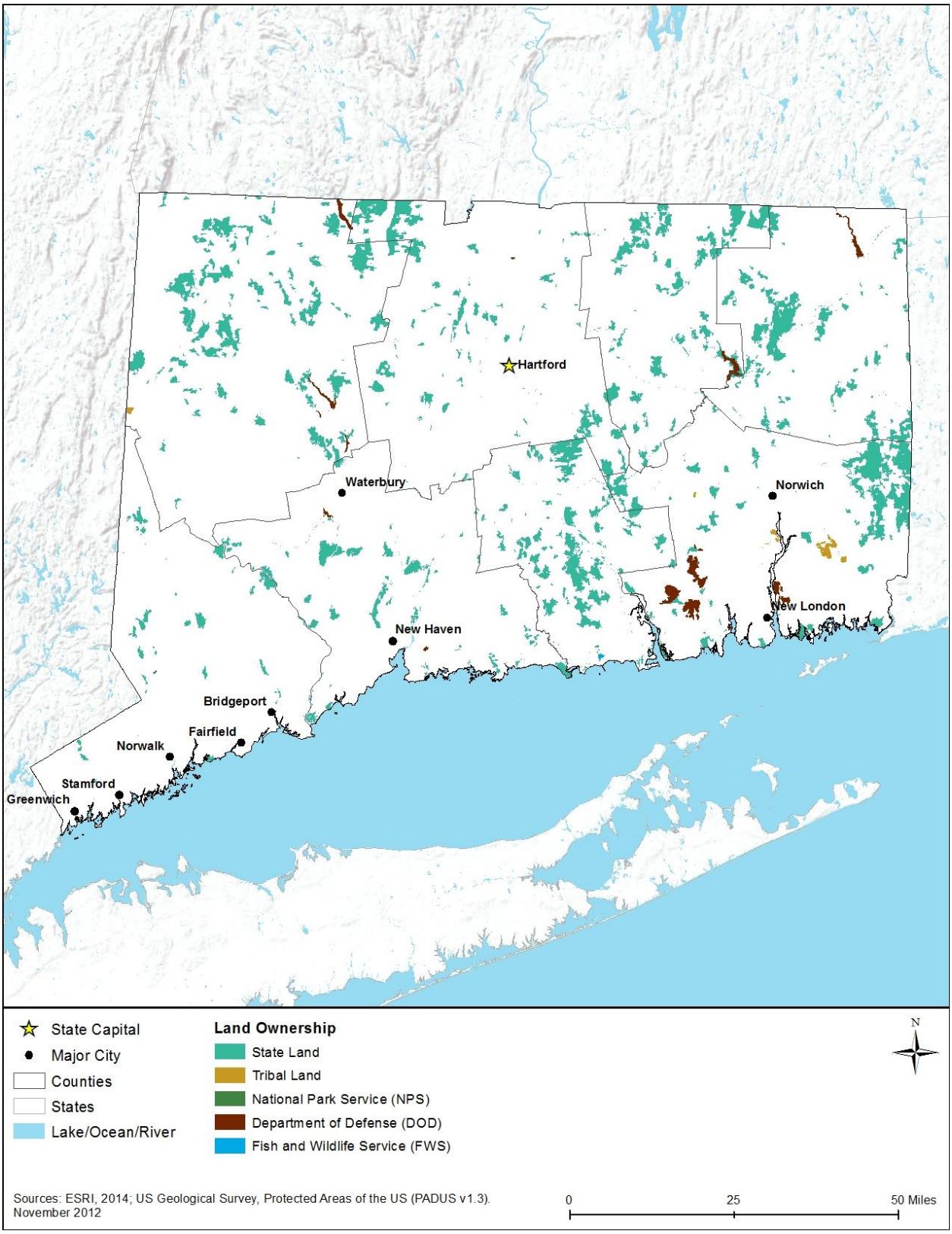


Figure 3.1.7-2: Land Ownership Distribution

3.1.7.4. Recreation

Connecticut is a small state, notable for having high population density and high per capita income (see section 3.1.9, Socioeconomics, and section 3.1.10, Environmental Justice). On the community level, towns and cities provide an assortment of indoor and outdoor recreational facilities, including athletic fields and courts, playgrounds, picnicking areas, beaches, boat launches, indoor and outdoor pools, and dog parks. Community-level programs, according to the population's needs, include summer camps and recreational leagues and classes. On the state level, Connecticut has 135 state forests, parks, reserves, recreation areas, monuments, and maintained multi-use trails (CT DEEP, 2015y). Federally, the National Park Service (NPS), USFWS, and USACE manage areas with recreational attributes. Connecticut also contains a museum in the Smithsonian Institution Affiliation Program (Recreation.gov, 2014).

This section discusses recreation on a regional basis, calling out specific areas representative of recreational opportunities in each region, at various locations throughout Connecticut (see Figure 3.1.7-3). For information on visual aspects, see Section 3.1.8, Visual Resources, and for information on the historical significance of locations, see Section 3.1.11, Cultural Resources.

According to the CT DEEP, Connecticut consists of three regions: Eastern District, Western District, and Marine District (see Figure 3.1.7-3) (CT DEEP, 2014m). As Connecticut counties are a geographical reference only (Watson, 1998), districts do not follow county lines. Much of the border between the Eastern and Western Districts is the Connecticut River. Townships sharing a southern border with the Long Island Sound are in the Marine District.

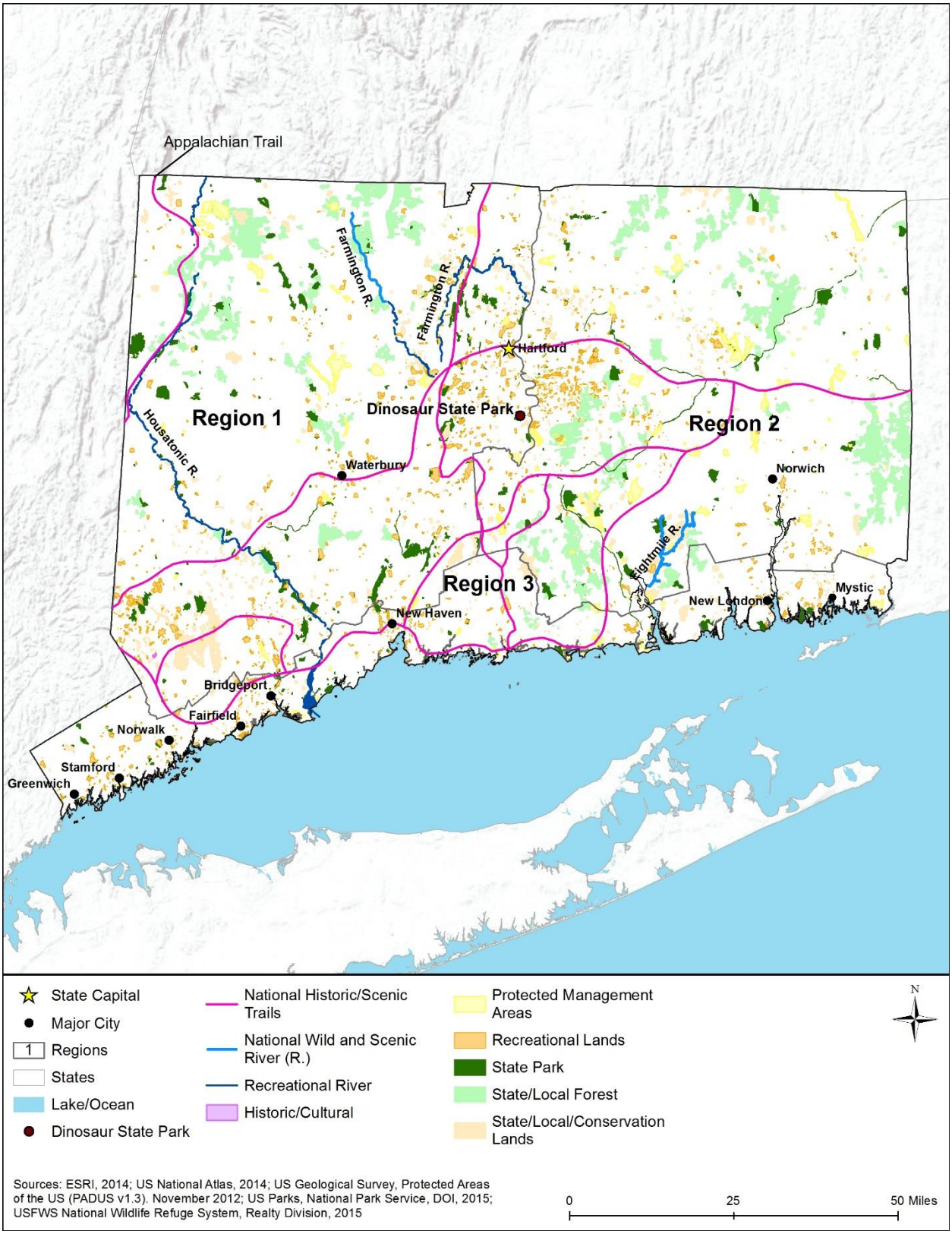


Figure 3.1.7-3: Connecticut Recreation Resources

Western District

The Western District is bordered by Massachusetts to the north and New York to the west. The Taconic Range of the Appalachian Mountains and the Housatonic River make up the westernmost part of the district, with the district ending at the Central Valley just east of Hartford.

Several sites in Connecticut highlight the state's paleontology: Jurassic-era dinosaur tracks were discovered at the Dinosaur State Park in Rocky Hill, CT. Visitors may create plaster casts of the tracks as souvenirs (Connecticut Office of Tourism, 2015a). Other areas with dinosaur-themed exhibits are the Connecticut Science Center in Hartford, and Lake Compounce in Bristol. Lake Compounce is America's oldest operating amusement park (Connecticut Office of Tourism, 2015b).

The Appalachian Trail runs for 51.6 miles in the northwestern corner of Connecticut; bordered by the Housatonic River Valley to the east, and the Taconic Range to the west. Hiking for this area is rated a six, with extended climbs that may last hours or shorter climbs with difficult footing (Appalachian Trail Conservancy, 2015). Connecticut's trails and forests are often visited during the autumn for leaf peeping, when the leaves begin to change color; Connecticut's most famous leaf peeping area is Litchfield Hills, which encompasses Humaston Brook State Park, Mount Tom State Park, and Tom State Park (Connecticut Office of Tourism, 2015c).

The Western District is also known for river activities. The Housatonic River, in northwestern Connecticut, is a popular site for white water rafting, with varying degrees of difficulty at various sites along the river. The Farmington River, traversing through Satan's Kingdom State Recreation Area, has tubing courses (Connecticut Office of Tourism, 2015d).

Eastern District

The Eastern District begins in Connecticut's Central Valley, and continues to the east through the hills within the Quinebaug and Shetucket Rivers Valley National Historic Corridor. It is bordered by Massachusetts to the north and Rhode Island to the east.

The Quinebaug and Shetucket Rivers Valley National Historic Corridor consists of 1,058 square miles in Connecticut and Massachusetts, bordered by the Quinebaug and Shetucket Rivers. This unique area is not a traditional park, but is managed by the NPS, state and local governments, nonprofit cultural and environmental organizations, local businesses, and the approximately 300,000 citizens residing in the park (NPS, 2015a). Recreational activities in the River Valley include hiking, camping, fishing, water sports, bicycling, and visiting local farms and business such as alpaca farms, orchards, Christmas tree farms, greenhouses, museums, farmer's markets, shops, and restaurants (The Last Green Valley, 2015).

In addition to the dinosaur-themed parks highlighted in the Western District, the Eastern District contains the Mashantucket Pequot Museum, in Ledyard, CT, and the Dinosaur Place at Nature's Art Village in Montville, CT. The museum contains interactive exhibits, including a simulated glacial crevasse highlighting the effects of the last ice age. The Dinosaur Place is a theme park

with animatronic dinosaurs on trails throughout the park (Connecticut Office of Tourism, 2015b).

Two casinos are in Connecticut's Eastern District: Mohegan Sun and Foxwoods. Run by Connecticut Native American tribes, the Mohegan Indian Tribe and the Mashantucket Pequot Tribe, respectively, the casinos offer gaming tables and slots, live shows, golf courses, spas, restaurants, and shopping (Connecticut Office of Tourism, 2015e).

Marine District

The Marine District consists of the coastal lowlands adjacent to the Long Island Sound off the Atlantic Ocean. Many of the recreation resources in the Marine District are water-related.

The Marine District has many locations for saltwater fishing and swimming, such as the Silver Sands State Park, the Hammonasset Beach State Park, and the Sherwood Island State Park (CT DEEP, 2015y).

The Thimble Islands, in the Long Island Sound, are a collection of 365 islands, 32 of which are populated. The islands are a popular site for kayakers, boat and ferry tours, and saltwater fishing (Connecticut Office of Tourism, 2015f).

The Mystic Seaport is one of the nation's premier maritime museums, with exhibits focusing on preserving historic ships, ships used during wartime and whaling, and a recreation of a 19th century seafaring village (Mystic Seaport, 2015). The nearby Mystic Aquarium, in 2014, became the only aquarium to receive the National Medal for Museum and Library Service (Connecticut Office of Tourism, 2015g). The Navy's Submarine Force Museum and the *Nautilus*, the first nuclear-powered submarine are also in the Marine District (Connecticut Office of Tourism, 2015h).

3.1.7.5. Airspace

The FAA uses the NAS to provide for aviation safety. The NAS includes Special Use Airspace (SUA) consisting of Restricted Areas, Warning Areas, and Military Operation Areas (MOAs). The FAA controls the use of the NAS with various procedures and practices (such as established flight rules and regulations, airspace management actions, and air traffic control procedures) to ensure the safety of aircraft and protection of the public.

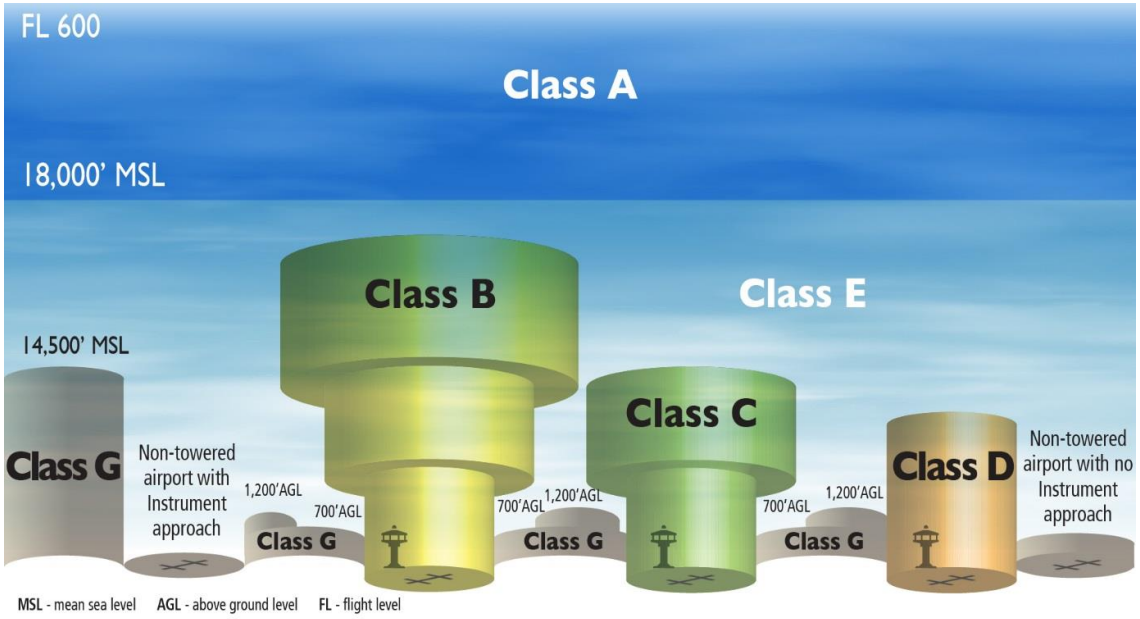
Airspace Categories

There are two categories of airspace or airspace areas.

1) **Regulatory airspace** consists of controlled airspace (Class A, B, C, D, and E airspace areas in descending order of restrictive operating rules), and restricted and prohibited areas.
2) **Non-regulatory airspace** consists of MOAs, warning areas, alert areas, and controlled firing areas.

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the

airspace, the level of safety required, and the national and public interest. Figure 3.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[107] service is based on the airspace classification." (FAA, 2016b).



Source: Derived from (FAA, 2016b)

Figure 3.1.7-4: National Air Space Classification Profile

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL).[108] Includes the airspace over waters off the U.S. coastlines (48 contiguous States and Alaska) within 12 Nautical Miles (NM). All operations must be conducted under Instrument Flight Rules (IFR).[109]
- **Class B:** Airspace from the surface up to 10,000 feet MSL near the busiest airports with heavy traffic operations. The airspace is tailored to the specific airport in several layers. An ATC clearance is required for all aircraft to operate in this area.
- **Class C:** Airspace from the surface to 4,000 feet above the airport elevation surrounding the airport. Applies to airports with an operational control tower, serviced by a radar approach control, and certain number of IFR operations or total number of passengers boarding aircrafts. Airspace is tailored in layers, but usually extends out to 10 NM from 1,200 feet to 4,000 feet above the airport elevation. Entering Class C airspace requires radio contact with the controlling ATC authority, and an ATC clearance is ultimately required for landing.

[107] ATC: Air Traffic Control, an FAA approved authority service to provide safe, orderly and expeditious flow of air traffic operations (FAA, 2015c).
[108] MSL: Mean Seal Level, also referred to as the "tidal datum, or frame of vertical reference defined by a specific phase of the tide. Tidal datums are locally derived based on observations at a tide station, and are typically computed over a 19-year period, known as the National Tidal Datum Epoch (NTDE) (NOAA NOS, 2016).
[109] IFR - Instrument Flight Rules, rules for the conduct of flights under instrument meteorological conditions (FAA, 2015d).

- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.
- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2016b).

Uncontrolled Airspace

- **Class G:** No specific definition. Refers generally to airspace not designated as Class A, B, C, D, or E. Class G airspace is from the surface to the base of Class E airspace.

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (see Table 3.1.7-6).

Table 3.1.7-6: SUA Designations

SUA Type	Definition
Prohibited Areas	"Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts."
Restricted Areas	"Airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute 14 CFR Part 73."
Warning Areas	"Airspace of defined dimensions, extending from three NM from the U.S. coast, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both."
MOAs	"Airspace of defined vertical and lateral limits established for separating certain military activities (e.g., air combat maneuvers, air intercepts, testing, etc.) from IFR traffic. Whenever an MOA is in use, non-participating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic."
Alert Areas	"Depicted on aeronautical charts to inform non-participating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an alert area must be conducted in accordance with CFRs, without waiver, and pilots of participating aircraft and pilots transiting the area are responsible for collision avoidance."
Controlled Firing Areas (CFAs)	"Activities that, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart CFAs since they do not cause a nonparticipating aircraft to change its flight path."

SUA Type	Definition
National Security Areas (NSA)	"Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 99.7. Regulatory prohibitions are issued by System Operations, System Operations Airspace and Aeronautical Information Manual (AIM) Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

Source: (FAA, 2015c) (FAA, 2016b)

Other Airspace Areas

Other airspace areas, explained in Table 3.1.7-7, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 3.1.7-7: Other Airspace Designations

Type	Definition
Airport Advisory	There are 3 types: • Local Airport Advisory – Operated within 10 statute miles (5,280 feet/mile) of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. • Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. • Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: • Protect people and property from a hazard; • Provide safety for disaster relief aircraft during operations; • Avoid unsafe aircraft congestion associated with an incident or public interest event; • Protect the U.S. President, Vice President, and other public figures; • Provide safety for space operations; and • Protect in the State of Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of "permanent" are included in this PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.
Published VFRs and Irs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

Source: (FAA, 2015c), (FAA, 2016b)

3.1.7.6. Aerial System Considerations

Unmanned Aerial Systems

Unmanned Aerial Systems (UASs) are widely used by the military, private entities, public service, educational institutions, federal/state/local governments, and other agencies. The FAA's Unmanned Aircraft Systems Integration Office integrates UAS into the NAS. The *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap of 2013* addresses the actions and considerations needed to integrate UAS into the NAS "without reducing existing capacity, decreasing safety, negatively impacting current operators, or increasing the risk to airspace users or persons and property on the ground any more than the integration of comparable new and novel technologies" (FAA, 2013).

UAS at airports is a complex operational challenge with the need to separate UAS flight operations from mainstream air traffic. Separation can be achieved with specific UAS launch windows, special airports, or off-airport locations that allow the UAS to easily launch and recover. Special aviation procedures are applied to UAS flights. There must be the capability of Sense and Avoid (SAA) and Control and Communication (C2) during UAS operations. An Unmanned Aircraft (UA) must be able to see (or sense) other aircraft in the area and avoid the aircraft through corrected flight path changes. General equipment and operational requirements can include aircraft anti-collision lights, an altitude encoding transponder, cameras, sensors, and collision avoidance maneuvers. The C2 of the UA occurs with the pilot/operator, the UAS control station, and ATC. Research efforts, a component of the FAA's UAS roadmap, continue to mature the technology for both SAA and C2 capabilities.

Balloons

Moored balloons and unmanned free balloons cannot be operated in a prohibited or restricted area unless approval is obtained from the controlling agency. Balloons also cannot be operated if they pose a hazard to people and their property.

3.1.7.7. Obstructions to Airspace Considerations

The Airports Division of the FAA is responsible for the evaluation and analysis of proposed construction or alterations on airports. The FAA Air Traffic Office is responsible for determining obstructions to air navigation as a result of construction off airports that may affect the safe and efficient use of navigable airspace and the operation of planned or existing air navigation and communication facilities. Such facilities include air navigation aids, communication equipment, airports, federal airways, instrument approach or departure procedures, and approved off-airway routes. An Obstruction Evaluation and Airport Airspace Analysis (OE/AAA) is required when there is the potential for airport construction/alteration of a facility that may impinge upon the NAS. Per 14 CFR Part 77.9, the FAA is to be notified about construction or alterations when:

- "Any construction or alteration exceeding 200 ft above ground level
- Any construction or alteration:
  - within 20,000 ft of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft
  - within 10,000 ft of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 ft
  - within 5,000 ft of a public use heliport which exceeds a 25:1 surface
- Any highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards
- When requested by the FAA
- Any construction or alteration located on a public use airport or heliport regardless of height or location." (FAA, 2015e)

Construction or alternative facilities (such as towers) that are subject to FCC licensing requirements are also required to have an OE/AAA performed by the FAA Airport Division.

Connecticut Airspace

The Connecticut Airport Authority (CAA) is responsible for all airport-related activities. The CAA is responsible for improving and operating the five state airports (i.e., Bradley International, Groton-New London Regional, Hartford-Brainard, Danielson Municipal, and Robertson Field) with the purpose of "making the state's airports more attractive to new routes, new commerce, and new companies who may be considering making Connecticut their home" (Connecticut Airport Authority, 2014b). There is one FAA FSDO for Connecticut in Enfield (FAA, 2015b).

Connecticut airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP addresses the strategic planning and future development for the state's airport system, as well as addressing key issues associated with their airports (NASAO, 2015). Figure 3.1.7-5 depicts the public and private aviation airports/facilities residing in Connecticut. There are approximately 114 airports (public and private) in the state as reflected in Table 3.1.7-8 (USDOT, 2015a).

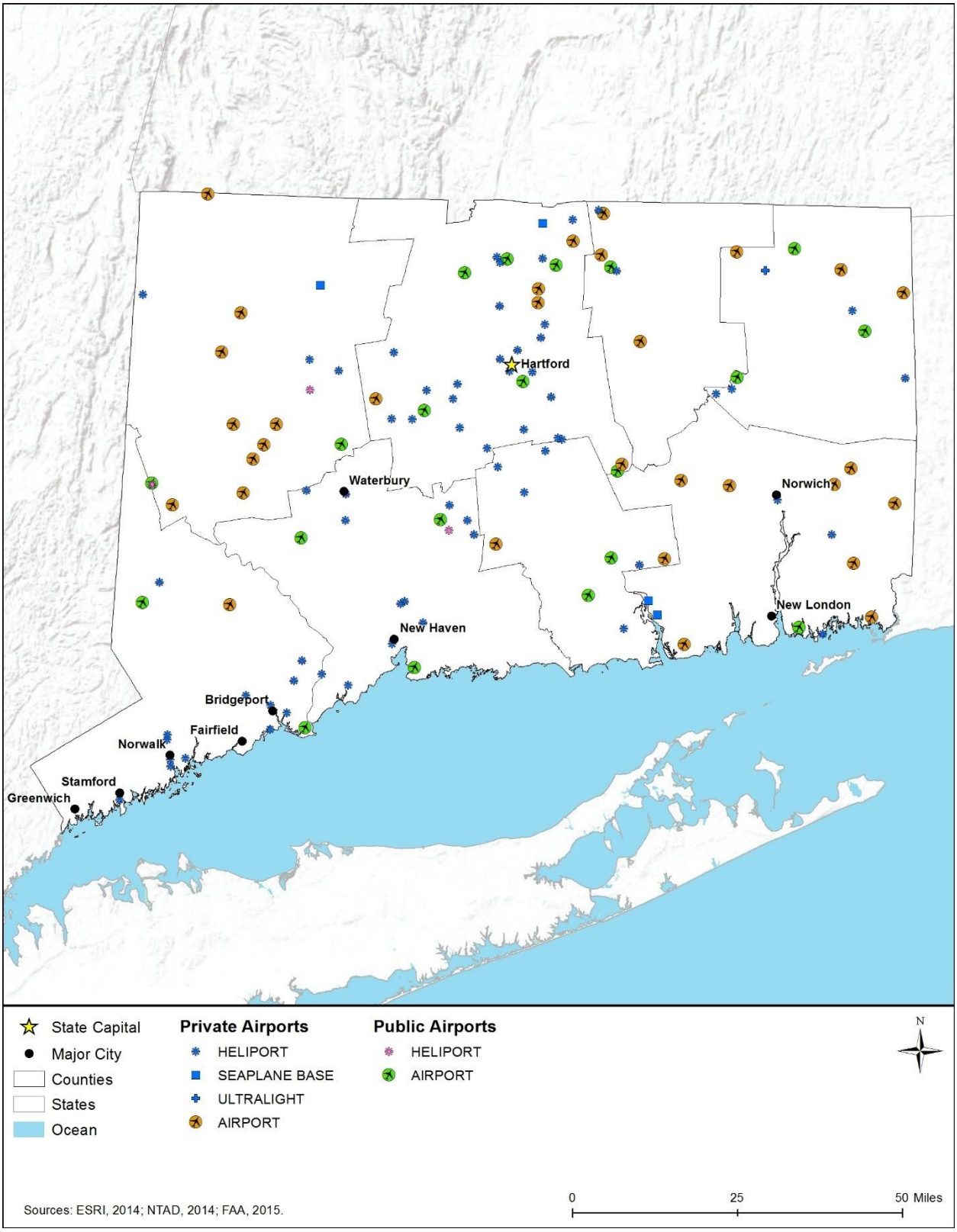


Figure 3.1.7-5: Public and Private Airports/Facilities in Connecticut

Table 3.1.7-8: Type and Number of Connecticut Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	20	21
Heliport	3	65
Seaplane	0	4
Ultralight	0	1
Balloonport	0	0
Gliderport	0	0
Total	23	91

Source: (USDOT, 2015a)

There is one controlled airspace, Class C, depicted on section charts for Connecticut – Windsor Locks, Bradley International (FAA, 2015c). No SUAs are identified for the state (FAA, 2014b). Figure 3.1.7-6 depicts two MTRs for the state, which are north, south, and east of Norwich (Slow Routes [SRs] 901 and 004).

UAS Considerations

The NPS signed a policy memorandum on June 24, 2014 that "directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service (NPS, 2014a)." Connecticut has one National Historic Site, one National Historic Trail, two Scenic Trails, and one National Historic Corridor (NPCA, 2017) (NPS, 2015b).

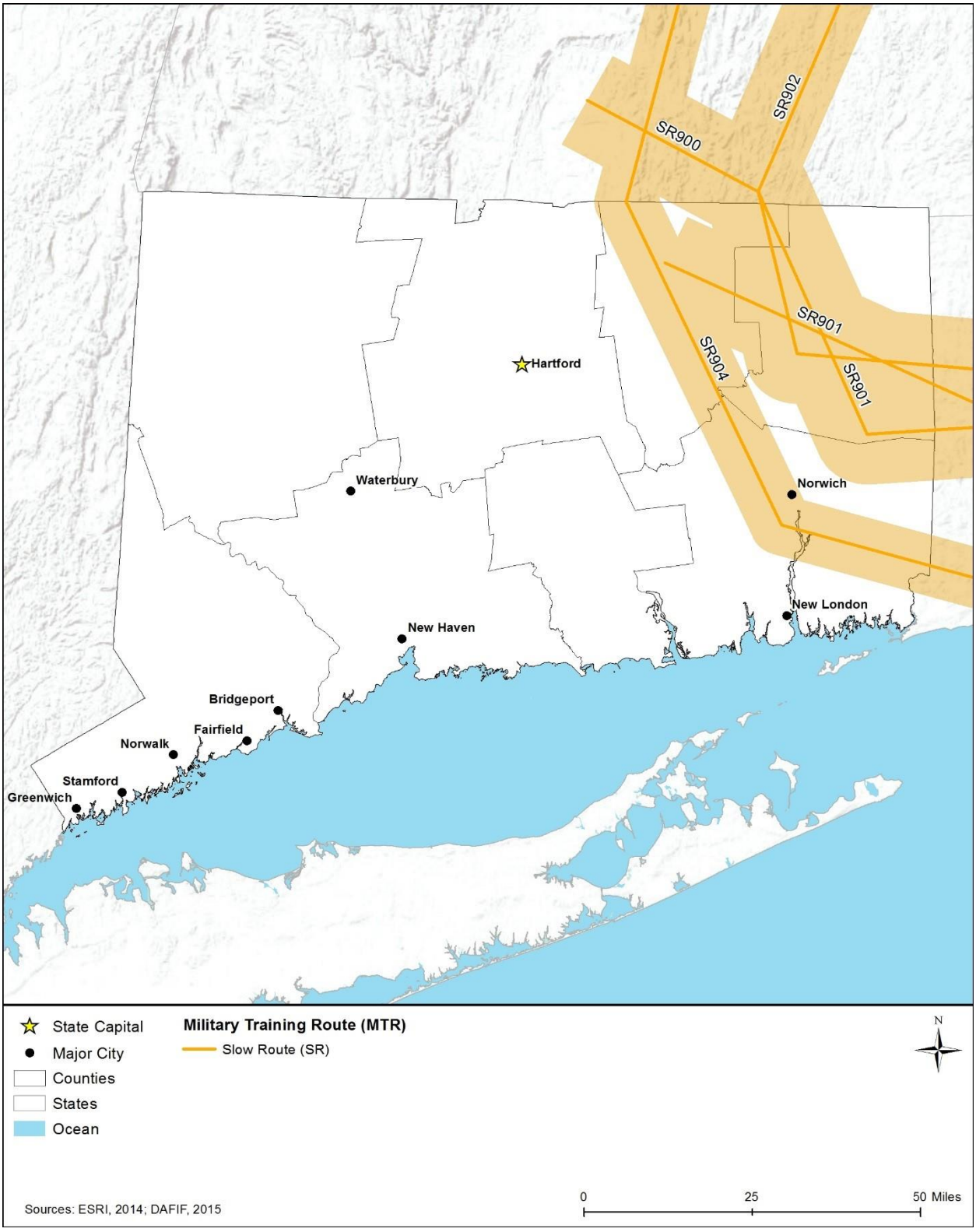


Figure 3.1.7-6: MTRs in Connecticut

3.1.8. Visual Resources

3.1.8.1. Definition of the Resource

Visual resources influence the human experience of a landscape. Various aspects combine to create visual resources, such as color, contrast, texture, line, and form. Features (e.g., mountain ranges, city skylines, ocean views, unique geological formations, rivers) and constructed landmarks (e.g., bridges, memorials, cultural resources, or statues) are considered visual resources. For some, cityscapes are valued visual resources, whereas others prefer natural areas. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for NEPA and National Historic Preservation Act (NHPA) compliance. A general definition of visual resources used by the Bureau of Land Management is "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)" (BLM, 1984).

3.1.8.2. Specific Regulatory Considerations

Connecticut has several policies regarding city planning and management of visual and scenic resources. Table 3.1.8-1 displays the policies and regulations regarding scenic resource management within the state.

Table 3.1.8-1: Relevant Connecticut Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Conservation and Development Policies Plan	Office of Policy and Management (OPM)	The plans "include policies that guide the planning and decision-making processes of state government relative to: (1) addressing human resource needs and development; (2) balancing economic growth with environmental protection and resource conservation concerns; and (3) coordinating the functional planning activities of state agencies to accomplish long-term effectiveness and economies in the expenditure of public funds."
CGS Sections 22a-15 to 22a-19	State Historic Preservation Office (SHPO)	Protects air, water, and other natural resources from unreasonable pollution, impairment, or destruction. Statute includes cultural resources as to prevent the demolition of historic structures and landmarks.
CGS Section 8-2j, Village Districts Act	SHPO	Permits municipalities to protect the distinctive character, landscape or historic value of such areas "that are specifically identified in the plan of conservation and development of the municipality" by regulating new construction, substantial reconstruction, and rehabilitations.
Connecticut Coastal Management Act	CT DEEP	Includes the requirement to prevent adverse impacts on coastal resources, including "degrading visual quality through significant alteration of the natural features of vistas and viewpoints."
Designation of Scenic Roads: Section 13b-31c-1 to 13b-31c-5.	ConnDOT	Allows for the designation of scenic roads and the protection of these designated roads from development that would detract from the natural or scenic character of the road.

Sources: (CT OPM, 2013), (CGA, 2017d), (Justia, 2017b), (CGA, 2017e), (CT Alert ENS, 2017)

Connecticut has a statewide Conservation and Development Policies Plan that helps guide the character and growth of the state and considers scenic and visual resources (Table 3.1.8-1). There are 15 regional planning agencies within the state that also have plans, along with many of the 169 towns. The plans depict where within the state, towns, municipalities, and regions, lands will be managed for conservation and where lands will be managed for development. Where counties, cities, towns, or villages have planning documents that address scenery, character, or visual resources, the placement of towers or temporary transmission structures would be required to comply with the management or provide mitigation measures to meet compliance. Scenic resources are protected within the conservation areas (Connecticut Office of Policy and Managment 2013). As of 2013, 80 municipal plans were available on the Connecticut Office of Policy and Management website (http://www.ct.gov/opm/cwp/view.asp?A=2990&Q=389822). For example, the city of New Haven's plan (in New Haven County) focuses more on the urban uses and character of the city while protecting the remaining open spaces through conservation easements and other mechanisms (New Haven City Plan Commission, 2003).

3.1.8.3. Character and Visual Quality of the Existing Landscape

Connecticut's landscape ranges from the Appalachian Mountains to the northwest, the central portion of the state containing the Connecticut River, and the southern shoreline along Long Island Sound. Other mountain ranges include the Bolton and Tolland Mountain Ranges and the east-to-west running Mohegan Range. The majority of the state is within the Lower New England Piedmont Ecoregion with the exception of the southern portion of the state, which is a part of the North Atlantic Coast Ecoregion. The visual resources of the state include deciduous forests, rolling hills, river-carved valleys, coastal shorelines, as well as characteristic New England style villages. (USGS, 2011)

According to the USGS, forested areas are the most prevalent land use within the state (USGS, 2011). Visual resources within forested areas are generally composed of continuous, natural looking cover with gradual transitions of line and color. They are typically characterized by the lack of disturbance or disruption of the landscape. The second most prominent land cover is developed and human use. (USGS, 2011)

One aspect of importance for visual resources is to maintain the character of the area. For example, in a farm community, keeping the character of the town consistent with farm-style houses, barns, and silos would be key in maintaining the character of the community. In a more metropolitan area, there may be many different visual styles within each neighborhood, but keeping the character of the neighborhood may be important to maintain if new development were to occur. Section 3.1.7 discusses land use and contains further descriptions of land cover within the state.

While the state and many municipalities have some regulation of scenic and visual resources, not all scenic areas within the state have been identified or have policy or regulations for management or protection by the state. The areas listed below have some measure of management, significance, or protection through state or federal policy, as well as being identified as a visually significant area.

3.1.8.4. Visually Important Historic Properties and Cultural Resources

Visual and aesthetic qualities of historic properties can contribute to the overall importance of a particular site. These qualities relate to the integrity of the appearance and setting of these properties or resources. Viewsheds (the natural and manmade environment visible from one or more viewing points) can also contribute to the significance of historic properties or cultural resources. Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 3.1.8-1 through Figure 3.1.8-4 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Connecticut, there are 1,596 NRHP listed sites, which include 2 National Heritage Areas, 61 National Historic Landmarks, and 1 National Historic Site (NPS, 2015c) (NPS, 2015d). Section 3.1.11 provides details on the historic resources in Connecticut. Some State Historic Sites, State Heritage Areas, and State Historic Districts may also be included in the NRHP, whereas others are not designated at this time.

The NPS is required to protect all aspects of historic landscapes, such as forests, gardens, trails, structures, ponds, and farming areas using *The Secretary of the Interior's Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes* (NPS, 1995). The standards and guidelines "require retention of the greatest amount of historic fabric, including the landscape's historic form, features, and details as they have evolved over time," which directly protects the historic properties and the visual resources therein (NPS, 1995).

National Heritage Areas

National Heritage Areas (NHAs) are "places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape" (NPS, 2011c). These areas help tell the history of the United States. Connecticut has two National Heritage Areas: the Upper Housatonic Valley National Heritage Area and the Quinebaug and Shetucket Rivers Valley National Heritage Corridor (NPS, 2017b). The Quinebaug and Shetucket corridor is managed by the NPS and considered a National Park unit; it contains 35 towns, many of which are archaeological sites, rural landscapes, several National Historic Landmarks and historic districts, large parks, and open spaces (Connecticut State Historic Preservation Office, 2011).

National Historic Landmarks

National Historic Landmarks (NHLs) are defined as "nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States" (NPS, 2015e). Generally, NHLs are composed of historic buildings, such as residences, churches, civic buildings, and institutional buildings. Other types of historic properties include battlefields and canals. The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities that may be considered visual resources or visually sensitive at these sites. According to the Connecticut State Historic Preservation Plan, "there are 61 total: 42 buildings, eight districts, four sites, and six structures listed as National Historic Landmarks in Connecticut" (Connecticut State Historic Preservation Office, 2011). The scenic and visual resources of these landmarks

and surrounding areas are managed for consistency with the historic resources and aesthetics of the landscape (Connecticut State Historic Preservation Office, 2011). By comparison, there are more than 2,500 NHLs in the United States.

National Historic Sites

The sole National Historic Site in Connecticut is the Weir Farm. The Weir Farm National Historic Site and its scenic resources are managed by the NPS and considered a National Park unit (NPS, 2012b). Weir Farm is the former home of American impressionist painter J. Alden Weir contains historic buildings, farmlands, and natural landscapes with scenic vistas of forested areas and wetlands (NPS, 2017b).

State Historic Sites, Resources, and Historic Parks

There are 10 State Historic Parks (Table 3.1.8-2) throughout Connecticut, some are small areas with structures, and others have interpretive trails and opportunities for hiking. The scenic resources are a part of what makes these areas unique and many are managed for consistency with the surrounding landscapes (CT DEEP, 2015z).

Table 3.1.8-2: State Historic Sites, Resources, and Historic Parks

State Historic Site/Park	Visual Attributes
Beckley Iron Furnace Industrial Monument	Historic structure, pond and stream
Fort Griswold Battlefield State Park	Historic battlefield and historic structures
Fort Trumbull State Park	Scenic views of Long Island Sound, and historic fort
Gillette Castle State Park	Unique, historic structure; 184 acres of trails, gardens, and open space
Harkness Memorial State Park	Scenic views of Long Island Sound, 230 acres of trails, gardens, farmland, and open space; and historic mansion
Osborne Homestead Museum	Historic estate, home, and gardens
Putnam Memorial State Park	Historic Revolutionary War encampment, historic buildings, ponds, geologic features, and forested hiking trails
Shenipsit State Forest – Civilian Conservation Corps Museum	7,078 forested acres, hiking trails with mountaintop vistas, historic buildings, and ponds
Talcott Mountain State Park	Historic home and tower with scenic vistas, 550 acres of forest, mountaintop vistas, and ponds
Topsmead State Forest	Historic 16 acre estate, home, gardens, forest, and ponds

Source: (CT DEEP, 2015aa)

State Heritage Landscapes

State heritage areas are prized for their cultural or aesthetic values. According to the Connecticut State Historic Preservation Plan, "as of 2011, the heritage landscape database contains information on 172 town greens throughout the state; and the SHPO also has a historic resource inventory of 60 significant designed municipal parks." (Connecticut State Historic Preservation Office, 2011)

Source: (Town of Lebanon, 2015)

Figure 3.1.8-1: Lebanon Green State Heritage Landscape

3.1.8.5. Parks and Recreation Areas

Parks and recreation areas in Connecticut include state parks, state trails and greenways, and USACE Recreation Areas. Parks and recreation areas often contain scenic resources and tend to be visited partly or entirely because of their associated visual or aesthetic qualities. Figure 3.1.8-2 displays the natural areas within the state, including park and recreation areas, in addition to natural areas and other scenic areas within the state. Figure 3.1.7-3 in Section 3.1.7, Land Use, Airspace, and Recreation, identifies parks and recreational resources that may be visually sensitive in Connecticut. For additional information about recreation areas, including national and state parks, see Section 3.1.7, Land Use, Airspace, and Recreation.

State Parks

The 65 state parks provide open space and scenic vistas both within towns and in natural areas away from civilization. Table 3.1.8-3 contains a sampling of state parks and their associated visual attributes. Some of the state parks are also protected as state historic sites. These areas may be protected from intrusions into vistas from structures or other infrastructure. (CT DEEP, 2015y)

Table 3.1.8-3: Examples of Connecticut State Parks and Associated Visual Attributes

State Park	Scenic Values
Dennis Hill State Park	Panoramic hilltop overlook, forested natural areas
Fort Griswold State Park	Historic battlefield and historic structures
Gillette Castle State Park	Unique and historic structure, trails, gardens, and open space
Haystack Mountain State Park	Mountain top and tower vistas, forest, scenic trails
Lamentation Mountain State Park	Forest and scenic vistas
Lovers Leap State Park	Historic bridge, geologic formations, historic ruins, forest, scenic trails and vistas
Mohawk Mountain State Forest	Mountaintop scenic vistas, forests, historic structures, unique natural area, ponds and streams
Mount Riga State Park (Bear Mountain)	Forest and scenic trails

State Park	Scenic Values
Mount Tom State Park	Mountaintop scenic vistas, forests, historic structures, and pond
Naugatuck State Forest	Forest, ponds, streams, river, and scenic trails
Pachaug State Forest (Mount Misery)	Riverside views, ponds, forest, unique natural area, historic structures, overlook vista, scenic trails
Penwood State Park	Hilltop scenic vista, lake, forest, and scenic trails
Platt Hill State Park,	Forest, scenic trails, and scenic vistas
Shenipsit State Forest (Soapstone Mountain)	Hiking trails with mountaintop vistas, forests, historic buildings, and ponds
Sleeping Giant State Park	Mountaintop scenic vistas, forests, historic structure, scenic trails, and streams
Southford Falls State Park	Forest, waterfalls, stream, ponds, scenic trails
Squantz Pond State Park	Pond, forest, scenic trails
Talcott Mountain State Park (Heublein Tower)	Historic home and tower with scenic vistas, forest, mountaintop vistas, and ponds
West Rock Ridge State Park	Geologic features, ponds, forest, scenic hilltop vistas, scenic trails

Source: (CT DEEP, 2015ab)

National Scenic and Historic Trails

National Scenic and Historic Trails are managed and protected for their cultural, historic, recreational, and scenic values (NPS, 2014b). The trails are often managed as joint ventures of the NPS with state or local agencies or non-profit organizations but are protected by the visual resources program under the NPS (New England Trail, National Scenic Trail, 2015). Connecticut has three national trails – New England National Scenic Trail (also known as the Metacomet, Monadnock, Mattabesett Trail); the Appalachian National Scenic Trail; and Washington-Rochambeau Revolutionary Route National Historic Trail (NPS, 2017b).

State Trails and Greenways

Connecticut has hundreds of trails within towns and through state parks and forests. A greenway is "a corridor of open space that (1) may protect natural resources, preserve scenic landscapes and historical resources or offer opportunities for recreation or nonmotorized transportation, (2) may connect existing protected areas and provide access to the outdoors, (3) may be located along a defining natural feature, such as a waterway, along a manmade corridor, including an unused ROW, traditional trail routes or historic barge canals or (4) may be a greenspace along a highway or around a village" (CT DEEP, 2015ac). Connecticut has more than 75 designated greenways throughout the state using abandoned rail lines or other corridors to provide multi-use recreational opportunities and preservation of natural and historic resources (CT DEEP, 2015ad).

U.S. Army Corps of Engineers Recreation Areas

There are eight USACE recreation and flood risk management areas within the state (USACE, 2015). These reservoirs are specifically managed by the USACE for scenic and aesthetic qualities in their planning guidance in addition to managing risks for floods (USACE, 2017).

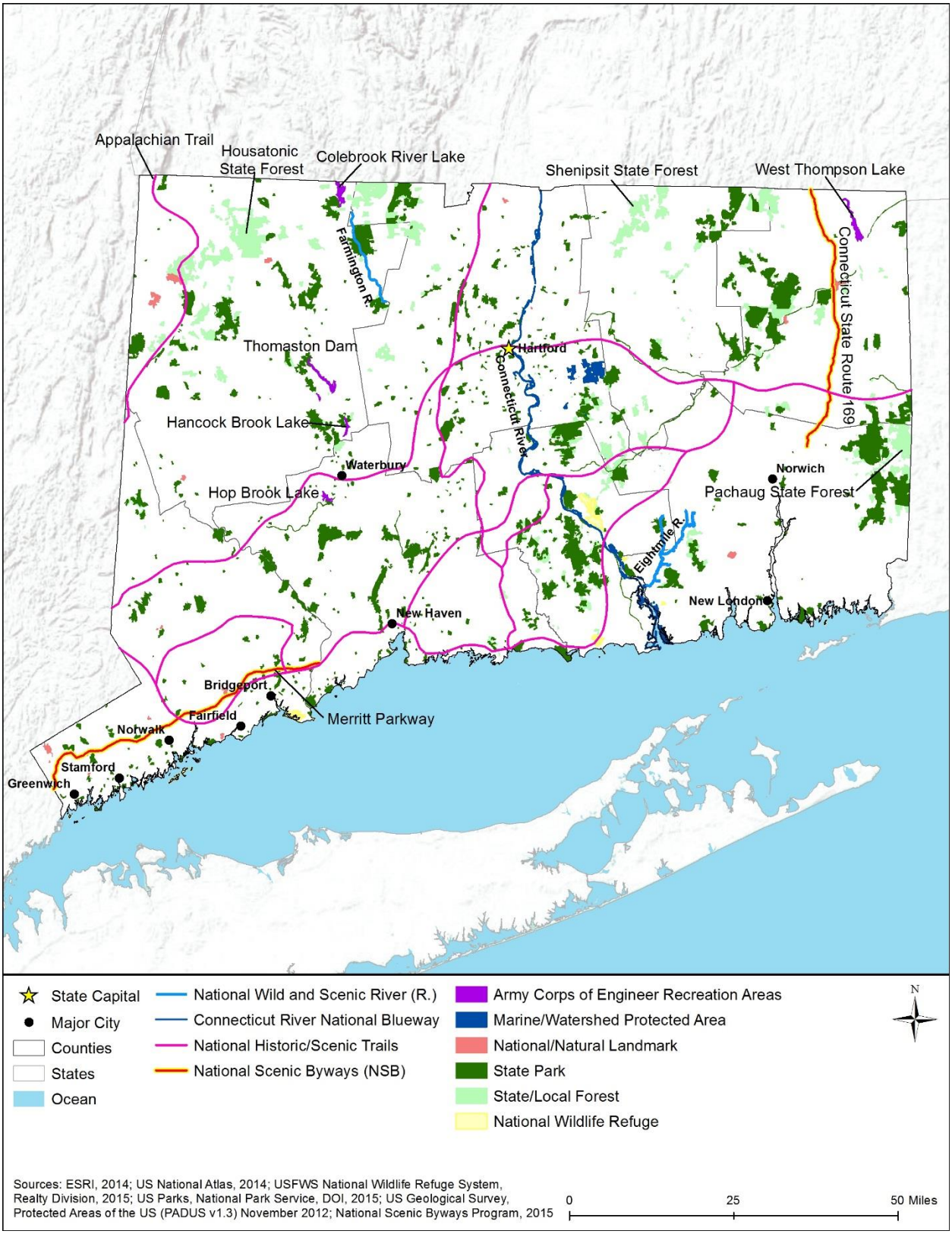


Figure 3.1.8-2: Natural Areas in Connecticut

3.1.8.6. Natural Areas

State Forest

There are 27 state forests in Connecticut that boast campgrounds, hiking trails, and opportunities to enjoy the great outdoors. The state does not have a forest management plan that specifically protects or manages for visual or scenic resources; however, these lands are protected for other natural resources. The largest state forest in Connecticut is the 22,000 acre Pachaug State Forest situated in Voluntown, and offers camping, hunting, hiking, and natural resources sources such as the Pachaug River (CT DEEP, 2015y).

Rivers Designated as National or State Wild, Scenic or Recreational

National Wild, Scenic, or Recreational Rivers are rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-1287). These rivers have outstanding natural, cultural, and recreational values, including potential visual resources. In Connecticut, there are two Partnership Wild and Scenic Rivers: the Eightmile River (25.3 miles designated as scenic) and the Farmington River (14 miles designated as recreational), which are managed in partnership with the NPS and state and local governments (Figure 3.1.4-2) (NPS, 2010).

National Blueway

The Connecticut River and its watershed was designated as the first—and only—National Blueway[110] in 2012 (USFWS, 2014d). The Connecticut River and its watershed covers 7.2 million acres within the states of Connecticut, Massachusetts, New Hampshire, and Vermont. The designation prioritized restoration, conservation, and recreation in the watershed, conserving two million acres of private and public land (USDOI, 2012).

National Wildlife Refuges

The USFWS manages NWRs throughout the state; these lands and waters are "set aside for the conservation, management and, where appropriate, restoration of fish, wildlife, and plant resources and their habitats" (USFWS, 2015w). Connecticut only has one National Wildlife Refuge; the Stewart B. McKinney National Wildlife Refuge covers 70 acres of wetlands, marshes, and upland vegetation. This refuge contains protected habitat for plants and animals without disturbance from development and habitat loss (USFWS, 2015x).

[110] Enacted in 2012, the National Blueway System was intended to preserve community-based watershed partnerships; however, in 2014, the Department of Interior dissolved the National Blueway System yet retained the designation for the Connecticut River National Blueway (USFWS, 2014d).

Source: (USFWS, 2012)

Figure 3.1.8-3: Connecticut River National Blueway

State Game Refuges and State Wildlife Management Areas

Connecticut has one designated state game refuge, the McLean Game Refuge, encompassing 3,200 wooded acres in north central Connecticut (McLean Game Refuge, 2015). In addition, there are thousands of acres of wildlife management areas throughout the state (CT DEEP, 2015aa). These areas contain protected habitat for plants and animals without disturbance from development and habitat loss. Table 3.1.8-4 displays a list of the wildlife management areas in Connecticut.

Table 3.1.8-4 Connecticut Wildlife Management Areas Containing Scenic Resources

Wildlife Management Area	Acres
Aldo Leopold	554
Assekonk Swamp	694
Babcock Pond	1,500
Barber Pond	75
Barn Island	1,014
Bartlett Brook	684
Bear Hill	357
Bishops Swamp	752
Cedar Swamp	278
Charles E. Wheeler	812
Cromwell Meadows	455
Connectuicut Light and Power	180
Durham Meadows	572
East River Marsh	147
East Swamp	85
Eightmile River	313

Wildlife Management Area	Acres
Franklin Swamp	684
Goshen	967
Great Harbor	220
Higganum Meadows	256
Housatonic River	556
Kollar	911
Larson Lot	209
Lord's Cove	261
Meadow Brook	161
Messerschmidt	460
Newgate	451
NU-Kings Island Coop.	158
NU-Maromas Coop.	1,400
NU-Skiff Mountain Coop.	710
Pease Brook	206
Quinebaug River	1,646
Ragged Rock Creek	202
Robbins Swamp	1,569
Roraback	1,975
Rose Hill	634
Ross Marsh	277
Sessions Woods	777
Simsbury	223
Spignesi	469
Stanley Works Coop.	1,100
Suffield	195
Talbot	504
Wopowog	475
Zemko Pond	463
Total	26,591

Source: (CT DEEP, 2015ae)

3.1.8.7. Additional Areas

National and State Scenic Byways

National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. The National Scenic Byways Program is managed by the DOT Federal Highway Administration (USDOT, 2015b). Similar to National Scenic Byways, scenic roads in Connecticut are at least a mile and length and have significant cultural or natural features. Development along these roads may be limited to minor improvements, but nothing that would "detract from the scenic or natural character or visual qualities of the highway area" (ConnDOT, 2015e). The state has 289.18 miles of scenic roads, two of which are nationally designated scenic byways: the Merritt Parkway and Route 169 (ConnDOT, 2015e) (USDOT, 2015b).

Coastal Areas

Connecticut coastal areas are described in the Coastal Management Act and are managed to protect these lands from adverse impacts on coastal resources, including protection from "degrading visual quality through significant alteration of the natural features of vistas and viewpoints" (CT DEEP, 1980). Connecticut's coastal access follows the coastline of the state and provides public access for outdoor aquatic recreational activities such as boating, swimming, and fishing (CT DEEP, 2015af).

Source: (CT DEEP, 2015af)

Figure 3.1.8-4: Lighthouse Point Park, New Haven, Connecticut

3.1.9. Socioeconomics

3.1.9.1. Definition of the Resource

NEPA requires consideration of socioeconomics; specifically, Section 102(A) of NEPA requires federal agencies to "insure the integrated use of the natural and social sciences…in planning and in decision making" (42 U.S.C. 4332(A)). Socioeconomics refers to a broad, social science-based approach to understanding a region's social and economic conditions. It typically includes population, demographic descriptors, economic activity indicators, housing characteristics, property values, and public revenues and expenditures. When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of the Proposed Action as it could affect the socioeconomic conditions of a region.

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet's mission is to provide public safety broadband and interoperable emergency communications coverage throughout the nation. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes.

The financial arrangements for deployment and operation of the FirstNet network may have socioeconomic implications. Section 1.1 frames some of the public expenditure and public revenue considerations specific to FirstNet; however this is not intended to be either descriptive or prescriptive of FirstNet's financial model or anticipated total expenditures and revenues associated with the deployment of the Nationwide Public Safety Broadband Network (NPSBN). This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898 (see Section 1.8). This PEIS addresses environmental justice in a separate section (Section 3.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use and recreation (Section 3.1.7, Land Use, Recreation, and Airspace); infrastructure and public services (Section 3.1.1, Infrastructure); and aesthetic considerations (Section 3.1.8, Visual Resources).

The financial arrangements for deployment and operation of the FirstNet network have socioeconomic implications. Section 1.1 frames some of the public expenditure and public revenue considerations specific to FirstNet; however this is not intended to be either descriptive or prescriptive of FirstNet's financial model or anticipated total expenditures and revenues associated with the deployment of the Nationwide Public Safety Broadband Network (NPSBN). This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau (Census Bureau)[111] and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this PEIS. In all cases, this section uses the most recent data available for each geography at the time of writing. At the county, state, region, and United States levels, the data are typically for 2013 or 2014. For smaller geographic areas, this section uses data from the Census Bureau's American Community Survey (ACS). The ACS is the Census Bureau's flagship demographic estimates program for years other than the decennial census years. This PEIS uses the 2009-2013 ACS, which is based on surveys (population samples) taken across that five-year period; thus, it is not appropriate to attribute its data values to a specific year. It is a valuable source because it provides the most accurate and consistent socioeconomic data across the nation at the sub-county level.

The remainder of this section addresses the following subjects: regulatory considerations specific to socioeconomics in the state, communities and populations, economic activity, housing, property values, and taxes.

3.1.9.2. Specific Regulatory Considerations

Research for this section did not identify any specific state, local, or tribal laws or regulations that are directly relevant to socioeconomics for this PEIS.

3.1.9.3. Communities and Populations

This section discusses the population and major communities of Connecticut. It includes the following topics:

[111] For U.S. Census Bureau sources, a URL (see references section) that begins with "http://factfinder.census.gov" indicates that the American FactFinder (AFF) interactive tool can be used to retrieve the original source data via the following procedure. If the reference's URL begins with "http://dataferrett.census.gov," significant socioeconomic expertise is required to navigate this interactive tool to the specific data. However, the data can usually be found using AFF. As of May 24, 2016, the AFF procedure is as follows: 1) Go to http://factfinder.census.gov. 2) Select "Advanced Search," then "Show Me All." 3) Select from "Topics" choices, select "Dataset," then select the dataset indicated in the reference; e.g. "American Community Survey, 2013 1-Year Estimates" or "2012 Census of Governments." Click "Close." Note: ACS is the abbreviation in the AFF for the American Community Survey. SF is the abbreviation used with the 2000 and 2010 "Summary Files." For references to the "2009-2013 5-Year Summary File," choose "2013 ACS 5-year estimates" in the AFF. 4) Click the "Geographies" box. Under "Select a geographic type," choose the appropriate type; e.g. "United States – 010" or "State – 040" or "..... County – 050" then select the desired area or areas of interest. Click "Add to Your Selections," then "Close." For Population Concentration data, select "Urban Area - 400" as the geographic type, then select 2010 under "Select a version" and then choose the desired area or areas. Alternatively, do not choose a version, and select "All Urban Areas within United States." Regional values cannot be viewed in the AFF because the regions for this PEIS do not match Census Bureau regions. All regional values were developed by downloading state data and using the most mathematically appropriate calculations (e.g., sums of state values, weighted averages, etc.) for the specific data. 5) In "Refine your search results," type the table number indicated in the reference; e.g. "DP04" or "LGF001." The dialogue box should auto-populate with the name of the table(s) to allow the user to select the table number/name. Click "Go." 6) In the resulting window, click the desired table under "Table, File, or Document Title" to view the results. If multiple geographies were selected, it is often easiest to view the data by clicking the "Download" button above the on-screen data table. Choose the desired comma-delimited format or presentation-ready format (includes a Microsoft Excel option). In some cases, the structure of the resulting file may be easier to work with under one format or another. Note that in most cases, the on-screen or downloaded data contains additional parameters besides those used in the FirstNet PEIS report table. Readers must locate the FirstNet PEIS-specific data within the Census Bureau tables. In many cases, the FirstNet PEIS report tables contain data from multiple Census Bureau tables andsometimes incorporate other sources.

- Recent and projected statewide population growth;
- Current distribution of the population across the state; and
- Identification of the largest population concentrations in the state.

Statewide Population and Population Growth

Table 3.1.9-1 presents the 2014 population and population density of Connecticut in comparison to the East region[112] and the nation. The estimated population of Connecticut in 2014 was 3,596,677. The population density was 743 persons per square mile (sq. mi.), which is higher than the population density of both the region (312 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Connecticut was the 29th largest state by population among the 50 states and the District of Columbia, 48th largest by land area, and had the fifth greatest population density (U.S. Census Bureau, 2015b; U.S. Census Bureau, 2015a).

Table 3.1.9-1: Land Area, Population, and Population Density of Connecticut

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Connecticut	4,842	3,596,677	743
East Region	237,157	73,899,862	312
United States	3,531,905	318,857,056	90

Sources: (U.S. Census Bureau, 2015b; U.S. Census Bureau, 2015a)

Population growth is an important aspect for this PEIS given FirstNet's mission. Table 3.1.9-2 presents the population growth trends of Connecticut from 2000 to 2014 in comparison to the East region and the nation. The state's annual growth rate dropped from 0.48 percent in the 2000 to 2010 period to 0.16 percent in the 2010 to 2014 period. The growth rate of Connecticut in the 2000 to 2010 period nearly matched the growth rate of the region, at 0.47 percent, dropping to one third of the regional rate (0.50 percent) during the 2010 to 2014 period. Both geographies showed lower growth rates in both periods compared to the nation's growth rate of 0.81 percent.

Table 3.1.9-2: Recent Population Growth of Connecticut

Geography	Population			Numerical Population Change		Rate of Population Change (AARC)[a]	
	2000	2010	2014 (estimated)	2000 to 2010	2010 to 2014	2000 to 2010	2010 to 2014
Connecticut	3,405,565	3,574,097	3,596,677	168,532	22,580	0.48%	0.16%
East Region	69,133,382	72,444,467	73,899,862	3,311,085	1,455,395	0.47%	0.50%
United States	281,421,906	308,745,538	318,857,056	27,323,632	10,111,518	0.93%	0.81%

Sources: (U.S. Census Bureau, 2015f; U.S. Census Bureau, 2015b)

[a] AARC = Average Annual Rate of Change (compound growth rate)

[112] The East region comprises the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia, as well as the District of Columbia. Throughout the socioeconomics section, figures for the East region represent the sum of the values for all "states" (including the District of Columbia) in the region, or an average for the region based on summing the component parameters. For instance, the population density of the East region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

Demographers prepare future population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore, Table 3.1.9-3 presents projections of the 2030 population from two sources that are national in scope and use different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data and analysis service. (ProximityOne, 2015) (University of Virginia Weldon Cooper Center, 2015) The table provides figures for numerical change, percentage change, and annual growth rate based on averaging the projections from the two sources. The average projection indicates Connecticut's population will increase by 8.9 percent (approximately 320,479 people), from 2014 to 2030. This reflects an average annual projected growth rate of 0.53 percent, which is very similar to the historical growth rate from 2000 to 2010 of 0.48 percent, but three times higher than the historical growth rate from 2010 to 2014. The projected growth rate of the state is similar to that of the region (0.57 percent) and less than the projected growth rate of the nation (0.80 percent).

Table 3.1.9-3: Projected Population Growth of Connecticut

Geography	Population 2014 (estimated)	Projected 2030 Population			Change Based on Average Projection		
		UVA Weldon Cooper Center Projection	Proximity One Projection	Average Projection	Numerical Change 2014 to 2030	Percent Change 2014 to 2030	Rate of Change (AARC)[a] 2014 to 2030
Connecticut	3,596,677	3,857,679	3,976,633	3,917,156	320,479	8.9%	0.53%
East Region	73,899,862	78,925,282	82,842,294	80,883,788	6,983,926	9.5%	0.57%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.6%	0.80%

Sources: (U.S. Census Bureau, 2015b) (University of Virginia Weldon Cooper Center, 2015) (ProximityOne, 2015)

[a] AARC = Average Annual Rate of Change (compound growth rate)

Population Distribution and Communities

Figure 3.1.9-1 presents the distribution and relative density of the population of Connecticut. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density – therefore, areas that are solid in color are particularly high in population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 2015g). Groupings of brown dots on the map represent additional, but smaller, population concentrations. Dispersed dots indicate dispersed population across the less densely settled areas of the state.

This map also presents the 10 largest population concentrations in the state, outlined in purple. These population concentrations reflect contiguous, densely developed areas as defined by the Census Bureau based on the 2010 census (U.S. Census Bureau, 2010b; U.S. Census Bureau,

2010c). These population concentrations often include multiple incorporated areas as well as some unincorporated areas.

Table 3.1.9-4 provides the populations of the 10 largest population concentrations in Connecticut, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[113] In 2010, the largest population concentration was the Connecticut portion of the Bridgeport/Stamford area, which had more than 800,000 people. The only other area with a population concentration of over 500,000 people was New Haven. The smallest of the 10 population concentrations was Willimantic, with a 2010 population of 29,669. The Connecticut portion of Worchester was the fastest growing area, by average annual rate of change from 2000 to 2010, with an annual growth rate of 11.34 percent. This large population increase most likely reflects a change in the area definition for the Worcester (MA/CT) Urbanized Area. The only other areas with a growth rate over 1.00 percent were Torrington (2.19 percent) and Willimantic (3.16 percent). The Springfield area (Connecticut portion) experienced a population decline during this period.

Table 3.1.9-4 also shows that the top 10 population concentrations in Connecticut accounted for over 86 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to over 118 percent of the entire state's growth. This figure of over 100 percent indicates that the population of the remainder of the state, as a whole, declined from 2000 to 2010.

[113] Census Bureau boundaries for these areas are not fixed. Area changes from 2000 to 2010 may include accretion of newly developed areas into the population concentration, Census Bureau classification of a subarea as no longer qualifying as a concentrated population due to population losses, and reclassification by the Census Bureau of a subarea into a different population concentration. Thus, population change from 2000 to 2010 reflects change within the constant area and change as the overall area boundary changes. Differences in boundaries in some cases introduce anomalies in comparing the 2000 and 2010 populations and in calculation of the growth rate presented in the table.

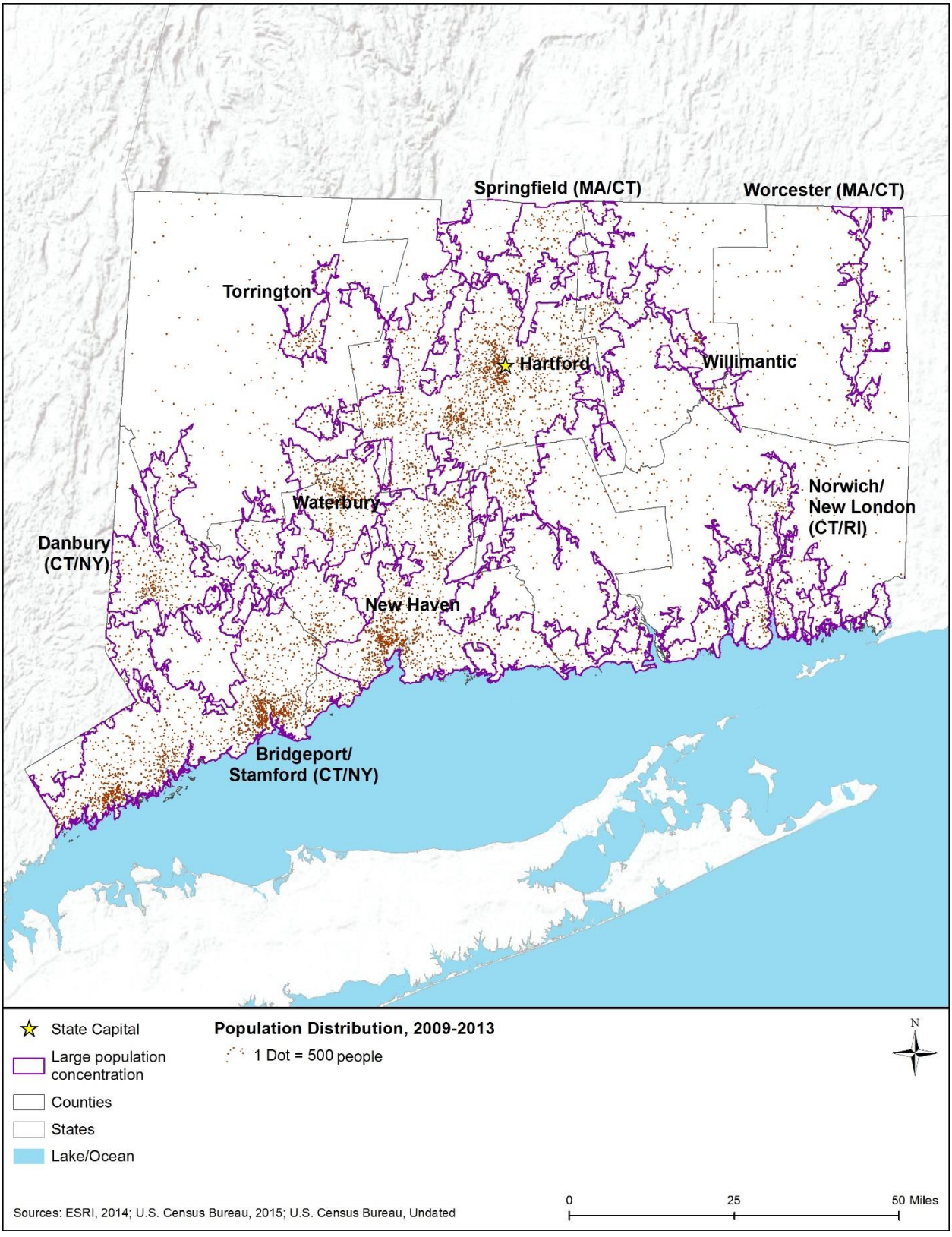


Figure 3.1.9-1: Population Distribution in Connecticut, 2009–2013

Table 3.1.9-4: Population of the 10 Largest Population Concentrations in Connecticut

Area	Population		Numerical Population Change		Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)[a]
Bridgeport/Stamford (CT/NY) (CT Portion)	846,174	877,630	884,444	2	31,456	0.37%
Danbury (CT/NY) (CT Portion)	149,724	161,323	163,240	6	11,599	0.75%
Hartford	851,535	924,859	926,044	1	73,324	0.83%
New Haven	531,314	562,839	562,728	3	31,525	0.58%
Norwich/New London (CT/RI) (CT Portion)	173,160	188,041	187,117	5	14,881	0.83%
Springfield (MA/CT) (CT Portion)	96,059	89,711	89,981	7	(6,348)	-0.68%
Torrington	34,412	42,754	42,773	8	8,342	2.19%
Waterbury	189,026	194,535	195,010	4	5,509	0.29%
Willimantic	21,745	29,669	29,573	10	7,924	3.16%
Worcester (MA/CT) (CT Portion)[b]	11,251	32,928	33,458	9	21,677	11.34%
Total for Top 10 Population Concentrations	2,904,400	3,104,289	3,114,368	NA	199,889	0.67%
Connecticut (statewide)	3,405,565	3,574,097	3,583,561	NA	168,532	0.48%
Top 10 Total as Percentage of State	85.3%	86.9%	86.9%	NA	118.6%	NA

Sources: (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015h; U.S. Census Bureau, 2015i)

NA = not applicable

[a] AARC = Average Annual Rate of Change (compound growth rate)

[b] The large population increase from 2000 to 2010 most likely reflects a change in the area definition for the Worcester (MA/CT) urbanized area.

3.1.9.4. Economic Activity, Housing, Property Values, and Government Revenues

This section addresses other socioeconomic topics that are potentially relevant to FirstNet. These topics include:

- Economic activity;
- Housing;
- Property values; and
- Government revenues.

Social institutions – educational, family, political, public service, military, and religious – are present throughout the state. The institutions most relevant to Proposed Action are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 3.1.1., Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 3.1.9-5 compares several economic indicators for Connecticut to the East region and the nation. The table presents two indicators of income[114] – per capita and median household – as income is a good measure of general economic health of a region.

Per capita income is total income divided by the total population. As a mathematical average, the very high incomes of a relatively small number of people tend to bias per capita income figures upwards. Nonetheless, per capita income is useful as an indicator of the relative income level across two or more areas. As shown in Table 3.1.9-5, the per capita income in Connecticut in 2013 ($37,726) was $4,874 higher than that of the region ($32,852), and $9,542 higher than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 3.1.9-5 shows that in 2013, the MHI in Connecticut ($67,262) was $6,758 higher than that of the region ($60,504), and $15,012 higher than that of the nation ($52,250).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the unemployment rate as the number of unemployed individuals who are looking for work divided by the total number of individuals in the labor force. Table 3.1.9-5 compares the unemployment rate in Connecticut to the East region and the nation. In 2014, Connecticut's statewide unemployment rate of 6.6 percent was higher than the rate for the region (6.0 percent) and very similar to the rate for the nation (6.2 percent).[115]

Table 3.1.9-5: Selected Economic Indicators for Connecticut

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Connecticut	$37,726	$67,262	6.6%
East Region	$32,852	$60,504	6.0%
United States	$28,184	$52,250	6.2%

Sources: (BLS, 2015b; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k; U.S. Census Bureau, 2015l)

[114] The Census Bureau defines income as follows: "'Total income' is the sum of the amounts reported separately for wage or salary income; net self-employment income; interest, dividends, or net rental or royalty income or income from estates and trusts; Social Security or Railroad Retirement income; Supplemental Security Income (SSI); public assistance or welfare payments; retirement, survivor, or disability pensions; and all other income. Receipts from the following sources are not included as income: capital gains, money received from the sale of property (unless the recipient was engaged in the business of selling such property); the value of income "in kind" from food stamps, public housing subsidies, medical care, employer contributions for individuals, etc.; withdrawal of bank deposits; money borrowed; tax refunds; exchange of money between relatives living in the same household; gifts and lump-sum inheritances, insurance payments, and other types of lump-sum receipts" (U.S. Census Bureau, 2015m).

[115] The timeframe for unemployment rates can change quarterly.

Figure 3.1.9-2 and Figure 3.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015j) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 3.1.9-1 (U.S. Census Bureau, 2010b; U.S. Census Bureau, 2010c). Following these two maps, Table 3.1.9-6 presents MHI and unemployment for the 10 largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to those on the maps. Nonetheless, both the maps and the table help portray differences in income and unemployment across Connecticut.

Figure 3.1.9-2 shows that all counties in Connecticut had a MHI above the national median. Table 3.1.9-6 is consistent with those observations. It shows that MHI was above the national average of $52, 250 in most of the top 10 urban areas in the state, with the exception of Willimantic and Worcester (Connecticut portion), which had MHI figures slightly below the national average. Willimantic and Worcester are the least populated areas (ranked ninth and tenth in Table 3.1.9-4). MHI was highest in the Connecticut portions of the Bridgeport/Stamford, Danbury, and Springfield areas, with figures higher than the state average (considerably so for Bridgeport/Stamford and Springfield).

Figure 3.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. Two of the four counties (Litchfield and Fairfield) with unemployment rates below the national average (that is, better employment performance) were bordering with New York State. The other two counties (Tolland and Middlesex) were in the central part of the state. The highest unemployment rate was in Windham County, around Willimantic and Worcester.

Table 3.1.9-6 compares unemployment in the population concentrations to the state average (9.8 percent). Only the Connecticut portions of the Norwich/New London and Springfield areas had 2009–2013 unemployment rates slightly lower than the state average.

Detailed employment data provide useful insights into the nature of a local, state, or national economy. Table 3.1.9-7 provides figures on employment percentages by type of worker and by industry based on surveys conducted in 2013 by the Census Bureau. By class of worker (type of worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers was similar in Connecticut, as in the East region and the nation. The percentage of government workers was somewhat higher in the state than in the region and nation. The percentage of self-employed workers in Connecticut was slightly higher than in the region and the nation.

By industry, Connecticut has a mixed economic base and some notable figures in the table are as follows. Connecticut in 2013 had a considerably higher percentage of persons working in "finance and insurance, and real estate and rental and leasing" than the region or nation. It also had a considerably higher percentage of persons working in "manufacturing" compared to the region, and "educational services, and health care and social assistance" compared to the nation. On the other hand, Connecticut had a considerably lower percentage of people working in "agriculture, forestry, fishing and hunting, and mining," "transportation and warehousing, and utilities," and "public administration" than the region or nation.

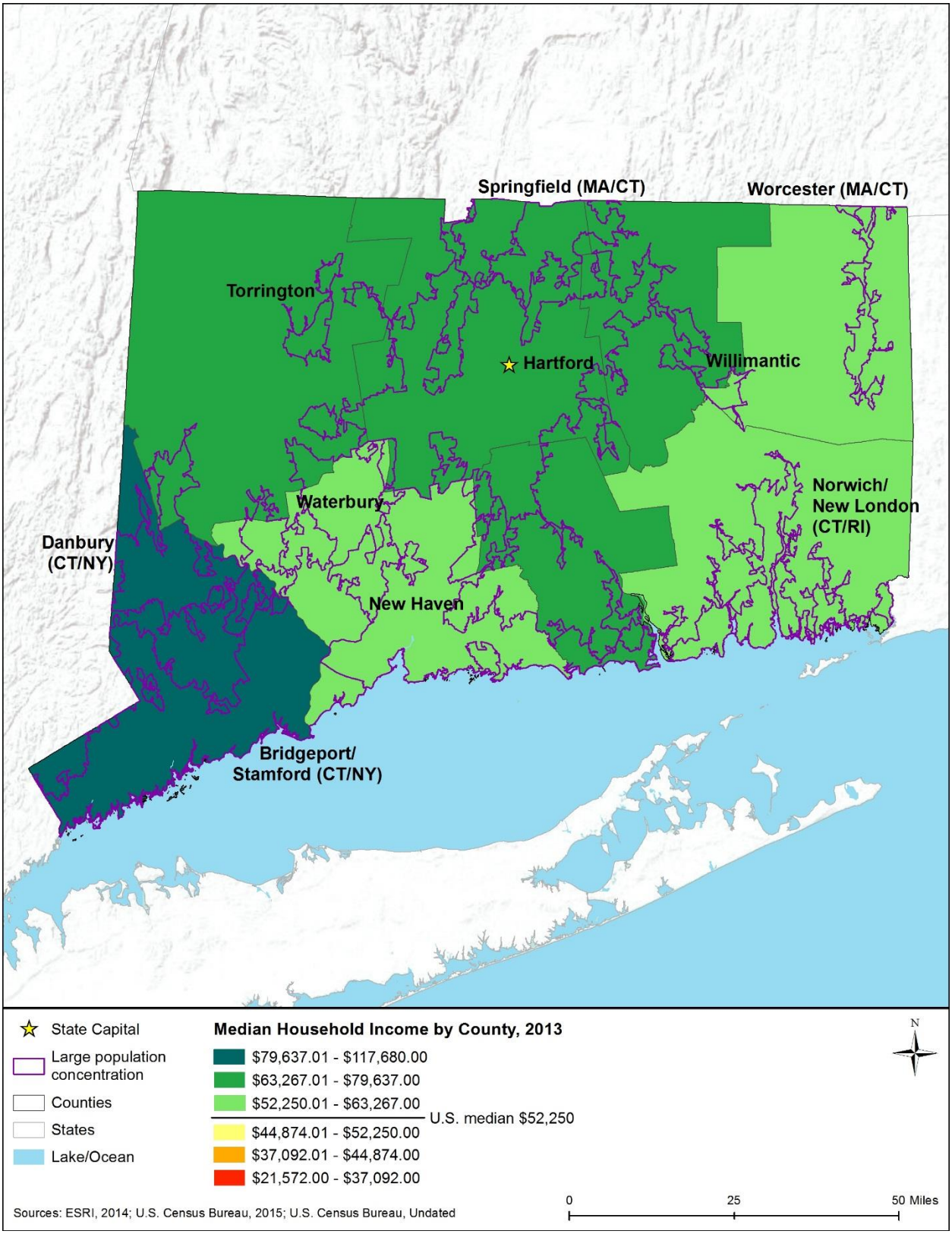


Figure 3.1.9-2: Median Household Income in Connecticut, by County, 2013

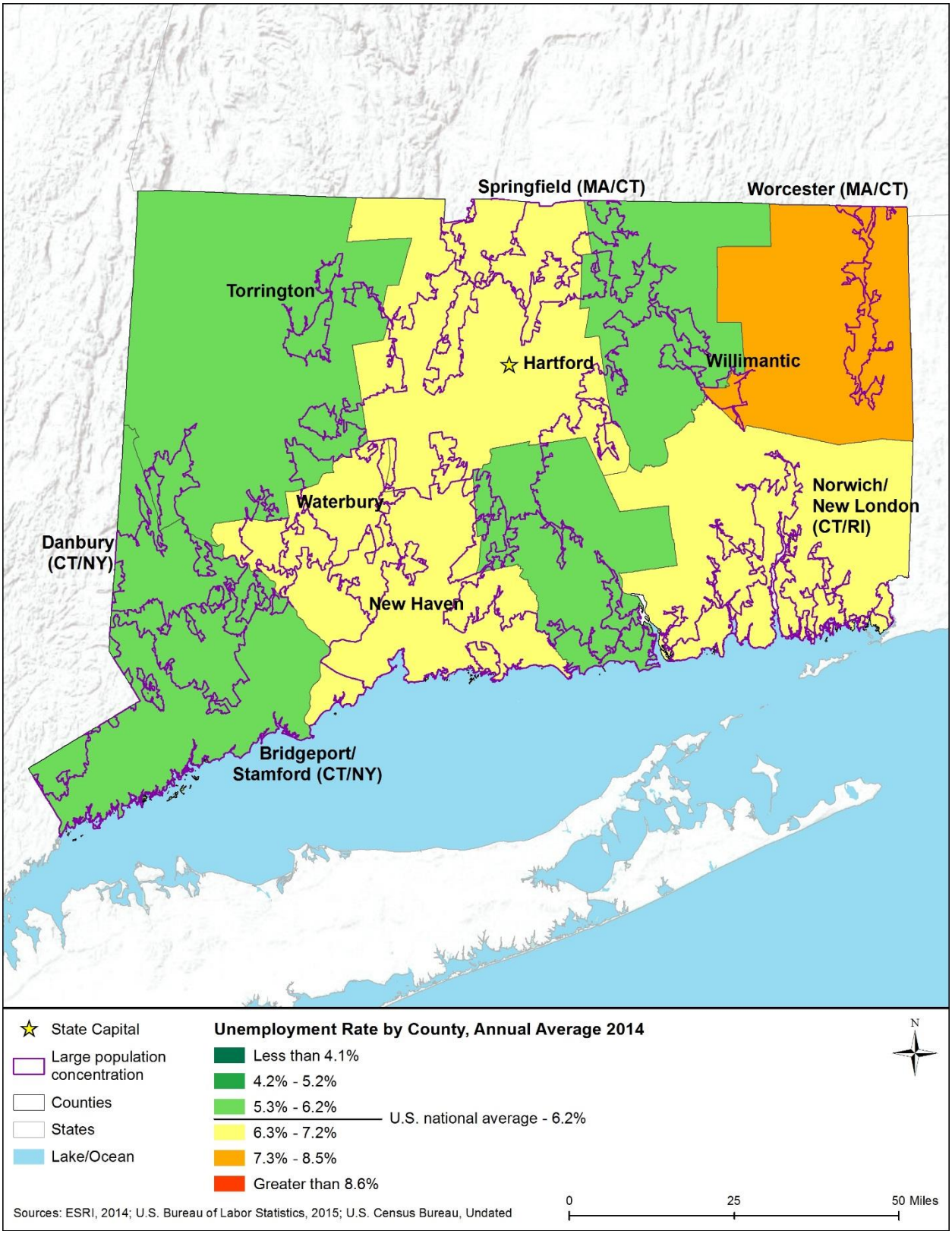


Figure 3.1.9-3: Unemployment Rates in Connecticut, by County, 2014

Table 3.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Connecticut, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Bridgeport/Stamford (CT/NY) (CT Portion)	$79,946	10.1%
Danbury (CT/NY) (CT Portion)	$77,210	8.7%
Hartford	$63,106	10.2%
New Haven	$61,980	10.2%
Norwich/New London (CT/RI) (CT Portion)	$60,514	9.6%
Springfield (MA/CT) (CT Portion)	$71,639	9.1%
Torrington	$53,636	10.5%
Waterbury	$53,622	11.8%
Willimantic	$46,839	11.0%
Worcester (MA/CT) (CT Portion)	$49,979	13.6%
Connecticut (statewide)	$69,461	9.8%

Source: (U.S. Census Bureau, 2015n)

Table 3.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Connecticut	East Region	United States
Civilian Employed Population 16 Years and Over	1,771,141	35,284,908	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	80.4%	79.3%	79.7%
Government workers	13.0%	15.1%	14.1%
Self-employed in own not incorporated business workers	6.4%	5.4%	6.0%
Unpaid family workers	0.2%	0.1%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	0.4%	0.9%	2.0%
Construction	5.6%	5.8%	6.2%
Manufacturing	10.9%	8.5%	10.5%
Wholesale trade	2.5%	2.5%	2.7%
Retail trade	11.2%	11.1%	11.6%
Transportation and warehousing, and utilities	3.4%	4.6%	4.9%
Information	2.1%	2.3%	2.1%
Finance and insurance, and real estate and rental and leasing	8.9%	7.3%	6.6%
Professional, scientific, management, administrative, and waste management services	12.0%	12.3%	11.1%
Educational services, and health care and social assistance	25.8%	25.6%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	8.8%	8.9%	9.7%
Other services, except public administration	4.7%	4.9%	5.0%
Public administration	3.6%	5.5%	4.7%

Source: (U.S. Census Bureau, 2015o)

Table 3.1.9-8 presents employment shares for selected industries for the 10 largest population concentrations in the state. The table reflects survey data taken by the Census Bureau from 2009 to 2013. Thus, its figures for the state are slightly different from those in Table 3.1.9-7 for 2013. The selected industries are those with the greatest relevance to the Proposed Action. In most of the 10 areas, the percentage of employment in the "Construction" industry was lower than the state average (5.7 percent), but in all cases was within two percentage points of the state average.

Table 3.1.9-8: Employment by Relevant Industries for the 10 Largest Population Concentrations in Connecticut, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Bridgeport/ Stamford (CT/NY) (CT Portion)	6.3%	3.3%	2.8%	15.2%
Danbury (CT/NY) (CT Portion)	8.1%	3.3%	2.2%	13.4%
Hartford	4.7%	3.8%	2.5%	10.2%
New Haven	4.7%	3.9%	2.4%	9.1%
Norwich/New London (CT/RI) (CT Portion)	4.9%	4.0%	1.4%	7.7%
Springfield (MA/CT) (CT Portion)	4.9%	5.9%	1.3%	8.7%
Torrington	6.7%	3.4%	1.2%	9.1%
Waterbury	5.0%	4.3%	2.1%	7.5%
Willimantic	4.5%	3.3%	2.4%	5.6%
Worcester (MA/CT) (CT Portion)	3.9%	6.2%	0.9%	5.6%
Connecticut (statewide)	5.7%	3.7%	2.4%	11.1%

Source: (U.S. Census Bureau, 2015n)

Housing

The housing stock is an important socioeconomic component of communities. The type, availability, and cost of housing in an area reflect economic conditions and affect quality of life. Table 3.1.9-9 compares Connecticut to the East region and nation on several common housing indicators.

As shown in Table 3.1.9-9, in 2013 Connecticut had a higher percentage of housing units that were occupied (90.0 percent) than the region (88.4 percent) or nation (87.5 percent). Of the occupied units, Connecticut also had a higher percentage of owner-occupied units (66.3 percent) than the region (62.8 percent) or nation (63.5 percent), consistent with the higher percentage of detached single-unit housing (also known as single-family homes) in Connecticut in 2013 (58.8 percent) compared to the region (52.7 percent) and nation (61.5 percent) (U.S. Census Bureau, 2015j). The vacancy rate among rental units was also higher in Connecticut (6.6 percent) than in the region (5.5 percent) and similar to that of the nation (6.5 percent).

Table 3.1.9-9: Selected Housing Indicators for Connecticut, 2013

Geography	Total Housing Units	Housing Occupancy and Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Connecticut	1,488,072	90.0%	66.3%	1.9%	6.6%	58.8%
East Region	31,108,124	88.4%	62.8%	1.6%	5.5%	52.7%
United States	132,808,137	87.5%	63.5%	1.9%	6.5%	61.5%

Source: (U.S. Census Bureau, 2015p)

Table 3.1.9-10 provides housing indicators for the largest population concentrations in the state by survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does present variation in these indicators for population concentrations across the state and compared to the state average for the 2009 to 2013 period.

As shown in Table 3.1.9-10, during this period the percentage of occupied housing units ranged from 87.1 to 93.9 percent across these population concentrations, which is consistent with the state percentage (91.2 percent). The Connecticut portion of the Springfield area had the highest percentage of occupied housing units (93.9 percent) and the Norwich/New London area (Connecticut portion) had the lowest percentage of owner-occupied units (87.1 percent). In these 10 communities, the percentage of occupied housing units that were owner-occupied ranged from 52.0 percent (Willimantic area) to 78.4 percent (Springfield area, Connecticut portion). The homeowner vacancy rates ranged from 0.7 percent (Springfield area, Connecticut portion) to 2.7 percent (Norwich/New London area, Connecticut portion), consistent with the state's rate (1.6 percent). The vacancy rate among rental units ranged from 5.4 percent in the Torrington area and the Connecticut portion of the Worcester area, to 8.4 percent in the Connecticut portion of the Springfield area.

Table 3.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Connecticut, 2009–2013

Area	Total Housing Units	Housing Occupancy and Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Bridgeport/Stamford (CT/NY) (CT Portion)	349,405	92.5%	68.5%	1.7%	7.4%	57.1%
Danbury (CT/NY) (CT Portion)	64,910	90.9%	72.3%	1.5%	6.5%	60.1%
Hartford	388,972	92.9%	63.4%	1.5%	6.9%	52.7%
New Haven	240,330	89.8%	62.7%	1.6%	7.8%	53.4%
Norwich/New London (CT/RI) (CT Portion)	85,013	87.1%	60.9%	2.7%	6.6%	58.1%
Springfield (MA/CT) (CT Portion)	34,547	93.9%	78.4%	0.7%	8.4%	70.1%
Torrington	20,161	89.0%	64.8%	2.1%	5.4%	56.0%
Waterbury	81,900	89.8%	60.9%	1.8%	7.2%	51.4%
Willimantic	11,662	91.0%	52.0%	1.6%	7.8%	44.9%
Worcester (MA/CT) (CT Portion)	14,911	89.4%	60.2%	0.9%	5.4%	52.0%
Connecticut (statewide)	1,486,995	91.2%	67.8%	1.6%	7.1%	59.3%

Sources: (U.S. Census Bureau, 2015q)

Property Values

Property values have important relationships to both the wealth and affordability of communities. Table 3.1.9-11 provides indicators of residential property values for Connecticut and compares these values to values for the East region and nation. The figures on median value of owner-occupied units are from the Census Bureau's ACS, based on owner estimates of how much their property (housing unit and land) would sell for if it were for sale (U.S. Census Bureau, 2015j). The table shows that the median value of owner-occupied units in Connecticut in 2013 ($267,000) was higher than the corresponding values for the East region ($249,074) and the nation ($173,900).

Table 3.1.9-11: Residential Property Values in Connecticut, 2013

Geography	Median Value of Owner-Occupied Units
Connecticut	$267,000
East Region	$249,074
United States	$173,900

Source: (U.S. Census Bureau, 2015p)

Table 3.1.9-12 presents residential property values for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does show variation in property values for population concentrations across the state and compared to the state average for the 2009 to 2013 period. Only the Connecticut portions of the Bridgeport/Stamford ($408,800) and Danbury ($331,300) areas had a median value higher than the state median value ($278,900). All other population concentrations had property values considerably below the state value, ranging from $177,300 in Willimantic to $264,700 in New Haven. The lowest median values were in the same two areas – Willimantic and the Connecticut portion of Worcester – that had the lowest median household incomes (Table 3.1.9-6).

Table 3.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Connecticut, 2009–2013

Area	Median Value of Owner-Occupied Units
Bridgeport/Stamford (CT/NY) (CT Portion)	$408,800
Danbury (CT/NY) (CT Portion)	$331,300
Hartford	$238,300
New Haven	$264,700
Norwich/New London (CT/RI) (CT Portion)	$238,100
Springfield (MA/CT) (CT Portion)	$215,200
Torrington	$183,800
Waterbury	$194,500
Willimantic	$177,300
Worcester (MA/CT) (CT Portion)	$187,200
Connecticut (statewide)	$278,900

Sources: (U.S. Census Bureau, 2015q)

Government Revenues

State and local governments obtain revenues from many sources. FirstNet projects may affect flows of revenue sources between different levels of government due to program financing and intergovernmental agreements for system development and operation. Public utility taxes[116] are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006a) These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. These revenue streams are typically highly localized and therefore are best considered in the deployment phase of FirstNet.

Table 3.1.9-13 presents total and selected state and local government revenue sources as reported by the Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures were particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure. General and selective sales taxes may change, reflecting expenditures during system development and maintenance.

Table 3.1.9-13 shows that the state government in Connecticut received more revenue in 2012 on a per capita basis than counterpart state governments in the region and nation. On the other hand, local governments in Connecticut collected lower per capita revenues than other local government entities in the region and nation. Connecticut state and local governments had lower levels of intergovernmental revenue[117]. The Connecticut state government obtained no revenue from property taxes. Local governments in Connecticut obtained higher levels of property taxes per capita than local governments in the region or nation. Local governments in Connecticut reported no general or selective sales taxes, or individual or corporate income taxes. General and selective sales taxes, and public utility taxes, were considerably higher on a per capita basis for the Connecticut state government compared to its counterparts in the region and nation. Individual tax revenues, on a per capita basis, were considerably higher for the Connecticut state government than for other state government entities in the region and nation. Connecticut state government corporate income taxes, on a per capita basis, were roughly similar to the region and nation.

[117] Intergovernmental revenues are those revenues received from the federal government or other government entities such as shared taxes, grants, or loans and advances.

Table 3.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		Connecticut		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$27,328	$17,107	$522,354	$431,898	$1,907,027	$1,615,194
	Per capita	$7,612	$4,765	$7,132	$5,897	$6,075	$5,145
Intergovernmental from Federal	($M)	$5,782	$616	$135,435	$20,289	$514,139	$70,360
	Per capita	$1,610	$172	$1,849	$277	$1,638	$224
Intergovernmental from State	($M)	$0	$4,467	$0	$120,274	$0	$469,147
	Per capita	$0	$1,244	$0	$1,642	$0	$1,495
Intergovernmental from Local	($M)	$17	$0	$9,810	$0	$19,518	$0
	Per capita	$5	$0	$134	$0	$62	$0
Property Taxes	($M)	$0	$9,427	$2,215	$144,319	$13,111	$432,989
	Per capita	$0	$2,626	$30	$1,971	$42	$1,379
General Sales Taxes	($M)	$3,784	$0	$49,123	$15,874	$245,446	$69,350
	Per capita	$1,054	$0	$671	$217	$782	$221
Selective Sales Taxes	($M)	$2,911	$0	$38,070	$5,996	$133,098	$28,553
	Per capita	$811	$0	$520	$82	$424	$91
Public Utilities Taxes	($M)	$331	$0	$4,314	$2,261	$14,564	$14,105
	Per capita	$92	$0	$59	$31	$46	$45
Individual Income Taxes	($M)	$7,371	$0	$102,813	$18,838	$280,693	$26,642
	Per capita	$2,053	$0	$1,404	$257	$894	$85
Corporate Income Taxes	($M)	$629	$0	$14,112	$6,733	$41,821	$7,210
	Per capita	$175	$0	$193	$92	$133	$23

Sources: (U.S. Census Bureau 2015p, U.S. Census Bureau 2015q)

Note: This table does not include all sources of government revenue. Summation of the specific source rows does not equal total revenue.

3.1.10. Environmental Justice

3.1.10.1. Definition of the Resource

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO. The fundamental principle of environmental justice as stated in the EO is, "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (Executive Office of the President, 1994). Under the EO, each federal agency must, "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Office of the President, 1994). In response to the EO, the Department of Commerce (DOC) developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (DOC, 2013).

In 1997, the Council on Environmental Quality (CEQ) issued Environmental Justice: Guidance under the National Environmental Policy Act (NEPA) to assist federal agencies in meeting the requirements of the EO (Council on Environmental Quality, 1997). Additionally, the USEPA's (USEPA, 2015f) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015g).

The CEQ guidance provides several important definitions and clarifications that this PEIS utilizes:

- Minority populations consist of "Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic."
- Low-income populations consist of individuals living in poverty, as defined by the U.S. Census Bureau (Census Bureau).
- Environmental effects include social and economic effects. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment." (Council on Environmental Quality, 1997)

In 2014, the USEPA issued the Policy on Environmental Justice for Working with Federally Recognized Tribes and Indigenous Peoples, which establishes principles to ensure that achieving environmental justice is part of the USEPA's work with federally recognized tribes and Indigenous Peoples in all areas of the U.S. and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands, and others living in Indian country. The policy, which is based on Executive Order 12898 as well as USEPA strategic plan and policy documents, contains 17 principles pertaining to the policy's four focus areas.These four focus areas are:

- Direct implementation of federal environmental programs in Indian country, and throughout the U.S.;
- Work with federally recognized tribes/tribal governments on environmental justice;
- Work with Indigenous Peoples (state recognized tribes, tribal members, etc.) on environmental justice; and
- Coordinate and collaborate with federal agencies and others on environmental justice issues of tribes, Indigenous Peoples, and others living in Indian country.

The policy includes accountability for the implementation of the policy, a definitions section, and an appendix that contains a list of implementation tools available. (USEPA, 2014c)

3.1.10.2. Specific Regulatory Considerations

In 1993, CT DEEP issued an Environmental Equity Policy, also referred to as the "Environmental Justice Policy." This policy states, "no segment of the population should, because of its racial, ethnic or economic makeup, bear a disproportionate share of the risks and consequences of environmental pollution or be denied equal access to environmental benefits." (Connecticut Department of Administrative Services, 2012). The Environmental Equity Policy proposed alternatives for incorporating environmental justice into CT DEEP's programs, policies, and regulations. The policy aims "to enhance meaningful access to all DEEP proceedings and ensure opportunities for communication with state regulators to our diverse communities." (CT DEEP, 1993) In 1998, following the issuance of this policy, CT DEEP established Environmental Justice Community Advisory Boards in Hartford and New Haven. (University of California, Hastings College of Law, 2010).CT DEEP currently manages various environmental justice programs and services to assess and respond to environmental problems in low income and minority communities, the "EJ Complaint Investigator" being one of them. This position was created specifically to answer and investigate environmental justice-related complaints (University of California, Hastings College of Law, 2010). Another example of the environmental justice initiative by CT DEEP is the development of a manual to help citizens understand the permitting process. The "User's Guide to Environmental Permits" is available on CT DEEP's website. (CT DEEP, 2013a)

Governor Jodi Rell in 2008 signed into law an "Act Concerning Environmental Justice Communities and the Storage of Asbestos Containing Material" (Public Act 08-94) (CGA, 2008). This Act, codified as Section 22a-20a of the Connecticut General Statutes (CGS), expands public participation notice requirements by asking applicants seeking a permit for new "applicable facilities" (and expansions) in environmental justice communities to undertake certain consultation and public participation steps. Applicable facilities do not appear to include the types of facilities and infrastructure that FirstNet would deploy (CGA, 2008). However, related to this Act, the Connecticut Department of Economic and Community Development (DECD) provides a list of distressed municipalities and census blocks to be considered under Section 22a-20a of the CGS (CT DEEP, 2015ag).

3.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 3.1.10-1 presents 2013 data on the composition of Connecticut's population by race and by Hispanic origin. The state's population has lower percentages of individuals who identify as Black/African American (10.3 percent) and Asian (4.1 percent) than the populations of the East region and the nation. (Those percentages are, for Black/African American, 14.4 percent for the East region and 12.6 percent for the nation; for Asian, 5.8 percent and 5.1 percent respectively.) The state's population of persons identifying as White (77.3 percent) is higher than that of the East region (72.1 percent) or the nation (73.7 percent).

The percentage of the population in Connecticut that identifies as Hispanic (14.7 percent) is slightly higher than in the East region (12.2 percent), and considerably lower than in the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. Connecticut's All Minorities population percentage (30.7 percent) is lower than that of the East region (34.0 percent) and considerably lower than that of the nation (37.6 percent).

Table 3.1.10-1 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for Connecticut (10.7 percent) is considerably lower than that for the East region (13.3 percent) and the nation (15.8 percent).

Table 3.1.10-1: Population by Race and Hispanic Status, 2013

Geography	Total Population (estimated)	Race							Hispanic	All Minorities[a]
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
Connecticut	3,596,080	77.3%	10.3%	0.2%	4.1%	0.0%	5.2%	2.9%	14.7%	30.7%
East Region	73,558,794	72.1%	14.4%	0.3%	5.8%	0.0%	4.8%	2.7%	12.2%	34.0%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

Source: (U.S. Census Bureau, 2015r)

[a] "All Minorities" is defined as all persons who consider themselves Hispanic or of any race other than White. Because some Hispanics identify as both Hispanic and of a non-White race, "All Minorities" is less than the sum of Hispanics and non-White races.

Table 3.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Connecticut	10.2%
East Region	13.3%
United States	15.8%

Source: (U.S. Census Bureau, 2015s)

3.1.10.4. Environmental Justice Screening Results

Analysis of environmental justice in a NEPA document typically begins by identifying potential environmental justice populations in the area of the Proposed Action. Appendix D, Environmental Justice Methodology, presents the methodology used in this PEIS to screen each state for the presence of potential environmental justice populations. The methodology builds on CEQ guidance and best practices used for environmental justice analysis. It uses data at the census-block group level; block groups are the smallest geographic units for which regularly updated socioeconomic data are readily available at the time of writing. (See footnote 114 for further information on how data was calculated.)

Figure 3.1.9-2 visually portrays the results of the environmental justice population screening analysis for Connecticut. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates and Census Bureau urban classification data (U.S. Census Bureau, 2010b; U.S. Census Bureau, 2010c).

Figure 3.1.9-2 shows that Connecticut has many areas with high potential for environmental justice populations. These high potential areas are mostly within the 10 largest population concentrations. The population concentration around and including the state's capital, Hartford, has the largest area with high potential for environmental justice populations. The distribution of areas with moderate potential for environmental justice populations is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations.

It is important to understand how the data behind Figure 3.1.9-2 affect the visual impact of this map. Block groups have similar populations (hundreds to a few thousand individuals) regardless of population density. In sparsely populated areas, a single block group may cover tens or even hundreds of square miles, while in densely populated areas, block groups each cover much less than a single square mile. Thus, while large portions of the state outside the areas defined as large population concentrations show moderate or high potential for environmental justice populations, these low density areas reflect modest numbers of minority or low-income individuals compared to the potential environmental justice populations within densely populated areas. The overall effect of this relative density phenomenon is that the map visually shows large areas of the state having environmental justice potential, but this over-represents the presence of environmental justice populations.

It is also very important to note that Figure 3.1.9-2 does not definitively identify environmental justice populations. It indicates *degrees of likelihood of the presence* of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. For instance, in the large block groups in sparsely populated regions of the state, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the Moderate Potential category draws a wide net for potential environmental justice populations. As discussed in Appendix D, the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. Before FirstNet deploys projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Additionally, site-specific

analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Such analyses could tier-off the methodology of this PEIS.

This map also does not indicate whether the Proposed Action would have actual impacts on environmental justice populations. An environmental justice effect on minority or low-income populations only occurs if the effect is harmful, significant (according to the significance criteria), and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (Council on Environmental Quality, 1997). The Environmental Consequences section (Section 3.2) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

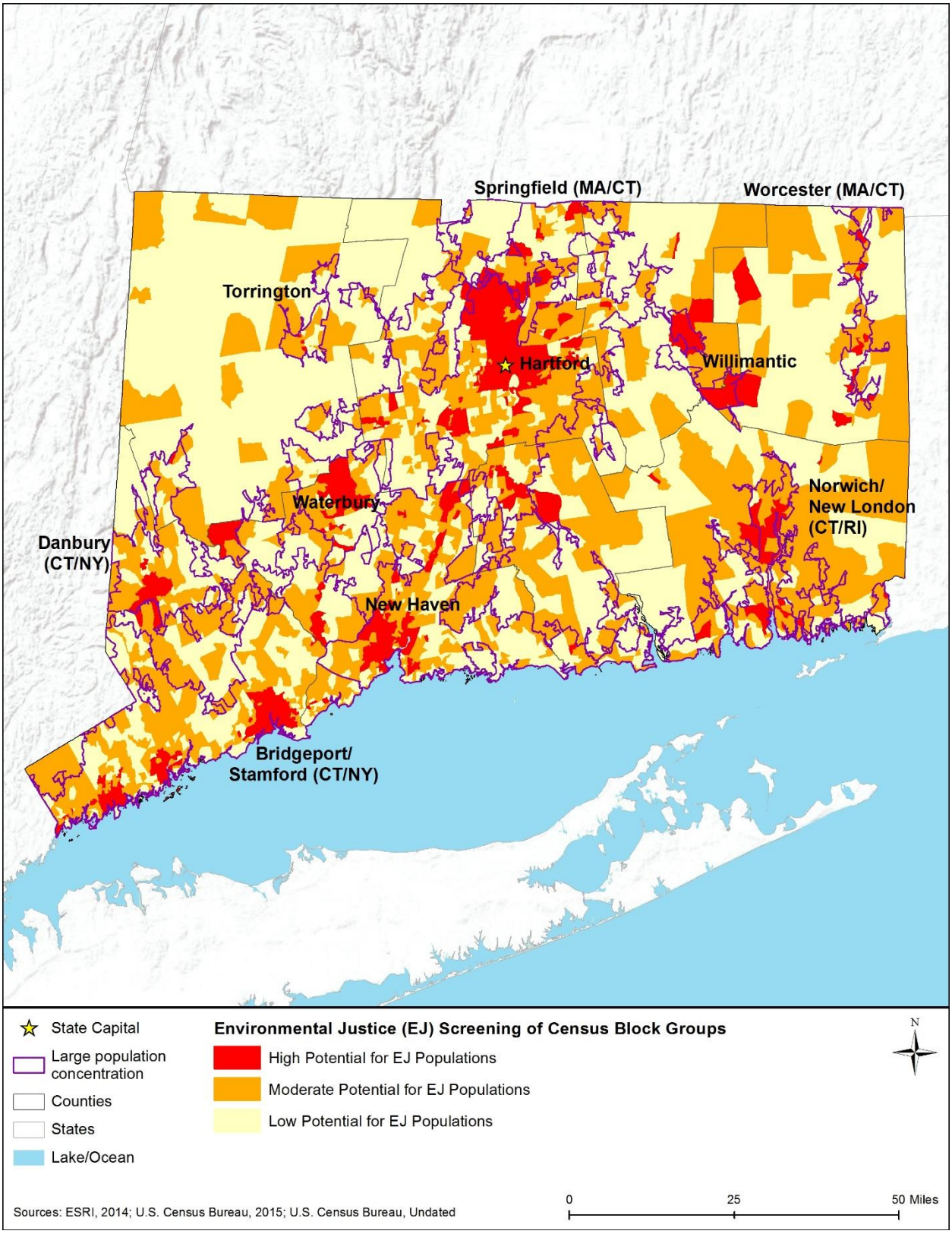


Figure 3.1.10-1: Potential for Environmental Justice Populations in Connecticut, 2009–2013

3.1.11. Cultural Resources

3.1.11.1. Definition of Resource

For the purposes of this PEIS, Cultural Resources are defined as:

> Natural or manmade structures, objects, features, locations with scientific, historic, and cultural value, including those with traditional religious or cultural importance and any prehistoric or historic district, site, or building included in, or eligible for inclusion in, the National Register of Historic Places (NRHP).

This definition is consistent with the how cultural resources are defined in the:

- Statutory language and implementing regulations for Section 106 of the NHPA, as amended, formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- Statutory language and Implementing regulations for the Archaeological Resources Protection Act of 1979 (ARPA), 16 U.S.C. 470cc(c) and 43 CFR 7.3(a);
- Statutory language and implementing regulations for the Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3001(3)(D) and 43 CFR 10.2(d);
- NPS's program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources (National Park Service n.d.); and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to Indian tribes or Native Hawaiian organizations (ACHP, 2004).

3.1.11.2. Specific Regulatory Considerations

Applicable federal laws and regulations that apply to Cultural Resources include the NHPA (detailed in Section 1.8), the American Indian Religious Freedom Act (AIRFA), ARPA, and NAGPRA. Appendix C summarizes these pertinent federal laws.

Connecticut has a state law that is similar to NEPA and NHPA (refer to Table 3.1.11-1). However, federal statutes supersede state laws and regulations. While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations.

Table 3.1.11-1: Relevant Connecticut Cultural Resources Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
Connecticut Environmental Policy Act, Section 22a-1a-3(a)(4)	Connecticut State Historic Preservation Office (SHPO)	The SHPO "is a mandated review agency for state-sponsored undertakings under the authority and regulations of the Connecticut Environmental Policy Act. Section 22a-1a-3 (a) (4) of the implementing regulations specifies that consideration of environmental significance shall include an evaluation concerning the 'disruption or alteration' of a historic, architectural, or archaeological resource or its setting."
Connecticut General Statutes, Title 10, Chapter 184a, Section 10-382-388	SHPO	All sites, objects and remains older than 50 years found on public or private lands are covered by the statute. The SHPO is charged with identifying and inventorying sacred and archaeological sites and issuing permits for excavations on state lands and coordinates with the Native American Heritage Advisory Council (NAHAC). If the permit allows disturbance of a known burial, cemetery or sacred site, the NAHAC reviews the application. If a burial is uncovered during development or construction, work must stop immediately in the area and local law enforcement should be notified. Following determination that the site does not constitute a crime scene and the remains are a prehistoric or historic human burial, the SHPO may assist the project proponent, developer, and/or landowner in contacting appropriate parties, considering options to avoid the burial(s), and advising on the legal process for potentially moving the remains.

Source: (Justia, 2017c), (Connecticut State Historic Preservation Office, 2014)

3.1.11.3. Cultural Setting

There are archeological sites throughout the northeastern United States, in a wide range of settings, including forests, floodplains, waterways, and mountaintops. Pre-European contact archeological sites range from temporary fishing encampments to large permanent villages (Moeller, 1980). There are also many "resource procurement sites" or areas where the activity appears to have consisted of a single action lasting for perhaps just a few hours, such as hunting sites that typically identify where animals were killed and butchered or well-established waterfront locations where groups of people gathered for a limited time on a regular basis to harvest and prepare fish.

Most archeological sites are found in relatively shallow deposits, within one to two feet of the surface. However, in some cases, natural factors have caused sites to be buried beneath multiple layers of sediment or organic materials, such as in floodplain deposits found along streams and rivers or peat deposits in wetlands. Artifacts are usually between one and ten feet below the current surface, with the older artifacts in the deeper sediments. Disturbed ground, including urban areas, may contain archaeological resources in deeper or shallower strata than undisturbed areas (Harris, 1979).

The area that encompasses the state of Connecticut has been inhabited by human beings for approximately 12,000 years (Keegan & Kristen, 1999; Peabody Museum of Natural History, 1985; Lavin, 2013). Evidence comes from the study of archeological sites of the state's pre-European contact and historic populations, which in turn helps document the various cultures,

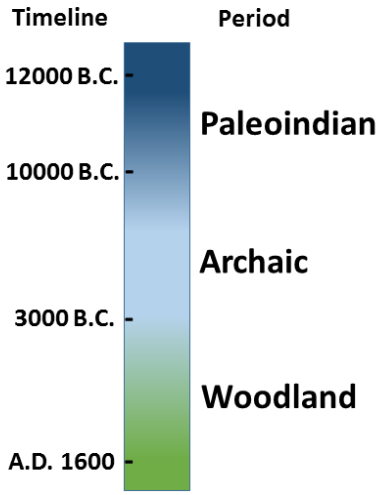
traditions, and human interactions with the environment. Among the hundreds of archaeological sites identified in Connecticut, 28 sites are listed on the NRHP, of which 13 are prehistoric and 15 are historic (NPS, 2014c).

The Templeton archaeological site in western Connecticut and the Hidden Creek archaeological site in southeastern Connecticut are representative of the earliest known Paleoindian habitation sites. The Templeton site was a tool-manufacturing complex associated with scrapers, gravers, points, and knives, occupied 10,000-12,000 years ago. Research of the Hidden Creek site has produced approximately 50 stone tools and tool fragments, and 4,000 small flakes. Scrapers, cutting tools and utilized touched flakes of stone traced to the Hudson Valley region of south Albany, NY, are the most common artifacts found at the Hidden Creek site (Lavin, 2013).

The following sections provide additional detail about Connecticut's prehistoric periods (approximately 12,000 B.C. to A.D. 1,600) and the historic period since European colonization in the 1600s. Section 3.1.11.4 presents an overview of the initial human habitation in Connecticut and the cultural development that occurred before European contact. Section 11.14.5 discusses the federally recognized American Indian Tribes with a cultural affiliation to the state. Section 3.1.11.6 provides a current list of significant archaeological sites in Connecticut and tools that the state has developed to ensure their preservation. Section 3.1.11.7 document the historic context of the state since European contact, and Section 3.1.11.8 summarizes the architectural context of the state during the historic period.

3.1.11.4. Prehistoric Setting

There are three distinct periods associated with the prehistoric human populations that inhabited Connecticut and the greater Northeast geography of North America: The Paleoindian period (12,000 to 10,000 B.C.); Archaic (10,000 to 3,000 B.C.); and, Woodland (3,000 B.C. to A.D. 1600). Figure 3.1.11-1 shows a timeline representing these periods of early human development in North America, including present day Connecticut. It is important to note here that there is potential for undiscovered archaeological remains representing every prehistoric period throughout the state. Evidence of human occupation has been discovered in every geographic region of Connecticut. Due to advancements in radiocarbon dating and other techniques, the timeline of early human occupation within the Connecticut region and throughout North America has become increasingly accurate (Kerber, 2012; Keegan & Kristen, 1999; Lavin, 2013; Pauketat, 2012; Haynes, Donahue, Jull, & Zabel, 1984; Haynes, Johnson, & Stafford, 1999).



Source: (Institute of Maritime History, 2015; Pauketat, 2012)

Figure 3.1.11-1: Timeline of Prehistoric Human Occupation

Paleoindian Period (12,000 - 10,000 B.C.)

The Paleoindian period represents the earliest human inhabitation of the northeast United States. Evidence of early man in Connecticut is based on the discovery of a scatter of fluted points, a few small campsites, and other more prominent sites throughout the state. Based on the evidence, it is likely that they were a highly nomadic and sparsely populated group of people. They used chipped-stone tools, including the "fluted javelin head" arrow and spear points, also referred to as the Clovis fluted point. Early hypotheses in American archaeology suggested that the Clovis fluted point was not invented until prehistoric people reached North America and began hunting the large game of that period (Ritchie W. A., 1969). However, studies that are more recent show that such technology was prevalent in northeastern Asia, the Arabian Peninsula, and Spain prior to human arrival into North America (Charpentier & Inizan, 2002). Most of the oldest known evidence of human settlement in Connecticut is based on the discovery of fluted points found in surface and shallow deposits throughout the state. Archaeologists hypothesize that the people of this period ranged across the state in small bands that followed migratory game. Early Paleoindian settlers used the Clovis fluted point technology to hunt large game such as mastodon, caribou, stag-moose, and giant beaver (Laub, 2000). These bands established seasonal camps, some of which likely became permanent settlements. No skeletal remains of these people have been identified to date in Connecticut. It is assumed that they were related to people who migrated to North America via a land bridge at the Bering Strait during the latter part of the last ice age, or Late Pleistocene epoch (Lavin, 2013; Peabody Museum of Natural History, 1985).

Archaic Period (11,000 – 3,800 B.C.)

The Early Archaic culture began developing tools such as choppers, narrow-bladed projectile points, beveled adzes, and various other small tools and pendants. However, because the culture did not have sophisticated food storage techniques, there was likely an abundance of food during the warmer months, which supported sedentary lifestyles, and food scarcity in colder months, which encouraged a nomadic lifestyle to pursue game (Lavin, 2013; Keegan & Kristen, 1999).

By the Middle Archaic Period, the climate in Connecticut had changed enough to support a more deciduous forest environment, and ecological conditions were much like those that exist today. There was a relative abundance of wild game, fowl, edible nuts, berries, tubers, roots, and various herbs, all of which could have supported larger populations of semi-nomadic peoples. Groups and bands of Middle Archaic peoples along Connecticut's river and ocean shores also had abundance of salmon, shad, and sturgeon, which is document by the discovery of large amounts of remains of these species at archaeological sites (Keegan & Kristen, 1999) (Ritchie W. A., 1969).

Although there are more archeological sites in northeastern United States from the Middle Archaic Period than the Early Archaic Period, there is little information about how Middle Archaic peoples lived. One reason is that the sea level was about 60 feet lower than it is today (Peabody Museum of Natural History, 1985). The Middle Archaic period shoreline was far from the current shoreline, as was the case with much of the northeast coast of North America. It is the consensus of archeologists that there were coastal sites that may have contained thriving communities of semi-nomadic peoples, which are now submerged under water and offshore sediments (Peabody Museum of Natural History, 1985).

Upland Middle Archaic sites in Connecticut, such as the Bolton Spring Site, Dill Farm Site, Lewis-Walpole Site, and the Great Cedar Swamp, have insight as to how the inhabitants of this region were living at the time, including exploitation of materials such as quartz, quartzite, and shale to craft tools, which is an indicator of advanced technology and culture. Similarly, the dugout canoe was developed by Middle Archaic Period Paleoindians of this region for travel and subsistence along waterways (Lavin, 2013; Peabody Museum of Natural History, 1985).

Archaeological sites of the Late Archaic Period have been well documented throughout Connecticut. Seasonal exploitation of the flora and fauna was becoming the predominant way of life. The forests were beginning to become much like they are in present day Connecticut, dominated by oak, alder, birch, pine, hemlock, beech, hickory and chestnut. Aquatic and wild vegetable food sources were also thriving within this region. The warmer climate, and abundance and variety of food sources led to human population increases, through new migration of extant groups, increases of indigenous populations, or both. Large habitation sites across the state from this period have been well documented, especially along major rivers where there were camps of large populations during various times of the year. Large habitation sites allowed for exchange of ideas and information, and supported development of a more sophisticated social life, including the marrying of partners (De Forest, 1852; Kerber, 2012; Lavin, 2013; Moeller, 1980).

The activities associated with Late Archaic sites included the development and use of more advanced tools. Projectile points, scrapers, adzes, gouges, axes, drills, blades, weights, pendants, pestles, and atlatl weights for spear throwing are well documented at these sites. Flint artifacts begin to show up in the archaeological record that indicate there was long-distance trade occurring, as flint is not found within Connecticut (De Forest, 1852; Kerber, 2012; Lavin, 2013; Moeller, 1980).

By this time in the archaeological record, people became much more sedentary in their way of life, while their subsistence economy remained virtually unchanged. The presence of soapstone cooking vessels begin to appear, indicating that the people were spending more time at permanent camps sites within their respective region or territory. Some of these cooking vessels weighed upwards of fifty pounds, which did not make for easy transport from site to site. The soapstone was quarried from mines in northwestern Connecticut, and the tools used to produce them (as well as unfinished bowls still attached to rock outcrops) have been found at these quarry sites. Trading amongst various groups is prevalent due to the wide distribution of these cooking vessels across the state (Kerber, 2012; Lavin, 2013; Moeller, 1980).

Based on the evidence of new tool making techniques and the flint materials associated with them, population increases in this region can be at least partly attributed to migration from other regions. (Kerber, 2012; Lavin, 2013; Moeller, 1980).

Woodland Period (3,000 B.C. to A.D 1600)

Hunting and fishing remained the predominant forms of subsistence during the Early Woodland Period. Tools that were previously used during the Archaic Period are still prevalent such as chipped stone technology, thick-stemmed, narrow-bladed projectile points, and some made from non-local sources, but used mostly local sources of materials for tool manufacturing. Evidence of small, seasonal campsites indicate that people moved around the region to exploit the increased variety of flora and fauna present during this period, with deer and nuts being the largest source of production. Wetlands lying within the interior of the state were exploited for their richness in shellfish, i.e. freshwater mussels, which currently exist in Connecticut and throughout the northeastern United States (Kerber 2012, Lavin 2013, Moeller 1980, CT DEEP 2015).

The primary technology that differentiates the Woodland Period from previous periods is the development and use of pottery. Clay containers with wide mouths and pointed bottoms were used for cooking. These vessels were decorated using cord or fabric that was impressed into the clay during manufacturing to give them a textured appearance. Also, the presence of other objects such as clay pipes are associated with the people of this period (Kerber, 2012; Lavin, 2013; Moeller, 1980).

Whether or not the people of this region had developed into sophisticated community structures with organized social practices and belief systems is not clear. There is no evidence of housing during this period and graves are virtually non-existent. (Kerber, 2012; Lavin, 2013; Moeller, 1980)

The Middle Woodland Period started around 4000 years ago. Pottery and other instruments, such as clay pipes, become more elaborate during the Middle Woodland Period. The introduction of maize horticulture begins to appear, which is an indicator of sedentary lifestyles. However, hunting and gathering continued to be the predominant means for subsistence (Kerber, 2012; Lavin, 2013; Moeller, 1980).

The Middle Woodland Phase is generally associated with a variety of plain and decorated ceramic types as well as numerous lithic and bone tool types. The period is differentiated from the earlier periods with the introduction of technologies that incorporate decorative techniques and motifs in the pottery. Additionally, functional improvements of pottery began in this period, such as smaller mouths in the jars and a more rounded base. Greater use of non-local materials such as jaspers, argillites, and hornblendes from the Mid-Atlantic region of the United States is a very good indication that trade amongst people from different regions was taking place (Kerber, 2012; Lavin, 2013; Moeller, 1980).

Shellfishing became a more important economic pursuit along the coast, while rudimentary horticulture began to make a significant contribution to the diet of the local populations. Based on the increase in size and number of archaeological sites in the archaeological record, the indigenous populations of Connecticut were increasing rapidly during this period. (Kerber, 2012; Lavin, 2013; Moeller, 1980).

During the Late Woodland, the archaeological record reveals a continued change in cultural lifestyle for the people in Connecticut, including the development of permanent houses. Based on the circular stains that form patterns on the earth, Late Woodland homes were likely oval or round-pole framed structures, sometimes referred to as wigwams. The structures were 15 to 20 feet in length, and probably sheltered one to two families each (Kerber, 2012; Lavin, 2013; Moeller, 1980).

Burials from this period have also shown that this culture was beginning to establish a basic belief in an afterlife. Although artifacts are not prevalent, the dead were buried facing west, where the afterlife was thought to be located (Kerber, 2012; Lavin, 2013; Moeller, 1980).

3.1.11.5. Federally Recognized Tribes of Connecticut

According to the Bureau of Indian Affairs and the National Conference of Legislators, the Mashantucket Pequot Indian Tribe of Connecticut and the Mohegan Indian Tribe of Connecticut are the only two federally recognized Tribes in Connecticut (National Conference of State Legislatures, 2010; DOE, 2017). The general location of the tribes are shown in Figure 3.1.11-2. Additionally, the figure depicts the general historic location of officially federally-recognized tribes that were known to exist in this region of the United States, but are no longer present in the state.

3.1.11.6. Significant Archaeological Sites in Connecticut

As previously mentioned in Section 3.1.11.3, there are 28 archaeological sites in Connecticut listed on the NRHP. Table 3.1.11-2 lists the names of the sites, the city they are closest to, and type of site. Both prehistoric and historic archaeological sites are listed. A current list of NRHP sites can be found on the NPS NRHP website at http://www.nps.gov/nr/ (NPS, 2014d)

Connecticut Cultural Resources Database and Tools

Statewide Historic Resource Inventory (SHRI)

The State Historic Preservation Office (SHPO), which is part of the Connecticut Offices of Culture and Tourism, maintains a Statewide Historic Resource Inventory, which documents historic structures identified within the state. The SHRI files are arranged by town and street address, and are available to the public for research purposes. Paper files are held at the University of Connecticut's Thomas J. Dodd Research Center in Stoors, and microfiche copies of the files are also available for review at the SHPO office in Hartford. Information on the SHRI can be obtained by calling (860) 256-2766. (Connecticut Office of Culture and Tourism, 2014)

Connecticut Archaeology Center (CAC)

The Connecticut Archaeology Center (http://www.cac.uconn.edu/osa.html), located within the University of Connecticut's Museum of Natural History in Stoors, serves as the Office of State Archaeology (OSA), a sister state agency to the SHPO. The CAC maintains information on the archaeology of the state, and reviews projects for impacts on archaeological sites. Research and technical information on the state's archaeological sites are available at the CAC to professional archaeologists, academics, and federal agencies. (UCONN, 2016b)

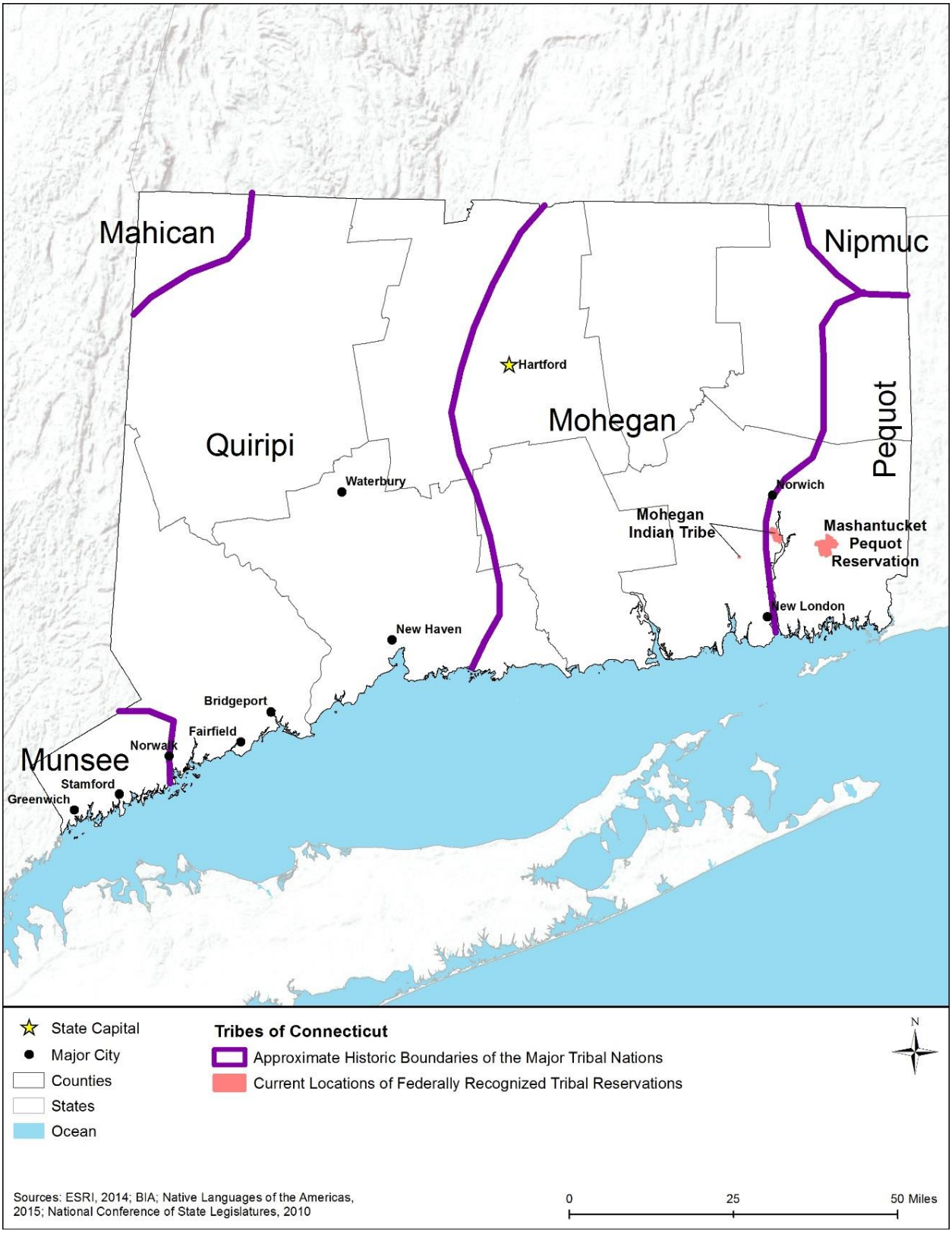


Figure 3.1.11-2: Federally Recognized Tribes in Connecticut[118]

Table 3.1.11-2: Archaeological sites on the National Register of Historic Places in Connecticut

Location (closest city)	Site Name	Type of Site
Barkhamsted	Lighthouse Archeological Site (5-37)	Historical
Canterbury	Quinebaug River Prehistoric Archaeological District	Prehistoric
Cornwall	Red Mountain Shelter	Historic (Mohawk Adirondack Shelter)
East Haddam	Roaring Brook Sites	Prehistoric
Haddam	BOC Site	Prehistoric
Hampton	Hemlock Glen Industrial Archaeological District	Historic
Killingly	Daniel's Village Archaeological Site	Historic
Ledyard	Mashantucket Pequot Reservation Archaeological District	Historic (Mashantucket Pequot Tribe)
Lyme	Cooper Site	Prehistoric
Lyme	Hamburg Cove Site	Prehistoric
Lyme	Lord Cove Site	Prehistoric
Lyme	Selden Island Site	Prehistoric
Manchester	Pitkin Glassworks Ruin	Historic
Montville	Fort Shantok	Historic (Mohegan)
Newtown	Nichols Satinet Mill Site	Historic
Old Lyme	Lieutenant River III Site	Prehistoric
Old Lyme	Lieutenant River IV Site	Prehistoric
Old Lyme	Lieutenant River No. 2	Prehistoric
Old Lyme	Natcon Site	Prehistoric
Ridgefield	Cain, Hugh, Fulling Mill and Elias Glover Woolen Mill Archeological Site	Historic
Southbury	Little Pootatuck Brook Archaeological Site	Prehistoric
Stamford	Rockrimmon Rock Shelter	Prehistoric
Storrs	Farewell Barn	Historic
Trumbull	Old Mine Park Archaeological Site	Historic
Vernon	Sharpe's Trout Hatchery Site	Historic
Vernon	Valley Falls Cotton Mill Site	Historic
Willington	Eldredge Mills Archaeological District	Historic
Woodstock	New Roxbury Ironworks Site	Historic

Source: (NPS, 2014c) (NPS, 2016)

[118] Figure 3.1.11-2 is provided for context and is not intended to be exact as the various sources that were consulted contain varying ancestral territory boundaries. Instead, this figure and corresponding ancestral territory boundaries are provided to show that the historic ancestral territories and the current ancestral interests of a given tribe within a given state are often times complex as ancestral territory boundaries shifted and overlapped over time.

3.1.11.7. Historic Context

In the early 1630s, English settlers arrived in what is now Connecticut, having moved from neighboring Massachusetts. The Dutch had occupied the area previously, but were displaced by the English. Indians lived largely in villages along the coastline and in river valleys, allowing for access to natural waterways. Colonial settlements were established in many of the same locations, putting the indigenous population in contact with settlers. By 1635, European settlements had been established at Wethersfield, Hartford, and Windsor, and in 1637, these settlements engaged in a joint military effort to drive out the Pequot Indians (Connecticut State Historic Preservation Office, 2011).

In 1638, the town of New Haven was established on Quinnipiac Bay, originally as a separate colony, but later becoming part of Connecticut. Villages were laid out in accordance with English and Puritan traditions, with home lots surrounding town commons. In the early 18th century, New Haven became home to Yale University, one of the oldest institutions of higher education in the country. "Constructed circa 1750, Connecticut Hall is the earliest remaining Yale building and has been designated a National Historic Landmark" (Connecticut State Historic Preservation Office, 2011). During the latter part of the 18th century, agricultural production remained important; however, industries including coopery, iron, and brass production began to grow, allowing Connecticut to play an important role in the American Revolution. With New England serving as a focal point for military activities, Connecticut suffered damages as a result of British raids (Connecticut State Historic Preservation Office, 2011).

During the 19th century, Connecticut continued to grow its industrial capabilities, aided in large part by improvements in transportation. Canal systems, such as the Farmington Canal, were followed by an expansion in rail facilities, enabling the easy movement of raw materials, commodities, and manufactured goods. Railroad infrastructure, such as bridges, tunnels, and tracks, remain as evidence of how transportation improvements influenced development patterns. Connecticut was a major supplier of arms during the Civil War. Despite industrialization efforts during the 19th century, Connecticut remained a major agricultural producer, with tobacco being important during the 19th century and tobacco barns being built widely (Connecticut State Historic Preservation Office, 2011).

As the economy of Connecticut shifted towards industry, the population shifted towards increasingly urban settings. Evidence of urban growth during the 19th and early 20th centuries remains in the form of historic downtowns. Residential neighborhoods in urban environments were also expanded to house the growing work force. As a consequence of this growth, land in the rural areas of Connecticut became devalued, facilitating the movement of immigrant farmers to the countryside. The largest group to take part in this movement was Eastern European Jews relocating from Russia during the late 19th century. Wealthy "gentlemen farmers" also bought rural estates to use as rural retreats (Connecticut State Historic Preservation Office, 2011).

Connecticut saw a growth of streetcar suburbs during the early 20th century, which was spurred by economic activity linked to Connecticut's production of supplies for World War I (WWI). Shipyards and industrial centers received purpose-built housing communities associated with the

growing manufacturing population; these communities were sometimes planned by the U.S. Housing Corporation (Connecticut State Historic Preservation Office, 2011). Connecticut saw a degree of building during the Great Depression associated with New Deal programs like the Works Progress Administration (WPA) and Civilian Conservation Corps (CCC) (National Register of Historic Places 1986).

Connecticut experienced a housing boom following World War II (WWII) to satisfy the need to house returning veterans and their families. This resulted in the development of much of the countryside with suburban housing tracts and commercial development. Suburban development in Connecticut continued during the latter part of the 20th century, resulting in a loss of rural heritage. Although Connecticut has shifted away from heavy industry of late, the state has retained certain aspects of this tradition, such as involvement in silversmithing, shipbuilding, firearm, and watch production (Connecticut State Historic Preservation Office, 2011).

Connecticut has 1,596 NRHP listed sites, as well as 61 NHLs (NPS, 2014c). Connecticut contains two NHAs, both of which stretch north into neighboring Massachusetts (Connecticut State Historic Preservation Office, 2011). Figure 3.1.11-3 shows the location of NHAs and NRHP sites within Connecticut.[119]

3.1.11.8. Architectural Context

Connecticut has a wide array of historic resources that reflect nearly 400 years of European settlement Figure 3.1.11-4). Approximately a "third of Connecticut's building stock pre-dates 1950 and includes a variety of agricultural, civic, commercial…and residential buildings" (Connecticut State Historic Preservation Office, 2011). Many of Connecticut's most significant structures relate to the state's agricultural heritage, with barns being a significant example (Connecticut State Historic Preservation Office, 2011). Connecticut's collection of historic barns dates back to the 18th and 19th centuries and includes a variety of different barn types, including English barns, New England barns, bank barns, tobacco barns, dairy barns, etc. The Connecticut Trust for Historic Preservation has made an effort to identify and record existing historic barns within the state (Connecticut Trust for Historic Preservation, 2012).

While Connecticut was heavily involved in agriculture for much of its history, it began to industrialize during the 18th century. Milling establishments, such as gristmills and sawmills, as well as other "manufactories," were built near natural waterways that would power machinery and facilitate transportation. While many of these mills have been abandoned, some are being adaptively reused as commercial and residential spaces. The Ponemah Mill in Taftville (1866) is one example. Historic mills were often accompanied by mill villages that included housing for workers, company stores, religious facilities, schools, etc. (Connecticut State Historic Preservation Office, 2011).

[119] See Section 3.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

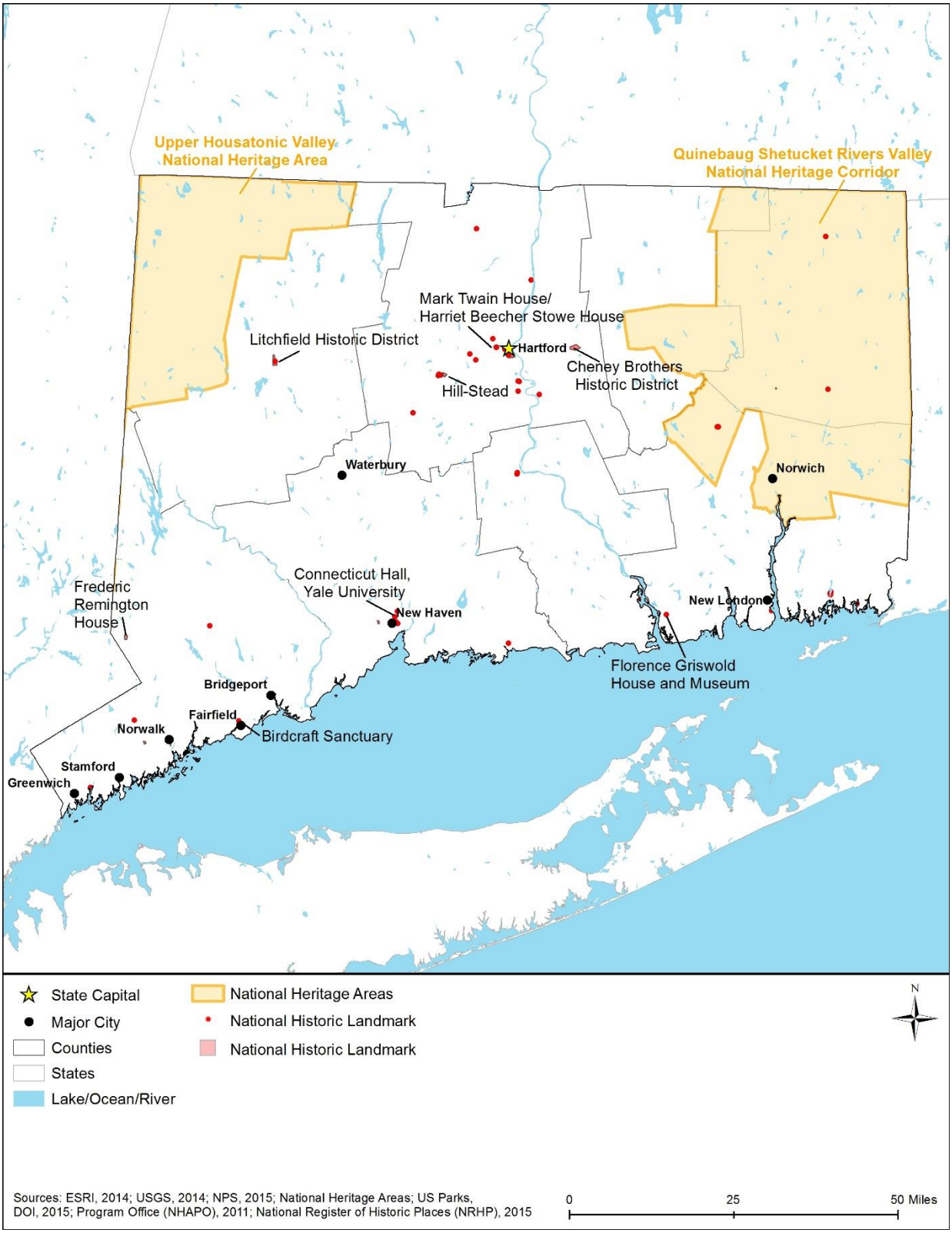


Figure 3.1.11-3: National Heritage Areas (NHA) and National Register of Historic Places (NRHP) Sites in Connecticut

During the 19th century, manufacturing increased throughout the state, as did related architecture. Examples of manufactured goods that Connecticut produced include watches, textiles, and firearms (Connecticut State Historic Preservation Office, 2011). The Colt Manufacturing Company, founded in 1855 in Hartford, supplied firearms to the Union during the Civil War. The original Colt Armory Complex still exists, and has been designated as a NHL. Connecticut has a history of shipbuilding and retains resources from historic shipyard facilities, some of which are still in use today. Commercial buildings accompanied the growth of industry and many from the late 19th and early 20th centuries still exist. Commercial building types range from storefronts from the 19th century, to theaters from the early 20th century, to early skyscrapers (Connecticut State Historic Preservation Office, 2011).

While much of the rural countryside was developed during the 20th century as suburbs became popular, numerous examples of rural houses from the 18th and 19th centuries remain. Large collections of historic buildings are also common in port towns, such as New London and Stonington. House types include First Period structures (pre-1730) that exhibit traditions brought from England, as well as Georgian architecture that typifies Colonial style. After the American Revolution, the Federal style became popular and lasted through the first quarter of the 19th century, eventually being surpassed by Greek Revival, Italianate, and Gothic Revival. The large number of houses from the mid-19th century relates to the industrial boom (Connecticut State Historic Preservation Office, 2011).

After the Civil War, Victorian-style houses grew in popularity, particularly in streetcar suburbs. Multi-family units were built during the late 19th and early 20th centuries to house factory workers. "A large variety of multi-family housing types were built in the state such as stacked duplexes, triple deckers (three units), 'Perfect Sixes' (six units), and multi-unit apartment buildings. These were also built in a variety of architectural styles with Tudor Revival and Colonial Revival especially prominent" (Connecticut State Historic Preservation Office, 2011). Mill housing tracts were also common and featured hundreds of identical houses, most of which were sold into private ownership following the closure of the factory or mill (Connecticut State Historic Preservation Office, 2011).

The growth of the automobile during the 20th century continued the trend of developing suburbs increasingly farther outside of cities. The construction of these modern suburbs has resulted in the destruction of traditionally agricultural landscapes, historic architecture, and archaeological sites. Suburban housing types included Tudor Revival and Colonial Revival during the early 20th century, bungalows prior to WWII, minimal traditional houses, and eventually ranches houses during the Mid-Century Era. Suburban commercial development in the form of strip malls, big box stores, and commercial campuses was common (Connecticut State Historic Preservation Office, 2011).

Connecticut also includes a collection of historic structures and objects, such as canals, bridges, railroads, stone walls, fountains, monuments, etc. Bridges within the state have been inventoried and documented in two historic contexts studies, one of which deals exclusively with moving bridges. Connecticut is home to several historic secondary and higher educational institutions. The most prominent of which is Yale University, originally Yale College (1701), in New Haven.

Historic religious buildings are common, including meeting houses from the Colonial Era (Connecticut State Historic Preservation Office, 2011). Construction actives associated with the New Deal work relief programs of the 1930s were common in Connecticut, with many resources from this era remaining within the state parks system (National Register of Historic Places 1986).

Left Top – Phelps Hall – (Detroit Photographic Co., 1901)
Right Top – Old Town Mill – (Historic American Buildings Survey, 1934)
Right Center – Tobacco Barn – (Highsmith, 2011)
Right Bottom – Colt Fire Arms Company, East Armory Building – (Library of Congress, 2016)

Figure 3.1.11-4: Representative Architectural Styles of Connecticut

3.1.12. Air Quality

3.1.12.1. Definition of the Resource

Air quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography[120] of the air basin, and the prevailing weather and climate conditions. The levels of pollutants and pollutant concentrations in the atmosphere are typically expressed in units of parts per million (ppm)[121] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[122] This section discusses the existing air quality in Connecticut. The USEPA designates areas within the United States as attainment,[123] nonattainment,[124] maintenance,[125] or unclassifiable[126] depending on the concentration of air pollution relative to ambient air quality standards. Information is presented regarding national and state ambient air quality standards and nonattainment areas that would be potentially sensitive to impacts from implementation of the Proposed Action or Alternatives.

3.1.12.2. Specific Regulatory Considerations

National and State Ambient Air Quality Standards

The Clean Air Act (CAA) establishes National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: Carbon monoxide (CO), lead, nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), and sulfur dioxide (SO_2). The NAAQS establish various standards, either primary[127] or secondary,[128] for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) were developed to prevent the acute health effects from short-term exposure at high concentrations. Longer averaging periods (e.g., 3 months or annual) are intended to prevent chronic health effects from long-term exposure. A description of the NAAQS is presented in Appendix E, Air Quality.

In addition to the NAAQS, there are standards for hazardous air pollutants (HAP), which are those typically associated with specific industrial processes such as chromium electroplating (hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated solvents) (USEPA, 2011a). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are

[120] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[121] Equivalent to 1 milligram per liter (mg/L).
[122] Averaging Time: "The period over which data are averaged and used to verify proper operation of the pollution control approach or compliance with the emissions limitation or standard" (USEPA, 2015h).
[123] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015i).
[124] Nonattainment areas: Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015i).
[125] Maintenance areas: An area that was previously nonattainment, but has met the national primary or secondary ambient air quality standards for the pollutant, and has been designated as attainment (USEPA, 2015i).
[126] Unclassifiable areas: Any area that cannot be classified on the basis of available information as meeting the national primary or secondary air quality standard for a pollutant (USEPA, 2015i).
[127] Primary standard: The primary standard is set to provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly (USGS, 2016b).
[128] Secondary standards: The secondary standard is set to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USGS, 2016b).

federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. (USEPA, 2015j). Appendix E, Air Quality, presents a list of 50 federally regulated HAPs.

In conjunction with the NAAQS, Connecticut maintains its own air quality standards, which are referred to as the Connecticut Ambient Air Quality Standards (CAAQS). While state air quality standards typically mimic national air quality standards, Connecticut established a separate air quality standard for Dioxins. Table 3.1.12-1 presents an overview of the CAAQS as defined by Connecticut Regulations of Connecticut State Agencies (RCSA). (CT DEEP, 2014n)

Table 3.1.12-1: Connecticut Ambient Air Quality Standards (CAAQS)

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		µg/m³	ppm	µg/m³	ppm	
CO	8-hour		9	Same as Primary		40 CFR 50.8
	1-hour		35	Same as Primary		40 CFR 50.8
Dioxins	Annual	0.000001				For the purposes of determining compliance with this standard the commissioner may use a concentration of 7.0 picograms per cubic meter (pg/m³) 8-hour average.
Lead	3 month	0.15		Same as Primary		Rolling average; 40 CFR 50.16
NO_X	Annual	53	0.053	Same as Primary		40 CFR 50.11
	1-hour		0.1	Same as Primary		40 CFR 50.11
O_3	8-hour		0.08	Same as Primary		40 CFR 50.10
	8-hour		0.075	Same as Primary		Daily max; 40 CFR 50.15
PM_{10}	24-hour	150		Same as Primary		40 CFR 50.6
$PM_{2.5}$	Annual	12		15		40 CFR 50.18; 40 CFR 50.13
	24-hour	35		Same as Primary		40 CFR 50.18 and 40 CFR 50.13
SO_X	1-hour		0.075			40 CFR 50.17
	24-hour		0.14			40 CFR 50.4
	Annual		0.03			40 CFR 50.4
	3-hour			0.5 ppm	0.5	40 CFR 50.5

Source: (CT DEEP, 2014n)

Title V Operating Permits/State Operating Permits

Connecticut has authorization to issue CAA Title V permits on behalf of the USEPA, as outlined in 40 CFR 70. The Title V program refers to Title V of the CAA that governs permitting requirements for major industrial air pollution sources and consolidates all CAA requirements for the facility into one permit (USEPA, 2017b). The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (USEPA, 2017b). Connecticut requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 3.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2017b) (CT DEEP, 2011a).

Table 3.1.12-2: Major Source Thresholds

Any Pollutant	100 Tons per Year
Single HAP	10 Tons per Year
Total/Cumulative HAPs	25 Tons per Year

Source: (USEPA, 2017b)

RCSA section 22a-174-33 outlines the requirements of the Title V permit program. The requirements state that a source must apply for a Title V permit if it is a stationary source subject to one or more of the 40 CFR 60-63, 68, or 72-78, and any stationary source that meets the major source thresholds shown in Table 3.1.12-2 (CT DEEP, 2011a).

Exempt Activities

RCSA section 22-174-3a, subsections (2)(A-C), details all activities, stationary sources, and other sources that are exempt from obtaining preconstruction permits. Notable exemptions include any mobile source or any non-road engine as defined in 40 CFR Part 89.

Emergency engines are also exempt from obtaining a general permit prior to operation. Connecticut defines "Emergency" as an "unforeseeable condition that is beyond the control of the owner or operator of an emergency engine." An owner may operate an emergency engine to "minimize damage from fire, flood, or any other catastrophic event, natural or manmade" (CT DEEP, 2013d).

Emergency engines, while exempt from obtaining a general permit, are subject to additional regulations (CT DEEP, 2013d):

- "The owner or operator of an emergency engine shall properly maintain equipment and operate such engine in accordance with this subsection.
- No owner or operator of an emergency engine shall cause or allow such engine to operate except during periods of testing and scheduled maintenance or during an emergency and unless the following conditions are met:
  - Prior to the effective date [January 1, 2005] of section 22a-174-42 of the [RCSA], operation of such engine shall not exceed 500 hours during any twelve (12) month rolling aggregate;
  - Prior to the effective date of section 22a-174-42 of the [RCSA], any nongaseous fuel consumed by such engine shall not exceed a sulfur content of 0.3 percent by weight, dry basis;
  - On and after the effective date of section 22a-174-42 of the [RCSA], operation of such engine shall not exceed 300 hours during any twelve (12) month rolling aggregate; and
  - On and after the effective date of section 22a-174-42 of the [RCSA], any nongaseous fuel consumed by such engine shall not exceed the sulfur content of motor vehicle diesel fuel where "motor vehicle diesel fuel" is defined as in section 22a-174-42 of the [RCSA]." (CT DEEP, 2006b)

Temporary Emissions Source Permits

CT DEEP does not issue temporary emissions source permits, rather it provides guidance regarding how long a distributed generator[129] can operate without needing to conduct a new source review and obtain a general permit. The generator, however, can only operate a certain number of hours which is determined by the following equation:

$$\frac{(0.90)\left(15\frac{\text{tons}}{\text{year}}\right)\left(2{,}000\frac{\text{lbs}}{\text{ton}}\right)}{(\text{G})(\text{E})} = \text{Operating Hours Limit}$$

Where:
G = Generator capacity (MW)
E = Applicable carbon monoxide emission limit (lbs/MWh) detailed in Tables Table 3.1.12-3 and Table 3.1.12-4 below (CT DEEP, 2005b).

For owners of existing distributed generators, operations cannot "cause or allow the emissions of any air pollutant in excess of the emissions standards identified" in Table 3.1.12-3. Additionally, existing distributed generators cannot "cause or allow the release of carbon dioxide into the ambient air from a stack in excess of 1,900 lb/MWh if such generator is installed on or after May 1, 2012" (CT DEEP, 2005b).

Table 3.1.12-3: Emission Limits for Existing Distributed Generators Outlined by RCSA

NO_X (lb/MWh)	PM (lb/MWh)	CO (lb/MWh)
4.0	0.7	10.0

Source: (CT DEEP, 2005b)

For owners of new distributed generators, operations cannot "cause or allow the emissions of any air pollutant in excess of the applicable emissions standards identified in" Table 3.1.12-4. "The applicable emissions standards are those standards in effect on the date that such generator is installed" (CT DEEP, 2005b). Additionally, the new distributed generator cannot "cause or allow the release of carbon dioxide into the ambient air from a stack in excess of:

- 1,900 lb/MWh, if such generator is installed on or before April 30, 2012, or
- 1,650 lb/MWh, if such generator is installed on or after May 1, 2012." (CT DEEP, 2005b)

Table 3.1.12-4: Emission Limits for New Distributed Generators Outlined by RCSA

Date of installation	NO_X (lb/MWh)	PM (lb/MWh)	CO (lb/MWh)
On or after January 1, 2005	0.6	0.7	10.0
On or after May 1, 2008	0.3	0.07	2.0
On or after May 1, 2012	0.15	0.03	1.0

Source: (CT DEEP, 2005b)

[129] A Distributed Generator, as defined by Connecticut Regulations Sec. 22a-174-42 is "any new or existing generator with a nameplate capacity less than 15 MW that generates electricity for other than emergency use. Electricity generated may be used either onsite or for sale under an agreement with a utility, other market participant or system operator. Such a generator may also generate electricity for use during an emergency but is not defined as an emergency generator. Such a generator may burn two fuels simultaneously but is not defined as a dual-fuel generator."

RCSA section 22-174-42 contains additional guidance for the operation of distributed generators including fuel restrictions and recordkeeping requirements.

Connecticut Clean Air Construction Initiative

Connecticut issued the *Connecticut Clean Diesel Plan* in January 2006. The plan seeks to limit $PM_{2.5}$ emissions emitted from combustion processes in diesel engines. The plan focuses on reducing these emissions by retrofitting or replacing transit and school buses so they run more efficiently. Additionally, the plan also outlines specific construction contract requirements for all ConnDOT, Department of Public Works, Office of Policy Management, Department of Economic and Community, and University of Connecticut projects greater than $5M in value. Some of these requirements include:

- Implementing emissions control devices (oxidation catalysts) or clean fuels for all diesel powered equipment with engines larger than 60 horsepower and operating for longer than 30 days;
- Establishing truck staging areas for loading/unloading materials in areas that will have the least impact on the general public and the surrounding area;
- Limit engine idling to three minutes;
- Ensure that sensitive areas (e.g., school zones, hospitals, and assisted living facilities) are not impacted by construction; and
- Not operating diesel engines near fresh air intakes, air conditioners, and windows. (CT DEEP, 2006c)

State Preconstruction Permits

RCSA section 22a-174-3A requires a preconstruction permit for any non-exempted stationary source or modification that is one or more of the following:

- "New major stationary source;
- Major modification;[130]
- New or reconstructed major source of hazardous air pollutants subject to the provisions of subsection (m) of this section [RCSA 22a-174-3A];
- New emission unit with potential emissions of fifteen (15) tons or more per year of any individual air pollutant;
- Modification to an existing emission unit which increases potential emissions of any individual air pollutant from such unit by fifteen (15) tons or more per year;
- Stationary source or modification that becomes a major stationary source or major modification solely by virtue of a relaxation in any enforceable limitation which was established after August 7, 1980, on the capacity of the source or modification otherwise to emit a pollutant;

[130] Any physical change in or change in the method of operation of a major stationary source that would result in 1) a significant emissions increase of a regulated New Source Review (NSR) pollutant and 2) a significant net emissions increase of that pollutant from the major stationary source (40 CFR 51.165).

- New stationary source that emits, or has the potential to emit, equal to or greater than 100,000 tons per year of CO_2e[131] and one hundred (100) tons per year of greenhouse gases;
- Major stationary source when such major stationary source undertakes a physical change or change in the method of operation that will result in a net emissions increase that is equal to or greater than 75,000 tons per year CO_2e; or
- Stationary source that emits, or has the potential to emit, equal to or greater than 100,000 tons per year of CO_2e and one hundred (100) tons per year of greenhouse gases, when such stationary source undertakes a physical change or change in the method of operation that will result in a net emissions increase that is equal to or greater than 75,000 tons per year CO_2e." (CT DEEP, 2015ah)

General Conformity

Established under section 176I(4) of the CAA, the General Conformity Rule ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality outlined in the state implementation plan (SIP) (USEPA, 2013b). An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and I, federal actions "in response to emergencies which are typically commenced on the order of hours or days after the emergency" and actions "which are part of part of a continuing response to emergency or disaster" that are taken up to six months after beginning response activities, will be exempt from any conformity determinations (U.S. Government Publishing Office, 2010).

The estimated pollutant emissions are compared to *de minimis*[132] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 3.1.12-5). All Connecticut counties lie in the Ozone Transport Region (OTR). As a result, lower *de minimis* thresholds for volatile organic compounds (VOCs) and NO_x could apply depending on the attainment status of a county.

[131] CO_2e refers to Carbon Dioxide Equivalent, "A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as million metric tons of carbon dioxide equivalents ($MMTCO_2e$). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. $MMTCO_2e$ = (million metric tons of a gas) * (GWP of the gas)" (USEPA, 2015k).
[132] "40 CFR 93.153 defines *de minimis* levels [as] the minimum threshold for which a conformity determination must be performed, for various criteria pollutants in various areas" (USEPA, 2015l).

Table 3.1.12-5: Air Pollutant *De Minimis* Levels

Pollutant	Area Type	TPY[a]
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
Ozone (NO_X)	Marginal and Moderate Nonattainment inside an OTR	100
	Maintenance	100
Ozone (VOC)	Marginal and Moderate Nonattainment inside an OTR	50
	Maintenance within an OTR	50
CO, SO_2, NO_2	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ Direct Emissions SO_2 NO_X (unless determined not to be a significant precursor) VOC or ammonia (if determined to be significant precursors)	All Nonattainment and Maintenance	100
Lead (Pb)	All Nonattainment and Maintenance	25

Source: 40 CFR 93.153 (U.S. Government Publishing Office, 2010)

[a] TPY: Tons Per Year

If an action does not result in an emissions increase above the *de minimis* levels in Table 3.1.12-5, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 3.1.12-5, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity[133], the federal agency would have to fulfill one or more of the following:

- Show any emissions increase is specifically identified and accounted for in the respective state's SIP;
- Receive acknowledgement from the state that any increase in emissions would not exceed the SIP emission budget;
- Receive acknowledgement from the state to revise the SIP and include emissions from the action;
- Show the emissions would be fully offset by implementing reductions from another source in the same area; or
- Conduct air quality modeling that demonstrates the emissions would not cause or contribute to new violations of the NAAQS, or increase the frequency or severity of any existing violations of the NAAQS (USEPA, 2017c).

[133] Conformity: Compliance with the State Implementation Plan.

State Implementation Plan (SIP) Requirements

Connecticut's SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Connecticut's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Connecticut's SIP actions are codified under 40 CFR Part 52 Subpart HH. A list of SIP actions for the six criteria pollutants can be found on CT DEEP's website. (http://www.ct.gov/deep/cwp/view.asp?a=2684&q=331234&deepNav_GID=1619) (CT DEEP, 2015ai).

3.1.12.3. Environmental Setting: Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Figure 3.1.12-1 and Table 3.1.12-6 present the current nonattainment areas in Connecticut as of January 30, 2015. Table 3.1.12-6 contains a list of the counties and their respective current nonattainment status of each criteria pollutant. The year(s) listed in the table for each pollutant indicate the date(s) when USEPA promulgated an ambient air quality standard for that pollutant. Note certain pollutants have more than one standard in effect (e.g., $PM_{2.5}$, O_3, and SO_x). Unlike Table 3.1.12-6, Figure 3.1.12-1 does not differentiate between standards for the same pollutant. Additionally, given that particulate matter is the criteria pollutant of concern, PM_{10} and $PM_{2.5}$ are merged in the figure and presented as a single pollutant.

Table 3.1.12-6: Connecticut Nonattainment and Maintenance Areas by Pollutant and County

County	Pollutant and Year USEPA Implemented Standard										
	CO	Lead		NO_X	PM_{10}	$PM_{2.5}$		O_3		SO_X	
	1971	1979	2008	1971	1987	1997	2006	1997	2008	1971	2010
Fairfield	M					M	M	X-4	X-5		
Hartford	M							X-4	X-5		
Litchfield	M							X-4	X-5		
Middlesex	M							X-4	X-5		
New Haven	M				M	M	M	X-4	X-5		
New London								X-4	X-5		
Tolland	M							X-4	X-5		
Windham								X-4	X-5		

Source: (USEPA, 2013c)

X-1 = Nonattainment Area (Extreme)
X-2 = Nonattainment Area (Severe)
X-3 = Nonattainment Area (Serious)
X-4 = Nonattainment Area (Moderate)
X-5 = Nonattainment Area (Marginal)
X-6 = Nonattainment Area (Unclassified)
M = Maintenance Area

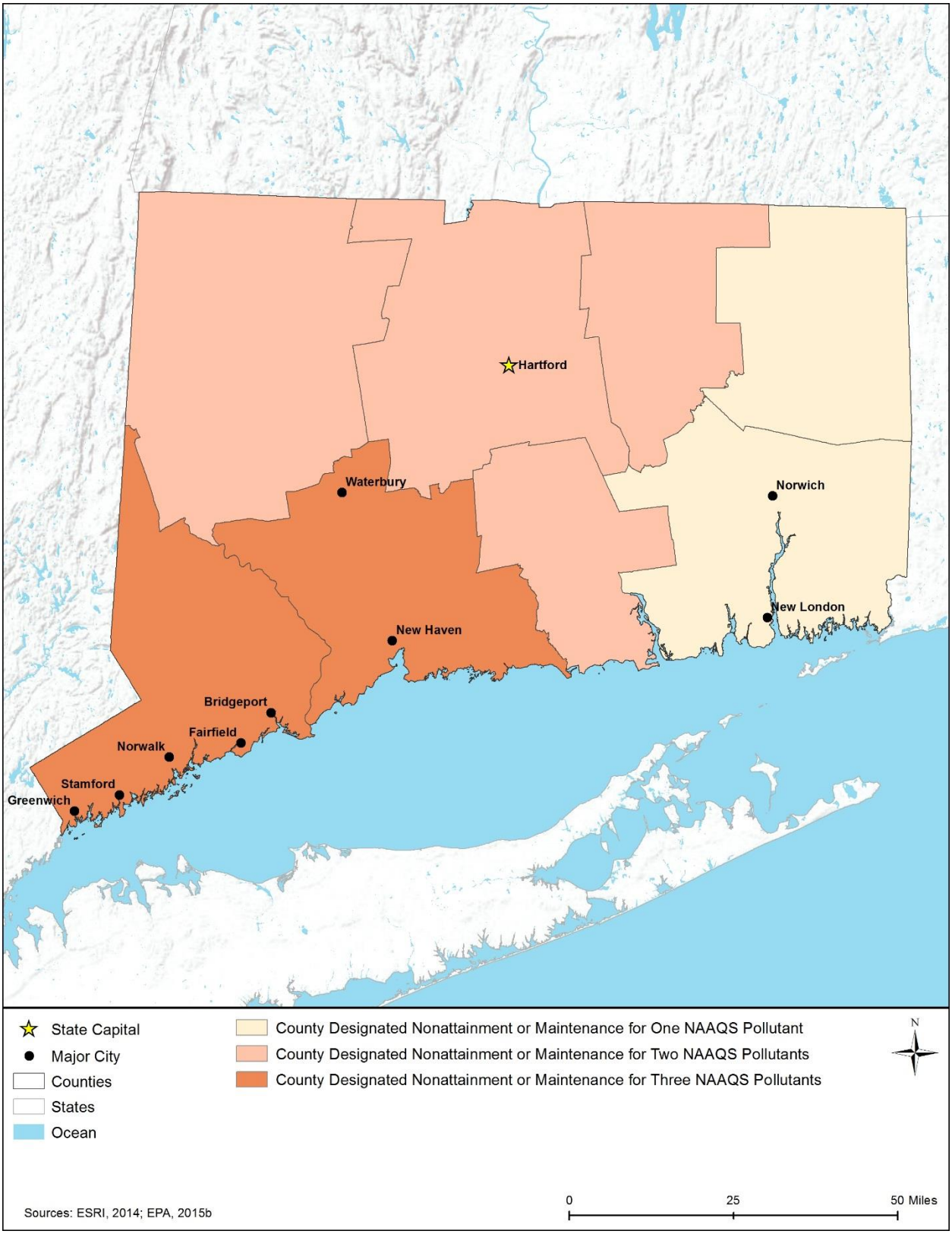


Figure 3.1.12-1: Nonattainment and Maintenance Counties in Connecticut

Air Quality Monitoring and Reporting

CT DEEP measures air pollutants at 15 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Annual Connecticut State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. In 2014, ambient air quality exceeded the 8-hour O3 threshold eight times. Middletown and Westport have had the most consecutive exceedance days (CT DEEP, 2015aj). CT DEEP reports real-time pollution levels of O3 on their website to inform the public, as O3 is the main pollutant of concern in Connecticut. No other criteria pollutants exceeded state or federal standards (USEPA, 2015m).

Air Quality Control Regions

USEPA classified all land in the United States as a Class I, Class II, or Class III Federal Air Quality Control Region (AQCR). These are different from the air quality classification levels defined in Table 3.1.12-1 as part of the CAAQS. Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size. Class I areas cannot be re-designated as Class II or Class III and are intended to maintain pristine air quality. Although USEPA developed the standards for a Class III AQCR, to date they have not actually classified any area as Class III. Therefore, any area that is not classified as a Class I area is, by default, automatically designated as a Class II AQCR (42 U.S.C. § 7470).

In a 1979 USEPA memorandum, the Assistant Administrator for Air, Noise, and Radiation (Hawkins, 1979) advised USEPA Regional Offices to provide notice to the Federal Land Manager (FLM) of any facility subject to the Prevention of Significant Deterioration (PSD) permit requirements and within 100 kilometers[134] of a Class I area. "The EPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (USEPA, 2012b). The 2005 USEPA guidelines for air quality modeling do not provide a precise modeling range for Class I areas.

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 50 kilometers[135] (the normal useful range of EPA-approved Gaussian plume models" (USEPA, 1992).

Connecticut does not contain any Federal Class I areas; all land within the state is classified as Class II (USEPA, 2017d). If an action is considered a major source and consequently subject to

[134] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.
[135] The memorandum and associated guidance use kilometers. 50 kilometers is equal to about 31 miles.

PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source " (USEPA, 1992). There are no Federal Class I areas within 100 kilometers of Connecticut and therefore, Class I areas will not be of concern for any proposed actions conducted within the state.

3.1.13. Noise and Vibration

This section presents a discussion of a basic understanding of environmental noise, background/ambient noise levels, noise standards, vibration, and guidelines.

3.1.13.1. Definition of the Resource

Noise is a form of sound caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012c). Noise is one of the most common environmental issues that interferes with normal human activities and otherwise diminishes the quality of the human environment. Typical sources of noise that result in this type of interference in urban and suburban surroundings includes interstate and local roadway traffic, rail traffic, industrial activities, aircraft, and neighborhood sources like lawn mowers, leaf blowers, etc.

Physiological effects such as hearing loss and anxiety. The effects of noise can be classified into three categories:

- Noise events that result in annoyance and nuisance;
- Interference with speech, sleep, and learning; and
- Physiological effects such as hearing loss and anxiety.

Ground-borne vibrations, which in many instances can be caused by tools or equipment that generate noise, can also result from roadway traffic, rail traffic, and industrial activities as well as from some construction-related activities such as blasting, pile-driving, vibratory compaction, demolition, and drilling. Unlike noise, most ground-borne vibrations are not typically experienced every day by most people because the existing environment does not include a significant number of perceptible ground-borne vibration events.

Fundamentals of Noise and Vibration

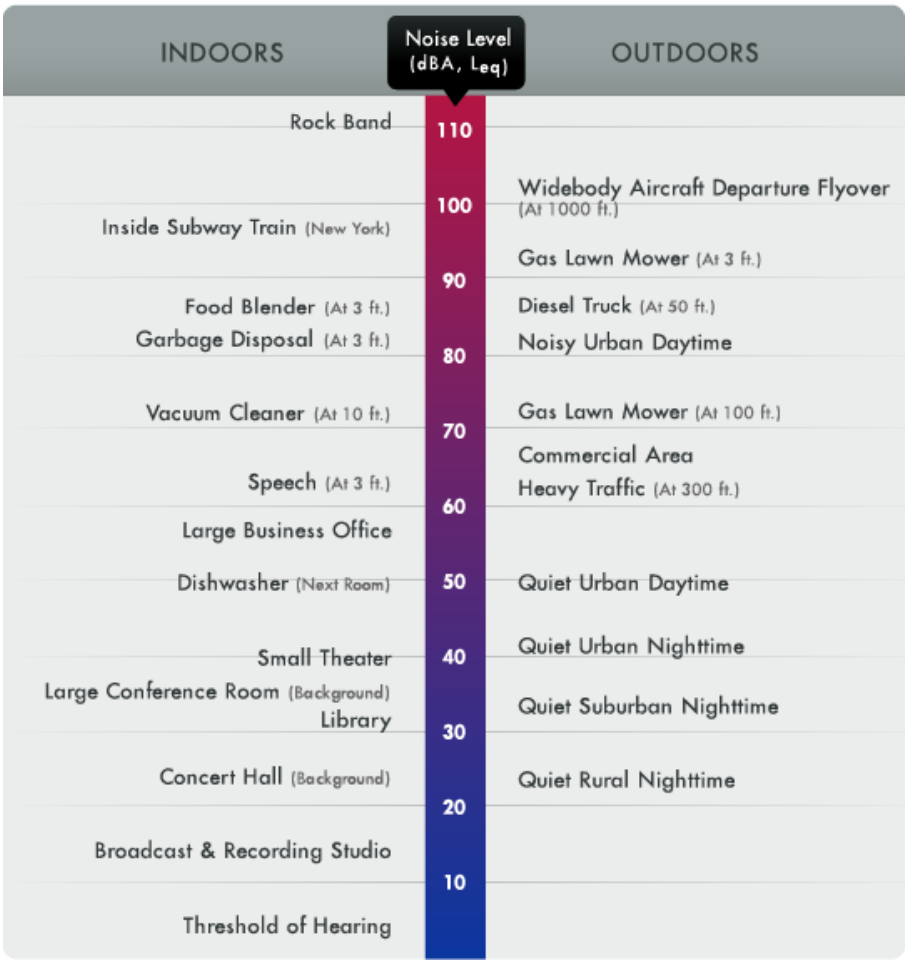
For environmental noise analyses, a noise metric refers to the unit that quantitatively measures the effect of noise on the environment. The unit used to describe the intensity of sound is the decibel (dB). Audible sounds range from 0 dB ("threshold of hearing") to about 140 dB ("threshold of pain"). The normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 2015f). The A-weighted scale, denoted as dBA, approximates the range of human hearing by filtering out lower frequency noises, which are not as damaging as the higher frequencies. The dBA scale is used in most noise ordinances and standards (OSHA, 2013).

Measurements and descriptions of noise (i.e., sounds) and vibrations are based on various combinations of the following factors (USDOT FTA, 2006):

- The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound.
- The total sound energy radiated by a source, usually reported as a sound power level.

- The actual air pressure changes experienced at a particular location, usually measured as a sound pressure level (SPL) (the frequency characteristics and SPL combine to determine the loudness of a sound at a particular location).
- The duration of a sound.
- The changes in frequency characteristics or pressure levels through time.

Figure 3.1.13-1 presents the sound levels of typical events that occur on a daily basis in the environment. For example, conversational speech is measured at about 55 to 60 dBA, whereas a band playing loud music may be as high as 120 dBA.



Source: (Sacramento County Airport System, 2015)

Prepared by: Booz Allen Hamilton, 2005.
Leq = Equivalent Continuous Sound Level

Figure 3.1.13-1: Sound Levels of Typical Sounds

Because of the logarithmic unit of measurement, sound levels cannot be added or subtracted linearly. However, several methods of estimating sound levels can be useful in determining approximate sound levels. First, if two sounds of the same level are added, the sound level increases by approximately three dB (for example: 60 dB + 60 dB = 63 dB). Secondly, the sum

of two sounds of a different level is slightly higher than the louder level (for example: 60 dB + 70 dB = 70.4 dB).

The changes in human response to changes in dB levels is categorized as follows (USDOT FTA, 2006):

- A 3-dB change in sound level is considered a barely noticeable difference;
- A 5-dB change in sound level will typically result in a noticeable community response; and
- A 10-dB change, which is generally considered a doubling of the sound level, almost certainly causing an adverse community response.

In general, ambient noise levels are higher during the day than at night and typically this difference is about 10 dB (USEPA, 1973). The ambient noise levels can differ considerably depending on whether the environment is urban, suburban, or rural.

Related to noise, vibration is a fluctuating motion described by displacement with respect to a reference point. Depending on the intensity, vibrations may create perceptible ground shaking and the displacement of nearby objects as well as rumbling sounds. Table 4.1.13-1 lists vibration source levels produced by typical construction machinery and activities at a distance of 25 feet in units of vibration decibels (VdB). The vibration thresholds for human perceptibility and potential building damage are 65 and 100 VdB, respectively *(FTA 2006*).

Table 3.1.13-1: Vibration Source Levels for Select Construction Equipment (VdB)

Equipment[a]	VdB at 25 feet Away
Pile Driver (impact type)	104-112
Pile Driver (sonic or vibratory type)	93-105
Vibratory Roller	94
Hoe Ram	87
Large Bulldozer	87
Caisson Drilling	87
Loaded Trucks	86
Jackhammer	79
Small Bulldozer	58

Source: (FTA, 2006)

VdB = vibration decibels

[a] The types of equipment listed in this table are included for reference purposes only. It is possible that not all equipment types listed here would be used in the deployment and operation of the Proposed Action.

3.1.13.2. Specific Regulatory Considerations

As identified in Appendix C, the Noise Control Act of 1972, along with its subsequent amendments (e.g., Quiet Communities Act of 1978 [42 U.S.C. Parts 4901−4918]), delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Although no federal noise regulations exist, the USEPA has promulgated noise guidelines (USEPA, 1974). Similarly, most states have no quantitative noise-limit regulations.

Connecticut's statewide noise law (Connecticut Public Law Chapter 442: Noise Pollution Control) authorizes the Commissioner of the CT DEEP to develop and maintain statewide noise regulations and policies (Table 3.1.13-2) (CGA, 2015).

Table 3.1.13-2: Relevant Connecticut Noise Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
Connecticut General Statute, Title 22a, Environmental Protection, Chapter 442 Sections 22a-67 to 22a-76, Noise Pollution Control	Connecticut General Assembly	Establishes policy, research, and activities in noise control, authorizes establishment and enforcement of state noise emission standards, and to provides information to the public about noise pollution and its control.
Connecticut Regulations for the Control of Noise (http://www.ct.gov/deep/lib/deep/regulations/22a/22a-69-1through7.pdf)	CT DEEP	Under Connecticut General Statutes, Section 22a-73, CT DEEP reviews and approves municipal noise ordinances.

Source: (CGA, 2015)

Under Connecticut General Statute Section 22a-73, CT DEEP detailed provisions of the state's noise regulations, and split applicable land uses into three distinct classes for determining environmental noise nuisance: Class A, which covers most residential uses; Class B, which covers commercial properties; and Class C, which covers a wide variety of industrial areas (CT DEEP, 1978). These provisions restrict noise from sources within the land use classes that would reach other properties, as shown in Table 3.1.13-3.

Table 3.1.13-3: Connecticut Noise Restrictions by Land Use Class

Connecticut Noise Restrictions by Land Use Class, Including Classes A – C				
Source Land Use Class C				
Receptor Land Use Class	Class C	Class B	Class A (Day)	Class A (Night)
Maximum Noise Level	70 dBA	66 dBA	61 dBA	51 dBA
Source Land Use Class B				
Receptor Land Use Class	Class C	Class B	Class A (Day)	Class A (Night)
Maximum Noise Level	62 dBA	62 dBA	55 dBA	45 dBA
Source Land Use Class A				
Receptor Land Use Class	Class C	Class B	Class A (Day)	Class A (Night)
Maximum Noise Level	62 dBA	55 dBA	55 dBA	45 dBA

Source: (CT DEEP, 1978)

If the baseline noise level is higher than the values presented in Table 3.1.13-3, the source is also considered to be creating excess noise if it creates noise levels that are 5 dBA higher than the baseline (CT DEEP, 1978).

Many cities and towns may have additional, local noise ordinances to further manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Large cities and towns, such as Bridgeport, Hartford, and New Haven are likely to have different regulations than rural or suburban communities largely due to the population density and difference in ambient noise levels (USDOT, 2011).

3.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in Connecticut varies widely based on the area and environment. The population of Connecticut can choose to live and interact in areas that are large cities, suburban areas, rural communities, and national and state parks. Figure 3.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Connecticut may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Connecticut. As such, this section describes the areas where the population of Connecticut can potentially be exposed to higher than average noise levels.

- **Urban Environments:** Urban areas are likely to have higher noise levels on a daily basis due to highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (DOI, 2008). The urban areas that are likely to have the highest ambient noise levels in the state are Bridgeport (and its neighboring boroughs and cities), New Haven, Stamford, Hartford, and Waterbury.
- **Airports:** Areas surrounding airports tend to have higher noise levels due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2015f). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports is in the proximity to urban communities resulting in noise exposure from aircraft operations (arrivals/departures) to surrounding areas at higher levels and with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In Connecticut, Bradley International Airport (BDL) and Tweed New Haven Regional Airport (HVN) have combined annual operations of more than 128,000 flights (FAA, 2015d). These operations result in increased ambient noise levels in the surrounding communities. In addition, residents of Danbury and Bridgeport may also experience increased ambient noise levels from aircraft operations at the general aviation airports of Danbury Municipal (DXR) and Igor I Sikorsky Memorial (BDR). See Section 3.1.1, Infrastructure, and Figure 3.1.1-1 for more information about airports in the state.
- **Highways:** Communities near major highways also experience higher than average noise levels when compared to areas that are not in close proximity to a highway (USDOT, 2015c). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living near those transportation corridors. The major highways within the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (USDOT, 2015c). See Section 3.1.1, Infrastructure, and Figure 3.1.1-1 for more information about the major highways in the state.

- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (USDOT FTA, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (USDOT FRA, 2015). Connecticut has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend from Hartford to New York, NY and New Haven to Providence, RI. There are also a number of other rail corridors that join these major rail lines and connect with other cities (ConnDOT, 2013b). See Section 3.1.1, Infrastructure, and Figure 3.1.1-1 for more information about rail corridors in the state.
- **National and State Parks:** The majority of national and state parks are likely to have lower than average ambient noise levels. National and state parks, historic areas, and monuments are protected areas with one aspect to "maintain the resilience of the natural soundscape136" (Friemund 2015). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014e). Connecticut has one National Historic Site, one National Historic Trail, two Scenic Trials, and one National Historic Corridor, which are all or partly managed by the NPS (NPCA, 2017) (NPS, 2015b). Connecticut also has 65 state parks and 27 state forests (CT DEEP, 2016c). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 11.1.7, Land Use, Recreation, and Airspace and Section 3.1.8, Visual Resources for more information about national and state parks in Connecticut.

3.1.13.4. Sensitive Noise Receptors

Noise-sensitive receptors include residences, schools, medical facilities, places of worship, libraries, churches, nursing homes, concert halls, playgrounds, and parks. Sensitive noise receptors are typically areas where the intrusion of noise can disrupt the use of the environment. A quiet urban area usually has a typical noise level in the daytime of 50 dBA, and 40 dBA during the evening. Noise levels in remote wilderness and rural nighttime areas are usually 30 dBA (BLM, 2014). Most cities, towns, and villages in Connecticut have at least one school, church, or park, in addition to likely having other noise-sensitive receptors. There are most likely thousands of sensitive receptors throughout the state of Connecticut.

3.1.14. Climate Change

3.1.14.1. Definition of the Resource

Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is defined as "…a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or human activity." (IPCC, 2007)

[136] A soundscape is the acoustic environment that encompasses an area, and includes natural and human/manmade sounds.

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 2012d). The IPCC is now 95 percent certain that human activities are the main cause of current global warming (IPCC, 2013). Human activities result in emissions of four main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons (a group of gases containing fluorine, chlorine, or bromine) (IPCC, 2007). The common unit of measurement for GHGs is metric tons of CO_2-equivalent (MT CO_2e[137]), which equalizes for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units will be in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units will be in MMT CO_2e.

The IPCC reports that "global concentrations of these four GHGs have increased significantly since 1750" with "Atmospheric concentrations of CO_2 increased from 280 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (IPCC, 2007). The atmospheric concentration of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270 parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (IPCC, 2007). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (IPCC, 2007).

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this PEIS (see Section 3.2, Environmental Consequences). Existing climate conditions in the area of the Proposed Action are described first by state and sub-region, where appropriate, and then by future projected climate scenarios. The discussion focuses on the following climate change impacts: 1) temperature; 2) precipitation; 3) sea level; and 4) severe weather events (including tropical storms, tropical cyclones, and hurricanes).

3.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C. The Council on Environmental Quality (CEQ) published draft National Environmental Policy Act (NEPA) guidance on the consideration of the effects of climate change and greenhouse gas in February of 2010. Revised draft guidance was published in December 2014 and in August 2016 (after publication of the Draft PEIS) CEQ published its final guidance. This guidance is applicable to all federal agency actions and is meant to facilitate compliance within the legal requirements of NEPA. The CEQ guidance describes how federal agency actions should evaluate GHG and climate change effects in their NEPA reviews, using GHG emissions as a proxy for assessing a proposed action's potential effect on climate change. CEQ defines GHGs to include CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, which is in accordance with Section 19 (m) of *Executive Order 13693*. The final CEQ guidance suggests that agencies consider "(1) the potential effects of a proposed action on

[137] CO_2e refers to Carbon Dioxide Equivalent, "A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as million metric tons of carbon dioxide equivalents ($MMTCO_2e$). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. $MMTCO_2e$ = (million metric tons of a gas) * (GWP of the gas)" (USEPA, 2015n).

climate change as indicated by assessing GHG emissions (e.g. to include, where applicable, carbon sequestration); and (2) the effects of climate change on a proposed action and its environmental impacts." The final guidance recommends that agencies quantify an action's projected direct and indirect GHG emissions when data inputs are reasonably available to support calculations. The final guidance states that "agencies should be guided by the principle that the extent of the analysis should be commensurate with the quantity of the projected GHG emissions and take into account available data and GHG quantification tools that are suitable for and commensurate with the proposed agency action." In addition, CEQ recommends agencies evaluate project emissions and changes in carbon sequestration and storage, when appropriate, in assessing a proposed action's potential climate change impacts. The analysis should assess direct and indirect climate change effects of a proposed project including connected actions, the cumulative impacts of its proposed action, and reasonable alternatives. CEQ advises that climate change effects on the environmental consequences of a proposed action should be described based on available studies, observations, interpretive assessments, predictive modeling, scenarios, and other empirical evidence. The temporal bounds should be limited by the expected lifetime of the proposed project. Mitigation and adaptation measures should be considered in the analysis for effects that occur immediately and in the future.

Connecticut has established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 3.1.14-1, three key state laws/regulations are the primary policy drivers on climate change preparedness and GHG emissions.

Table 3.1.14-1: Relevant Connecticut Climate Change Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Public Act 04252 [Sec. 2 (b)]: "An Act Concerning Climate Change"	Governor's Steering Committee on Climate Change	Created the 2005 Connecticut Climate Action Plan, which identified 38 measures to reduce CO_2e emissions by 2010 and 2020.
Public Act No. 08-98: "An Act Concerning Connecticut Global Warming Solutions"	Adaptation Subcommittee of the Governor's Steering Committee on Climate Change	Created the Connecticut Climate Preparedness Plan to evaluate "the projected impacts of climate change on Connecticut agriculture, infrastructure, natural resources and public health and develop strategies to mitigate these impacts."
2013 Comprehensive Energy Strategy for Connecticut	Connecticut's Department of Energy and Environmental Protection	Organizes recommendations in five sectors: energy efficiency; industrial; electricity (including renewable power); natural gas; and transportation to reduce state GHG emissions.

Sources: (Connecticut Governor's Steering Committee on Climate Change, 2005), (CT DEEP, 2013e), (CT DEEP, 2013f)

In addition, Connecticut has established other action plans that address some of the impacts of climate change events. For example, Connecticut created a "Natural Hazards Mitigation Plan Update" in January 2014 to meet FEMA guidelines set forth in the Disaster Mitigation Act of 2000. This Plan represents Connecticut's efforts to approach mitigating the effects of natural disasters on a multi-hazard basis, and shifts from a disaster-response driven system to one based on effective hazard mitigation planning" (CT DEEP, 2014o). Connecticut is also one of nine states participating in the Regional Greenhouse Gas Initiative (RGGI). RGGI is a CO_2 emissions trading scheme, launched in 2008, which sets an annual cap on CO_2 emissions from power plants

over 25 MW capacity within those nine states. The cap for 2015 was set at 88.7 million short tons of CO_2, with an annual reduction of 2.5 percent per year until 2020 (RGGI, 2015).

3.1.14.3. Connecticut's Greenhouse Gas Emissions

Estimates of Connecticut's total GHG emissions vary. The Department of Energy's Energy Information Agency (EIA) collects and disseminates national-level emission on CO_2 from fossil fuels by state. In addition, EIA maintains data on other GHGs such as CH_4 and nitrous oxide (NO_x), but these are not broken down by state (EIA, 2011). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2014d). Individual states have developed their own GHG inventories and these are updated with different frequencies and trace GHG in different ways.

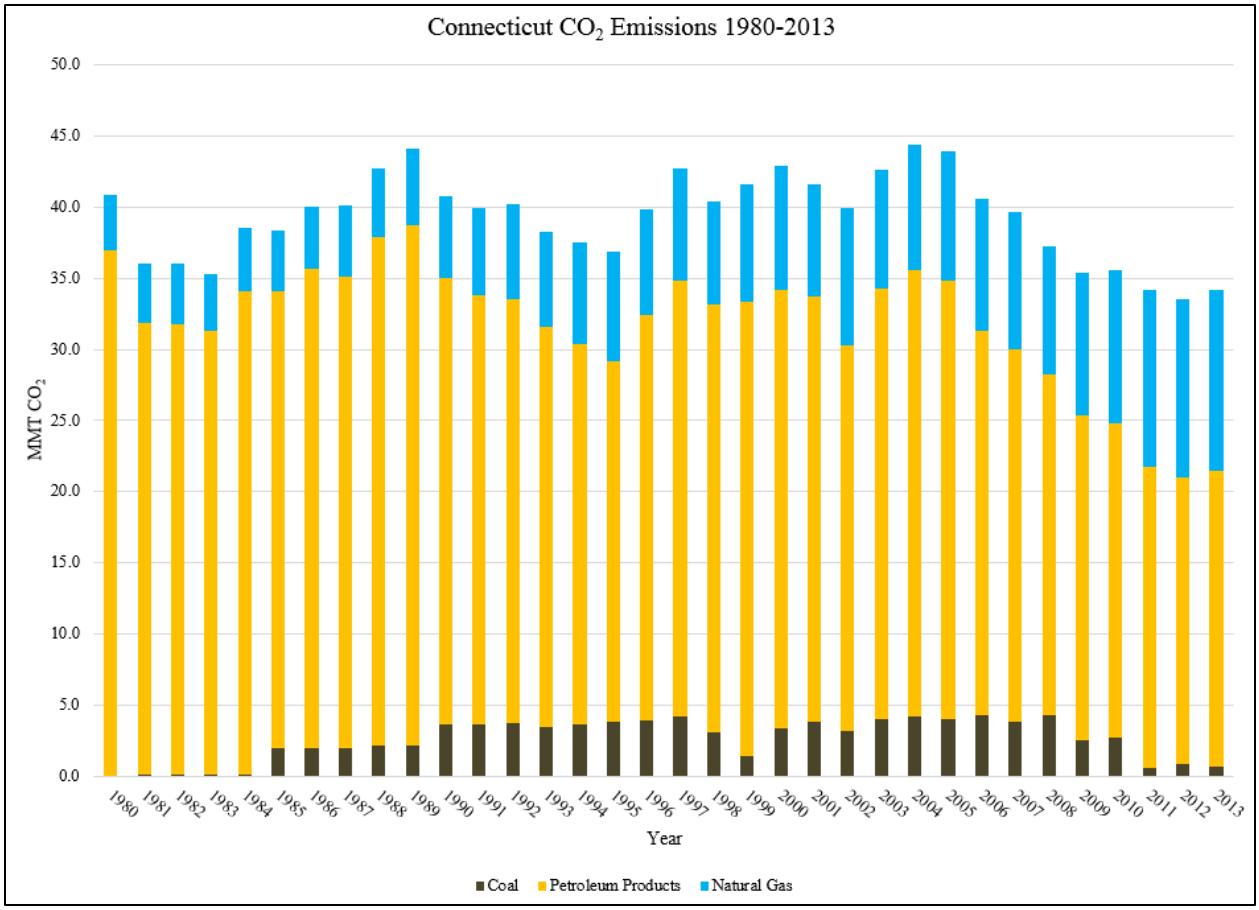
For the purposes of this PEIS, the EIA data on CO_2 emission will be used as the baseline metric to ensure consistency and comparability across the 50 states. However, if additional data sources are available for a given state, they will be described and cited.

According to the EIA, Connecticut emitted 35.1 MMT of CO_2 in 2014, with transportation being the highest emitter (Table 3.1.14-2) (EIA, 2014b). Annual emissions between 1980 and 2014 declined by 14.2 percent. The decline was led by emissions reductions from petroleum products by the transportation sector, supplemented by reductions in emissions from coal by the electric power sector (EIA, 2014b). Connecticut is ranked 41st in the U.S. in total CO_2 emissions, and 45th in the U.S. for per capita emissions (EIA, 2014c).

Table 3.1.14-2: Connecticut CO_2 Emissions from Fossil Fuels by Fuel Type and Source, 2014

Fuel Type	Emissions (MMT)	Source	Emissions (MMT)
Coal	0.9	Residential	7.4
Petroleum Products	21.4	Commercial	3.8
Natural Gas	12.8	Industrial	2.1
		Transportation	15.1
		Electric Power	6.7
Total	**35.1**	**Total**	**35.1**

Source: (EIA, 2014b)



Source: (EIA, 2013)

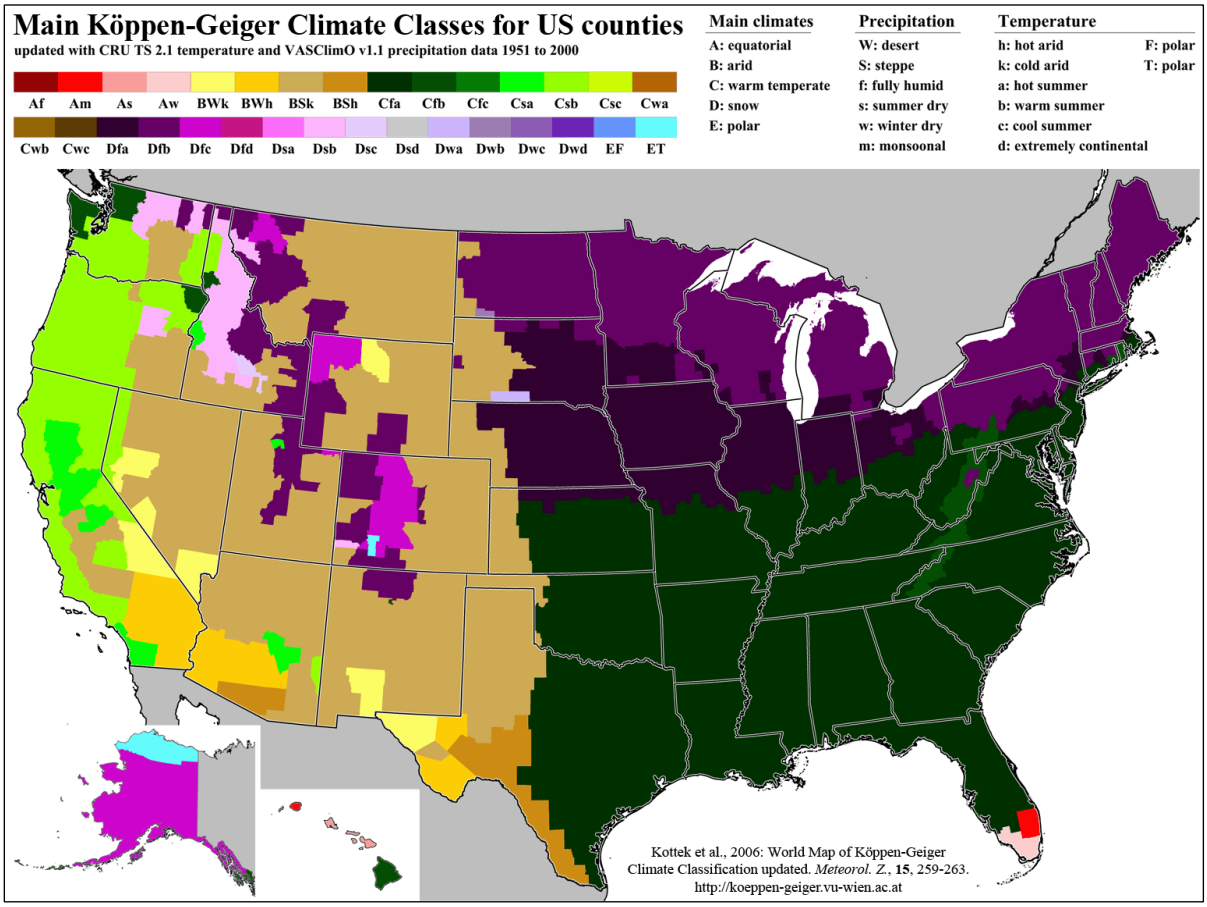
Figure 3.1.14-1: Connecticut CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

3.1.14.4. Environmental Setting: Existing Climate

The National Weather Service defines climate as "The composite or generally prevailing weather conditions of a region, throughout the year, averaged over a series of years." (NWS, 2009). The widely accepted division of the world into major climate categories is referred to as the Köppen-Geiger climate classification system. Climates within this system are classified based "upon general temperature profiles related to latitude" (NWS, 2011). The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly temperature characteristics (NWS, 2006).

Across the United States, the five most common climate groups are (A), (B), (C), (D), and I. Hartford and Middleton are within the (D) climate group. Climates classified as (D), are "moist continental mid-latitudinal climates," with "warm to cool summers and cold winters" (NOAA, 2006) (NOAA, 2015c). In (D) climates, the "average temperature of the warmest month is greater than 50 degrees Fahrenheit (°F), while the coldest month is less than negative 22 °F" (NOAA, 2006) (NOAA, 2015c). Winter months in (D) climate zones are cold and severe with

"snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NOAA, 2006) (NOAA, 2015c). Stamford, Danbury, and Norwalk are within the (C) climate group. Climates classified as (C) generally have "warm and humid summers with mild winters," including many thunderstorms during summer months (NOAA, 2006) (NOAA, 2015c). During winter months, "the main weather feature is the mid-latitude cyclone" (NOAA, 2006) (NOAA, 2015c).



Source: (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006)

Figure 3.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Sub-climates

Connecticut has three sub-climate categories, which are described in the following paragraphs. The majority of Connecticut falls into climate group Dfa and Dfb, with southern areas of the state falling into Cfa (NWS, 2011) (NWS, 2006).

Cfa – The Köppen-Geiger climate classification system classifies Stamford, Danbury, and Norwalk as Cfa. Cfa climates are generally warm, with humid summers and mild winters. Connecticut's secondary classification indicates year-round rainfall, but it is highly variable; thunderstorms are dominant during summer months. The tertiary classification indicates mild,

hot summers, with average temperatures of warmer months above 72°F. Average temperatures of the coldest months are under 64°F (NWS, 2006).

Dfa – The Köppen-Geiger climate classification system classifies middle and northern portions of Connecticut, such as Hartford and Middleton, as Dfa. Climates classified as Dfa are characterized by warm and humid temperatures, with hot summers and regular precipitation all year (see Figure 3.1.14-2 above). Connecticut's Dfa climate group is a continental, mid-latitude climate. Connecticut's secondary classification indicates substantial precipitation during all seasons. Connecticut's tertiary classification indicates hot summer months, with warmer temperatures averaging above 71.6°F (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006) (NWS, 2011) (NWS, 2006).

Dfb – Portions of eastern and western Connecticut, such as Norfolk and Putnam, are classified as Dfb. Climates classified as Dfb are characterized as humid, with warm summers and snowy winters (see Figure 3.1.14-2 above). Connecticut's secondary classification indicates substantial precipitation during all seasons. Connecticut's tertiary classification indicates that at least four months out of the year average above 50°F (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006) (NWS, 2011) (NWS, 2006).

3.1.14.5. Existing Climate

This section discusses the current state of Connecticut's climate with regard to temperature, precipitation, sea level, stream flow, and extreme weather events (e.g., tropical storms, tropical cyclones, and hurricanes) in Connecticut's three climate regions: Cfa, Dfa, and Dfb.

Air Temperature

The highest temperature to occur in Connecticut was on July 15, 1995 with a record high of 106°F (NOAA NCEI, 2015). The coldest temperature to occur in Connecticut was on February 16, 1943 with a record low of negative 32°F (NOAA NCEI, 2015). Winters are typically severe, "with snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NWS, 2011). Temperatures in January typically average 27°F, while temperatures in July typically average 70°F for most of the state (NOAA, 2015c). While temperatures above 100°F are uncommon, they do occur in southern areas of the state (NOAA, 2006) (NOAA, 2015c) (NWS, 2011).

The average annual high temperature in Connecticut is 60.3°F (NOAA, 2015c). The average annual low temperature in Connecticut is 44.7°F (NOAA, 2015c). The overall average annual temperature in Connecticut is 52.5°F (NOAA, 2015c). Coastal towns or cities typically have warmer winters and colder summers than the inland areas of Connecticut (NOAA, 2006) (NOAA, 2015c). For example, in Norfolk, temperatures in January average 22°F and 66°F in July (NOAA, 2015c). Bridgeport on the other hand, averages 30°F in January and 71°F in July (NOAA, 2015c).

The Köppen-Geiger climate classification system classifies Connecticut's air temperatures into three climate regions, as described below.

Cfa – Stamford, Danbury, and Norwalk are within the climate classification Cfa. Stanford has an annual average mean temperature of approximately 52.3°F; 41.3°F during winter months; and 63.2°F during summer months (NOAA, 2015c). The summer climate in cities such as Stamford, Danbury, and Norwalk is cooler than other more northern areas of the state (NWS, 2011) (NWS, 2006) (NOAA, 2006).

Dfa – Central Connecticut is within the climate classification zone Dfa. The average annual mean temperature for this area is approximately 50.6°F, while the coldest months can drop below 10°F (NOAA, 2006) (NOAA, 2015c). Winters in Dfa climate areas are typically cold, with "snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NWS, 2011). Hartford, in central Connecticut, has an average annual temperature of 51.2°F (NOAA, 2015c). Hartford has an average temperature of 30.0°F during winter months; 71.9°F during summer months; 49.1°F during spring months; and 53.4°F during autumn months (NOAA, 2015c) (NWS, 2011) (NWS, 2006).

Dfb – Parts of eastern and western Connecticut are within the climate classification zone Dfb. Climates classified as Dfb typically experience humidity, severe winters, and warm summers. Norfolk, in western Connecticut, has an average annual temperature of 45.4°F (NOAA, 2015c). Norfolk has an average temperature of 23.8°F during winter months; 66.2°F during summer months; 43.5°F during spring months; and 48.0°F during autumn months (NOAA, 2015c). Norfolk regularly experiences temperatures five to ten degrees (°F) cooler than other regions such as Hartford (CT DEEP, 2009b). Windham, in eastern Connecticut, has an average annual temperature of 49.5°F (NOAA, 2015c). Windham has an average temperature of 28.8°F during winter months; 69.6°F during summer months; 47.5°F during spring months; and 51.7°F during autumn months (NOAA, 2015c) (NWS, 2006) (NOAA, 2006) (NOAA, 2015c) (CT DEEP, 2009b).

Precipitation

Topography within the state and proximity to the Atlantic Ocean strongly influences the distribution of rainfall. Weather systems from the Gulf of Mexico and the Atlantic Ocean are primarily responsible for transporting precipitation into Connecticut through circulation patterns and storm systems. Overall, Connecticut experiences a substantial amount of precipitation throughout the year, although, this is sometimes variable. For example, Connecticut experienced heavy snows during the winter of 2010 – 2011, but experienced no snow accumulation the following winter (McCarthy, 2013). However, even during Connecticut's drier seasons, there is still significant precipitation accumulation as compared to other states (McCarthy, 2013) (NOAA, 2006) (NOAA, 2015c).

On average, the state receives an annual rainfall amount of 42.74 inches (NOAA, 2006). In addition to rainfall, Connecticut commonly experiences abundant snowfall. On average, the state receives an annual amount of 29 inches or more of snow (NOAA, 2015c) (McCarthy, 2013). Between 1895 and 2011, precipitation in the Northeast has increased by 5 inches, or 0.4 inches per decade (more than a 10 percent increase) (McCarthy, 2013). The Northeast region of the United States has experienced "a greater increase in extreme precipitation over the past few

decades than any other region in the United States" (McCarthy, 2013). Between 1958 and 2010, the amount of heavy precipitation events increased by 74 percent in the Northeast region (McCarthy, 2013) (NOAA, 2006) (NOAA, 2015c).

The Köppen-Geiger climate classification system classifies Connecticut's precipitation accumulation averages into three climate regions, as described below.

Cfa – Close proximity to the Atlantic Ocean moderates snowfall within the state, especially in coastal areas (CT DEEP, 2012d). Annual accumulations of snowfall average around 30 inches within coastal areas of Connecticut (CT DEEP, 2012d). On average, this coastal area receives approximately 46.33 inches of rainfall annually (NOAA, 2006) (NOAA, 2015c).

Dfa – Hartford is in central Connecticut, within the climate classification zone Dfa. This area on average receives approximately 45.85 inches of precipitation annually (NOAA, 2015c). Hartford receives an average of 9.56 inches of precipitation during winter months; 12.46 inches of precipitation during summer months; 11.69 inches of precipitation during spring months; and 12.14 inches of precipitation during autumn months (NOAA, 2015c). Central and inland areas of Connecticut receive approximately 40 inches of snowfall per year (CT DEEP, 2012d). Hartford, in central Connecticut, receives an average of 48.2 inches of snowfall per year (NOAA, 2015d) (NOAA, 2006) (NOAA, 2015c).

Dfb – Parts of northeastern and northwestern Connecticut are within the climate classification zone Dfb. Climates classified as Dfb typically experience severe winters. Norfolk is known as the "coldest and snowiest town in the state" due to its high elevation (CT DEEP, 2012d). The average annual snowfall amount in areas of northwest Connecticut is 60 inches (CT DEEP, 2012d). Norfolk, in northwest Connecticut, receives approximately 50 inches of snowfall annually (CT DEEP, 2015ak). Average annual rainfall in Norfolk is 53.12 inches (NOAA, 2015c). The average annual rainfall for northwestern areas of Connecticut is 48.47 inches (NOAA, 2015c). The average annual precipitation amount in areas of northeast Connecticut, such as Windham, is 48.42 inches (NOAA, 2015c). Putnam, in the top east corner of Connecticut, averages slightly higher annual accumulations of rainfall, with 50.04 inches (NOAA, 2006).

Sea Level

Connecticut has approximately 332 miles of coastline, "including bays, harbors, and coves" and 1,065 miles of coastal shoreline when "all saltwater influenced watercourses are included" (CT DEEP, 2015al). Tide gauges located in coastal New London and Bridgeport track relative sea level rise in Connecticut (to include geologic subsidence and uplift). Between 1938 and 2006, tide gauges in New London recorded a mean sea level rise of 2.25mm per year (CT DEEP, 2010). Between 1964 and 2006, tide gauges in Bridgeport recorded a mean sea level rise of 2.56mm per year (CT DEEP, 2010). These values exceed previous rates of sea level rise for other states due to Connecticut's rate of subsidence. As sea level continues to rise, the risks associated with living along the coast also rise. Further land subsidence is putting already low-lying areas of Connecticut at an even greater risk for flooding, storm surges, and inundation (CT DEEP, 2015al) (CT DEEP, 2010).

Severe Weather Events

In Connecticut, coastal storm intensity is projected to increase. In addition, the annual number of winter storms is projected to increase in coastal areas. "For its location in temperate latitudes, Connecticut is particularly vulnerable to hurricanes due to the southern exposure and east-west orientation of its shoreline" (CT DEEP, 2010). During one 16-year period, six hurricanes struck Connecticut, "four of which were Category 3 hurricanes: The Great New England Hurricane of 1938, the Great Atlantic Hurricane of 1944, and Hurricanes Carol and Edna in 1955" (CT DEEP, 2010). The Great New England Hurricane was the "deadliest disaster in the history of Connecticut and New England in general," killing 125 people in six hours (CT DEEP, 2010).

Connecticut is directly adjacent to the Atlantic Ocean, which makes the state highly vulnerable to coastal storms and flooding. Coastal areas, along with other low-lying areas in Connecticut, are subject to "flooding from severe storms or regular extended precipitation events" (CT DEEP, 2012e). Flooding is considered the "foremost natural hazard" for Connecticut (CT DEEP, 2012e). Floods in Connecticut are classified into three categories: riverine, flash, and coastal flooding. Connecticut has no distinct flooding season, "in fact, major flooding can occur in almost any month of the year" (CT DEEP, 2012e). However, the National Oceanic and Atmospheric Administration (NOAA) has identified three times of the year that are particularly vulnerable to flood activity: late winter/spring melt, late summer/early fall, and early winter. FEMA has recorded that since 1954, eleven major flooding events have resulted in federally declared disasters (CT DEEP, 2015al) (CT DEEP, 2012e).

One of the most costly, widespread, and damaging floods to occur in Connecticut was in June 1982 (CT DEEP, 2012e). During this storm, "three to 16 inches of rain fell over most of Connecticut" fell between June 4 and June 7 (CT DEEP, 2012e).In total, Connecticut estimated "more than $276 million (1982 dollars)" worth of damage (CT DEEP, 2012e). The storm was also responsible for eleven deaths, and the destruction of 15,000 homes (CT DEEP, 2012e).

Heavy winds in Connecticut can also contribute to property loss and damage (CT DEEP, 2012f). Five types of damaging winds affect Connecticut: straight-line winds, downdrafts, downbursts, microbursts, and gust fronts (CT DEEP, 2012f). Winter winds originating from the northwest "prevail at greater velocities, often in excess of approximately 38 miles per hour (mph)" (CT DEEP, 2012f). Storms during the late winter and early spring are most likely in Connecticut, with winds originating from the east (CT DEEP, 2012f).

Winter storms, or Nor'easters, produce "high winds, storm surges, and massive amounts of precipitation" (CT DEEP, 2012g). Winter storms, coupled with the following three criteria, can lead to extreme coastal flooding: "winds greater than 30 mph lasting more than 12 hours, wind direction in a range from the northeast to the east-southeast, and astronomical high tides" (CT DEEP, 2012g). The last winter storm that met all three of these criteria was in December 1992. This storm generated winds that reached 55 mph and a 10.16 foot high tide, the "third highest recorded [high tide] in Long Island Sound" (CT DEEP, 2012g). Strong winter storms in Connecticut occur so frequently, that they "cause more coastal flooding, erosion, and annual damage to property than do hurricanes" (CT DEEP, 2012g). In addition to heavy rainfall and associated flooding, "frozen precipitation is a unique hazard associated with winter storms" (CT

DEEP, 2012g). Frozen precipitation includes "sleet, freezing rain, snow, and hail" all of which can "create hazardous conditions on roads and walkways, and damage infrastructure like power lines, buildings and trees from the weight of ice and snow" (CT DEEP, 2012g).

The following paragraphs describe severe weather events as they occur in the various climate classification zones:

Cfa – Coastal areas of Connecticut, such as Norwalk and Westport, are particularly vulnerable to coastal flooding and storm surge (CT DEEP, 2012h). In 1985, Hurricane Gloria made landfall in Westport, and resulted in a 5.8-foot peak surge at New London (CT DEEP, 2012h). Although this peak storm surge was relatively low, this storm occurred during low tide. Had this storm occurred during high tide, the flooding would have been significantly more severe (CT DEEP, 2012h).

Dfa – In addition to coastal storm vulnerabilities, areas of central Connecticut, such as Hartford, are subject to severe winds, winter storms, hurricanes, and flooding. As was observed during Hurricane Sandy, inland properties and structures may be more vulnerable to hurricanes and inland flooding than those in coastal areas may, as building codes are less strict (NOAA NOS, 2004).

Dfb – Areas of eastern and western Connecticut, classified as a Dfb climate, are subject to strong winds, winter storms, hurricanes, and flooding. Although it is uncommon for hurricanes to travel inshore once they make landfall, storms can re-intensify if they come into contact and combine with pre-existing low-pressure storms. In 1991, Hurricane Bob mainly affected eastern Connecticut, however, it hit as far west as the Connecticut River (CT DEEP, 2012h). The heaviest amounts of rainfall during the storm totaled 7 inches and resulted in six deaths (CT DEEP, 2012h) (Ho, Su, Hanevich, Smith, & Richards, 1987).

3.1.15. Human Health and Safety

3.1.15.1. Definition of the Resource

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the construction, operation, and maintenance of towers, antennas, cables, utilities, and other equipment and infrastructure at existing and potential FirstNet telecommunication sites. There are two human populations of interest within the existing environment of health and safety, (1) telecommunication occupational workers and (2) the general public near telecommunication sites. Each of these populations could experience different degrees of exposure to hazards as a result of their relative access to FirstNet telecommunication sites and their function throughout the implementation of the FirstNet telecommunication network infrastructure.

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) emissions, vehicular traffic, or the transportation of hazardous materials and wastes. RF is

evaluated in Section 2.4, Radio Frequency Emissions. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 3.1.1, Infrastructure.

There are unique infectious diseases throughout the continental U.S. because of the great variety of diseases, as well as the variables associated with contracting them, this PEIS will not be evaluating infectious diseases. For information on Infectious Diseases, please visit the Centers for Disease Control and Prevention website at www.CDC.gov.

3.1.15.2. Specific Regulatory Considerations

Federal agencies, such as the Occupational Safety and Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. Federal OSHA regulations apply to workers through either OSHA, or stricter state-specific plans, which must be approved by OSHA. Connecticut has an OSHA-approved "State Plan," which allows CTDOL to enforce occupational safety and health laws and regulations for its state and local public sector employees, through the Connecticut Occupational Safety and Health Division (CONN-OSHA). The occupational health and safety of private workers is regulated only by the Federal OSHA laws and regulations, not CONN-OSHA. Additionally, the Connecticut Department of Public Health (CTDPH) regulates health and safety of the public. CT DEEP regulates waste and environmental pollution.

Federal laws relevant to protect occupational and public health and safety are summarized in Appendix C. Table 3.1.15-1 below summarizes the major Connecticut laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 3.1.15-1: Relevant Connecticut Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Regulations of Connecticut State Agencies, Section 31, Connecticut Occupational Safety and Health Act	CONN-OSHA	Details Connecticut's adoption of federal standards and authorizes CONN-OSHA to conduct workplace inspections of state and local public sector employers to ensure compliance with the standards.
Regulations of Connecticut State Agencies, Section 31-53b	CTDOL	Describes the requirements for construction safety and health training in public works projects.
Regulations of Connecticut State Agencies, Section 22a-449(c)	CT DEEP	Describes the waste transportation permit process managed by the CT DEEP Bureau of Materials Management and Compliance Assurance, including standards for generators and transporters of hazardous waste, used oil and universal waste management, and land disposal restrictions.

State Law/Regulation	Regulatory Agency	Applicability
General Statutes of Connecticut, Title 22a, Chapter 445	CT DEEP	"The purpose of this chapter is to establish a process for the siting of hazardous waste facilities that will protect the health and safety of Connecticut citizens and assure responsible economic development and to have that siting process be at least as strict as that required by federal law."
Regulations of Connecticut State Agencies, Section 19-24	CT DEEP	Describes state regulations relating to the labelling, shipment, instruction, and reporting of radiation sources and radioactive materials.

Sources: (CTDOL, 2012), (Connecticut Secretary of State, 2017), (Justia, 2017d), (CTSOTS, 2015)

3.1.15.3. Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over water bodies, and on communication towers. Tasks may also be performed at dangerous heights, inside trenches or confined spaces, while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring (OSHA, 2016a). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

Working from height, overhead work, and slips, trips, or falls – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights up to 2,000 feet above the ground's surface (OSHA, 2015a). In addition to tower climbing hazards, telecommunication workers have restricted workspace on rooftops or work from bucket trucks parked on uneven ground. Cumulatively, these conditions present fall and injury hazards to telecommunication workers, and the public who may be observing the work or transiting the area. (International Finance Corporation, 2007)

Trenches and confined spaces – Installation of underground utilities, building foundations, and work in utility manholes[138] are examples of when confined space work is necessary. Installation of telecommunication activities involves laying conduit and limited trenching (generally 6 to 12 inches in width) would occur. Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics. (OSHA, 2016b)

Heavy equipment and machinery – New and replacement facility deployment and maintenance can involve the use of heavy equipment and machinery. During the lifecycle of a

[138] Manholes may be used for telecommunications activities, especially in cities and urban areas, depending on the location of other utilities. In cities, power, water, and telecommunication lines are often co-located; if access is through a manhole in the street, that access will be used.

telecommunication site, heavy equipment such as bulldozers, backhoes, dump trucks, cement trucks, and cranes are used to prepare the ground, transport materials and soil, and raise large sections of towers and antennas. Telecommunication workers may be exposed to the additional site traffic and often work near heavy equipment to direct the equipment drivers and to accomplish work objectives. Accessory machinery such as motorized pulley systems, hydraulic metal shears, and air driven tools present additional health and safety risks as telecommunication work sites. These pieces of machinery can potentially sever skin and bone, or cause other significant musculoskeletal injuries to the operator. (OSHA, 2016b)

Energized equipment and existing utilities – Electrical shock from energized equipment and utilities is an elevated risk at telecommunication sites due to the amount of electrical energy required for powering communication equipment and broadcasting towers. Telecommunication cables are often co-located with underground and overhead utilities, which can further increase occupational risk during earth-breaking and aerial work. (International Finance Corporation, 2007)

Optical fiber safety – Optical fiber cable installation and repair presents additional risks to telecommunications workers, including potential eye or tissue damage, through ingestion, inhalation, or other contact with glass fiber shards. The shards are generated during termination and splicing activities, and can easily penetrate exposed skin (International Finance Corporation, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation presents risk of fire or explosion (Fiber Optic Association, 2010).

Noise – Sources of excess noise at telecommunication sites include heavy equipment operation, electrical power generators and other small engine equipment, air compressors, electrical and pneumatic power tools, and road vehicles, such a diesel engine work trucks. The cumulative noise environment has the potential to exceed the OSHA acceptable level of 85 decibels (dB) per 8-hour time weighted average (see Section 3.1.13, Noise) (OSHA, 2002). Fugitive noise may emanate beyond the telecommunication work site and impact the public living in the vicinity, observing the work, or transiting through the area. (OSHA, 2016b)

Hazardous materials and hazardous waste – Work at telecommunication sites may require the storage and use of hazardous materials such as fuel sources for backup power generators and compressed gases used for welding and metal cutting (new towers only). In some cases, telecommunication sites require treatments, such as pesticide application. Secondary hazardous materials, like exhaust fumes, may be a greater health risk than the primary hazardous material (e.g., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. While it is unlikely that any FirstNet activities would involve the generation or storage of hazardous waste, older existing telecommunication structures and sites could have hazardous materials present, such as lead-based (exterior and interior) paint at outdoor structures or asbestos tiles and insulation in equipment sheds. The public, unless a telecommunication work site allows unrestricted access, are typically shielded from hazardous materials and hazardous wastes that are components of telecommunication site work. (OSHA, 2016b)

Aquatic environments – Installation of telecommunication lines may include laying, burying, or boring lines under wetlands and waterways, including lakes, rivers, ponds, and streams. Workers responsible for these activities operate heavy equipment from soft shorelines, boats, barges, and other unstable surfaces. There is potential for equipment and personnel falls, as well as drowning in waterbodies. Wet work conditions also increase risks of electric shock and hypothermia. (OSHA, 2016b)

Outdoor elements – Weather conditions have the potential to quickly and drastically reduce safety, and increase hazards at telecommunication work sites. Excessive heat and cold conditions impact judgement, motor skills, hydration, and in extreme cases may lead to hyper- or hypothermia. Precipitation, such as rain, ice, and snow, create slippery climbing conditions and wet or muddy ground conditions. Lightning strikes are risks to telecommunication workers climbing towers or working on top of buildings. (OSHA, 2016b)

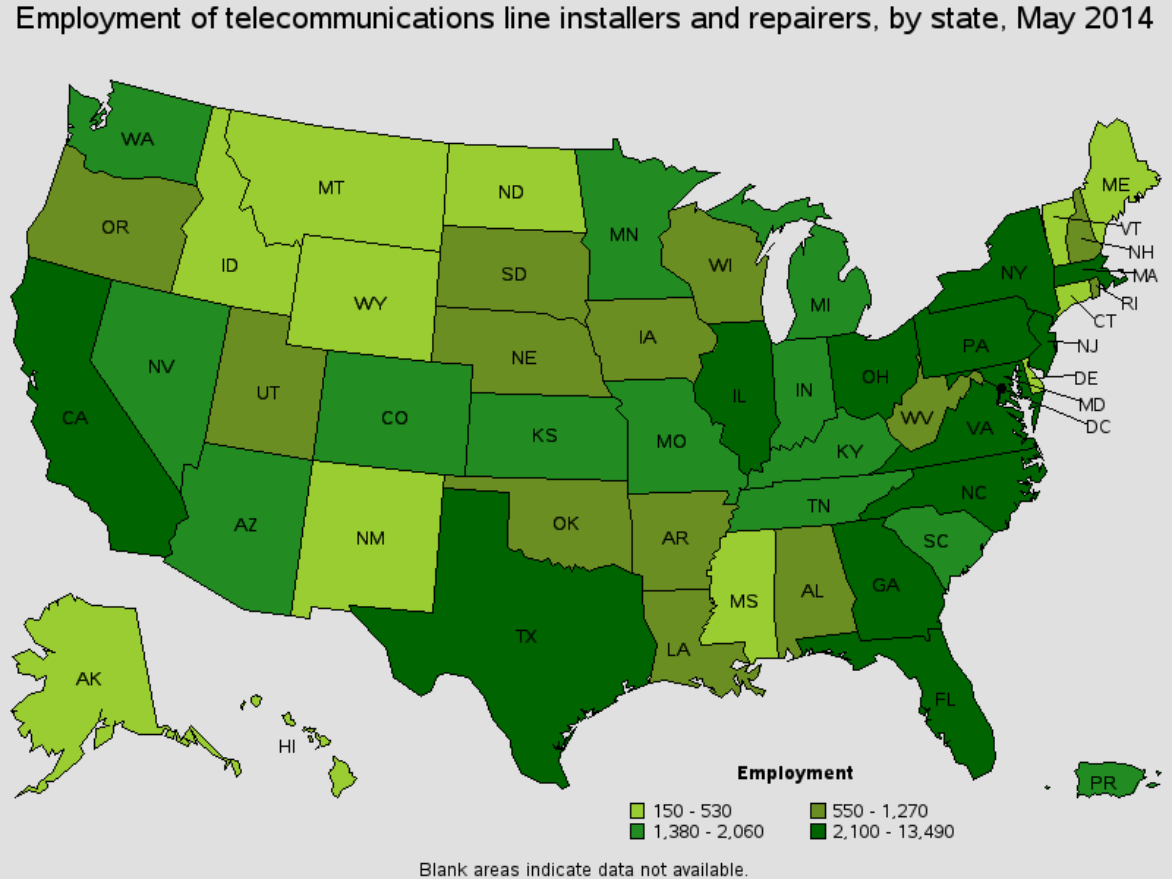
Telecommunication Worker Occupational Health and Safety

As of May2015, Connecticut employed 390 telecommunication line installers and repairers (Figure 3.1.15-1) (BLS, 2015c), and 2,450 telecommunication equipment installers and repairers (BLS, 2015d). In 2013, the most recent year that data are available, Connecticut reported approximately 3.4 reportable cases of nonfatal occupational injuries and illnesses in the telecommunications industry per 100 full-time workers (Bureau of Labor Statistics, 2013). By comparison, there were 2.1 nonfatal occupational injuries and illnesses reported nationwide per 100 full-time workers in the telecommunications industry (BLS, 2014).

Nationwide in 2013, there were 370 fatalities reported across the installation, maintenance, and repair occupations industry, with an hours-based fatal injury rate of 7.2 per 100,000 full-time equivalent workers. Telecommunications line installers and repairers accounted for 15 of the 370 fatal injuries (4 percent). However, telecommunication line installers and repairer had a slightly higher hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2015e). In Connecticut, there was one fatality in the telecommunications industry in 2011, and two fatalities in in 2013, primarily due to vehicular traffic accidents (BLS, 2015f).

Public Health and Safety

The public are not likely to encounter occupational hazards at telecommunication sites, due to limited access. Connecticut has not recorded incidents of injuries from the public to these sites. Among the public, trespassers entering telecommunication sites would be that the greatest risk for exposure to the health and safety hazards.



Source: (BLS, 2015c)

Figure 3.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

3.1.15.4. Environmental Setting: Contaminated Properties at or near Telecommunication Sites

Existing and surrounding land uses, including landfills or redeveloped brownfields, near telecommunication sites have the potential to impact human health and safety. Furthermore, undocumented environmental practices of site occupants at telecommunication sites, prior to creation of environmental laws, could result in environmental contamination, affecting the quality of soil, sediments, groundwater, surface water, and air.

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[139] or listed on the National Priorities List (NPL), as well as the Resource Conservation and Recovery Act (RCRA) Corrective Action sites and Brownfields. These regulated cleanup sites are known to contain environmental contaminants at concentrations exceeding acceptable human

[139] The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted in 1980, commonly referred to as the Superfund Program, governs abandoned hazardous waste sites, and collects a tax on chemical and petroleum industries. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986; see Appendix C, Environmental Laws and Regulations (USEPA, 2011b).

health exposure thresholds. Contact with high concentrations of contaminated media can result in adverse health effects, such as dermatitis, pulmonary and cardiovascular events, organ disease, central nervous system disruption, birth defects, and cancer. It generally requires extended periods of exposure over a lifetime for the most severe health effects to occur.

In Connecticut, the state Superfund Program is used to remediate contaminated sites. Sites are assigned a Superfund Priority Score (SPS) to determine whether they receive state cleanup funding (CT DEEP, 2006d). Title 22A of the Connecticut State Codes, § 22a-133f, outlines the SPS and identifies six categories; exposure potential, impact to groundwater, impact to surface water, toxicity, impact to the environment, and other factors. A site is assessed and scored against the factors within these categories to determine its total score out of 105 possible points. The SPS is then used to determine the priority of funding for state superfund sites. As of September 2015, Connecticut had 154 RCRA Corrective Action sites,[140] 355 brownfields, and 15 proposed or final Superfund/NPL sites (USEPA, 2015o). Based on a September 2015 search of USEPA's Cleanups in My Community (CIMC) database, two Superfund sites still exist in Connecticut where contamination has been detected at an unsafe level, or a reasonable human exposure risk exists (Broad Brook Mill and Raymark Industries) (USEPA, 2015p). Connecticut's Remediation Standard Regulations (RSRs) describe cleanup standards that must be met to achieve safe reuse of a contaminated site (CT DEEP, 2015am). Brownfield sites in Connecticut are managed through the State Voluntary Remediation Program and the Property Transfer Program (CT DEEP, 2011b).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by human beings or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). In 2014, Connecticut had 280 TRI reporting facilities (USEPA, 2014e). According to the USEPA, Connecticut generated a total of 2,099,282 pounds of onsite and offsite disposal or other TRI releases in 2013, the most recent data available, largely from the fabricated metals industry. This accounted for 0.05 percent of total nationwide TRI releases, ranking Connecticut 35 out of 56 states/territories (USEPA, 2014e).

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment.

[140] Data gathered using the USEPA's CIMC search on August 24, 2015, for all sites in Connecticut, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active).

The National Institute of Health, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (NIH, 2015a). Figure 3.1.15-2 provides an overview of potentially hazardous sites in Connecticut.

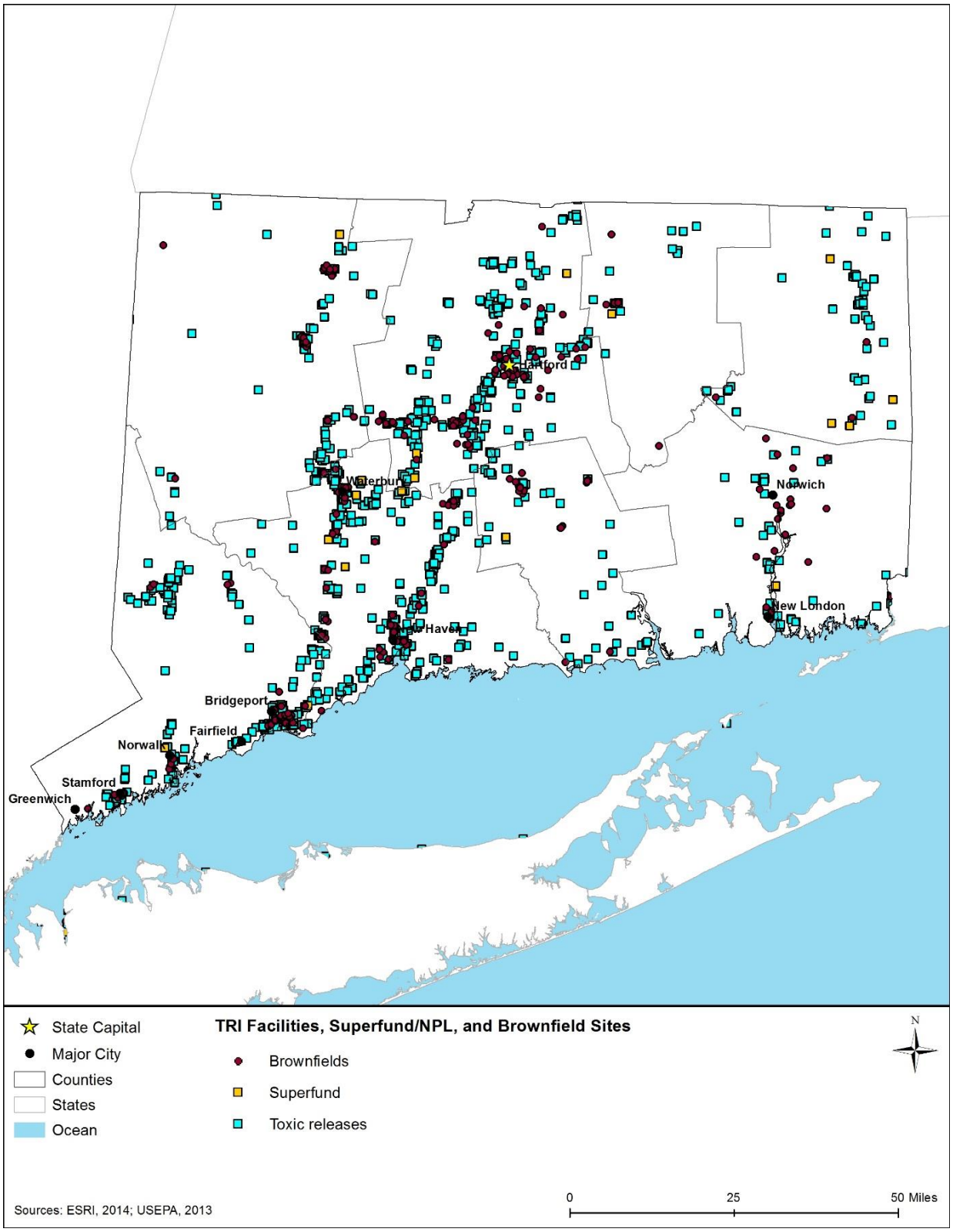
In addition to hazardous waste contamination, another health and safety hazard includes surface and subterranean mines. Health and safety hazards known to be present at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (FAA, 2015a). Gradual settling or sudden sinking of the Earth's surface, also known as subsidence, presents additional risks and is further discussed in Section 3.1.3.8, including land subsidence areas in Cheshire, CT, due to the collapse of abandoned mines. As of May 2015, there were no high priority AMLs (sites posing health and safety hazards) in Connecticut (USEPA, 2015i).

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be situated at or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over waterbodies. Indoor air quality may be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. Connecticut reported one occupational fatality within the telecommunications industry in 2011, and two in 2013, however none of these fatalities resulted from exposure to harmful substances or environments. By comparison, there were three reported fatalities in 2011 and three facalities in 2014 nationwide within the telecommunications industry, due to exposure to harmful substances or environments (BLS, 2015g), therefore hazards relating to mines are not discussed further.

Public Health and Safety

As described earlier, access to telecommunication sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunication sites present an inherent low risk to non-occupational workers, the public could be potentially exposed to contaminants and other hazards in a variety of ways. One example would be if occupational workers disturb contaminated soil while digging, causing hazardous chemicals to mix with an underlying groundwater drinking water sources. If a contaminant enters a drinking water source, the surrounding community would then inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors. The CTDPH is responsible for collecting public health data resulting from exposure to environmental contamination, and provides publicly available health assessments and consultations for hazardous waste sites where documents have been produced (Connecticut Department of Public Health, 2014).



Source: (NIH, 2015b)

Figure 3.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Connecticut (2013)

3.1.15.5. Environmental Setting: Natural & Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the general public. Telecommunications, including public safety communications, can be knocked out (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Hazardous chemicals and sanitary wastes often contaminate floodwaters, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003).

Physical hazards may also be present at disaster sites, such as downed utility lines, debris blockage or road washout conditions, which increases exposure risks to telecommunication workers. Climbing and working from tower structures damaged by wind increases the risk of slips, trips, and falls. During natural and manmade disasters, access to the telecommunication sites can be littered by debris.

Spotlight on Connecticut Superfund Sites: Broad Brook Mill

Broad Brook Mill, a former condominium site in the Broad Brook section of East Windsor, CT, was originally an industrial site dating back to the mid-1800s when a woolen mill was built on the site. Later, various products were manufactured on the site, which included electroplating, etching, soldering, and printing processes. In May 1986, many of the former mill buildings were destroyed in a fire and 21 residential condominium units were the developed on the site by 1993. Several sampling events were conducted at the site from 1993 until 1998. Polycyclic Aromatic Hydrocarbons (PAHs) and volatile organics (solvents) were identified in soils, and in December 2000, the site was proposed for the NPL. Presently, no residents are living in the condominiums and the site is fenced-off. (USEPA, 2015q)

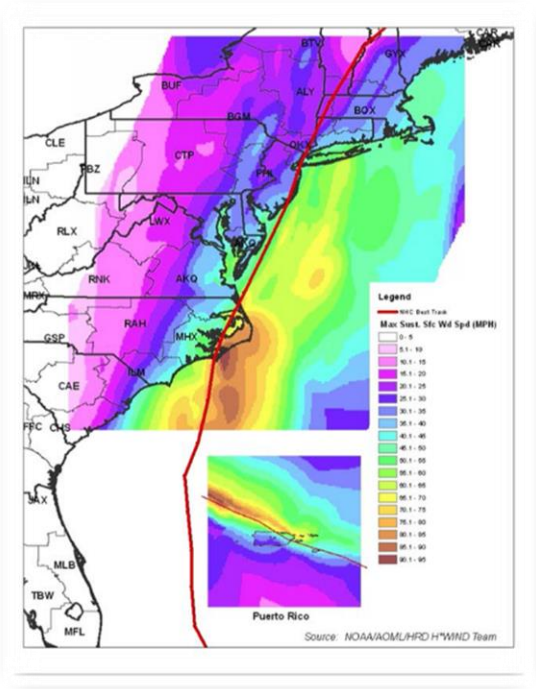
Source: (USEPA, 2012a)

Figure 3.1.15-3 : Photo of Mill Pond Dam Outfall

In 1998, CTDPH determined that PAHs in the soil represented a hazard to public health. The USEPA conducted cleanup actions to mitigate exposure to onsite soils, including covering the ground with geotextile fabric. Immediate threats to residents were reduced by site remediation, but contamination at deeper soil levels still poses a risk, and controls are in place to prevent future human exposures. (Connecticut Department of Public Health, 2002)

Spotlight on Connecticut Natural Disaster Sites: Hurricane Irene

During Hurricane Irene in August 2011, the Connecticut coastline experienced high winds, flooding from precipitation and runoff, and a 3 to 6 foot storm surge. The result was numerous downed trees, utility outages, and closed roads. The storm also caused a power outage at the University of Connecticut's Department of Marine Sciences, which maintains National Weather Service (NWS) Buoy 44039 in central Long Island Sound, and transmits real-time weather data. The service interruption occurred during a period of highest surface winds along Connecticut's south central coastline, and caused loss of weather information that "severely limited ability to predict wave action on top of surge," hindering support services, including first responder deployment. (NWS, 2012)



Source: (NWS, 2012)

Figure 3.1.15-4: Surface Wind Speed during Hurricane Irene

Telecommunication Worker Occupational Health and Safety

Telecommunication workers are often called upon to provide support to natural and manmade disaster response efforts because of the critical need to restore and maintain telecommunication capabilities. The need to enter disaster areas as part of the initial recovery effort exposes telecommunication workers to elevated risks because chemical, biological, and physical hazards have not been fully assessed or cleared prior to telecommunication workers entering an area to complete repairs. Transportation infrastructure and utilities in the affected areas are often compromised and present unknown chemical and biologic hazards. Correspondingly, if telecommunication workers are injured during response operations that might be depending on damaged medical infrastructure and over-extended staff who are delivering care to victims of the initial incident.

Currently, CTDOL and U.S. Bureau of Labor do not report data specific to injuries or fatalities among telecommunication workers responding to natural or manmade disasters. However, the National Response Center (NRC), managed by the U.S. Coast Guard, compiles reports of oil spills, chemical releases, or other maritime security incidents, including incident records related to occupational health and safety. For example, during a tree removal operation near Oxford, CT, following Hurricane Irene, an electrical transformer fell from an electrical utility pole and spilled 20 gallons of transformer oil, some of which leaked into the nearby Hammonasset River (U.S. Coast Guard, 2011). Response and cleanup operations such as this present technical challenges and hazards to telecommunication workers restoring services during and following natural disasters.

Public Health and Safety

Hazards present during natural and manmade disasters are often ubiquitous, affecting large geographic areas and affecting all populations living within the areas. Connecticut is the third smallest state by area, but the fourth most densely populated (U.S. Census Bureau, 2010d). Similar to telecommunication workers, the public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities and potential for exposure to unknown chemical and biologic hazards. Infrastructure damage was extensive during Hurricane Irene, with several storage tank spills due to flooding and fallen transformers. (U.S. Coast Guard, 2011)

In 2014, Connecticut experienced one weather related injury and no fatalities (NWS, 2015). For comparison, in 2011, the year Hurricane Irene affected the northeast, there were four weather related fatalities and eight weather related injuries in Connecticut (NWS, 2013).

3.2. ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental impacts, beneficial, or adverse, resulting from the Proposed Action and Alternatives. As this is a programmatic evaluation, site- and project-specific issues are not assessed. The categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Each resource area identifies the range of possible impacts on resources for the Proposed Action and Alternatives, including the No Action Alternative. The No Action Alternate provides a comparison to describe the effects of environmental resources of the existing conditions to the proposed Alternatives.

NEPA requires agencies to assess the potential direct and indirect impacts each Alternative could have on the existing environment (as characterized earlier in this section). Direct impacts are those impacts that are caused by the Proposed Action and occur at the same time and place, such as soil disturbance. Indirect impacts are those impacts related to the Proposed Action but result from an intermediate step or process, such as changes in surface water quality because of soil erosion.

For each resource, the potential impact is assessed in terms of context of the action and the intensity of the potential impact, per CEQ regulations (40 CFR §1508.27). *Context* refers to the timing, duration, and where the impact could potentially occur (i.e., local vs. national; pristine vs. disturbed; common species vs. protected species). In terms of duration of potential impact, context is described as short or long term. *Intensity* refers to the magnitude or severity of the effect as either beneficial or adverse. Resource-specific significance rating criteria are provided at the beginning of each resource area section.

3.2.1. Infrastructure

3.2.1.1. Introduction

This section describes potential impacts to infrastructure in Connecticut associated with construction, deployment, and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 3.2.1-1. The categories of impacts are defined at the programmatic level as *potentially significant, less than significant with BMPs and mitigation measures incorporated, less than significant, or no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to infrastructure addressed in this section are presented as a range of possible impacts.

Table 3.2.1-1: Impact Significance Rating Criteria for Infrastructure at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Transportation system capacity and safety	Magnitude or Intensity	Creation of substantial traffic congestion/delay and/or a substantial increase in transportation incidents (e.g., crashes, derailments)	Effect that is *potentially significant*, but with mitigation is *less than significant*	Minimal change in traffic congestion/delay and/or transportation incidents (e.g., crashes, derailments)	*No effect* on traffic congestion or delay, or transportation incidents
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Persisting indefinitely		Short-term effects will be noticeable for up to the entire construction phase or a portion of the operational phase	NA
Capacity of local health, public safety, and emergency response services	Magnitude or Intensity	Impacted individuals or communities cannot access health care and/or emergency services, or access is delayed, due to the Proposed Action	Effect is *potentially significant*, but with mitigation is *less than significant*	Minor delays to access to care and emergency services that do not impact health outcomes	*No impacts* on access to care or emergency services
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state)		Impacts only at a local/neighborhood level	NA
	Duration or Frequency	Duration is constant during construction and deployment phase		Rare event during construction and deployment phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Modifies existing public safety response, physical infrastructure, telecommunication practices, or level of service in a manner that directly affects public safety communication capabilities and response times	Magnitude or Intensity	Substantial adverse changes in public safety response times and the ability to communicate effectively with and between public safety entities	Effect that is *potentially significant*, but with mitigation is *less than significant*	Minimal change in the ability to communicate with and between public safety entities	No perceptible change in existing response times or the ability to communicate with and between public safety entities
	Geographic Extent	Local/City, County/Region, or State/Territory		Local/City, County/Region, or State/Territory	Local/City, County/Region, or State/Territory
	Duration or Frequency	Permanent or perpetual change in emergency response times and level of service		Change in communication and/or the level of service is perceptible but reasonable to maintaining effectiveness and quality of service	NA
Effects to commercial telecommunication systems, communications, or level of service	Magnitude or Intensity	Substantial adverse changes in level service and communications capabilities	Effect that is *potentially significant*, but with mitigation is *less than significant*	Minor changes in level of service and communications while transitioning to the new system	No perceptible effect to level of service or communications while transitioning to the new system
	Geographic Extent	Local/City, County/Region, or State/Territory		Local/City, County/Region, or State/Territory	Local/City, County/Region, or State/Territory
	Duration or Frequency	Persistent, long-term, or permanent effects to communications and level of service		Minimal effects to level of service or communications lasting no more than a short period (minutes to hours) during the construction and deployment phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to utilities, including electric power transmission facilities and water and sewer facilities	Magnitude or Intensity	Substantial disruptions in the delivery of electric power or to physical infrastructure that results in disruptions, including frequent power outages or drops in voltage in the electrical power supply system ("brownouts"). Disruption in water delivery or sewer capacity, or damage to or interference with physical plant facilities that impact delivery of water or sewer systems	Effect that is *potentially significant*, but with mitigation is *less than significant*	Minor disruptions to the delivery of electric power, water, and sewer services, or minor modifications to physical infrastructure that result in minor disruptions to delivery of power, water, and sewer services	There would be no perceptible impacts to delivery of other utilities and no service disruptions.
	Geographic Extent	Local/City, County/Region, or State/Territory		Local/City, County/Region, or State/Territory	Local/City, County/Region, or State/Territory
	Duration or Frequency	Effects to other utilities would be seen throughout the entire construction phase		Effects to other utilities would be of short duration (minutes to hours) and would occur sporadically during the entire construction phase	NA

NA = Not Applicable

3.2.1.3. Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would primarily occur during the construction phases of deployment. Depending on the exact site locations and placement of new assets in the field, temporary impacts on traffic congestion, railway use, airport or harbor operations, or use of other transportation corridors could occur if site locations were near or adjacent to roadways and other transportation corridors, requiring temporary closures (lane closures on roadways, for example). Coordination would be necessary with the relevant transportation authority (i.e., departments of transportation, airport authorities, railway companies, and harbormasters) to ensure proper coordination during deployment. Based on the impact significance criteria presented in Table 3.2.1-1, such impacts would be *less than significant* at the programmatic level due to the temporary nature of the deployment activities, even if such impacts would be realized at one or more isolated locations. Such impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

Capacity of Local Health, Public Safety, and Emergency Response Services

The capacity of local health, public safety, and emergency response services would experience *less than significant impacts* at the programmatic level during construction or operation phases. During construction and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of first responders through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders to communicate during emergency response situations. Based on the impact significance criteria presented in Table 3.2.1-1, such potential negative and positive impacts would be *less than significant* at the programmatic level.

Modifies Existing Public Safety Response Telecommunication Practices, Physical Infrastructure, or Level of Service in a Manner that Directly Affects Public Safety Communication Capabilities and Response Times

The Proposed Action and Alternatives contemplated by FirstNet would not cause negative impacts to existing public safety response telecommunication practices, physical infrastructure, or level of service in a manner that directly affects public safety communication capabilities and response times. Based on the impact significance criteria presented in Table 3.2.1-1, any potential impacts would be *less than significant* at the programmatic level during deployment. As described above, during deployment and system optimization, existing services would likely

remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to compliment such practices and SOPs in a positive manner; therefore, only beneficial or complimentary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience such beneficial impacts through enhanced communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus such infrastructure would also experience a positive and beneficial impact. Disposal or reuse of older public safety communications infrastructure would also likely need to be considered once the specifics are known.

Effects to Commercial Telecommunication Systems, Communications, or Level of Service

Commercial telecommunication systems, communications, or level of service would experience *no impacts*, as such commercial assets would be using a different spectrum for communications. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, such spectrum use may be over-built or under-utilized,[141] which could allow FirstNet to lease any excess spectrum to commercial telecommunication organizations. Such leases would then have *less than significant* positive impacts at the programmatic level on commercial telecommunication systems, communications, or level of service, per the impact significance criteria presented in Table 3.2.1-1.

Effects to Utilities, including Electric Power Transmission Facilities, and Water and Sewer Facilities

The activities proposed by FirstNet would have *less than significant impacts* at the programmatic level on utilities, including electric power transmission facilities, and water and sewer facilities. Depending on the specific elements of the Proposed Action, installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on a temporary or permanent basis. Also, depending on the specific project contemplated, the draw or use of power from the transmission facilities may need to be examined; however, it is not anticipated that such use of power would have negative impacts, due to the local nature of the proposed activities and the widespread availability and use of the power grid in the United States.

3.2.1.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

[141] Telecommunications equipment for specific spectrum use can be built where other equipment for other spectrum use already exists. If the new equipment and spectrum is not fully utilized, the geographic region may experience "over-build," where an abundance of under-utilized equipment may exist in that geographic location. This situation can be caused by a variety of factors including changes in current and future use patterns, changes in spectrum allocation, changes in laws and regulations, and other factors.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to infrastructure and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of *no impacts* to *less than significant impacts* at the programmatic level depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* at the programmatic level to infrastructure under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to infrastructure resources at the programmatic level since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would have *no impacts* to infrastructure resources at the programmatic level because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.
  - New Build – Submarine Fiber Optic Plant: At the programmatic level, the installation of cables in or near bodies of water would have *no impacts* on infrastructure resources because there would be no local infrastructure to impact, other than harbor operations. Impacts to infrastructure resources associated with the construction of landings and/or facilities on shore or the banks of water bodies that accept the submarine cable are addressed below, and depend on the proximity of such infrastructure to the landing site.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to infrastructure at the programmatic level. The section below addresses potential impacts to infrastructure if construction of new boxes, huts, or other equipment is required near or adjacent to local infrastructure assets.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any

impacts to infrastructure resources, given that construction activities would occur on existing structures, would not be expected to interfere with existing equipment, and transportation capacity and safety, and access to emergency services would not be impacted.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have *no impact* on infrastructure resources.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to infrastructure as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of direct interface with existing infrastructure, most notably existing telecommunication infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to infrastructure include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs),[142] huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase, however, it is anticipated that this tie-in would cause *less than significant* impacts as the activity would be temporary and minor.
  - New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new or replacement of existing telecommunications poles.
  - Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
  - New Build – Submarine Fiber Optic Plant: As stated above, the installation of cables in limited nearshore or inland bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact, other than harbor operations. However, impacts to infrastructure resources could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable, depending on the exact site location and proximity to existing infrastructure.
  - Installation of Optical Transmission or Centralized Transmission Equipment: As stated above, if installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to infrastructure. However, installation of transmission equipment could potentially impact infrastructure if small

[142] Points of Presence are connections or access points between two different networks, or different components of one network.

boxes or huts, or access roads required ground disturbance. Impacts could include disruption of service in transportation corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current utility services during installation or interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. In addition, installation activities would have beneficial impacts due to expansion of infrastructure at a local level. Such activities can enhance public safety infrastructure, and other telecommunications as the site could potentially be available for subsequent collocation.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would result in localized impacts to that tower and such as minor disruptions in services. As a result of collocation of equipment, the potential addition of power units, structural hardening, and physical security measures could potentially have beneficial impacts on existing infrastructure assets, depending on the site specific plans.
- Deployable Technologies
  - Deployable technologies such as COWs, COLTs, and SOWs are comprised of cellular base stations, sometimes with expandable antenna masts, and generators that connect to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however, this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road ROWs and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation congestion and delays. Implementation of deployable technologies could result in potential impacts to infrastructure resources in terms of infrastructure expansion, if deployment requires paving of previously unpaved surfaces or other new infrastructure build to accommodate the deployable technology. Also, beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Where deployable technologies would be implemented on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, or where aerial deployable technologies may be launched or recovered on existing paved surfaces, it is anticipated that there would be *no impacts* to infrastructure resources at the programmatic level because there would be no disturbance of the natural or built environment.

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. These impacts are expected to be *less than significant* at the programmatic level as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the on-going phase of deployment, and minor. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Positive impacts to infrastructure resources may result from the expansion of public safety and commercial telecommunications capacity and an improvement in public safety telecommunications coverage, system resiliency, response times, and system redundancy.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned deployment impacts. It is anticipated that there would be *no impacts* at the programmatic level to infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if further construction related activities are required along public road and utility ROWs, increased traffic congestion, current telecommunication system interruption, and utility interruptions could occur. These potential impacts would be expected to be minor and temporary as explained above.

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would also likely result in substantial improvements in level of service and communications capabilities. Operation of the NPSBN is intended to involve high-speed data capabilities, location information, images, and eventually streaming video, which would likely significantly improve communications and the ability of the public safety community to effectively engage and respond. The NPSBN is also intended to have a higher level of redundancy and resiliency than current commercial networks to support the public safety community effectively, even in events of extreme demand. This improvement in the level of resiliency and redundancy is intended to increase the reliability of systems, communications, and level of service, and also minimize disruptions and misinformation resulting from limited or disrupted service.

3.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[143]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant impacts* at the programmatic level to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try to avoid any negative impacts to such resources. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *no impacts* at the programmatic level to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections and maintenance. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access road or utility ROW, or if additional maintenance-related construction activities occur within public road and utility ROWs, *less than significant* impacts would likely

[143] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated deployment or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. Therefore, there would be *no impacts* to infrastructure as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

3.2.2. Soils

3.2.2.1. Introduction

This section describes potential impacts to soil resources in Connecticut associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 3.2.2-1. The categories of impacts are defined, at the programmatic level, as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to soil resources addressed in this section are presented as a range of possible impacts.

Table 3.2.2-1: Impact Significance Rating Criteria for Soils at the Programmatic Level

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Soil erosion	Magnitude or Intensity	Severe, widespread, and observable erosion in comparison to baseline, high likelihood of encountering erosion-prone soils	Effect that is *potentially significant*, but with mitigation is *less than significant*	Perceptible erosion in comparison to baseline conditions; low likelihood of encountering erosion-prone soil types	No perceptible change in baseline conditions
	Geographic Extent	State or territory		Region or county	NA
	Duration or Frequency	Chronic or long-term erosion not likely to be reversed over several years		Isolated, temporary, or short-term erosion that that is reversed over few months or less	NA
Topsoil mixing	Magnitude or Intensity	Clear and widespread mixing of the topsoil and subsoil layers	Effect that is *potentially significant*, but with mitigation is *less than significant*	Minimal mixing of the topsoil and subsoil layers has occurred	No perceptible evidence that the topsoil and subsoil layers have been mixed
	Geographic Extent	State or territory		Region or county	NA
	Duration or Frequency	NA		NA	NA
Soil compaction and rutting	Magnitude or Intensity	Severe and widespread, observable compaction and rutting in comparison to baseline	Effect that is *potentially significant*, but with mitigation is *less than significant*	Perceptible compaction and rutting in comparison to baseline conditions	No perceptible change in baseline conditions
	Geographic Extent	State or territory		Region or county	NA
	Duration or Frequency	Chronic or long-term compaction and rutting not likely to be reversed over several years		Isolated, temporary, or short term compaction and rutting that is reversed over a few months or less	No perceptible change in baseline conditions

NA = Not Applicable

3.2.2.3. Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern of nearly every construction activity that involves ground disturbance. Construction erosion typically only occurs in a small area of land with the actual removal of vegetative cover from construction equipment or by wind and water erosion. Of concern in Connecticut and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment can impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Areas exist in Connecticut that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Aquepts and Udepts (see Section 3.1.2.4, Soil Suborders and Figure 3.1.2-2).

Based on the impact significance criteria presented in Table 3.2.2-1, building of some of FirstNet's network deployment sites could cause erosion at locations with highly erodible soil and steep grades. For the majority of projects, impacts to soils would be expected to be *less than significant* at the programmatic level given the relatively small scale (less than an acre)and temporary duration of the construction activities.

To the extent practicable, FirstNet would attempt to minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 17).

Topsoil Mixing

The loss of topsoil (i.e., organic and mineral topsoil layers) by mixing is a potential impact at all ground disturbing construction sites, including actions requiring clearing, excavation, grading, trenching, backfilling, or site restoration/remediation work.

Based on impact significance criteria presented in Table 3.2.2-1, and due to the relatively small-scale (less than 1 acre) of most FirstNet project sites, *less than significant* impacts from topsoil mixing is anticipated. BMPs and mitigation measures (see Chapter 17) could be implemented to further reduce potential impacts.

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Heavy equipment could cause perceptible compaction and rutting of susceptible soils.

Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 3.1.2.4, Soil Suborders). The most compaction susceptible soils in Connecticut are hydric soils with poor drainage conditions, which include Aquepts.

Aquepts, found in less than one percent of Connecticut,[144] mostly only in the northwestern corner of the state in the Berkshire Mountains (see Figure 3.1.2-2). The potential for compaction or rutting impact would be generally low at FirstNet network deployment sites where other soil types predominate.

Based on impact significance criteria presented in Table 3.2.2-1, the risk of soil compaction and rutting resulting from FirstNet deployment activities would be *less than significant* at the programmatic level, due to the small extent of susceptible soils in the state and the relatively small-scale (less than one acre) of most FirstNet construction projects. Potential impacts could be further reduced with implementation of BMPs and mitigation measures (see Chapter 17).

3.2.2.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to soil resources and others would not. In addition, and as explained in this section, the same type of proposed action infrastructure could result, at the programmatic level, in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to soil resources at the programmatic level under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand-holes, pulling vaults, junction boxes, huts, and POP structures and would have *no impact* on soil resources at the programmatic level because it would not produce perceptible changes to soil resources.
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have *no impact* on soils at the programmatic level because there would be no ground disturbance from pole/structure installation. Heavy equipment use would typically be limited to bucket trucks operated from existing paved, gravel, or dirt roads. Impacts to soils associated with the construction of new poles to accept aerial fiber or on shore to accept submarine cable are addressed below.

[144] This percentage was calculated by dividing the acres of soils that fall within the suborders listed above by the total soil land cover for the state.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no ground disturbing activity, and therefore *no impacts* to soil resources at the programmatic level. If physical access is required to light dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures and would not require any ground disturbing activity. Impacts to soil resources associated with the construction of new poles to accept aerial fiber or on shore to accept submarine cable are addressed below, and depend on the proximity of such infrastructure to the landing site.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would have *no impact* on soil resources at the programmatic level because there would be no ground disturbance associated with this activity (see Section 3.2.4, Water Resources, for a discussion of potential impacts to water resources). Impacts to soil resources associated with the construction of landings or facilities on shore to accept submarine cable are addressed below.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to soils at the programmatic level. The section below addresses potential impacts to soils if construction of new boxes, huts, or other equipment is required.
- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation is the mounting or installing of new equipment on existing structures (such as antennas on an existing tower). This activity would have *no impact* on soil resources at the programmatic level because there would be no ground disturbance. Potential impacts to soil resources from structural hardening, addition of power units, or security measures are addressed below.
  - Deployable Technologies: Where technologies such as Cell on Wheels (COW), Cell on Light Trucks (COLT), or System on Wheels (SOW) are deployed on existing paved surfaces or dirt or gravel areas, there would be *no impacts* to soil resources at the programmatic level because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite phones, and video cameras, would have *no impact* on soil resources at the programmatic level because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact soil resources, it is anticipated that this activity would have *no impact* on soil resources at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

Implementation of the Preferred Alternatives could include potential deployment-related impacts to soil resources resulting from ground disturbance activities, including soil erosion, topsoil mixing, and soil compaction and rutting. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to soil resources at the programmatic level include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: As stated above, collocation with no groud disturbance would result in *no impacts* to soil resources at the programmatic level. However, topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: As stated above, lighting up of dark fiber in existing conduits or cables would have *no impact* on soil resources, However, if installation of new huts or equipment we necessary, the activitycould result in soil erosion and topsoil mixing during grading or excavation activities. This activity could also require the short-term use of heavy equipment for grading or other purposes, which could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: As stated above, the installation of cables in or near bodies of water would not impact soil resources at the programmatic level because there would be no soil resources to impact. However, installation of fiber optic plants in limited nearshore and inland bodies of water could potentially impact soil resources at and near the landings or facilities on shore to accept submarine cable. Soil erosion and topsoil mixing could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Perceptible soil compaction and rutting could potentially occur due to heavy equipment use during these activities depending on the duration of the construction activity.

  - Installation of Optical Transmission or Centralized Transmission Equipment: As stated above, if installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to soils at the programmatic level. However, installation of optical transmission equipment or centralized transmission equipment, including associated new utility poles, hand holes, pulling vault, junction box, hut, and POP structure installation, would require ground disturbance that could potentially impact soil resources. Potential impacts to soils resulting from soil erosion, topsoil mixing, soil compaction, and rutting are anticipated to be small-scale and short-term.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - Collocation on Existing Wireless Tower, Structure, or Building: As stated above, collocation that would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, and would result in *no impacts* on soils. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: As stated above, if deployment occurred on paved surfaces or previously disturbed land, there would be *no impact* on soil resources, however, implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be *no impacts* to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy

equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be *less than significant* at the programmatic level as the activity would likely be short term and localized to the deployment locations, and conditions and those locations would return to normal as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility ROWs for deployment activities, as feasible. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be *no impacts* to soil resources at the programmatic level associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, soil compaction and rutting impacts could result as explained above. The impacts are expected to be *less than significant* at the programmatic level due to the temporary nature and small-scale of operations activities with the potential to create impacts. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.2.5. Alternatives Impact Assessment

The following section assesses potential impacts to soils associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to soil resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, at the programmatic level, implementation of deployable technologies could result in *less than significant* impacts to soil resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas. However, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale and short term nature of the deployment. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, at the programmatic level it is anticipated that there would be *no impacts* to soil resources associated with routine inspections of deployable assets, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, at the programmatic level, *less than significant* soil compaction and rutting impacts could result as previously explained above. Finally, if deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in minimal soil erosion. However, it is anticipated that the potential soil erosion would result in *less than significant* impacts at the programmatic level as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to soil resources as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.2, Soils.

3.2.3. Geology

3.2.3.1. Introduction

This section describes potential impacts to Connecticut geology resources associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geological resources were evaluated using the significance criteria presented in Table 3.2.3-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined, at the programmatic level, as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to geological resources addressed in this section are presented as a range of possible impacts.

Table 3.2.3-1: Impact Significance Rating Criteria for Geology at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Seismic Hazard	Magnitude or Intensity	High likelihood that a Proposed Action activity could be located within a high-risk earthquake hazard zone or active fault	Effect that is *potentially significant*, but with mitigation is *less than significant*	Low likelihood that a Proposed Action activity could be located within an earthquake hazard zone or active fault	No likelihood of a Proposed Action activity being located in an earthquake hazard zone or active fault
	Geographic Extent	Hazard zones or active faults are highly prevalent within the state/territory		Earthquake hazard zones or active faults occur within the state/territory, but may be avoidable	Earthquake hazard zones or active faults do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
Volcanic Activity	Magnitude or Intensity	High likelihood that a Proposed Action activity could be located near a volcano lava or mud flow area of influence	Effect that is *potentially significant*, but with mitigation is *less than significant*	Low likelihood that a Proposed Action activity could be located near a volcanic ash area of influence	No likelihood of a Proposed Action activity located within a volcano hazard zone
	Geographic Extent	Volcano lava flow areas of influence are highly prevalent within the state/territory		Volcano ash areas of influence occur within the state/territory, but may be avoidable	Volcano hazard zones do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
Landslide	Magnitude or Intensity	High likelihood that a Proposed Action activity could be located within a landslide area	Effect that is *potentially significant*, but with mitigation is *less than significant*	Low likelihood that a Proposed Action activity could be located within a landslide area	No likelihood of a Proposed Action activity located within a landslide hazard area

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Landslide areas are highly prevalent within the state/territory		Landslide areas occur within the state/territory, but may be avoidable	Landslide hazard areas do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
Land Subsidence	Magnitude or Intensity	High likelihood that a Proposed Action activity could be located within an area with a hazard for subsidence (e.g., karst terrain)	Effect that is *potentially significant*, but with mitigation is *less than significant*	Low likelihood that a Proposed Action activity could be located within an area with a hazard for subsidence	Project activity located outside an area with a hazard for subsidence
	Geographic Extent	Areas with a high hazard for subsidence (e.g., karst terrain) are highly prevalent within the state/territory		Areas with a high hazard for subsidence occur within the state/territory, but may be avoidable	Areas with a high hazard for subsidence do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
Mineral and Fossil Fuel Resource impacts	Magnitude or Intensity	Severe, widespread, observable impacts to mineral and/or fossil fuel resources	Effect that is *potentially significant*, but with mitigation is *less than significant*	Limited impacts to mineral and/or fossil resources	No perceptible change in mineral and/or fossil fuel resources
	Geographic Extent	Regions of mineral or fossil fuel extraction areas are highly prevalent within the state/territory		Mineral or fossil fuel extraction areas occur within the state/territory, but may be avoidable	Mineral or fossil fuel extraction areas do not occur within the state/territory
	Duration or Frequency	Long-term or permanent degradation or depletion of mineral and fossil fuel resources		Temporary degradation or depletion of mineral and fossil fuel resources	NA
Paleontological Resources impacts	Magnitude or Intensity	Severe, widespread, observable impacts to	Effect that is *potentially significant*, but with mitigation is *less than significant*	Limited impacts to paleontological and/or fossil resources	No perceptible change in paleontological resources.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
		paleontological resources			
	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory		Areas with known paleontological resources occur within the state/territory, but may be avoidable	Areas with known paleontological resources do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
Surface Geology, Bedrock, Topography, Physiography, and Geomorphology	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes	Effect that is *potentially significant*, but with mitigation is *less than significant*	Minor degradation or alteration of surface geology, bedrock, topography that do not result in measurable changes in physiographic characteristics or geomorphological processes	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes
	Geographic Extent	State/territory		State/territory	NA
	Duration or Frequency	Permanent or long-term changes to characteristics and processes		Temporary degradation or alteration of resources that is limited to the construction and deployment phase	NA

NA = Not Applicable

3.2.3.3. Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts on the Proposed Action, such as seismic hazards and landslides, and those that would have impacts from the Proposed Action, such as land subsidence, mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geological resources are discussed below.

Seismic Hazard

As discussed in Section 3.1.3.8 (Figure 3.1.3-5), Connecticut is not at risk of significant earthquake events. Based on the impact significance criteria presented in Table 3.2.3-1, seismic impacts from deployment or operation of the Proposed Action would have *no impact* on seismic activity at the programmatic level; however, seismic impacts to the Proposed Action could occur if FirstNet's deployment locations were within high-risk earthquake hazard zones. Given the potential for minor to moderate earthquakes in parts of Connecticut, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Volcanic Activity

Volcanoes were considered but not analyzed for Connecticut, as they do not occur in the state; therefore, volcanoes do not present a hazard to the state.

Landslides

Similar to seismic hazards, another concern would be placement of equipment in areas that are highly susceptible to landslides.

As discussed in Section 3.1.3, the majority of Connecticut is at low risk of experiencing landslide events, though portions of the Connecticut River Valley are highly susceptible to landslides. Based on the impact significance criteria presented in Table 3.2.3-1, potential impacts to landslides from deployment or operation of the Proposed Action would have *less than significant* impacts at the programmatic level as it is likely that the project would attempt to avoid areas that are prone to landslides. However, impacts from landslides could be realized if FirstNet's deployment locations were within areas in which landslides are highly prevalent. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that several of Connecticut's major cities, including Hartford, New Haven, and Fairfield, are in areas at moderate to high risk of landslides, some amount of infrastructure could be subject to landslide hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Land Subsidence

As discussed in Section 3.1.3.8, portions of Connecticut are vulnerable to land subsidence due to mine collapse. Based on the impact significance criteria presented in Table 3.2.3-1: Impact Significance Rating Criteria for Geology, subsidence impacts could be *potentially significant* at the programmatic level if FirstNet's deployment locations were within areas at high risk to karst topography, mine collapse, or inundation due to long-term land subsidence. Equipment that is exposed to land subsidence, such as sinkholes created by karst topography or mine collapse, is subject to misalignment, alteration, or, in extreme cases, destruction. Long-term land subsidence, due to factors such as aquifer compaction, in coastal areas could lead to relative sea level rise[145] and inundation of equipment. All of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in known areas where subsidence is possible. However, where infrastructure is subject to landslide hazards, BMPs and mitigation measures (see Chapter 17) could be implemented to help avoid or minimize the potential impacts.

Mineral and Fossil Fuel Resource Impacts

As discussed in Section 3.1.3.7, mineral resources are found throughout Connecticut. Equipment deployment near mineral resources are not likely to affect these resources. Rather the new construction is only likely to limit access to extraction of these resourcesTo the extent practicable, FirstNet would avoid construction in areas where these resources exist. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Paleontological Resource Impacts

Equipment installation and construction activities that require ground disturbance could damage existing paleontological resources, which are both fragile and irreplaceable. Based on the impact significance criteria presented in Table 3.2.3-1, impacts to paleontological resources could be *potentially significant* at the programmatic level if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 3.1.3.6, fossils are abundant throughout parts of Connecticut, particularly the Ancient Connecticut River Valley. It is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized thus potential impacts would be *less than significant* at the programmatic level. Site- specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. BMPs and mitigation measures could further help avoid or minimize the potential impacts. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation

[145] Relative Sea Level Rise: "[Sea level rise that] includes the combined movement of both water and land. Even if sea level was constant, there could be changes in relative sea level. For example, a rising land surface would produce a relative fall in sea level, whereas a sinking land surface would produce a relative rise in sea level." (U.S. Geological Survey, 2015)

measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities would not require modification or removal of the surrounding terrain and therefore would not cause irreparable damage to that area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 3.2.3-1, impacts, at the programmatic level, could be *potentially significant* if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and *less than significant* at the programmatic level as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures (see Chapter 17) could be implemented to help avoid or minimize the potential impacts.

3.2.3.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operation activities.

Deployment Impacts

Implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities have the potential to be impacted by geologic hazards, some activities could result in potential impacts to geological resources, and other activities would have *no impacts*. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result, at the programmatic level, in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, the following are likely, at the programmatic level, to have *no impacts* to geological resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. There would be *no impacts* to geologic resources at the programmatic level since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible

changes. The section below addresses potential impacts if entry/exit points are installed in coastal locations that are susceptible to land subsidence.

- Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have *no impact* on geologic resources at the programmatic level because there would be no ground disturbance for pole/structure installation, and heavy equipment use would be typically limited to bucket trucks operated from existing paved, gravel, or dirt roads. Impacts to geologic resources associated with the construction of new poles to accept aerial fiber or on shore to accept submarine cable are addressed below.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to geologic resources because there would be no ground disturbance at the programmatic level. The section below addresses potential impacts if ground disturbing activities associated with new huts or structures were to occur in locations that are susceptible to specific geologic hazards.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to geologic resources at the programmatic level. The section below addresses potential impacts if the boxes/huts are installed in locations that are susceptible to specific geologic hazards (e.g., land subsidence, landslides, or earthquakes).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would result in *no impacts* to geologic resources at the programmatic level if no ground disturbance were associated with this activity. The potential addition of power units, structural hardening, and physical security measures would not impact geologic resources if this activity did not require ground disturbance. The section below addresses potential impacts if ground disturbing activities occur in locations that are susceptible to specific geologic hazards.
  - Deployable Technologies: Where deployable technologies would be implemented on existing paved surfaces, there would be *no impacts* to/from geologic resources at the programmatic level because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts associated with site preparation for staging or landing areas is discussed below.
- Satellites and Other Technologies
  - Satellite -Enabled Devices and Equipment: In most cases, installation of permanent equipment on existing structures, adding equipment to satellites being launched for other purposes, and the use of portable devices that use satellite technology would *not impact* geologic resources at the programmatic level because those activities would not require ground disturbance. The section below addresses potential impacts if ground disturbance activities occur in locations that are susceptible to specific geologic hazards.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact geology resources, it is anticipated that this activity would have *no impact* on geologic resources at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral resources and paleontological resources. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Aerial Fiber Optic Plant: As stated above, if collocation does not require new utility poles or ground disturbance, there would be *no impacts* to geologic resources. However, replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: As stated above, although lighting up of dark fiber would have *no impacts* to geologic resources at the programmatic level, installation of new associated huts or equipment, if required, could result in ground disturbance during grading or excavation activities. Where equipment is installed in locations that are susceptible to specific geologic hazards, it is possible that equipment could be affected by that hazard.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: As stated above, disturbance associated with the installation of fiber optic cable in existing conduit have *no impacts* to geologic resources at the programmatic level. However, if fiber were installed in

locations susceptible to landslides, earthquakes, or other geologic hazards, it is possible that the equipment could be affected by that hazard.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water is not expected to impact geologic resources, including marine paleontological resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
- Installation of Optical Transmission or Centralized Transmission Equipment: As stated above, if installation of equipment were to take place in existing facilities, there would be *no impact* to/from geologic resources. However, if installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to specific geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or perturbation of geologic resources. Where equipment is installed in locations that are susceptible to specific geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: As stated above, collocation that would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance, and therefore would have *no impact* on geologic resources. However, if structural hardening and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to specific geologic hazards, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: As stated above, where deployable technologies would be implemented on existing paved surfaces, there would be *no impacts* to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. However, implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: As stated above, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other

purposes, or the use of portable devices that use satellite technology would have *no impact* on geologic resources because those activities would not require ground disturbance. However, where equipment is permanently installed in locations that are susceptible to specific geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact on the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could include minimal removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet projects are likely to be small-scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small-scale. These potential impacts are expected to be *less than significant* at the programmatic level. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 3.2.1, Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be *no impacts* to geological resources associated with routine inspections of the Preferred Alternative at the programmatic level, assuming that the same access roads used for deployment are also used for inspections.

The operation of the Preferred Alternative could be affected by/ to geologic hazards including seismic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be *less than significant* at the programmatic level as it is anticipated that deployment locations would avoid, as practicable and feasible, locations that are more likely to be affected by potential seismic activity, landslides, or land subsidence. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.3.5. Alternatives Impact Assessment

The following section assesses potential impacts to geological resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to geological resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

Implementation of deployable technologies on existing paved surfaces would not result in impacts to geologic resources (or from geologic hazards) as there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be *less than significant* at the programmatic level due to the minor amount of paving or new infrastructure needed to accommodate the deployables. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, at the programmatic level, it is anticipated that there would be *no impacts* to geologic resources (or from geologic hazards) associated with routine inspections of the Preferred Alternative.

The operation of the Deployable Technologies Alternative could be affected by geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, at the programmatic level, potential impacts would be anticipated to be *less than significant* as the deployment would be temporary and likely would attempt to avoid locations that was subject to increased seismic activity, landslides, and land subsidence. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be *no impacts*, at the programmatic level, to geologic resources (or from geologic hazards) as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.3, Geology.

3.2.4. Water Resources

3.2.4.1. Introduction

This section describes potential impacts to water resources in Connecticut associated with construction/deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 3.2.4-1. The categories of impacts are defined at the programmatic level as *potentially significant, less than significant with BMPs and mitigation measures incorporated, less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to water resources addressed in this section are presented as a range of possible impacts.

Table 3.2.4-1: Impact Significance Rating Criteria for Water Resources at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) – sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, SDWA	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant* at the programmatic level.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		The impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Floodplain degradation[a]	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant* at the programmatic level.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		The impact is temporary, lasting no more than one season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant* at the programmatic level.	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent		The impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant* at the programmatic level.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent		Impact is temporary, not lasting more than six months.	NA
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant* at the programmatic level.	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts	Activities do not impact groundwater or aquifers
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact is ongoing and permanent		Potential impact is temporary, not lasting more than six months.	NA

NA = Not Applicable

[a] Since public safety infrastructure is considered a critical facility, Proposed Action activities should avoid the 500-year floodplain wherever practicable, per the Executive Orders on Floodplain Management (EO 11988 and EO 13690).

3.2.4.3. Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the Clean Water Act (CWA) requires states to assess and report on the quality of waters in their state. Section 303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, to restore and protect such uses.

Approximately 41 percent of Connecticut's rivers and streams, and 20 percent of the state's lakes and ponds are impaired (see Table 3.1.4-2, Figure 3.1.4-4). Various sources affect Connecticut's waterbodies, causing impairments. For example, from 1932 to 1977 industrial manufacturing and improper disposal of electrical transformers lead to extensive PCBs contamination of the Housatonic River, extending from Pittsfield, MA, through Connecticut into Long Island Sound (USEPA, 2014a). Approximately 70 percent of Connecticut's estuaries and bays are impaired, with the overall condition of Long Island Sound rated as being poor. Legacy discharges of PCBs have resulted in fish consumption advisories on striped bass and bluefish for all estuaries, as well as consumption advisories for all freshwater fish, except trout, due to atmospheric deposition of mercury (CT DEEP, 2012a). Groundwater quality within the State is generally good.

Deployment activities can contribute pollutants in a number of ways but the primary manner is increased sediment in surface waters. Vegetation removal on site exposes soils to rain and wind that can increase erosion. Impacts to water quality may occur from post construction vegetation management, such as herbicides, that may leach into groundwater or move to surface waters through soil erosion or runoff, spray drift, or inadvertent direct overspray. Fuel, oil, and other lubricants from equipment can contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, water volume flows, pH or dissolved oxygen levels, water odor, color, or taste, or addition of suspended solids.

Soil erosion or the introduction of suspended solids into waterways from implementation of the Preferred Alternative could contribute to degradation of water quality. If the Proposed Action and Alternatives would disturb more than 1 acre of soil, a State or USEPA Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could

result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs and mitigation measures, where practicable and feasible, would reduce potential impacts to surface water quality.

The deployment activities would not violate applicable state, federal (e.g., CWA, and Safe Drinking Water Act), and local regulations, cause a threat to the human environment, biodiversity, or ecological integrity through water degradation, or cause a sediment water quality violation from local construction, or otherwise substantially degrade water quality.

Therefore, based on the impact significance criteria presented in Table 3.2.4-1, water quality impacts would likely be *less than significant* at the programmatic level particularly if BMPs and mitigation measures were to be incorporated where practicable and feasible.

During implementation of the Proposed Action and Alternatives, there is the potential to encounter shallow groundwater due to clearing and grading activities, shallow excavation, or relocation of utility lines. This is unlikely, as trenching is not expected to exceed a 48-inch depth. However, groundwater contamination may exist in areas directly within or near the project area. If trenching[146] were to occur near or below the existing water table (depth to water), then dewatering would be anticipated at the location. Residual contaminated groundwater could be encountered during dewatering activities. Construction activities would need to comply with Connecticut dewatering requirements. Any groundwater extracted during dewatering activities or as required by a dewatering permit would be treated prior to discharge or disposed of at a wastewater treatment facility.

Due to average thickness of most Connecticut aquifers (50 to 100 feet) (CT DEEP, 2014g), there is little potential for groundwater contamination within a watershed or multiple watersheds. Thus, it is unlikely that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer, and based on the impact significance criteria presented in Table 3.2.4-1, there would likely be *less than significant* impacts on groundwater quality at the programmatic level within most of the state. However, it should be noted that most of the wells in Connecticut are less than 300 feet deep (Moody, Carr, Chase, & Paulson, 1986), BMPs and mitigation measures could be implemented to reduce further potential impacts. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on human beings, buildings, roads and other infrastructure. The 500-year floodplain is the area of minimal flood

[146] Telecommunications activities involve laying conduit, with minimal trenching. Trenching activities would likely be at a minimal depth (less than 36 inches) and width (6 to 12 inches).

hazard, where there is a 0.2-percent-annual-chance flood. Some Proposed Action projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 3.2.4-1, floodplain degradation impacts would be *less than significant* at the programmatic level since the majority of FirstNet's likely deployment activities, on the watershed or subwatershed level, would occur inside the 500-year floodplain, would use minimal fill, would not substantially increase impervious surfaces, would not impede or redirect flood flows or impact floodplain hydrology, and would not occur during flood events. Additionally, any effects would be temporary, lasting no more than one season or water year,[147] or occur only during an emergency.

Examples of activities that would have *less than significant* impacts at the programmatic level include:

- Construction of any structure in the 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.
- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented to help reduce the risk of additional impacts of floodplain degradation. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Drainage Pattern Alteration

Flooding and erosion from land disturbance can changes drainage patterns. Storm water runoff causes erosion while construction activities and land clearing can change drainage patterns. Clearing or grading activities, or the creation of walls or berms can alter water flow in an area or cause changes to drainage patterns. Drainage can be directed to stormwater drains, storage, and retention areas designed to slow water and allow sediments to settle. Improperly handled drainage can cause increased erosion, changes in runoff, flooding, and damage to water quality. Existing drainage patterns can be modified by channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 3.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or sub-watershed level would be considered *less than significant* at the programmatic level.

[147] A water year is defined as "the 12-month period October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months" (USGS, 2014f).

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited storm water runoff.
- Where stormwater is contained on site and does not flow to or impact surface waterbodies off-site on other properties.
- Activities designed so that the amount of storm water generated before construction is the same as afterwards.
- Activities designed using low impact development techniques for storm water.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term; impacts to drainage patterns would be *less than significant* at the programmatic level. BMPs and mitigation measures could be implemented to further reduce any impacts. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Flow Alteration

Flow alteration refers to the modification of flow characteristics, relative to natural conditions. Human activities may change the amount of water reaching a stream, divert flow through artificial channels, or alter the shape and location of streams. Surface water and groundwater withdrawals can alter flow by reducing water volumes in streams. Withdrawals may return to the surface/groundwater system at a point further downstream, be removed from the watershed through transpiration by crops, lawns or pastures, or be transferred to another watershed altogether (e.g., water transferred to a different watershed for drinking supply). Altered flow can increase flooding and introduce more erosion and potential for pollution. Alternatively, if water is diverted from its normal flow, the opposite may occur; wetlands and streams may not receive as much water as necessary to maintain the ecology and previous functions.

Activities that do not impact discharge or stage of waterbody (stream height) are not anticipated to have an impact on flow, according to Table 3.2.4-1. Projects that include minor consumptive use of surface water with *less than significant* impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) basis are likely to have *less than significant* impacts on flow alteration at the programmatic level, on a watershed or subwatershed level. Examples of projects likely to have *less than significant* impacts at the programmatic level include:

- Construction of any structure in a 100-year or 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns off site or into surface waterbodies that have not received that volume of stormwater before.
- Minor clearing or grading activities.

Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be *less than significant* impacts to flow alteration at the programmatic level. BMPs, mitigation measures, and avoidance could be implemented to further reduce any impacts. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 3.1.4.7, approximately one-third of Connecticut's three million residents use groundwater as their primary source for their drinking water. "Approximately one-half of those residents draw groundwater from private well, and the other one-half from community wells" (CT DEEP, 2015h). Groundwater is an important natural resource used by industrial, commercial, agricultural, and residential uses for manufacturing, irrigation, and drinking water purposes. Generally, the water quality of Connecticut's aquifers is suitable for drinking and daily water needs. Once a groundwater supply is exhausted or contaminated, it is very expensive, and sometimes impossible, to replace. Water supply demand from the deployment activities is unlikely to exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would be unlikely to cause any *potentially significant* impacts to water quality due to the small volume of fuels anticipated to be stored on site and the likelihood that any spilled material would be cleaned up promptly. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater, generation.
- Storage of petroleum or chemical products.

Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).

Deployment activities should be *less than significant* at the programmatic level since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. The siting of deployment activities should be considered to avoid areas that would extract groundwater from potable groundwater sources in the area. According to Table 3.2.4-1, *potentially significant* impacts to groundwater or aquifer characteristics would only occur if actions resulted in substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime on a watershed or within multiple watersheds that is ongoing and permanent. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.4.4. Potential Impacts of the Preferred Alternative at the Programmatic Level

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities could result in potential impacts to water resources and others would not. In addition, and as explained in this section, the various types of Preferred Alternative Infrastructure could result in a range of *no impacts* to *less than significant* impacts at the programmatic level depending on the deployment scenario or site-specific conditions. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to water resources at the programmatic level under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to water resources at the programmatic level since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to water resources at the programmatic level because there would be no ground disturbance.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to water resources at the programmatic level. The section below addresses potential impacts if construction of new boxes, huts, or other equipment is required.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not

require ground disturbance, construction in floodplains, or use of motorized equipment near streams.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have *no impact* on water resources at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential construction/deployment-related impacts to water resources as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of ground disturbance activities, including in-stream construction work, resulting primarily in sediments entering streams, but also potentially to near-shore or inland waters, as well as the potential for other impacts to water quality and floodplains. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water could potentially impact water quality due to disruption of sediments on the floor of the waterbody. Impacts to water resources could also potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable. Sediments entering limited near-shore or inland waterbodies could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Construction of facilities in floodplains could potentially impact floodplain functionality and drainage patterns.
  - New Build – Aerial Fiber Optic Plant: Soil exposure from installation of new poles or construction of new roads, POPs, huts, or other facilities near waterbodies could result in ground disturbance, potentially resulting in sediment deposition and increased turbidity in nearby waterbodies. The use of heavy equipment during the installation of new poles and cables could result in potential soil disturbance and the resulting potential sedimentation impacts to streams, disturbance of riparian vegetation, leaching of PCPs, and accidental spills of fuels or lubricants to waterbodies.

  - Collocation on Existing Aerial Fiber Optic Plant: Ground disturbance during the replacement of poles and structural hardening could result in potential soil erosion and sedimentation impacts to streams, particularly where this work would be done in proximity to waterbodies. Collocation on Existing Aerial Fiber Optic Plant projects could present a lower risk to water resources because of their relatively low degree of soil disturbance compared to the other types of projects.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to water resources at the programmatic level.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to water resources because there would be no ground disturbance or in-water construction associated with this activity. The potential addition of power units, structural hardening, and physical security measures would not impact water resources if this activity would not require ground disturbance or in-water construction. However, if the on-site delivery of additional power units, structural hardening, and physical security measures required travel through streams or ground disturbance, such as grading or excavation activities near streams, potential impacts to water resources could occur including stream sedimentation and physical disturbance associated with heavy equipment use.
  - Deployable Technologies: Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct

and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Where deployable technologies would be implemented on existing paved surfaces, or where aerial and vehicular deployable technologies may be used on existing paved surfaces, it is anticipated that there would be *no impacts* to water resources at the programmatic level because there would be no ground disturbance.

- Deployment of drones, balloons, blimps, or piloted aircraft could have indirect impacts on water quality if fuels spill or other chemicals seep into ground or surface waters. In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts, but are expected to be *less than significant* at the programmatic level. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure would likely be *less than significant* at the programmatic level due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is complete. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be *no impacts* to water resources at the programmatic level associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections, and assuming that all refueling and vehicle maintenance BMPs and mitigation measures are followed. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Chapter 17, BMPs and Mitigation Measures,

provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.4.5. Alternatives Impact Assessment

The following section assesses potential impacts to water resources at the programmatic level associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to water resources as a result of implementation of this Alternative could be as described below.

Potential Deployment Impacts

As explained above, at the programmatic level, implementation of deployable technologies could result in *less than significant* impacts to water resources at the programmatic level if those activities occurred on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving; however, these activities would be isolated and short term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites and from fuels leaking into surface or groundwater. However, spills from vehicles or machinery used during deployment tend to be associated with re-fueling operations, and as such, would likely be a few gallons or less in volume and would likely be easily contained or cleaned up, and therefore would have *less than significant* impacts at the programmatic level. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or

short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be *no impacts* to water resources at the programmatic level associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods of time, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies; however, due to the limited and temporary nature of the deployable activities, at the programmatic level, it is anticipated that these potential impacts would be *less than significant* at the programmatic level. Site maintenance, including mowing or herbicides, may result in *less than significant* effects at the programmatic level to water quality at the programmatic level, due to the small-scale of expected FirstNet activities in any particular location. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to water resources at the programmatic level as a result of the No Action Alternative.

3.2.5. Wetlands

3.2.5.1. Introduction

This section describes potential impacts to wetlands in Connecticut associated with construction/deployment and operation of the Proposed Action and Alternatives. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 3.2.5-1. The categories of impacts are defined at the programmatic level as *potentially significant, less than significant with BMPs and mitigation measures incorporated,*

less than significant, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to wetlands addressed in this section are presented as a range of possible impacts.

Table 3.2.5-1: Impact Significance Rating Criteria for Wetlands at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Direct wetland loss (fill or conversion to non-wetland)	Magnitude[a] or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 404 of the CWA	Effect that is *potentially significant*, but with mitigation is *less than significant* at the programmatic level	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No direct loss of wetlands.
	Geographic Extent/Context	USGS watershed level, and/or within multiple watersheds		USGS watershed or subwatershed level.	NA
	Duration or Frequency	Long-term or permanent loss, degradation, or conversion to non-wetland		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality degradation (spills or sedimentation)	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	Effect that is *potentially significant*, but with mitigation is *less than significant* at the programmatic level	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality
	Geographic Extent	USGS watershed level, and/or within multiple watersheds		USGS watershed or subwatershed level	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA
Indirect Effects: [b] Change in Function(s)[c] Change in Wetland Type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.)	Effect that is *potentially significant*, but with mitigation is *less than significant* at the programmatic level	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No changes in wetland function or type
	Geographic Extent	USGS watershed level, and/or within multiple watersheds		USGS watershed or subwatershed level	NA
	Duration or Frequency	Long-term or permanent change in function or type that is not restored within two growing seasons, or ever		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA

NA = Not Applicable

[a] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories (USACE 2014). Category 1 are the highest quality, highest functioning wetlands

[b] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type

[c] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

3.2.5.3. Description of Environmental Concerns

Potential Direct Wetland Loss (Fill or Conversion to Non-Wetland)

Construction-related impacts from several of the deployment activities have the potential for direct wetland impacts such as filling, draining, or conversion to a non-wetland. Examples include placement of fill in a wetland to construct a new tower, trenching through a wetland or directly connected waterway to install a cable, and placement of a structure (tower, building) within the wetland.

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, vibration, light, and other human disturbance. To the extent practicable or feasible, FirstNet and/ or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be *less than significant* at the programmatic level given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

There are approximately 209,000 acres of wetlands throughout Connecticut (USFWS, 2014a). Palustrine (freshwater) wetlands are found on river and lake floodplains across the state, particularly within the Connecticut, Housatonic and Thames river watersheds, and estuarine (tidal) wetlands along the shore and estuaries of the Long Island Sound and South Central Coast watershed, as shown in Section 3.1.5, Figure 3.1.5-1.

Based on the impact significance criteria presented in Table 3.2.5-1, and given the temporary nature of most proposed activities, the deployment activities would most likely have *less than significant* direct impacts on wetlands at the programmatic level. Additionally, most of the deployment activities would not violate applicable federal (e.g., CWA Section 404), state, and locally required regulations.

In Connecticut, as discussed in Section 3.1.5.4, Wetlands, regulated high quality wetlands (or wetlands of special value) includes vernal pools and the wetlands associated with the Lower Connecticut River.

- Vernal pools are seasonal wetlands in confined depressions or basins that lack a permanent outlet stream. Connecticut's vernal pools vary in size from small mud puddles to shallow lakes, and are generally at low spots in forests or meadows, as shown in Section 3.1.5.4,

Figure 3.1.15-2. Vernal pools are often difficult to identify as climatic changes during each season dramatically alter their appearance. Vernal pools lack fish populations but are able to provide ideal breeding grounds for amphibian or invertebrate species. (USDA, 2015a). Due to their small size, and temporal nature, vernal pools are not included on state wetland maps, and are often overlooked by state planners.

- The Lower Connecticut River is home to many ecologically sensitive tidal marsh communities, which have been designated as Wetlands of International Importance under the Ramsar Convention.[148] The area offers habitat for a "multitude of creatures, including six kinds of plants and animals that are rare or endangered worldwide" (The Nature Conservancy, 2015a).

If any of the proposed deployment activities were to occur in these high quality wetlands, *potentially significant* impacts could occur. High quality wetlands occur throughout the state, and are not always included on state maps; therefore, site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work to avoid *potentially significant* impacts to wetlands. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Other Direct Effects

Direct impacts consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through chemical, mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 3.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) could cause *potentially significant* impacts. In addition, introduction and establishment of invasive species to high quality wetlands within a watershed or multiple watersheds could be *potentially significant*. Other direct effects to high- and low-quality wetlands would be *less than significant* at the programmatic level given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and locally required wetlands regulations. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation

[148] The Ramsar Convention is the "oldest of the modern global intergovernmental environmental agreements. The treaty was negotiated through the 1960s by countries and non-governmental organizations concerned about the increasing loss and degradation of wetland habitat for migratory waterbirds" (Ramsar Convention, 2014).

measures. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Examples activities that could have other direct effects to wetlands in Connecticut include:

- *Vegetation Clearing*: removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.
- *Ground Disturbance*: Increased amounts of stormwater runoff in wetlands can alter water level response times, depths, and duration of water detention. Reduction of watershed infiltration capacity could cause wetland water depths to rise more rapidly following storm events.
- *Direct Soil Changes*: Changes in soil chemistry can lead to degradation of wetlands that have a specific pH range and/or other parameter, such as the acidic conditions of bogs and alkaline conditions of fens (which often provide habitat for rare species).
- *Water Quality Degradation (spills or sedimentation)*: The loss of wetlands results in a depletion of water quality both in the wetland and downstream. Filtering of pollutants by wetlands is an important function and benefit. High levels of suspended solids (sedimentation) can reduce light penetration, dissolved oxygen, and overall wetland productivity. Toxic materials in runoff can interfere with the biological processes of wetland plants, resulting in impaired growth, mortality, and changes in plant communities.

Indirect Effects:[149] Change in Function(s)[150] or Change in Wetland Type

Indirect effects to wetlands could include change in wetland function or conversion of a resource to another type (i.e., wetland to an open body of water). The construction of curb and gutter systems could divert surface runoff and can cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to high- and low-quality wetlands would be *less than significant* at the programmatic level given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and locally required wetlands regulations. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts. Examples of functions related to wetlands in Connecticut that could potentially be impacted from construction-related deployment activities include:

[149] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type.
[150] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

- *Flood Attenuation:* Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they can lower flood peaks by providing detention of storm flows.
- *Bank Stabilization:* By reducing the velocity and volume of flow, wetlands provide erosion control, floodwater retention, and reduce stream sedimentation.
- *Water Quality:* Water quality impacts on wetland soils can eventually threaten a wetland's existence. Where sediment inputs exceed rates of sediment export and soil consolidation, a wetland would gradually become filled.
- *Nutrient Processing:* Wetland forests retain ammonia during seasonal flooding. Wetlands absorb metals in the soils and by plant uptake via the roots. They also allow metabolism of oxygen-demanding materials and reduce fecal coliform populations. These pollutants are often then buried by newer plant material, isolating them in the sediments.
- *Wildlife Habitat:* Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding can harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes can have impacts on the preferred food supply and animal cover.
- *Recreational Value:* Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- *Groundwater Recharge:* Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According to the significance criteria defined in Table 3.2.5-1, impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity), would be considered *less than significant* at the programmatic level. Since the majority of the wetlands in Connecticut are not considered high quality, deployment activities could have *less than significant* indirect impacts on wetlands at the programmatic level in the state. BMPs and mitigation measures could be implemented, as feasible and practicable, to reduce potential impacts to all wetlands.

In areas such as the Lower Connecticut River, where all wetlands are considered high quality, there could be *potentially significant* impacts at the project level that may require site-specific analysis depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. If avoidance were not possible, potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.5.4. Potential Impacts of the Preferred Alternative at the Programmatic Level

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wetlands and others would not. In addition, and as explained in this section, the same type of Preferred Alternative Infrastructure could result in a range of *no impacts* to *potentially significant* impacts at the programmatic level depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to wetlands at the programmatic level under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to wetlands at the programmatic level since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to wetlands at the programmatic level because there would be no ground disturbance.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to wetlands at the programmatic level. The section below addresses potential impacts if construction of new boxes, huts, or other equipment is required.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launches for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would not impact wetlands, it is anticipated that this activity would have *no impact* on wetlands at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments, including coastal and marine environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
  - Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in suspended solids running off construction sites and into wetlands depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, or blimps piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be *less than significant* at the programmatic level due to the small about of land disturbance (generally less than one acre) and the short timeframe of deployment activities. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned potential deployment impacts. It is anticipated that there would be *no impacts* at the programmatic level to wetland resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections, and assuming that all federal, state, and local requirements associated with refueling and vehicle maintenance are followed. If heavy equipment is used as part of routine maintenance or inspections off of established access roads or corridors, or if application of herbicides is used to control vegetation, potential wetland impacts could be *less than significant* at the programmatic level as explained above. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.5.5. Alternatives Impact Assessment

The following section assesses potential impacts to wetlands at the programmatic level associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wetlands as a result of implementation of this Alternative could be as described below.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to wetlands at the programmatic level. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be *less than significant* at the programmatic level due to the small-scale and temporary duration of expected

FirstNet deployment activities in any one location. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance could result in impacts similar to the abovementioned deployment impacts. The wetlands impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the wetland's quality and function.

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *no impacts* at the programmatic level to wetland resources associated with routine inspections of the Deployable Technologies Alternative, assuming the use of access roads and compliance with refueling and vehicle maintenance requirements, and *less than significant* potential impacts at the programmatic level associated with maintenance activities if heavy equipment is used as part of routine maintenance, if or inspections occur off of established access roads or corridors, or if routine maintenance or application of herbicides, is used to control vegetation. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to wetlands at the programmatic level as a result of the No Action Alternative.

3.2.6. Biological Resources

3.2.6.1. Introduction

This section describes potential impacts to vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Connecticut associated with deployment and operation of the Proposed Action and its Alternatives. BMPs and mitigation measures that would avoid or minimize those potential impacts are identified in Chapter 17.

3.2.6.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on vegetation, wildlife, fisheries, and aquatic habitats were evaluated using the significance criteria presented in Table 3.2.6-1. The categories of impacts are defined at the programmatic level as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 3.2.6.3, 3.2.6.4, and 3.6.2.5, respectively, are presented as a range of possible impacts.

Refer to Section 3.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Connecticut.

Table 3.2.6-1: Impact Significance Rating Criteria for Vegetation, Wildlife, Fisheries, and Aquatic Habitats at the Programmatic Level

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury /mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including Marine Mammal Protection Act (MMPA), Magnuson Stevens Fishery Conservation And Management Act (MSFCMA), Migratory Bird Treaty Act (MBTA), and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is *potentially significant*, but with mitigation is *less than significant*	Individual mortality observed but not sufficient to affect population or sub-population survival	No direct individual injury or mortality would be observed
	Geographic Extent	Regional effects observed within Connecticut for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated or short-term effects that are reversed within one to three years	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with mitigation is *less than significant*	Habitat alteration in locations not designated as vital or critical for any period. Temporary losses to individual plants within cover types, or small habitat alterations take place in important habitat that is widely distributed and there are no cover type losses or cumulative effects from additional projects	Sufficient habitat would remain functional to maintain viability of all species. No damage or loss of terrestrial, aquatic, or riparian habitat from the Proposed Action would occur.
	Geographic Extent	Regional effects observed within Connecticut for at least one species. Anthropogenic disturbances that lead to the loss or alteration of nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated or short-term effects that are reversed within one to three years	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances that lead to mortality, disorientation, the avoidance or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with mitigation is *less than significant*	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic disturbances are measurable but minimal as determined by individual behavior and propagation, and the potential for habituation or adaptability is high given time.	No stress or avoidance of feeding or important habitat areas. No reduced population resulting from habitat abandonment.
	Geographic Extent	Regional or site specific effects observed within Connecticut for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts, resulting in injury or mortality.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated or short-term effects that are reversed within one to three years	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long term loss of migratory pattern/path, or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with mitigation is *less than significant*	Temporary loss of migratory rest stops due to anthropogenic activities take place in important habitat that is widely distributed and there are no cumulative effects from additional projects	No alteration of migratory pathways, no stress or avoidance of migratory paths/patterns due to the Proposed Action.
	Geographic Extent	Regional effects observed within Connecticut for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species		Temporary, isolated, or short-term effects that are reversed within one to three years	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with mitigation is *less than significant*	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success
	Geographic Extent	Regional effects observed within Connecticut for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning, or anthropogenic disturbances that lead to stress, abandonment and loss of productivity for endemics or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated or short-term effects that are reversed within one breeding season	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is *potentially significant*, but with mitigation is *less than significant*	Mortality observed in individual native species with no measurable increase in invasive species populations	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to Proposed Action project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout Connecticut.		Effects realized at one location	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons	NA

NA = Not Applicable

3.2.6.3. Vegetation

Impacts to vegetation occurring in Connecticut's environment are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are permanent or temporary loss or disturbance of individual plants. Based on the impact significance criteria presented in Table 3.2.6-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale. The implementation of BMPs and mitigation measures and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat.

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. Further, if proposed sites with sensitive or rare regional vegetative communities are unavoidable, BMPs and mitigation measures would be implemented to minimize or avoid potential impacts. Comments received on other regional Draft PEIS documents for the Proposed Action expressed concerns related to the potential impacts to vegetation from RF emissions. Some studies have indicated the potential for *adverse effects* to vegetation from RF emissions. As explained in Section 2.4, Radio Frequency Emissions, as well as the Wildlife portion of this Biological Resources Section, additional, targeted research needs to be conducted to more fully document the nature and effects of RF exposure, including the potential impacts to vegetation.

Indirect Injury/Mortality

"Indirect effects" are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality can include stress related to disturbance. The alteration of soils or hydrology within a localized area can result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to the small size of expected FirstNet activities. Increasing

or decreasing hydrology in an area could lead to moisture stress and/or mortality of plant species that are adapted to specific hydrologic regimes. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment, though BMPs and mitigation measures could help to minimize or avoid the potential impacts.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for vegetation (e.g., forest migration) are expected as a result of the Proposed Action given the small-scale of deployment activities.

Reproductive Effects

No reproductive effects to vegetation are expected as a result of the Proposed Action given the small-scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species can have a dramatic effect on natural resources and biodiversity.

When non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. Natural or native community species evolve together into an ecosystem with many checks and balances that limit the population growth of any one species. These checks and balances include such things as predators, herbivores, diseases, parasites, and other organisms competing for the same resources and limiting environmental factors. However, when an organism is introduced into an ecosystem in which it did not evolve naturally, those limits may not exist and its numbers can sometimes dramatically increase. The unnaturally large population numbers can then have severe impacts to the environment, local economy, and human health. Invasive species can out-compete the native species for food and habitats and sometimes even cause their extinction. Even if natives are not completely eliminated, the ecosystem often becomes much less diverse.

The potential to introduce invasive plants within construction zones and during long-term site maintenance can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 17) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to vegetation as a result of the introduction of invasive species.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to vegetation resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range impacts at the programmatic level, from *no impacts* to *less than significant* impacts, depending on the deployment scenario or site-specific conditions. The vegetation that would be affected would depend on the ecoregion, the species' phenology[151], and the nature as well as the extent of the habitats affected.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have *no impacts* to vegetation under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to vegetation because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not impact vegetation because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have *no impact* on vegetation.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect

[151] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to vegetation include the following:

- Wired Projects
  - o New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. BMPs and mitigation measures (see Chapter 17) could help to avoid or minimize potential impacts.
  - o Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although vegetation could be impacted, it is anticipated that effects to vegetation would be relatively minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - o New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. BMPs and mitigation measures (see Chapter 17) could help to avoid or minimize potential impacts.Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - o New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact vegetation. However, impacts to vegetation could potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. BMPs and mitigation measures (see Chapter 17) could help to avoid or minimize potential impacts.
  - o Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct or indirect injury to plants, the vegetation loss, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers or Backhaul Equipment: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete and pads), microwave facilities, or access roads could result in impacts to vegetation. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to vegetation. However, if new power units, replacement towers, structural hardening, and physical security measures require land clearing or excavation activities, impacts would be similar to new wireless construction.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct impacts to vegetation if deployment occurs on vegetated areas, or the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving.
    Deployment of drones, balloons, blimps or piloted aircraft could potentially impact vegetation if launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs.

In general the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the vegetation affected. These impacts are expected to be *less than significant* at the programmatic level due to the small-scale of expected deployment activities. See See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The vegetation that would

be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

At the programmatic level, it is anticipated that there would *no impacts* to vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in *less than significant* effects due to the small-scale of expected deployment activities. These potential impacts could result from accidental spills from maintenance equipment or release of herbicides and because these areas would not be allowed to revert to a more natural state. If usage of heavy equipment or land clearing activities occurs off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species could occur to vegetation, however impacts are expected to be *less than significant* at the programmatic level due to the small-scale of expected activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to vegetation associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to vegetation as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As described above, at the programmatic level, implementation of deployable technologies could result in *less than significant* impacts from land/vegetation clearing, excavation, and paving activities. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts. However, impacts are expected to remain *less than significant* at the programmatic level due to the relatively small-scale of FirstNet activities at individual locations. See Chapter 17, BMPs and Mitigation

Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that, at the programmatic level, there would be *less than significant* impacts to vegetation associated with routine operations and maintenance due to the relatively small-scale of likely FirstNet project sites. The impacts can vary greatly among species, vegetative community, and geographic region, but are expected to remain *less than significant*.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. Therefore, there would be *no impacts* to vegetation as a result of the No Action Alterrnative. Environmental conditions would therefore be the same as those described in Section 3.1.6.3, Vegetation.

3.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, marine mammals, birds, and invertebrates occurring in Connecticut and Connecticut's near offshore environment (i.e., less than two miles from the edge of the coast) are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle or vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 3.2.6-1, *less than significant* impacts would be anticipated at the programmatic level, as discussed further below (except for birds which would be *less than significant with BMPs and mitigation measures incorporated*), given the anticipated small size and nature of the majority of the proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, impacts to individual behavior of animals would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Connecticut. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, preferred vegetation along roadways, areas of insect relief, and ease of

travel along road corridors (USDOT, 2015d). Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur.

Entanglement in fences or other barriers could be a source of mortality or injury to terrestrial mammals, though entanglements would likely be isolated, individual events.

For bats, and particularly if maternity colonies are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be associated with the amount of tree removal and if maternity colonies are present. However, given the small scale of anticipated FirstNet activities (less than 1 acre), direct injury/mortality are not anticipated to be widespread or affect populations of bat species. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or further minimize potential impacts.

Marine Mammals

Marine mammals swimming or hauled out on land are sensitive to boats, aircraft, and human presence. Noises, vibrations, smells, sounds, and sights may elicit a flight reaction. Trampling deaths associated with haulout disturbance are known source of mortality for seals but are not anticipated from the types of FirstNet deployment activities.

Entanglements from marine debris as well as ingestion of marine debris could result in injury or death to marine mammals. Marine debris is any manmade object discarded, disposed of, or abandoned that enters the marine environment. Entanglements from marine debris are not anticipated from FirstNet activities.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and violate MBTA and BGEPA. Generally, collision events occur to night-migrating birds, “poor” fliers (e.g., ducks), heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (Gehring, Kerlinger, & Manville, 2011).

Avian mortalities or injuries can also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds can occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation and trenching, and other ground disturbing activities. Individual species impacts may be realized depending on the nature of the deployment activity. Removal of trees during land clearing activities could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for resting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced if birds temporarily avoid IBAs within the state as these areas provide them with essential habitat

that supports various life stages (Hill D. e., 1997). Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small-scale of likely FirstNet actions, however, DOI comments dated October 11, 2016[152] state that communication towers are "currently estimated to kill between four and five million birds per year", although collisions with towers have the potential to impact a large number of birds unless BMPs and mitigation measures are incorporated, tower collisions are unlikely to cause population-level impacts. Of particular concern is avian mortality due to collisions with towers at night, when birds can be attracted to tower obstruction lights. Research has shown that birds are attracted to steady, non-flashing red lights and are much less attracted to flashing lights, which can reduce migratory bird collisions by as much as 70%. The FAA has issued requirements to eliminate steady-burning flashing obstruction lights and use only flashing obstruction lights. Additionally, on Jan. 6, 2017 the FCC issued a notice titled Opportunities to Reduce Bird Collisions with Communications Towers While Reducing Tower Lighting Costs (FAA, 2016c) (FAA, 2016d) (FCC, 2017). See Chapter 17, BMPs and Mitigation Measures, for BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential impacts to birds from tower lighting. Site-specific analysis and/or consultation with FWS may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. If siting considerations, BMPs, and mitigation measures are implemented (Chapter 17), potential impacts could be minimized. Applicable BMPs and mitigation measures, as defined through consultation with USFWS for MBTA or BGEPA, if required, could help to avoid or minimize any potential impacts (including possible "take").

Environmental consequences pertaining to federally listed species will be discussed in Section 3.2.6.6, Threatened and Endangered Species.

Reptiles and Amphibians

The majority of Connecticut's amphibian and reptile species are widely distributed throughout Connecticut. Either direct mortality to amphibians or reptiles could occur in construction zones by excavation activities or by vehicle strikes; however, these events are expected to be temporary and isolated, affecting only individual animals.

Three species of marine turtles – all listed as threatened or endangered under the ESA – occur in Connecticut's offshore environment. Environmental consequences pertaining to these reptiles are discussed in Section 3.2.6.6, Threatened and Endangered Species.

Invertebrates

Ground disturbance or land clearing activities as well as use of heavy equipment could result in direct injury or mortality to invertebrates. However, deployment activities are expected to be temporary and isolated, thereby limiting the potential for direct mortality and likely affecting only a small number of invertebrates. The invertebrate populations of Connecticut are so widely distributed that injury/mortality events are not expected to affect populations of species as a whole.

[152] See Appendix F, Draft PEIS Public Comments, for the full text of the Department of Interior comments.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat, and impeding access to resources and mates. There are areas in Connecticut that have experienced extensive land use changes from urbanization and agriculture. However, there are portions of the state are forested and remain relatively unfragmented.

Additionally, habitat loss can occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the Proposed Action would cause exclusion effects only in very special circumstances, as in most cases an animal could fly, swim, or walk to a nearby area that would provide refuge.

Potential effects of vegetation and habitat loss, alteration, or fragmentation are described for Connecticut's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Connecticut and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures.

Marine Mammals

A number of seal species may occur in the offshore areas of Connecticut. Harbor seals tend to be non-migratory; they can be found in open waters and also using rocks, beaches or other coastal habitats as haulouts and pupping sites in Connecticut, particularly in Long Island Sound (NOAA 2015). Seals could be temporarily excluded from a resource or abandon their haulout locations due to the presence of human beings, noise, vibrations or vessel traffic during deployment activities. For example, the seals would need to find a new haulout, likely at a less favorable location. Effects on seals from exclusion from resources would be low magnitude and temporary in duration.

Loss of habitat or exclusions from these areas for seals and whales could be avoided or minimized by BMPs and mitigation measures (see Chapter 17).

Birds

The direct removal of most bird nests is prohibited under the MBTA. The USFWS and the CT DEEP can provide regional guidance on the most critical periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation can affect avian species directly by loss of nesting, foraging, stopover, and cover habitat.

Noise and vibration disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced if birds temporarily avoid IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, et al., 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact on passerine[153] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration can have major impacts to species that migrate in large flocks and concentrate at stop overs (e.g., shorebirds). BMPs and mitigation measures, including nest avoidance during construction-related activities, could help to avoid or minimize the potential impacts to birds from exclusion of resource, as appropriate.

Reptiles and Amphibians

Important habitats for Connecticut's amphibians and reptiles typically consist of wetlands and, in some cases the surrounding upland forest. Impacts are expected to be *less than significant*. If Proposed Action sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 17) could be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 3.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to Connecticut's amphibian and reptile populations, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.[154]

Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many common invertebrates is generally assumed to be abundant and widely distributed across the state, therefore no significant effects to invertebrates are expected at the programmatic level. Impacts to sensitive invertebrate species are discussed below in Section 3.2.6.6, Threatened and Endangered Species and Species of Concern.

[153]Passerines are an order of "perching" birds that have four toes, three facing forward and one backward, which allows the bird to easily cling to both horizontal and nearly vertical perches.
[154] See Chapter 17, Wetlands, for a discussion of BMPs for wetlands.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment. Overall, potential impacts are expected to remain *less than significant* at the programmatic level (except for birds and bats due to potential exposure to RF emissions, see below), due to the short-term nature and limited geographic scope of expected activities. Additionally, FirstNet would attempt to avoid these areas, though BMPs and mitigation measures could further help to avoid or minimize the potential impacts. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.Terrestrial Mammals

Stress from repeated disturbances during critical time periods (e.g., roosting and mating) can reduce the overall fitness and productivity of young and adult terrestrial mammals. Indirect effects could occur result to roosting bats from noise, vibration, light, or human disturbance causing them to leave their roosting locations or excluding them from their summer roosting/maternity colony roosts. For example, some bat species establish summer roosting or maternity colonies in the same general area that they return to year and after year. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur.

Depending on the project type and location, individual species may be disturbed resulting in *less than significant* impacts at the programmatic level (except for bats, see below) due to the limited extent and temporary nature of deployment.

There are no published studies that document physiological or other *adverse effects* to bats from radio frequency (RF) exposure. However, because bats are similar ecologically and physiologically to birds, they have the potential to be affected by RF exposure in similar ways to birds (see the birds subsection below). One study demonstrated that foraging bats avoided areas exposed to varying levels of electromagnetic radiation compared with control sites, and attributed this behavior to the increased risk of overheating and echolocation interference caused by electromagnetic field exposure (Nicholls & Racey, 2009). As stated below, experts emphasize that targeted field research needs to be conducted to more fully document the nature and extent of effects of RF exposure on bats and other wildlife, and the implications of those effects on populations over the long term (Manville, 2015) (Manville, 2016a) (Appendix G). FirstNet recognizes that RF exposure has the potential to adversely impact bats, particularly bats that communally roost or breed and nurture young in areas with RF exposure, and concurs with the need for further research. As such, and as a precaution, FirstNet would implement BMPs and mitigation measures that focus on siting towers away from known communal bat use areas to the extent practicable or feasible (described in Chapter 17, BMPs and Mitigation Measures). See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts.

Marine Mammals

Repeated disturbance (e.g., from vessel traffic), especially near haulouts, can cause stress to individuals resulting in lower fitness and productivity. Given that the majority of FirstNet deployment activities are not expected to be onshore or in the oceanic environment, *less than significant* impacts to *no impacts* would be anticipated for marine mammals.

Birds

Repeated disturbance, especially during the breeding and nesting season, can cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, et al., 1997). The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances are not expected.

Depending on the Proposed Action type and location, individual species may be disturbed resulting in *less than significant* impacts at the programmatic level.

Research indicates that RF exposure may adversely affect birds. A comment letter on the Draft Programmatic Environmental Impact Statement for this region, presented by Dr. Albert Manville, former USFWS agency lead on avian-structural impacts, summarizes the state of scientific knowledge of the potential effects of RF exposure on wildlife, particularly migratory birds; the comment letter is presented in its entirety in Appendix G. RF exposure may result in adverse impacts on wildlife, although a distinct causal relationship between RF exposure and responses in wild animal populations has not been established. Further, important scientific questions regarding the mechanisms of impact, the exposure levels that trigger *adverse effects*, and the importance of confounding factors in the manifestation of effects, among other questions, remain unanswered (Manville, 2016b) (Appendix G).

Research conducted to date under controlled laboratory conditions has identified a wide range of physiological and behavioral changes in avian and mammalian subjects, including embryonic mortality in bird eggs, genetic abnormalities, cellular defects, tumor growth, and reproductive and other behavioral changes in adult birds and rodents (Wyde, 2016) (Levitt & Lai, 2010) (DiCarlo, White, Guo, & Litovitz, 2002) (Grigor'ev, 2003) (Panagopoulos & Margaritis, 2008).

Few studies of the effects of RF exposure on wild animal populations have been conducted due to the difficulty of performing controlled studies on wild subjects. Those that have been conducted are observational in nature (i.e., documenting of reproductive success and behavior in birds near RF-emitting facilities). These studies lack controls on exposure levels or other potentially confounding factors. Nevertheless, findings from these studies indicate reduced survivorship at all life stages; physiological problems related to locomotion and foraging success; and behavioral changes that resulted in delayed or unsuccessful mating in several species of nesting birds (Balmori, 2005) (Balmori, 2009) (Balmori & Hallberg, 2007) (Manville, 2016b) (Appendix G). Balmori (2005) documented effects as far as 1,000 feet from an RF source consisting of multiple cellular phone towers. Another study of wild birds conducted by Engels et al. (2014) documented that migratory birds are unable to use their magnetic compass in

the presence of urban electromagnetic noise,[155] which can disrupt migration or send birds off course, potentially resulting in reduced survivorship.

Experts emphasize that targeted field research needs to be conducted to more fully document the nature and extent of effects of RF exposure on birds and other wildlife and the implications of those effects on wildlife populations over the long term (Manville, 2015) (Manville, 2016b) (Appendix G). Such studies should be conducted over multiple generations and include controls to more clearly establish causal relationships, identify potential chronic effects, and determine threshold exposure levels. FirstNet recognizes that RF exposure may adversely impact wildlife, particularly birds that nest, roost, forage, or otherwise spend considerable time in areas with RF exposure, and concurs with the need for further research. As such, and as a precaution, FirstNet would implement BMPs and mitigation measures that focus on siting towers away from high bird use areas to the extent practicable or feasible (described in Chapter 17, BMPs and Mitigation Measures). See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, can cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature; therefore, repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in *less than significant* impacts at the programmatic level.

Invertebrates

Invertebrates can experience chronic stress, either by changes in habitat composition or competition for resources, resulting in lower productivity. Due to the large number of invertebrates distributed throughout the state, and given the short-term nature of most of the deployment activities, this impact would likely be *less than significant*.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. Overall, potential impacts are anticipated to be *less than significant* at the programmatic level due to the small-scale and localized nature of expected activities, which would be unlikely to result in long-term avoidance. Additionally, FirstNet would attempt to avoid areas of known migratory pathways. Potential effects to migration patterns of Connecticut's amphibians and reptiles, terrestrial mammals, marine mammals, birds, and invertebrates are described below. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential

[155] Urban electromagnetic noise is a term used to describe an area with a concentration of cell phone towers and users, which by sheer volume and level of use, creates a zone of electromagnetic noise.

impacts. See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure.

Terrestrial Mammals

Large game animals have well-defined migratory routes. Route knowledge is passed on from one generation to the next and includes important feeding and calving areas. Small mammals also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula.[156]

Any clearance, drilling, and construction activities needed for network deployment, including noise and vibrations associated with these activities, has the potential to divert mammals from these migratory routes. Impacts can vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be *less than significant*. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Marine Mammals

Noise and vibrations associated with the installation of cables in the near/offshore waters of coastal Connecticut could impact marine mammal migration patterns, though impacts are likely to be short-term provided the noise and vibration sources are not wide ranging and below Level A and B sound exposure thresholds[157]. It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. Marine mammals have the capacity to divert from sound sources during migration, and impacts are expected to be *less than significant*. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. For example, as a group shorebirds undertake some of the longest-distance migrations of all animals. Connecticut is within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. Connecticut has 27 IBAs spread throughout the state that serve as important stopover areas for migratory birds (National Audubon Society, 2015a). Many migratory routes are passed from one generation to the next. Impacts can vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, and impacts are expected to be *less than significant* at the programmatic level. Additionally, there is some evidence in the scientific literature that RF emissions could affect bird migration. Engels et al. (2014) documented that migratory birds are unable to use their magnetic compass in the presence of urban electromagnetic noise, which can disrupt migration or send birds off course, potentially resulting

[156] A location chosen by an animal for hibernation.
[157] Level A: 190 dB re 1µPa (rms) for seals and 180 dB re 1µPa (rms) for whales, dolphins, and porpoises. It is the minimum exposure criterion for injury at the level at which a single exposure is estimated to cause onset of permanent hearing loss. Level B: 160 dB re 1µPa (rms). It is defined as the onset of significant behavioral disturbance is proposed to occur at the lowest level of noise exposure that has a measurable transient effect on hearing (Southall et al. 2007).

in reduced survivorship. It is unlikely that the limited amount of infrastructure, the amount of RF emissions generated by Project infrastructure, and the temporary nature of the deployment activities would result in impacts to large populations of migratory birds, but more likely that individual birds could be impacted. Chapter 17, BMPs and Mitigation Measures, provides a list of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential effects to migratory pathways.

Reptiles and Amphibians

Several species of mole salamanders and the wood frog are known to seasonally migrate in Connecticut. These amphibians often travel by the hundreds on their migration pathway that often crosses roadways. Mole salamanders are typically found in burrows in the forest floor. Wood frogs use diverse vegetation types from grassy meadows to open forests. After they emerge from dormancy, wood frogs migrate up 900 feet to breeding pools, where they breed rapidly in early spring in both permanent and ephemeral water (Homan, Atwood, Dunkle, & Karr, 2010). However, (Berven & Grudzien, 1990) found that a small percentage of juvenile wood frogs can migrate over 1.5 miles from natal ponds, suggesting juveniles may be capable of migrating relatively long distances. Mortality and barriers to movement could occur as result of the Proposed Action (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but and impacts are expected to be *less than significant*. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. *No effects* to migratory patterns of Connecticut's invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which can affect the overall population of individuals. Overall, potential impacts are anticipated to be *less than significant* at the programmatic level due to the short-term and limited nature of expected activities (except for birds and bats which are anticipated to be *less than significant with BMPs and mitigation measures incorporated*, see below), as FirstNet would attempt to avoid these areas. Chapter 17, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts. See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and calving grounds for large mammalshas the potential to negatively affect body condition and reproductive success of mammals in Connecticut.

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small-scale and impacts are expected to be *less than significant*. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

There are no published studies that document *adverse effects* to bats from RF exposure. As stated above, experts emphasize that targeted field research needs to be conducted to more fully document the nature and extent of effects of RF exposure on bats and other wildlife, and the implications of those effects on populations over the long term (Manville, 2015) (Manville, 2016b) (Appendix G). FirstNet recognizes that RF exposure has the potential to adversely impact bats, particularly bats that communally roost or breed and nurture young in areas with RF exposure, and concurs with the need for further research. As such, and as a precaution, FirstNet would implement BMPs and mitigation measures that focus on siting towers away from known communal bat use areas to the extent practicable or feasible (described in Chapter 17, BMPs and Mitigation Measures). See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small-scale and impacts are expected to be *less than significant* at the programmatic level. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

Marine Mammals

Restricted access to important calving grounds has the potential to negatively affect body condition and reproductive success of marine mammals in Connecticut. For example, the displacement of female seals from preferred pupping habitats due to deployment and operations may reduce fitness and survival of pups potentially affecting overall productivity, though activities are likely to be small-scale in nature and contribute only minimally to minor, short-term displacement, and BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Disturbance to hauled out seals from activities associated with the Proposed Action could result in the abandonment, or death of offspring, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

Birds

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual, noise, and vibration) may displace birds into less suitable habitat and thus reduce survival and reproduction. These impacts could be

particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, et al., 1997). The majority of FirstNet deployment or operation activities are likely to be small-scale in nature.

Research conducted to date under controlled laboratory conditions has identified a wide range of physiological and behavioral changes in avian subjects, including embryonic mortality in bird eggs and reproductive changes in adult birds (Wyde, 2016) (Levitt & Lai, 2010) (DiCarlo, White, Guo, & Litovitz, 2002) (Grigor'ev, 2003) (Panagopoulos & Margaritis, 2008). Laboratory studies conducted with domestic chicken embryos have shown that emissions at the same frequency and intensity as that used in cellular telephones have appeared to result in embryonic mortality (DiCarlo, White, Guo, & Litovitz, 2002) (Manville, 2007). These studies suggest that RF emissions at low levels (far below the existing exposure guidelines for humans) (see Section 2.4.2, RF Emissions and Humans) may be harmful to wild birds; however, given the controlled nature of the studies and potential exposure differences in the wild, it is unclear how this exposure would affect organisms in the wild.

As such, and as a precaution, FirstNet would implement BMPs and mitigation measures that focus on siting towers away from high bird use areas to the extent practicable or feasible (described in Chapter 17, BMPs and Mitigation Measures) to help reduce bird mortalities associated with both RF emissions and tower collisions. See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts.

The majority of FirstNet deployment or operation activities are likely to be small scale in nature. BMPs and mitigation measures as defined through consultation with USFWS for compliance with MBTA or BGEPA, or another appropriate regulatory agency, if required, could help to avoid or minimize any potential impacts.

Reptiles and Amphibians

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests. For example, the spotted turtle (*Clemmys guttata*) leaves its breeding pool in May and travels to its nesting site.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs and mitigation measures would help to avoid or minimize the potential impacts. Overall, impacts to reptiles and amphibians are expected to be *less than significant* at the programmatic level due to the limited extent and temporary nature of the deployment.

Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; no reproductive effects to invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species can have a dramatic effect on natural resources.

FirstNet deployment or operation activities could result in short-term or temporary changes to specific Proposed Action project sites; these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to Proposed Action project sites as part of the deployment activities from machinery or construction workers. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities.

Potential invasive species effects to Connecticut's wildlife are described below.

Terrestrial Mammals

In Connecticut, Eurasian boars (*Sus scrofa*) adversely impact several native large and small mammals, including bear (*Ursus americanus*), and deer. They feed on young mammals, destroy native vegetation resulting in erosion and water resource concerns, and can carry/transmit disease to livestock and human beings. This, in turn, can seriously reduce native populations of animals and lead to the degradation of their habitat.

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 17) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to terrestrial mammals as a result of the introduction of invasive species.

Marine Mammals

Invasive species displace native fauna and flora communities and/or radically change the nature of the habitats they invade. They also compete for the same natural resources and life requirements (i.e., food, space, and shelter) as native species and degrade local ecologies by disrupting the food chain, thereby causing the extinction of native species. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would be limited. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 17) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to marine mammals as a result of the introduction of invasive species.

Birds

Invasive plant and pest species directly alter the landscape or habitat to a condition that is more favorable for an invasive species and less favorable for native species and their habitats. For example, in Connecticut, mute swans (*Cygnus olor*) can impact native waterfowl and wetland birds causing nest abandonment or impacts to rearing young due to their aggressive behavior. Further, this invasive bird can lead to declines in water quality from increased fecal coliform loading in the water, and declines in submerged aquatic vegetation that support native fish and other wildlife (Swift, Clarke, Holevinski, & Cooper, 2013). FirstNet deployment activities could result in short-term or temporary changes to specific project sites; these sites are expected to return to their natural state in a year or two. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 17) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to birds as a result of the introduction of invasive species.

Reptiles and Amphibians

No invasive reptiles or amphibians are regulated in Connecticut; although non-native reptiles and amphibians are known to occur there. Non-native reptiles and amphibians tend to be highly adaptable and can threaten native wildlife by competing with them for food sources and also spread disease. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would be limited. Invasive reptile or amphibian species are not expected to be introduced at Proposed Action project sites from machinery or laborers. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 17) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to reptiles and amphibians as a result of the introduction of invasive species.

Invertebrates

Invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects in particular pose a large threat to Connecticut's forest and agricultural resources (DOE, 2017). Species such as the Asian longhorn beetle (*Anoplophora glabripennis*), and emerald ash borer (*Agrilus planipennis*) are of particular concern in Connecticut and are known to cause irreversible damage to native forests. As a result, both species are regulated in Connecticut. The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities

are complete. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 17) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to invertebrates as a result of the introduction of invasive species.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts at the programmatic level, from *no impacts* to *less than significant impacts with BMPs and mitigation measures incorporated*, depending on the deployment scenario or site-specific conditions. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have *no impacts* to wildlife resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise and vibration generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to wildlife resources because there would be no ground disturbance.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have *no impact* on wildlife resources at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g. reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise and vibration, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects. BMPs and mitigation measures (see Chapter 17) could help to avoid or minimize potential impacts.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Impacts may vary depending on the number or individual poles installed and the extent of ground disturbance, but could include direct injury/mortality of individual species as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and

invasive species effects. Noise and vibration disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could potentially impact wildlife, marine mammals in particular (see Section 3.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical periods, effects to migratory patterns as well as reproductive effects and indirect injury/ mortality could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wildlife. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, and SOWs could result in direct injury/mortalities to wildlife on roadways. If external generators are used, noise and vibration disturbances could potentially impact migratory patterns of wildlife. RF emissions could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployment of drones, balloons, blimps, and piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise or vibrations. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be *less than significant* with the exception of impacts to birds and bats, which are expected to be *less than significant with BMPs and mitigation measures incorporated.* Some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

At the programmatic level, it is anticipated that there would be *less than significant* impacts to wildlife resources associated with routine inspections of the Preferred Alternative. Site maintenance would be infrequent, including mowing or limited application of herbicides, may result in *less than significant* effects to wildlife at the programmatic level, including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. In particular, collisions with new cell towers that may be installed as part of the Preferred Alternative could increase avian mortality. As stated above, these impacts would likely be limited to individual wildlife species. DOI comments dated October 11, 2016 state communication towers are "currently estimated to kill between four and five million birds per year". Although collisions with towers have the

potential to impact a large number of birds unless BMPs and mitigation measures are incorporated, tower collisions are unlikely to cause population-level impacts. Therefore, impacts to birds may result in *less than significant* impacts with BMPs and mitigation measures incorporated. As stated above, potential impacts associated with RF emissions on birds and bats are also anticipated, at the programmatic level, to be *less than significant with BMPs and mitigation measure incorporated*.

Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and therefore would likely be *less than significant* at the programmatic level. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to wildlife resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wildlife resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As described above, at the programmatic level, implementation of deployable technologies could result in *less than significant* impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and

region of the state. However, impacts are expected to remain *less than significant* at the programmatic level because deployment activities are expected to be temporary, likely affecting only a small number of wildlife. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *less than significant* impacts at the programmatic level,, because deployable activities are expected to be temporary and would likely affect only a small number of wildlife. The impacts can vary greatly among species and geographic region. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. Therefore, there would be *no impacts* to wildlife resources as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.6.4, Terrestrial Wildlife.

3.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Connecticut and Connecticut's near offshore environment are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (USEPA, 2012e).

Based on the impact significance criteria presented in Table 3.2.6-1, at the programmatic level, *less than significant* impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable but minimal for some Proposed Action projects, individual behavior of fish species would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed.

BMPs and mitigation measures could help to avoid or minimize potential impacts to fisheries and aquatic invertebrate population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the breaking down of continuous and connected habitat, and impeding access to resources and mates.

Depending on the location, construction of new infrastructure and long-term facility maintenance could result in the shoreline habitat alteration in localized areas; in some instances, the permanent loss of riparian vegetation could occur, which could lead to water quality impacts and in turn aquatic habitat alteration. Habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location, depending on the nature of the deployment activity. Additionally, deployment activities with the potential for impacts under the MSFCMA or other sensitive aquatic habitats can be addressed through BMPs and mitigation measures. Overall, impacts are expected to be *less than significant* at the programmatic level.

Indirect Injury/Mortality

Water quality impacts from exposure to contaminants from accidental spills from vehicles and equipment, and erosion or sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, streams, and other aquatic habitats could result in changes to habitat, food sources, or prey resulting in indirect mortality/ injury to fish and aquatic invertebrates. Indirect injury/mortality impacts vary depending on the species, time of year, and duration of deployment. These impacts are expected to be *less than significant* at the programmatic level, and BMPs and mitigation measures to protect water resources (see Section 3.2.4, Water Resources) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. For example, restrictions or alterations to waterways could alter migration patterns, limit fish passage, or affect foraging and spawning site access. Impacts are expected to be *less than significant* at the programmatic level, and are anticipated to be localized and at a small-scale, and would vary depending on the species, time of year, and duration of deployment. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which can affect the overall population of individuals. Restrictions to spawning/breeding areas

for fish and aquatic invertebrates and the alteration of water quality through sediment infiltration, obstruction of natural water flow, or loss of submerged vegetation resulting from the deployment of various types of infrastructure, are expected to be *less than significant* at the programmatic level, though BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invasive Species Effects

FirstNet deployment activities could result in *less than significant* impacts to aquatic populations at the programmatic level due to introduction of invasive species. The potential to introduce invasive plant (and plant seeds) and pest species (e.g., invasive insects) within construction zones could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. FirstNet deployment activities could result in short-term or temporary changes to specific project sites however, these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 17) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to aquatic resources as a result of the introduction of invasive species. Should invasive species be found on a site, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented to minimize invasive species effects to fisheries and aquatic species.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have *no impacts* to fisheries and aquatic habitats under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise and vibration, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to fisheries and aquatic habitats because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have *no impact* on the aquatic environment.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects. BMPs and mitigation measures, as described in Chapter 17, could help to avoid or minimize potential impacts.

- Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise and vibration, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. If areas to be disturbed would result in erosion or sedimentation into aquatic habitats, impacts to fisheries and aquatic habitats could occur, but it is expected effects would be temporary and not conducted in locations designated as vital or critical for any period.
- New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g. mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise and vibration, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects. BMPs and mitigation measures, as described in Chapter 17, could help to avoid or minimize potential impacts.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resrouces. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly

unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to fisheries and aquatic habitats. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be *less than significant* at the programmatic level due to the small-scale of deployment activities and the limited number of aquatic species expected to be impacted. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

At the programmatic level, it is anticipated that there would be *less than significant* impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance, if conducted near water resources that support fish, including application of

herbicides, may result in *less than significant* effects to fisheries and aquatic habitats at the programmatic level, including exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

Fisheries and aquatic habitat could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition, the presence of new access roads and transmission line ROWs near water resources that support fish may increase human use of the surrounding areas, which could increase disturbance to fisheries and aquatic habitats resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. Fisheries and aquatic habitat may also be impacted if increased access leads to an increase in the legal or illegal take of biota. However, impacts are expected to be *less than significant* at the programmatic level, due to the small-scale of expected activities with the potential to affect fisheries and aquatic habitat. As a result of the small-scale, only a limited number of individuals are anticipated to be impacted, furthermore, habitat impacts would also be minimal in scale.

Alternatives Impact Assessment

The following section assesses potential impacts to fisheries and aquatic habitats associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to fisheries and aquatic habitats as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, at the programmatic level, implementation of deployable technologies could result in *less than significant* impacts from habitat loss, alteration, and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain *less than significant* at the programmatic level due to the limited nature of expected deployment activities. See Chapter 17, BMPs and Mitigation

Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

Operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, at the programmatic level, it is anticipated that there would be *less than significant* impacts to fisheries and aquatic habitats associated with routine operations and maintenance due to the limited nature of expected deployment activities. The impacts can vary greatly among species and geographic region. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. Therefore, there would be *no impacts* to fisheries and aquatic habitats as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.6.5, Fisheries and Aquatic Habitats.

3.2.6.6. Threatened and Endangered Species

This section describes potential impacts to threatened and endangered species in Connecticut's inland and offshore environment associated with deployment and operation of the Proposed Action and Alternatives. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on threatened and endangered species and their habitat were evaluated using the significance criteria presented in Table 3.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as *may affect*, *likely to adversely affect*; *may affect, not likely to adversely affect*; and *no effect*.

These impact categories are comparable to those defined in the *Endangered Species Consultation Handbook* and are described in general terms below (USFWS, 1998):

- *No effect* means that no listed resources would be exposed to the action and its environmental consequences.
- *May affect, not likely to adversely affect* means that all effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any *adverse effects* to the species or habitat. Insignificant effects relate to the size of the impact and

include those effects that are undetectable, not measurable, or cannot be evaluated. Discountable effects are those extremely unlikely to occur.

- *May affect, likely to adversely affect* means that listed resources are likely to be exposed to the action or its environmental consequences and would respond in a negative manner to the exposure.

At the programmatic level, characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes across the state, the potential impacts to threatened and endangered species addressed below are presented as a range of possible impacts.

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 3.2.6-2, any direct injury or mortality of a listed species at the individual-level could be *potentially significant* as well as any impact that has more than a negligible potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency. Direct injury/mortality environmental concerns pertaining to federally listed mammals, birds, reptiles, invertebrates, and plants with known occurrence in Connecticut are described below.

Table 3.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species at the Programmatic Level

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Injury/Mortality of a Listed Species	Magnitude or Intensity	As per the ESA, this impact threshold applies at the individual level so applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under *likely to adversely affect* category). Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Includes permitted take.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species.	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to infrequent, temporary, and short-term effects.	
Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success of a listed species.	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success.	No measurable effects on listed species.
	Geographic Extent	Reduced breeding success of a listed species at any geographic extent.	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success of listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success of a listed species.	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success of a listed species within a breeding season.	

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat.
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the *likely to adversely affect* threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large *adverse effect* on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Mammals

The northern long-eared bat (*Myotis septentrionalis*) and the Indiana bat (*myotis sodalist)* are believed or known to occur in Connecticut. Direct mortality or injury to the bat species could occur from collisions or electrocutions with cables and wires, vehicle strikes, or when roosts are either disturbed or destroyed. Impacts would likely be isolated, individual events. When disturbed by noise, vibration, or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (USFWS, 2015g). BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Birds

Three federally listed birds are believed or known to occur within coastal areas of Connecticut: the piping plover, red knot, and roseate tern. Depending on the project types and location, direct mortality or injury to these birds could occur from collisions or electrocutions with manmade cables and wires, vehicle strikes, or by disturbance or destruction of nests during ground disturbing activities. If proposed project sites are unable to avoid sensitive areas, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

There are no federally listed amphibians in Connecticut. The federally listed threatened bog turtle occurs within wetland and floodplain areas. Direct mortality to the bog turtle could occur in construction zones either by excavation activities or by vehicle strikes. Impacts would likely be isolated, individual events.

Three federally listed sea turtles are also believed or known to occur in the coastal area and offshore environment of Connecticut, the hawksbill sea turtle the Kemp's ridley sea turtle, and the leatherback sea turtle. None of these turtles nest in the Connecticut area. Direct mortality or injury events from watercraft and vessels strikes are unlikely as the majority of the FirstNet deployment projects would not occur in an aquatic environment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

One federally listed mollusk (dwarf wedgemussel) and one endangered terrestrial invertebrate (Puritan tiger beetle) occur in Connecticut. Direct mortality or injury could occur to these species if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Distribution of these species is limited to in or near the Connecticut River. BMPs and mitigation measures, as defined through consultation with the

appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Plants

Two federally listed plants occur in Connecticut, the sandplain gerardia and small whorled pogonia. Direct mortality to federally listed plants could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. In general, distribution of these species is limited throughout the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce the breeding success of a listed species by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which can affect the breeding success. Potential effects to federally listed mammals, birds, terrestrial reptiles and marine reptiles, amphibians, fish, invertebrates, and plants with known occurrence in Connecticut are described below.

Mammals

Noise, vibration, light, and other human disturbances associated with the Proposed Action could *adversely affect* the federally listed Northern long-eared bat located within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Birds

The piping plover, red knot, and roseate tern are the only federally listed bird species that are believed or known to nest in Connecticut. They are believed to nest along sandy beaches (both species) or saltmarshes (roseate tern). The majority of FirstNet deployment activities would not occur on beaches or saltmarshes; therefore, impacts to these bird species are not anticipated. Noise, vibration, light, or other human disturbance within nesting areas could cause the birds to abandon their nests, relocate to less desirable locations, or cause stress to individuals reducing survival and reproduction. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

There are no federally listed amphibians in Connecticut. The federally listed threatened bog turtle (*Clemmys muhlenbergii*) occurs within wetland and floodplain areas. Changes in water quality, especially during the breeding seasons, resulting from ground disturbing activities could cause stress resulting in lower productivity. Land clearing activities, noise, vibration, and other human disturbance during the critical time periods (e.g., mating, nesting) could lower fitness and productivity. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

The three listed sea turtles found in the offshore areas of Connecticut are migrants. Consequently, no long-term reproductive effects to federally listed sea turtles are expected.

Invertebrates

Changes in water quality from ground disturbing activities could cause stress resulting in lower productivity for the federally listed mollusk and beetle known to occur in Connecticut. In addition, introduction of invasive aquatic species can indirectly affect the endangered dwarf wedgemussel (*Alasmidonta heterodon*) and the threatened Puritan Tiger Beetle (*Cicindela puritan*) as result of fish populations that they rely on for their reproductive cycle being altered: (USFWS, 2015e). Deployment activities are not expected to cause changes to water quality that could result in impacts.

Plants

No reproductive effects to federally listed plants are expected as a result of the Proposed Action as limited pesticides would be used and avoidance measures would likely be undertaken.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered *potentially significant*. Potential effects to federally listed mammals, birds, reptiles, invertebrates, and plants with known occurrence in Connecticut are described below.

Mammals

Direct mortality or injury to the federally listed bat could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present. While projects would not likely directly affect winter hibernacula (e.g., caves), human disturbance in and around hibernacula when bats are present could lead to *adverse effects* to this species; when disturbed by noise, vibration or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (USFWS, 2015g). It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures,

as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. Disturbance in stopover, foraging, or breeding areas (visual, noise or vibration) or habitat loss/fragmentation can cause stress to individuals causing them to abandon areas for less desirable habitat and potentially reduce over fitness and productivity. Activities related to the Proposed Action, such as aerial deployment or construction activities, could result *adverse effects* to federally listed birds. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

There are no federally listed amphibians in Connecticut. Habitat loss or alteration, particularly from fragmentation or invasive species, could *adversely affect* nesting and foraging sites of the bog turtle, resulting in reduced survival and productivity, However, disturbances during deployment activities are not anticipated to stress federally listed reptiles. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in water quality and quantity, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed mollusk and tiger beetle resulting in lower productivity. Disturbances to wild lupine, especially during the breeding season, in areas known to have Karner blue butterflies could impact survival. Deployment activities are not expected to cause changes to water quality that could result in impacts.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an *adverse effect* and could be *potentially significant*. Depending on the species or habitat, the *adverse effect* threshold would vary for geographic extent. In some cases, large-scale impacts could occur that would not diminish the functions and values of the habitat, while in other cases small-scale changes could lead to *potentially significant adverse effects*. For example, impacts to designated critical habitat for a listed species that is only known to occur in one specific location

geographically. However, the threatened and endangered species that occur in New Jersey do not have critical habitat in the state.

Mammals

No designated critical habitat occurs for mammals in Connecticut. Therefore, *no effect* to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Birds

No critical habitat has been designated for the piping plover, red knot, or roseate tern that are known to occur in Connecticut; therefore, *no effect* to these federally listed birds from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Reptiles and Amphibians

No designated critical habitat occurs for reptiles or amphibians in Connecticut. Therefore, *no effect* to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Invertebrates

No designated critical habitat occurs for invertebrates in Connecticut. Therefore, *no effect* to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Plants

No designated critical habitat occurs for plants in Connecticut. Therefore, *no effect* to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operational activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Effect at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have *no impacts* to threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise and vibration, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened and endangered because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact protected species, it is anticipated that this activity would have *no impact* on protected species.

Activities with the Potential to Affect Listed Species at the Programmatic Level

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g. mollusks and young), that utilize burrows, or that are defending nest sites (e.g., ground-nesting birds).

Disturbance, including noise and vibration, associated with the above activities could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat if BMPs and mitigation measures are not implemented.

- New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.
- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat to threatened and endangered species. Noise and vibration disturbances from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could potentially impact threatened and endangered species and their habitat, particularly aquatic species (see Section 3.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical time periods, reproductive effects and behavioral changes could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be *no impacts* to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive

effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are required, impacts could be similar to new wireless construction. Hazards related security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise and vibration disturbances could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployment of drones, balloons, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. These impacts *may affect*, but are not likely *adversely affect* protected species at the programmatic level. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The threatened and endangered species that would be affected would depend on the species' phenology and the nature and extent of the habitats affected.

It is anticipated that operational impacts *may affect, but are not likely to adversely affect* threatened and endangered species at the programmatic level due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, *may affect*, *but are not likely to adversely affect* threatened and endangered species at the programmatic level, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species *may be affected, but are not likely to be adversely affected* at the programmatic level. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species *may be affected, but are not likely to be adversely affected* at the programmatic level, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to threatened and endangered species associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to threatened and endangered species as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, at the programmatic level, implementation of deployable technologies *may affect*, *but is not likely to adversely affect*, threatened and endangered species through direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that activities *may affect*, *but are not likely to adversely affect*, threatened and endangered species and their habitats at the programmatic level as a result of routine operations, management, and monitoring. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. Therefore, there would be *no effects* to threatened and endangered species as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.6.6, Threatened and Endangered Species.

3.2.7. Land Use, Recreation, and Airspace

3.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Connecticut associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.7.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on land use, recreation, and airspace resources were evaluated using the significance criteria presented in Table 3.2.7-1. The categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including

magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to land use, recreation, and airspace resources addressed in this section are presented as a range of possible impacts

Table 3.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands	Effect that is *potentially significant*, but with mitigation is *less than significant*	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Land use altered indefinitely		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase	NA
Indirect land use change	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses	Effect that is *potentially significant*, but with mitigation is *less than significant*	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses	No conflicts with adjacent existing or planned land uses
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Land use altered indefinitely		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities	Effect that is *potentially significant*, but with mitigation is *less than significant*	Restricted access to recreation land or activities	No disruption or loss of access to recreational lands or activities
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory	NA
	Duration or Frequency	Persists during the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites	Effect that is *potentially significant*, but with mitigation is *less than significant*	Small reductions in visitation or duration of recreational activity	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory	NA
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace	Effect that is *potentially significant*, but with mitigation is *less than significant*	Alteration to airspace usage is minimal	No alterations in airspace usage or flight patterns
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Airspace altered indefinitely		Short-Term: Airspace altered for as long as the entire construction phase or a portion of the operations phase	NA

NA = Not Applicable

3.2.7.3. Description of Environmental Concerns

Direct Land Use Change

The deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of ROW or easement could influence changes in land use. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROW or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could change the existing land use to another category or result in the short- or long-term loss of the existing land use.

Based on the impact significance criteria presented in Table 3.2.7-1, *less than significant* impacts would be anticipated at the programmatic level given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of ROW or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROW or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 3.2.7-1, *less than significant* impacts would be anticipated at the programmatic level as any new land use would be small-scale and consistent with the surrounding land uses in the area; only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

The deployment, operation, and maintenance of facilities and the acquisition of ROW or easement could influence access to public or private recreation land or activities. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features. In the long-term, the deployment and installation of poles, towers, structures, or other aboveground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 3.2.7-1, *less than significant* impacts would be anticipated at the programmatic level as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features could temporarily impact enjoyment of recreation land. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise and vibration impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 3.2.7-1, *less than significant* impacts would be anticipated at the programmatic level as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could obstruct navigable airspace depending on the tower location. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 3.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. As drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period, FirstNet would not impact airspace resources. Therefore the potential impacts to Airspace is expected to be *less than significant* at the programmatic level.

3.2.7.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure, and the specific deployment requirements, some activities would result in potential impacts to land use, recreation, and airspace resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to land use, recreation, and airspace resources under the conditions described below:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road ROWs.
    - Land Use: See *Activities Likely to Have Impacts* below.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: *No impacts* to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 3.1.7.7 Obstructions to Airspace Considerations).
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: It is anticipated that there would be *no impacts* at the programmatic level to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: It is anticipated that there would be *no impacts* to airspace at the programmatic level since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 3.1.7.7 Obstructions to Airspace Considerations).
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: See *Activities Likely to Have Impacts* below.

- Recreation: See *Activities Likely to Have Impacts* below.
- Airspace: Installation of new poles would have *no impact* on airspace at the programmatic level because utility poles are an average of 40 feet in height and do not intrude into useable airspace.

o Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
- Land Use: It is anticipated that there would be *no impacts* to land use at the programmatic level since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
- Recreation: *No impacts* to recreation at the programmatic level would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
- Airspace: *No impacts* are anticipated to airspace at the programmatic level from collocations.

o Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
- Land Use: It is anticipated that there would be *no impacts* to land use at the programmatic level since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
- Recreation: Use of existing dark fiber would not impact recreation at the programmatic level because it would not impede access to recreational resources.
- Airspace: Lighting of dark fiber would have *no impacts* to airspace at the programmatic level.

o New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
- Land Use: See *Activities Likely to Have Impacts* below.
- Recreation: See *Activities Likely to Have Impacts* below.
- Airspace: The installation of cables in limited nearshore and inland bodies of water and construction of landings/facilities would *no impact* at the programmatic level on flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 3.1.7.7 Obstructions to Airspace Considerations).

o Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
- Land Use: See *Activities Likely to Have Impacts* below.
- Recreation: See *Activities Likely to Have Impacts* below.
- Airspace: *No impacts* to airspace would be anticipated at the programmatic level since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use,*

and Preservation of the Navigable Airspace (See Section 3.1.7.7 Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be *no impacts* at the programmatic level to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: See *Activities Likely to Have Impacts* below.
- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: It is anticipated that there would be *no impacts* to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: *No impacts* to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
    - Airspace: See *Activities Likely to Have Impacts* below. Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: It is anticipated that there would be *no impacts* to existing or surrounding land uses at the programmatic levelbecause these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: See *Activities Likely to Have Impacts* below.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would very unlikely be *no impact* at the programmatic level on land use, it is anticipated that this activity would have *no impact* on land use.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to land use, recreation resources, or airspace as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: *No impacts* are anticipated at the programmatic level– see previous section.
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) rights-of-way or easements and the potential construction of access roads.
    - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed rights-of-way or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: *No impacts* are anticipated at the programmatic level – see previous section.
  - New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.
    - Airspace: *No impacts* are anticipated at the programmatic level – see previous section.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.

- Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
- Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
- Airspace: *No impacts* are anticipated at the programmatic level – see previous section.

- Wireless Projects
  - New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.
    - Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet AGL or meets the other criteria listed in Section 3.1.7.7 Obstructions to Airspace Considerations. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight patterns of an airport if the aerial fiber optic plant is located in proximity to one of Connecticut's airports.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
    - Land Use: *No impacts* are anticipated at the programmatic level – see previous section.
    - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airports or air navigation facilities.

- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: *No impacts* are anticipated at the programmatic level – see previous section.
    - Recreation: *No impacts* are anticipated at the programmatic level – see previous section.
    - Airspace: Implementation of deployable aerial communications architecture could result in temporary or intermittent impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near Connecticut airports (See obstruction criteria in Section 3.1.7.7 Obstructions to Airspace Considerations). Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, untethered balloons, and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: *No impacts* are anticipated at the programmatic level – see previous section
    - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities, including the construction of access roads. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace are expected to be *less than significant* at the programmatic level due to the temporary and small-scale nature of deployment activities. Additionally FirstNet (or its network partners), would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. See Chapter 17, BMPs

and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be *no impacts* to land use, recreation resources, or airspace at the programmatic level associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections. If routine maintenance or inspection activities would conflict with existing or surrounding land uses, impact recreation resources, or conflict with airspace, impacts could result as explained above. Operation of the Deployable Technologies options of the Preferred Alternative could result in the temporary presence of deployable vehicles and equipment (including airborne equipment), potentially for up to two years in some cases. The degree of change in the visual environment (see Section 3.2.8, Visual Resources)—and therefore the potential indirect impact on a landowner's ability to use or sell of their land as desired—would be highly dependent on the specific deployment location and length of deployment. The use of deployable aerial communications architecture could temporarily add new air traffic or aerial navigation hazards. The magnitude of these effects would depend on the specific location of airborne resources along with the duration of their use. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to land use, recreation, and airspace resources as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to land use at the programmatic level. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected, however, impacts would be *less than significant* at the programmatic level due to the temporary nature of likely deployment activities If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, FirstNet (or its partners) would consult with the FAA to determine how to proceed. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would *be no impacts* at the programmatic level to land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this Alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall these potential impacts would be *less than significant* due to the temporary nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. Therefore, there would be *no impacts* at the programmatic level to land use, recreation resources, or airspace as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.7, Land Use, Recreation, and Airspace.

3.2.8. Visual Resources

3.2.8.1. Introduction

This section describes potential impacts to visual resources in Connecticut associated with construction/deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 3.2.8-1. The categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to visual resources addressed in this section are presented as a range of possible impacts.

Table 3.2.8-1: Impact Significance Rating Criteria for Visual Resources at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse change in aesthetic character of scenic resources or viewsheds	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character	Effect that is *potentially significant*, but with mitigation is *less than significant*	Intermittently noticeable change in aesthetic character that is marginally negative	No visible effects
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	No visible effects
	Duration or Frequency	Permanent or persistent changes to aesthetic character lasting throughout or beyond the construction or deployment phase		Persisting through the construction and deployment phase, but aesthetics of the area would be returned to original state following the construction and deployment phase	Transient or no visible effects
Nighttime lighting	Magnitude or Intensity	Lighting dramatically alters night-sky conditions	Effect that is *potentially significant*, but with mitigation is *less than significant*	Lighting alters night-sky conditions to a degree that is only intermittently noticeable	Lighting does not noticeably alter night-sky conditions
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	No visible effects
	Duration or Frequency	Permanent or persistent changes to night-sky conditions lasting throughout or beyond the construction or deployment phase		Persisting through the construction and deployment phase, but lighting would be removed and night-sky conditions would be returned to original state following the construction and deployment phase	Transient or no visible effects

NA = Not Applicable

3.2.8.3. Description of Environmental Concerns

Adverse Change in Aesthetic Character of Scenic Resources or Viewsheds

A primary concern during and following construction of structures, towers, roads or other permanent features is the long-term disruption of scenery and viewsheds. In Connecticut, residents and visitors travel to many National Historic Sites, National Heritage Areas, and state parks, including the Weir Farm National Historic Site to view the historic farmstead and to enjoy the scenic forests and wetlands in the area. If lands considered visually significant or scenic were subject to vegetation loss or removal, short- or long-term effects to viewsheds or scenic resources could occur. Bare ground or interruption of a landscape due to vegetation removal could be considered an adverse change in the aesthetic character of scenic resources or viewsheds. New towers or structures constructed within scenic areas could disrupt the perceived aesthetic character or scenery of an area. Connecticut has a statewide Conservation and Development Policies Plan that helps guide the character and growth of the state, which considers scenic and visual resources. The plans depict where within the state, towns, municipalities, and regions, lands will be managed for conservation and where lands will be managed for development (CT DEEP, 2013a). If new towers were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Based on the impact significance criteria presented in Table 3.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered *potentially significant* at the programmatic level if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. The majority of FirstNet deployment activities would not cause negative impacts to the aesthetic character to a noticeable degree. However, some projects, such as towers, facilities, or infrastructure could cause a negative impact on the aesthetic character of local viewsheds depending on their size and location. However, given the small scale of likely FirstNet activities, impacts are expected to be *less than significant* at the programmatic level. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Nighttime Lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility that caused regional impacts or permanent changes to night sky conditions, those effects would be considered *potentially significant*.

Based on the impact significance criteria presented in Table 3.2.8-1, lighting that illuminates the night sky, diminishes night sky viewing over long distances, and persists over the long-term would be considered *potentially significant*. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience *potentially significant* impacts at the

programmatic level to night skies. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.8.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to visual resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of *no impacts* to *less than significant impacts with BMPs and mitigation measures incorporated* depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to visual resources under the conditions described below:

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited and would result in *no impacts* to visual resources at the programmatic level.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to visual resources at the programmatic level since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to visual resources at the programmatic level because there would be no ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use

satellite technology would not impact visual resources at the programmatic level since those activities would not require ground disturbance or vegetation removal.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have *no impact* on visual resources at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs , huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to visual resources. The degree of impact would depend on the timing, location, and type of project; installation of a hut or POP would be permanent, whereas ground disturbing activities would be short-term. In most cases, development located next to existing roadways would not affect visual resources unless vegetation were removed or excavation occurred in scenic areas.
  - New Build – Aerial Fiber Optic Plant: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public rights-of-ways would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, at the programmatic level, *potentially significant impacts* to night skies could occur.Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lightning.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be *less than significant* at the programmatic level due to the temporary and small-scale nature of deployment activities. As discussed above, at the programmatic level, potential impacts to night skies from lighting are expected to be *less than significant with BMPs and mitigation measures incorporated*. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be *no impacts* to visual resources at the programmatic level associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for

deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park would be *less than significant with BMPs and mitigation measures incorporated* during operations. Additionally, FirstNet would work closely with the NPS to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit.

3.2.8.5. Alternatives Impact Assessment

The following section assesses potential impacts to visual resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be *less than significant* as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *no impacts* to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. The potential visual impacts—including aesthetic conditions and nighttime lighting—of the operation of deployable technologies would be *less than significant* at the programmatic level. These potential impacts would be similar to the

potential impacts described for the Deployable Technologies option of the Preferred Alternative, above, only likely with greater numbers of deployable units.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. Therefore, there would be *no impacts* to visual resources at the programmatic level as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.8, Visual Resources.

3.2.9. Socioeconomics

3.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Connecticut associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 3.2.9-1. The categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to socioeconomics addressed in this section are presented as a range of possible impacts.

Table 3.2.9-1: Impact Significance Rating Criteria for Socioeconomics at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift	Effect that is *potentially significant*, but with mitigation is *less than significant*	Indiscernible impact to property values and/or rental fees	*No impacts* to real estate in the form of changes to property values or rental fees
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Persists during the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift	Effect that is *potentially significant*, but with mitigation is *less than significant*	Indiscernible economic change	No change to tax revenues, wages, major industries, or direct spending
	Geographic Extent	Regional impacts observed throughout the state/ territory		Effects realized at one or multiple isolated cities/towns	NA
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to employment	Magnitude or Intensity	High level of job creation at the state or territory level	Effect that is *potentially significant*, but with mitigation is *less than significant*	Low level of job creation at the state/territory level	No job creation due to Proposed Action activities at the state/territory level
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated cities/towns	NA
	Duration or Frequency	Persists during the life of the Proposed Action.		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Changes in population number or composition	Magnitude or Intensity	Substantial increases in population, or changes in population composition (age, race, gender)	Effect that is *potentially significant*, but with mitigation is *less than significant*	Minor increases in population or population composition	No changes in population or population composition
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Persists during the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	NA

NA = Not Applicable

3.2.9.3. Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts related to Changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values below typical market values due to below average public safety communication services.

Improved services would likely reduce response times and improve responses. These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Existing Environment, property values vary considerably across Connecticut. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $400,000 in the Bridgeport/Stamford area, to below $200,000 in areas such as Torrington, Waterbury, Willimantic, and the Connecticut portion of the Worchester area. These figures are general indicators only. Property values are no doubt both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing *no effect* beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, *may affect* property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts related to Changes in pending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and *less than significant*. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the

installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006b). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet partners may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

FirstNet may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment is a direct, beneficial impact of expenditures on FirstNet. Additional, indirect employment increases would occur as additional businesses hire workers to provide supporting goods and services. For instance, FirstNet and/or its partners would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and *less than significant*. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across Connecticut. The average unemployment rate in 2014 was 6.6 percent. County-level unemployment rates were lowest in the counties bordering the state of New York and in some central Connecticut counties, and highest in the northeastern portion of the state.

Large companies that win major contracts for deploying and operating the NPSBN may have concentrations of employees in some specific locations; for instance, engineers and other system designers may be in one or a few specific offices. While such employment concentrations could be important to specific communities, these and other employment impacts would still not be significant based on the criteria in Table 3.2.9-1 because they would not constitute a "high level of job creation at the state or territory level."

Changes in Population Number or Composition

In general, changes in population numbers occur when employment increases or decreases to a degree that affects the decisions of workers on where they can find employment; that is, when workers and their families move to or leave an area because of employment opportunities or the lack thereof. As noted above, deployment and operation of the NPSBN is likely to generate new employment opportunities (directly and indirectly), but employment changes would not be large enough in any state to be considered significant. Therefore, it is highly unlikely that the NPSBN would lead to significant changes in population numbers according to the significance criteria table above. Further, it is unlikely that the NPSBN would lead to any measurable changes in population numbers in any geographic areas, with the possible exception of cities where companies that win major NPSBN contracts establish centers for NPSBN deployment and operation activities. Smaller numbers of employees in any area would not produce measurable population changes because population is always in flux due to births, deaths, and in-migration and out-migration for other reasons.

Population composition refers to age, gender, race, ethnicity, and other characteristics of the individuals making up a population. Given the Low Potential for changes to population numbers, it is highly unlikely that the NPSBN would lead to any changes in population composition.

3.2.9.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 3.2.9-1.

Activities Likely to Have No Impacts at the Programmatic Level

- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact socioeconomics, it is anticipated that this activity would have *no impact* on socioeconomic resources at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below indicates which of the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate
- Changes to Spending, Income, Industries, and Public Revenues
- Impacts to Employment
- Changes in Population Number or Composition

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be

small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment through existing or new boxes or huts would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.

  - New Build – Aerial Fiber Optic Plant: Pole/structure installation would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus the impacts would be *less than significant* at the programmatic level.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:

    - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise and vibration, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be *less than significant* at the programmatic level.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.

In general, the abovementioned activities would have *less than significant* beneficial socioeconomic impacts. To the extent that certain activities could have adverse impacts to property values, those impacts are also expected to be *less than significant* at the programmatic level, as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

The discussion above characterized the impacts of each type of activity. The socioeconomic impacts of all activities considered together would also be *less than significant*. Even when considered together, the impacts would be very small relative to the total economic activity and property value of any region or the state. In addition, with the possible exception of property values, all deployment impacts would be limited to the construction phase.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. As with deployment activities, all operational activities would have socioeconomic impacts, because all represent economic activity. Public or private sector employees would conduct all operational activities, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity, and not significant across the entire state, they are measurable socioeconomic impacts.

Potential socioeconomic impacts would primarily be beneficial, and generally of these types:

- Changes to Spending, Income, Industries, and Public Revenues – Operational activities would require expenditures, which then generate business income and employee wages, and may result in new public sector revenues such as taxes on sales and income. All such effects would be small in scale relative to the regional and state economy; their impacts would be *less than significant* at the programmatic level.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a *less than significant* number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would be *less than significant* at the programmatic level as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.9.5. Alternatives Impact Assessment

The following section assesses potential impacts to socioeconomics associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater

numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to socioeconomics resulting from implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, all deployment activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, such as generation of business income and employee wages, and creation or sustainment of jobs. The impacts would be small for each activity and therefore *less than significant* at the programmatic level.

Deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, would require storage, staging, and launch/landing areas. Development or enlargement of these facilities could have adverse impacts on nearby property values. The potential for such impacts is higher under this Alternative than the Preferred Alternative because it is likely that these facilities would be implemented in greater numbers and over a larger geographic extent. These potential impacts are anticipated to be *less than significant* at the programmatic level as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be *less than significant* at the programmatic level.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise, vibration and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this Alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be *less than significant* as they would be limited to a relatively small number of sites within the region and state. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated deployment or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* at the programmatic level to socioeconomics as a result of the No Action Alternative. Socioeconomic conditions would therefore be the same as those described in Section 3.1.9, Socioeconomics.

3.2.10. Environmental Justice

3.2.10.1. Introduction

This section describes potential impacts to environmental justice in Connecticut associated with construction/deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 3.2.10-1. The categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to environmental justice addressed in this section are presented as a range of possible impacts.

Table 3.2.10-1: Impact Significance Rating Criteria for Environmental Justice at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Effects associated with other resource areas (e. g., human health and safety, cultural resources, socioeconomics) that have a disproportionately high and adverse impact on low-income populations and minority populations	Magnitude or Intensity	Direct and disproportionately high and *adverse effects* on environmental justice communities (as defined by EO 12898) that cannot be fully mitigated	Effect that is *potentially significant*, but with mitigation is *less than significant*	Direct effects on environmental justice communities (as defined by EO 12898) that are not disproportionately high and adverse, and therefore do not require mitigation	No direct effects on environmental justice communities, as defined by EO 12898
	Geographic Extent	Effects realized within counties at the Census Block Group level		Effects realized within counties at the Census Block Group level	Effects realized within counties at the Census Block Group level
	Duration or Frequency	Persists during the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	NA

NA = Not Applicable

3.2.10.3. Description of Environmental Concerns

Effects associated with other Resource Areas that have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment." (Council on Environmental Quality, 1997) Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise and Vibration, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, vibrations, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. Indian tribes are considered an environmental justice population (Council on Environmental Quality, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both "*adverse" and "disproportionately high" in their incidence on environmental justice populations relative to the general population (Council on Environmental Quality, 1997). The focus in environmental justice impact assessments is always, by definition, on *adverse effects*. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences (Section 3.2.9).

In general, environmental justice impacts manifest at the local level. Environmental justice populations are often highly localized. Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deployment, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this PEIS. As discussed in Affected Environment (Section 3.1.10), Connecticut's population has lower percentages of minorities than the region or the nation, and lower rates of poverty than the region or the nation. The areas shown in the environmental justice screening map of Section 3.1.10 as having moderate potential or high potential for environmental justice populations would particularly warrant further screening. The high potential areas are mostly within the 10 largest population concentrations. The distribution of areas with moderate potential for environmental justice populations is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations. Further analysis using the data developed for the screening analysis in Section 3.1.10 may be useful. In addition, USEPA's EJSCREEN tool and USEPA's lists of environmental justice grant and cooperative agreement recipients may help identify local environmental justice populations (USEPA, 2015r; USEPA, 2014f).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts can use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

3.2.10.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2 Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to environmental justice communities and others would not. In addition, and as explained in this section, the same type of proposed action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2 Proposed Action Infrastructure, the following are likely to have *no impacts* to environmental justice under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand-holes, pulling vaults, junction boxes, huts, and POP structures. Activities at these small entry points would be limited and

temporary and thus are not likely to produce perceptible changes affecting any surrounding communities. Therefore, they would have *no impact* at the programmatic level on environmental justice communities.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and therefore would have *no impacts* to environmental justice. If physical access is required to light dark fiber, it would likely be through existing hand-holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts at the programmatic level on environmental justice communities.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance, *no impacts* to environmental justice communities at the programmatic level would occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice, it is anticipated that this activity would have *no impact* at the programmatic level on environmental justice.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, vibrations, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand-holes, pulling vaults, junction boxes, huts, and POP structures. These activities could temporarily generate noise, vibrations and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Aerial Fiber Optic Plant: Pole/structure installation could temporarily generate noise, vibrations and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing

facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities at the programmatic level. Construction of new landings and/or facilities onshore to accept submarine cable could temporarily generate noise, vibrations and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts at the programmatic level. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand-holes, pulling vaults, junction boxes, huts, and POP structures could generate noise, vibrations and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise, vibrations and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities at the programmatic level. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise, vibrations and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise, vibrations and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, vibrations, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be *less than significant* at the programmatic level, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. Furthermore, site-specific analysis could evaluate site conditions and the impacts of the type of deployment, and could satisfy requirements associated with any other permits or permissions necessary to perform the work. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Activities to Have No Impacts at the Programmatic Level

As described in Section 2.1.2 Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. It is anticipated that such activities would not result in environmental justice impacts, as the intensity of these activities would be low (low potential for objectionable effects such as noise, vibrations, and dust) and their duration would be very short. Routine maintenance and inspection would not adversely affect property values, for the same reasons. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment activities that involve construction.

Impacts are expected to be *less than significant* at the programmatic level. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.10.5. Alternatives Impact Assessment

The following section assesses potential impacts to environmental justice associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land

clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to environmental justice communities resulting from implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise, vibrations and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be *less than significant* at the programmatic level because they would be temporary in nature. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) that could negatively affect the value of surrounding properties. In addition, equipment maintenance activities at such facilities may temporarily generate noise, vibrations and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be *less than significant* at the programmatic level as operations are expected to be temporary in nature. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. Therefore, there would be *no impacts* to environmental justice as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.10, Environmental Justice.

3.2.11. Cultural Resources

3.2.11.1. Introduction

This section describes potential impacts to cultural resources in Connecticut associated with deployment and operation of the Proposed Action and Alternatives. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.11.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 3.2.11-1. The categories of impacts are defined at the programmatic level as an *adverse effect; mitigated adverse effect; effect, but not adverse;* and *no effect*. These impact categories are comparable to those defined in *36 CFR § 800*, Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (NPS 1983), and the United States (U.S.) National Park Service's *National Register Bulletin: How to Apply the National Register Criteria for Evaluation* (NPS 2002). Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to cultural resources addressed in this section are presented as a range of possible impacts.

Table 3.2.11-1: Effect Significance Rating Criteria for Cultural Resources at the Programmatic Level

Type of Effect	Effect Characteristics	Effect Level			
		Adverse Effect	**Mitigated Adverse Effect[a]**	**Effect, but Not Adverse**	**No Effect**
Physical damage to and/or destruction of historic properties[b]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	*Adverse effect* that has been procedurally mitigated through Section 106 process at the programmatic level	Effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
	Geographic Extent	Direct effects APE		Direct effects APE	Direct effects APE
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties		Permanent direct effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
Indirect effects to historic properties (i.e. visual, noise,vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	*Adverse effect* that has been procedurally mitigated through Section 106 process at the programmatic level	Effects to a contributing or non-contributing portion of a single or many historic properties	No indirect effects to historic properties
	Geographic Extent	Indirect effects APE		Indirect effects APE	Indirect effects APE
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties	No indirect effects to historic properties
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	*Adverse effect* that has been procedurally mitigated through Section 106 process at the programmatic level	Effects to a non-contributing portion of a single or many historic properties	No direct or indirect effects to historic properties
	Geographic Extent	Direct and/or indirect effects APE		Direct and/or indirect effects APE	Direct and/or indirect effects APE
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties	No direct or indirect effects to historic properties

Type of Effect	Effect Characteristics	Effect Level			
		Adverse Effect	**Mitigated Adverse Effect[a]**	**Effect, but Not Adverse**	**No Effect**
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	*Adverse effect* that has been procedurally mitigated through Section 106 process at the programmatic level.	Effects to a non-contributing portion of a single or many historic properties	No segregation or loss of access to historic properties
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties	No segregation or loss of access to historic properties
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties		Infrequent, temporary, or short-term changes in access to a single or many historic properties	No segregation or loss of access to historic properties

[a] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "*less than significant with BMPs and mitigation measures incorporated*," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable *adverse effects* to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/THPO and other consulting parties, including Indian Tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[b] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a Proposed Action's APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian Tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

3.2.11.3. Description of Environmental Concerns

Physical Damage to and/or Destruction of Historic Properties

One of the primary environmental concerns during deployment activities is damage to or destruction of historic and cultural resources. Deployment involving ground disturbance has the potential to damage or destroy archaeological sites, and the attachment of communications equipment to historic building and structures has the potential to cause damage to features that are historically significant.

Based on the impact significance criteria presented in Table 3.2.11-1, direct deployment impacts could be *adverse* if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given that archaeological sites and historic properties are present throughout Connecticut, some deployment activities may be in these same areas, in which case BMPs would help avoid or minimize the potential impacts. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of *adverse effects* from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alter historic architectural features. *Adverse effects* such as these could be avoided or minimized through BMPs and mitigation measures, as defined through consultation with the appropriate resource agency. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts. Chapter 17,

BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Loss of Access to Historic Properties

The deployment of equipment requiring a secure area has the potential to cause the loss of access to historic properties. The highest potential for this type of *adverse effect* would be from the deployment of equipment in secure areas that impact the access to sites of cultural importance to American Indians. It is anticipated that FirstNet would identify potential impacts to such areas by conducting research on particular areas and through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.11.4. Potential Effects of the Preferred Alternative at the Programmatic Level

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Potential Deployment Effects

As described in Section 2.1.2, Proposed Action Imfrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to cultural resources, while others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range from *no effect* to *effect, but not adverse* depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Effect at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no effect* to cultural resources at the programmatic level under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no effect* to cultural resources at the programmatic level since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no effect* to cultural resources at the programmatic level. If required, and if done in existing huts with no ground disturbance, installation of new

associated equipment would also have *no effect* to cultural resources at the programmatic level because there would be no ground disturbance and no perceptible visual changes.
    - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance or new above group components, there would be *no effect* to cultural resources at the programmatic level. The section below addresses potential impacts if construction of new boxes, huts, or other equipment is required.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would have *no effect* to cultural resources at the programmatic level because those activities would not require ground disturbance or create perceptible visual effects.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to affect cultural resources, it is anticipated that this activity would have *no effect* on cultural resources at the programmatic level.

Activities with the Potential to Have Effects at the Programmatic Level

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in a potential effect to cultural resources at the programmatic level include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
    - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could impact submerged cultural resources, as coastal areas of Connecticut have the potential to contain prehistoric archaeological sites, as well as sites associated with the state's significant maritime history since European colonization, such

as shipwrecks. Impacts to cultural resources could also potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cable, which could result in the disturbance of archaeological and historical sites, such as wharves and seawalls (Connecticut has numerous maritime and riverine archaeological sites associated with its 18th and 19th century commercial expansion), and the associated network structures could have visual effects on historic properties.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no effect* to cultural resources at the programmatic level. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
- Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
  - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in impacts to archaeological sites, and the deployment of co-located equipment could result in visual impacts or physical damage to historic properties, especially in urban areas such as Hartford that have larger numbers of historic buildings.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could

include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could *affect, but not adversely affect*, cultural resources at the programmatic level as the potential effect*s* would be temporary and limited to the area near individual Proposed Action deployment site. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Operation Effects

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be *no effect* to cultural resources at the programmatic level associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties, however, due to the small scale of expected activities, these actions could *affect, but would not likely adversely affect*, cultural resources at the programmatic level. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.11.5. Alternatives Effect Assessment

The following section assesses potential impacts to cultural resources at the programmatic level associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater

numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to cultural resources as a result of implementation of this Alternative could be as described below.

Potential Deployment Effects

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could *affect, but not adversely affect*, cultural resources at the programmatic level due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Operation Effects

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be *effects, but no adverse effects* to historic properties at the programmatic level associated with implementation/running of the deployable technology. No *adverse effects* at the programmatic level would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be *no effect* to cultural resources at the programmatic level associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur, however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. Therefore, there would be *no effect* to cultural resources at the programmatic level as a result of the No Action Alternative.

3.2.12. Air Quality

3.2.12.1. Introduction

This section describes potential impacts to Connecticut's air quality from deployment and operation of the Proposed Action and Alternatives. Mitigation measures, as defined through permitting and/or consultation with the appropriate resource agency, would be implemented as part of deployment and operation of the Proposed Action to help avoid or reduce potential impacts to air quality. Implementation of best management practices (BMPs), as practicable or feasible, could further reduce the potential for impacts. Both mitigation measures and BMPs are discussed in Chapter 17, BMPs and Mitigation Measures.

3.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Connecticut's air quality were evaluated using the significance criteria presented in Table 3.2.12-1. The categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to Connecticut's air quality addressed in this section are presented as a range of possible impacts.

Table 3.2.12-1: Impact Significance Rating Criteria for Air Quality at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased air emissions	Magnitude or Intensity	Pollutant concentrations would exceed one or more NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would cause an area to be out of attainment for any NAAQS. Projects do not conform to the SIP covering nonattainment and maintenance areas.	Effect that is *potentially significant*, but with mitigation is *less than significant*	Negligible emissions would occur for any criteria pollutants within an attainment area but would not cause a NAAQS exceedance.	Action would not cause pollutant concentrations to exceed the NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would not cause air quality to go out of attainment for any NAAQS. Projects are *de minimis* or conform to the SIP covering nonattainment and maintenance areas.
	Geographic Extent/Context	NA		NA	NA
	Duration or Frequency	Permanent or long-term		Short term	Temporary

NA = Not Applicable

3.2.12.3. Description of Environmental Concerns

Increased Air Emissions

The Proposed Action has the potential to generate air pollutant emissions. These emissions could be above and beyond what is typically generated in a given area and may alter ambient air quality. Deployment activities may involve the use of vehicles, heavy equipment, and other equipment that could emit exhaust and create fugitive dust in localized areas. During operations, routine maintenance and other use of generators at tower facilities may emit exhaust for specific durations (maintenance) or unknown timeframes (if power is lost to a site, for example). Impacts are likely to be *less than significant* due to the mobile nature of the sources and the temporary and short-term duration of deployment activities. Although unlikely, the emissions of criteria pollutants could impair the air quality of the region and potentially affect human health. Potential impacts to air quality from emissions may occur in areas where the current air quality exceeds, or has a history of exceeding, one or more NAAQS.

Based on the significance criteria presented in Table 3.2.12-1, there would likely be *less than significant* at the programmatic level given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of emission sources be deployed/operated long-term in the same area from fixed or mobile sources or construction activities. At the programmatic level, *less than significant* emissions could occur for any of the criteria pollutants within attainment areas in Connecticut; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present throughout Connecticut (Figure 3.1.12-1), and because infrastructure could be deployed in these areas, BMPs and mitigation measures (see Chapter 17, BMPs and Mitigation Measures) could help avoid or minimize potential air quality impacts. In addition, it is anticipated that any air pollution increase due to deployment would likely be short-term with pre-existing air quality levels generally achieved after some months (typically less than a year, and could be as short as a few hours or days for some activities such as pole construction).

3.2.12.4. Potential Impacts of the Preferred Alternative at the Programmatic Level

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction, deployment, and operation activities.

Deployment and Operation Impacts

As described in Section 2.1.2 Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* at the programmatic level to air quality under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points, however this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions at the programmatic level.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create no new sources of emissions at the programmatic level.
- Satellites and Other Technologies
  - *Satellite Enabled Devices and Equipment:* The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to *no impact* on ambient air quality concentrations at the programmatic level.
  - *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have *no impact* on those resources at the programmatic level.

Activities with the Potential to Impact at the Programmatic Level

Construction, deployment, and operation activities related to the Preferred Alternative could impact air quality by generating various quantities of criteria and air pollutant emissions. It is expected that such impacts would be *less than significant* at the programmatic level due to the shorter duration and localized nature of the activities. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant:* Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in fugitive dust and products of combustion from the use of vehicles and heavy equipment.

- *Use of Existing Conduit – New Buried Fiber Optic Plant:* Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable could result in products of combustion from the use of heavy equipment and machinery.
- *New Build – Aerial Fiber Optic Plant:* The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POPs, huts, or other associated facilities to house plant equipment could result in products of combustion from the use of vehicles and machinery, as well as fugitive dust emissions from site preparation.
- *Collocation on Existing Aerial Fiber Optic Plant:* Excavation equipment used during pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in products of combustion from the use of vehicles and heavy equipment, as well as fugitive dust from site preparation.
- *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Installation of new associated huts or equipment, if required, could result in products of combustion and fugitive dust if the activity required the use of heavy equipment for grading or other purposes.
- *New Build – Submarine Fiber Optic Plant:* The installation of cables in limited nearshore and inland bodies of water could generate products of combustion from vehicles used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- *Installation of Optical Transmission or Centralized Transmission Equipment*: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate products of combustion and fugitive dust emissions.

- Wireless Projects
  - *New Wireless Communication Towers:* Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - *Collocation on Existing Wireless Tower, Structure, or Building:* Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If structural hardening and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
  - *Deployable Technologies:* The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines

associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be *less than significant* at the programmatic level due to the limited nature of the deployment. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be *less than significant* impacts to air quality at the programmatic level associated with routine inspections of the Preferred Alternative due to the limited nature of the activity. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors additional air quality impacts may occur, however, they would be *less than significant* at the programmatic level as they would still be limited in nature.

3.2.12.5. Alternatives Impact Assessment

The following section assesses potential impacts to air quality associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial deployment. The Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows:

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be *less than significant* at the programmatic level based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations would dictate the concentrations and associated impacts. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be *less than significant* at the programmatic level, given that these activities are of low-intensity and short duration.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be *no impact* at the programmatic level on ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

3.2.13. Noise and Vibration

3.2.13.1. Introduction

This section describes potential noise and vibration impacts from construction, deployment, and operation of the Proposed Action and Alternatives in Connecticut. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise and vibration impacts of the Proposed Action were evaluated using the significance criteria presented in Table 3.2.13-1. The categories of impacts are defined as *potentially significant, less than significant with BMPs and mitigation measures incorporated, less than significant, or no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the

potential noise and vibration impacts to Connecticut addressed in this section are presented as a range of possible impacts.

Table 3.2.13-1: Impact Significance Rating Criteria for Noise and Vibration at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased noise and vibration levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific state noise limits. Noise levels plus baseline noise levels would exceeds 10 dBA increase from baseline noise levels (i.e., louder). Project noise levels near noise receptors at National Parks would exceed 65 dBA. Vibration levels would exceed 65 VdB for human receptors and 100 VdB for buildings.	Effect that is *potentially significant*, but with mitigation is *less than significant*	Noise and vibration levels resulting from Proposed Action activities would exceed natural sounds, but would not exceed typical noise and vibration levels from construction equipment or generators.	Natural sounds would prevail. Noise and vibration generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.
	Geographic Extent/Context	County or local		County or local	County or local
	Duration or Frequency	Permanent or long-term		Short term	Temporary

NA = Not Applicable
dBA = A-weighted decibel(s); VdB = vibration decibel(s)

3.2.13.3. Description of Environmental Concerns

Increased Noise and Vibration Levels

The Proposed Action has the potential to generate noise and vibration during construction and operation of various equipment used for deployment. These noise and vibration levels could be above what is typically generated in a given area and may alter the ambient acoustical environment. If significant, the noise and vibration could cause impacts on residential areas, or other facilities that are sensitive to noise and vibration, such as churches, hospitals, or schools. The construction activities for deploying some of the various equipment evaluated under the Proposed Action could cause short-term impacts to nearby populations. However, it is likely that there would be less long-term effects from operational use of the proposed equipment (see 3.2.13, Noise and Vibration).

Based on the significance criteria presented in Table 3.2.12-1, noise and vibration impacts could be *potentially significant* at the programmatic level if:

- Noise and vibration levels from construction activities caused noise levels to increase by 10 dBA over baseline levels;Operational noise and vibration activities caused the noise and vibration levels to increase to levels that are considered unacceptable for residences or noise and vibration-sensitive areas; or
- Project noise and vibration levels near noise and vibration receptors at national parks should not exceed 65 dBA.

Noise and vibration impacts would likely be *less than significant* at the programmatic level given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be in sensitive areas nor would a large number of noise and vibration sources be deployed/operated long-term in the same area. Noise and vibration levels from deployment activities are not expected to exceed typical noise and vibration levels for short-term/temporary construction equipment or generators.

To the extent practicable, FirstNet would attempt to mitigate or minimize noise and vibration effects during construction or operation. BMPs and mitigation measures would be followed to limit impacts on nearby noise and vibration-sensitive receptors. However, given that much of the construction and operation of the Proposed Action would often occur in populated areas, FirstNet would not be able to completely avoid noise or vibration impacts.

3.2.13.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction, deployment, and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment

requirements, some activities would result in potential noise and vibration impacts and while others would not.

In addition, the same type of Proposed Action Infrastructure could result in a range of *no impacts to less than significant impacts* st the programmatic level depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios, the following are likely to have no noise and vibration impacts under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise and vibration generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have *no impacts* to noise and vibration.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise and vibration would be emitted during installment of this equipment. Noise and vibration caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to *no impact* on the noise and vibration environment.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to result in noise and vibration impacts, it is anticipated that this activity would have *no impact* on those resources.

Activities with the Potential for Impacts at the Programmatic Level

Construction, deployment, and operation activities related to the Preferred Alternative could create noise and vibration impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to noise and vibration include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and

landscape grading could result in short-term/temporary high noise levels and a temporary increase in vibration from the use of heavy equipment and machinery.

- New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment would be short-term and could result in increased noise and vibration levels from the use of vehicles and machinery.
- Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in noise and vibration levels from the use of heavy equipment and machinery.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise and vibration levels if the activity required the use of heavy equipment for grading or other purposes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could generate noise and vibration if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in short-term and temporarily increased noise and vibration levels to local residents and other noise and vibration-sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise and vibration associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise from optical networks is relatively low, and vibration impacts do not occur. Heavy equipment used to grade and construct access roads could generate increased levels of noise and vibration over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise and vibration. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise and vibration levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise and vibration environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise and vibration generated. For example, mobile equipment deployed via heavy trucks could generate noise and vibration from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise and

vibration during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise and vibration environment.

In general, noise and vibration from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be *less than significant* at the programmatic level due to the temporary duration of deployment activities. Additionally, pre-existing noise and vibration levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be *less than significant* at the programmatic level for routine maintenance and inspection of the facilities because of the temporary nature of the activities which would not create new permanent sources of noise and vibration. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise and vibration impacts would be similar to or less than those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections or onsite generator use occurs, potential noise and vibration impacts could result as explained above. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.13.5. Alternatives Impact Assessment

The following section assesses potential noise and vibration impacts associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage

locations and the duration of deployment. The potential noise and vibration impacts are as follows:

Deployment Noise and Vibration Impacts

Implementing deployable technologies could result in noise and vibration from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise and vibration levels. Several vehicles traveling together could also create short-term noise and vibration impacts on residences or other noise and vibration-sensitive receptors as they pass by. With the exception of balloons, the deployment of aerial technology is anticipated to generate noise and vibration during all phases of flight. Aerial technologies would have the highest level of noise and vibration impact if they are required to fly above residential areas, areas with a high concentration of noise and vibration-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be *less than significant* at the programmatic level, given that these activities are of low-intensity and short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Deployable Technologies Alternative would be similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Operation of generators could also generate noise and vibration in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise and vibration impacts could be minimal in those areas. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise and vibration impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise and vibration impacts could result as explained above.

Operational impacts from aerial technologies would include repeated flyovers by UAS vehicles while they are needed in the area. At the programmatic level, this could generate *less than significant* short-term impacts on any residential areas or other noise and vibration-sensitive receptors under the flight path of these vehicles. However, once these operations cease, noise and vibration levels would quickly return to baseline levels. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be *no impact* on ambient noise and vibration at the programmatic level. By not deploying NPSBN, FirstNet would avoid generating noise and vibrations from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

3.2.14. Climate Change

3.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Connecticut associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.14.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on climate and potential climate change impacts on the Proposed Action's installations and infrastructure were evaluated using the significance criteria presented in Table 3.2.14-1. The categories of impacts are defined as *potentially significant, less than significant with BMPs and mitigation measures incorporated, less than significant, or no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to climate and climate change-vulnerable resources addressed in this section are presented as a range of possible impacts from *no impact* to *less than significant with BMPs and mitigation measures incorporated*.

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or Alternatives. The second is related to the implications and possible effects of climate change on the environmental consequences of the Proposed Action or Alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or Alternatives (CEQ, 2016).

In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2016). Projects in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process can provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 3.2.14-1: Impact Significance Rating Criteria for Climate Change at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Contribution to climate change through GHG emissions	Magnitude or Intensity	See discussion below in Section 3.2.14.4, Potential Impacts of the Preferred Alternative	Effect that is *potentially significant*, but with mitigation is *less than significant*	Only slight change observed	No increase in greenhouse gas emissions or related changes to the climate as a result of Proposed Action activities
	Geographic Extent	See discussion below in Section 3.2.14.4, Potential Impacts of the Preferred Alternative		Global impacts observed	NA
	Duration or Frequency	See discussion below in Section 3.2.14.4, Potential Impacts of the Preferred Alternative		Changes occur on a longer time scale. Changes cannot be reversed in the short term	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure	Effect that is *potentially significant*, but with mitigation is *less than significant*	Only slight change observed	No measurable impact of climate change on FirstNet installations or infrastructure
	Geographic Extent	Local and regional impacts observed		Local and regional impacts observed	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term		Changes occur on a longer time scale. Changes cannot be reversed in the short term	NA

NA = Not Applicable

Air Temperature

Figure 3.2.14-1 and Figure 3.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Connecticut from a 1969 to1971 baseline.

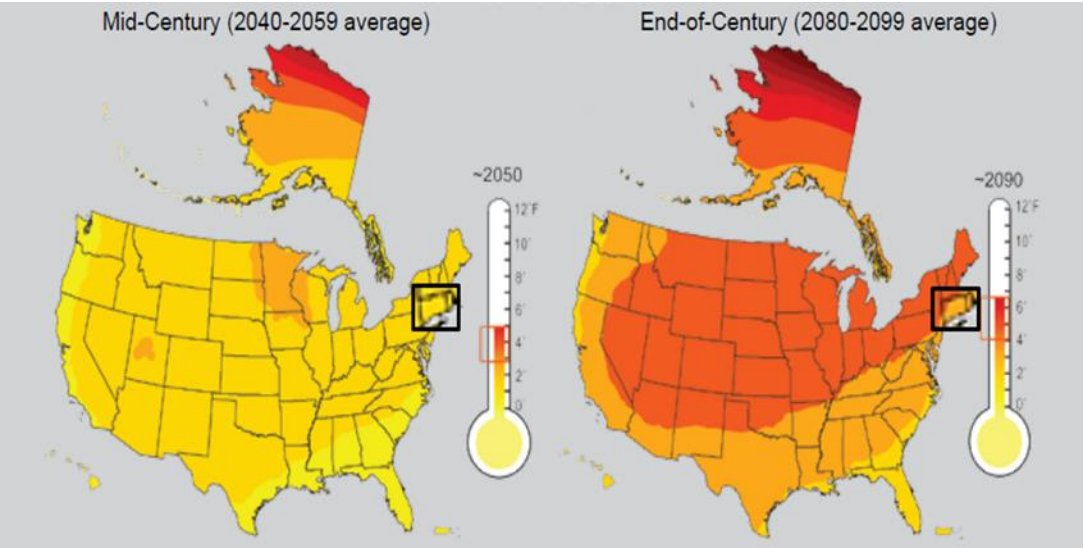
Cfa – Figure 3.2.14-1 shows that by mid-century (2040 to 2059) temperatures in the entire state of Connecticut under a low emissions scenario will increase by approximately 4°F, and under a low emissions scenario for the period (2080 to 2099) temperatures in the Cfa region will increase by approximately 5°F (USGCRP, 2009).

Figure 3.2.14-2 shows that by mid-century temperatures will increase by approximately 5°F in the entire state of Connecticut under a high emissions scenario. By the end of the century (2080 to 2099) temperatures in the Cfa region of Connecticut under a high-emissions scenario will increase by approximately 8°F (USGCRP, 2009).

Dfa – Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Cfa region under both low and high emissions scenarios (USGCRP, 2009).

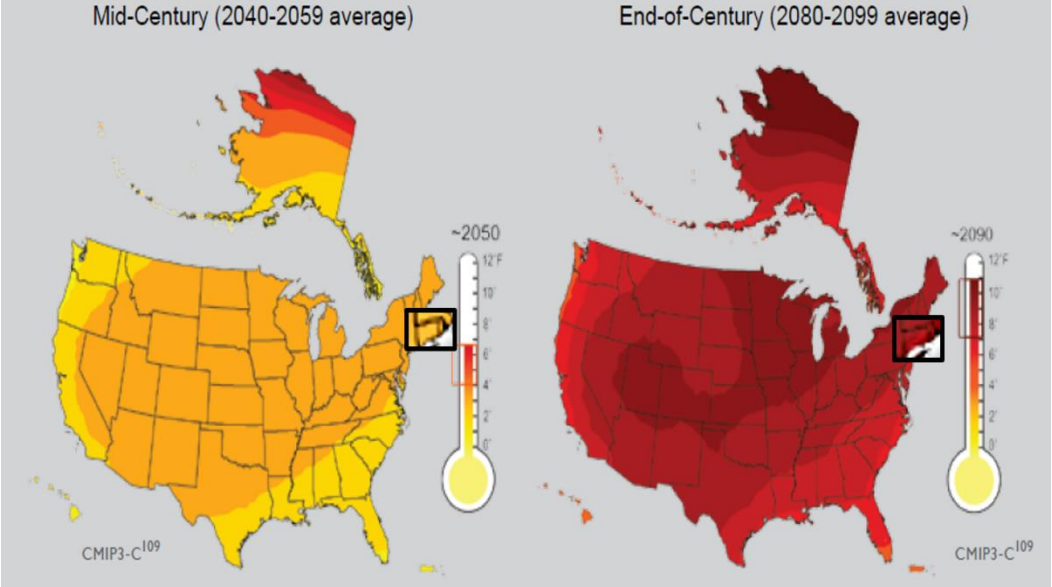
Dfb – Temperatures in this region under a low emissions scenario are expected to increase by mid-century (2040 to 2059) at the same rate as the Cfa and Dfa regions. The majority of the Dfb region's temperature is expected to rise at the same rate as Cfa and Dfa in a low emissions scenario by the end of the century. However, temperatures in the Northwestern most portion of the state may increase up to 6°F by the end of the century (USGCRP, 2009).

Temperatures in the Dfb region under a high emissions scenario for the period (2040 to 2059) temperatures will increase at the same rate as the Cfa and Dfa regions. Temperatures in the Dfb region under a high emissions scenario for the period (2080 – 2099) will increase by approximately 9°F (USGCRP, 2009).



Source: (USGCRP, 2009)

Figure 3.2.14-1: Connecticut Low Emission Scenario Projected Temperature Change



Source: (USGCRP, 2009)

Figure 3.2.14-2: Connecticut High Emission Scenario Projected Temperature Change

Precipitation

By late in the century under a high emissions scenario, winters in the Northeast are projected to be much shorter with fewer cold days and more precipitation. Winter and spring precipitation is projected to increase, and the frequency of heavy downpours is projected to continue to increase as the century progresses. Seasonal drought risk is also projected to increase in summer and fall as higher temperatures lead to greater evaporation and earlier winter and spring snowmelt (USGCRP, 2009).

Figure 3.2.14-3 shows predicted seasonal precipitation change for an approximate 30-year period of 2071 to 2099 compared to a 1970 to 1999 approximate 30-year baseline. Figure 3.2.14-3 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050 (USGCRP, 2014a).

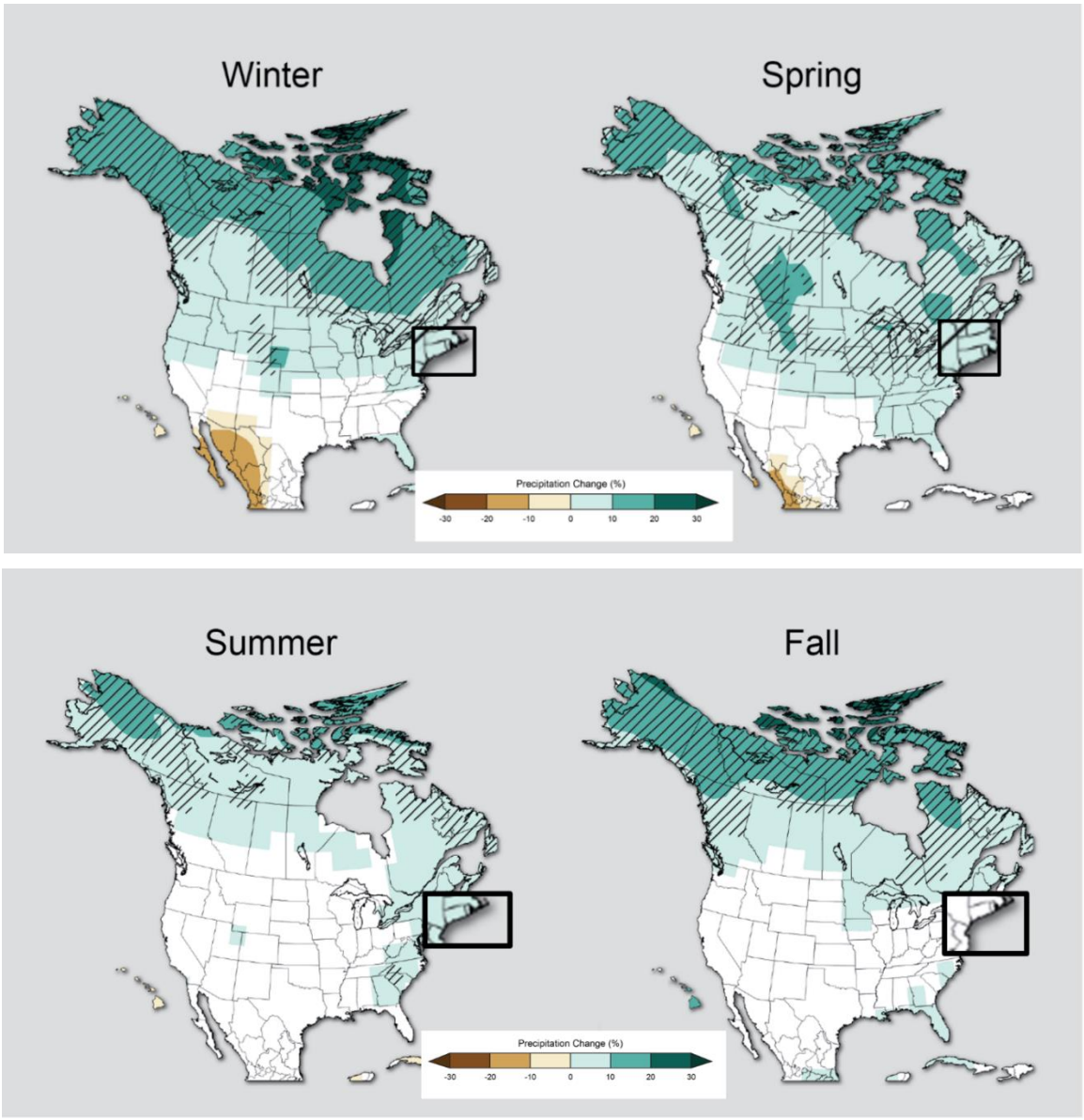
Figure 3.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. Continued increases in emissions would lead to large reductions in spring precipitation in the Northeast. Note: white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability (USGCRP, 2014a).

Cfa – Figure 3.2.14-3 shows that in a rapid emissions reduction scenario in the 30-year period for 2070 to 2099, precipitation will increase by 10 percent in winter, spring and summer for the entire state of Connecticut. However, there are no expected increases in precipitation in fall other than fluctuations due to natural variability (USGCRP, 2014a).

Figure 3.2.14-4 shows that if emissions continue to increase, winter and spring precipitation could increase as much as 20 percent over the period 2071 to 2099. In summer, precipitation under this scenario could increase as much as 10 percent. No significant change in fall and summer rainfall is anticipated over the same period (USGCRP, 2014a).

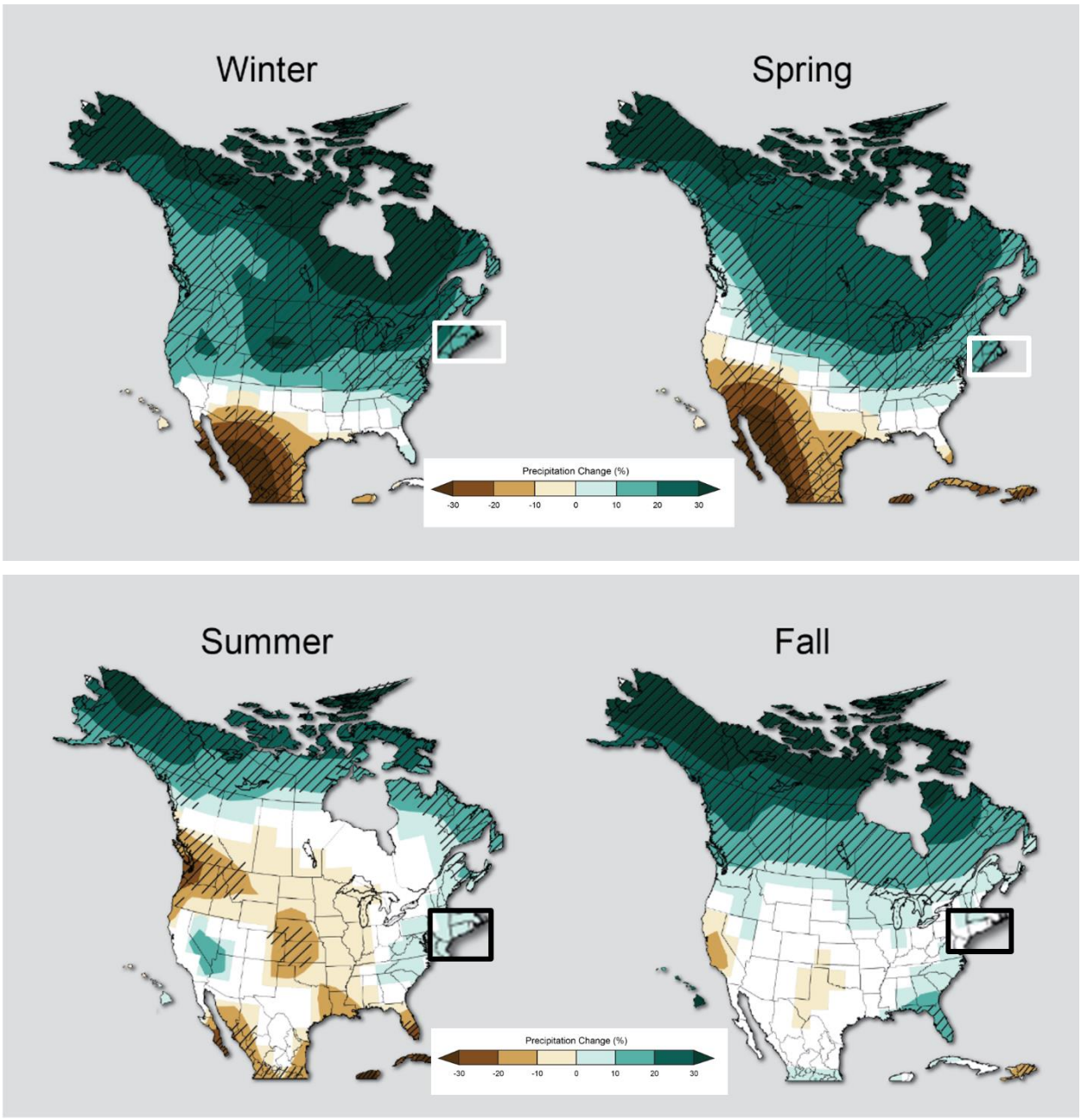
Dfa – Precipitation changes for the Dfa region are consistent with projected changes for the Cfa region of Connecticut in both low and high GHG emissions scenarios.

Dfb – Precipitation changes for the Dfb region are consistent with projected changes for the Cfa and Dfa regions of Connecticut in both low and high emissions scenarios.



Source: (USGCRP, 2014a)

Figure 3.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario



Source: (USGCRP, 2014a)

Figure 3.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Sea Level

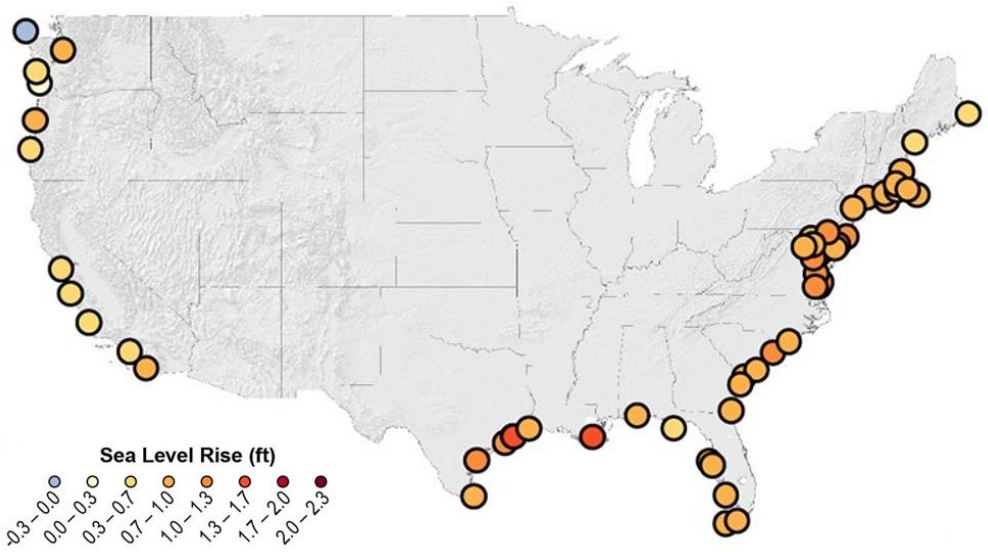
Several factors will continue to affect sea level rise in the future. Glacier melt adds water to the ocean, and increasing ocean temperatures result in thermal expansion. Worldwide, "glaciers have generally shrunk since the 1960s, and the rate at which glaciers are melting has accelerated over the last decade. The loss of ice from glaciers has contributed to the observed rise in sea level" (USEPA, 2012d). When water warms, it also expands, which contributes to sea level rise

in the world's oceans. "Several studies have shown that the amount of heat stored in the ocean has increased substantially since the 1950s" (USEPA, 2012d). "Ocean heat content also influences sea level and currents" (USEPA, 2012d).

The amount of sea level rise will vary in the future along different stretches of the U.S. coastline and under different absolute global sea level rise scenarios. Variation in sea level rise along different stretches of coast is mostly due to varying rates of land subsidence (also known as relative sea level rise). In the National Climate Assessment (NCA) potential sea level rise scenarios were reported. These scenarios were developed based on varying degrees of ocean warming and ice sheet loss as estimated by organizations like IPCC (NOAA, 2012). Figure 3.2.14-5 and Figure 3.2.14-6 shows feet of sea level above 1992 levels at different tide gauge stations. Figure 3.2.14-5 shows an 8 inch global sea level rise above 1992 levels by 2050 and Figure 3.2.14-6 shows a 1.24-foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014b).

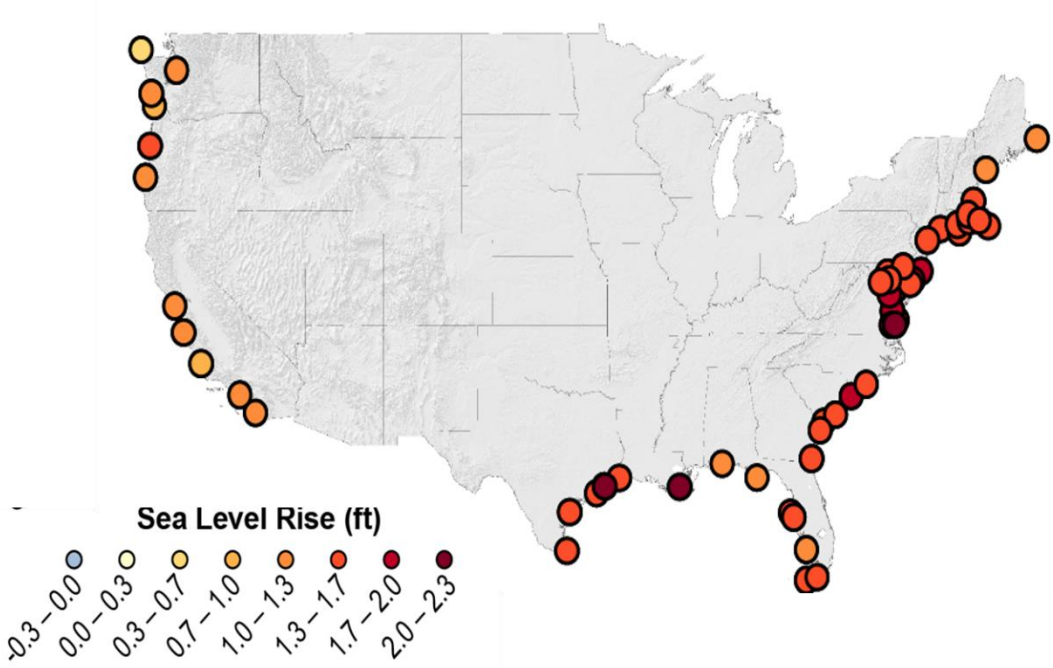
Cfa – Figure 3.2.14-5 presents an 8-inch global average sea level rise above 1992 levels resulting in a 0.7- to 1-foot sea level rise in 2050 along the coast of Connecticut. Figure 3.2.14-6 indicates that a 1.24-foot sea level rise above 1992 level would result in a 1.3 to 1.7 foot sea level rise in 2050 along the coast of Connecticut.

Dfa and Dfb – These Connecticut regions are not affected by sea level rise.



Source: (USGCRP, 2014b)

Figure 3.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050



Source: (USGCRP, 2014b)

Figure 3.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050

Severe Weather Events

It is difficult to forecast the impact of climate change on severe weather events such as thunderstorms and hurricanes. Trends in thunderstorms and hurricanes are subject to greater uncertainties than trends in temperature and associated variables directly related to temperature such as sea level rise. Climate scientists are studying the influences of climate change on severe storms such as hurricanes. Recent research has yielded insights into the connections between warming and factors that cause severe storms. For example, atmospheric instability and increases in wind speed with altitude link warming with tornadoes and thunderstorms. Additionally, research has found a link between warming and conditions favorable for severe thunderstorms. However, more research is required to make definitive links between severe weather events and climate change (USGCRP, 2014c).

United States coastal waters are expected to experience more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of storms that make landfall) (USGCRP, 2014c). Changes in hurricane intensity are difficult to forecast because there are contradictory effects at work. Warmer oceans increase storm strength with higher winds and increased precipitation. However, changes in wind speed and direction with height are also projected to increase in some regions; this tends inhibit storm formation and growth. Current research suggests stronger, more rain-producing tropical storms and hurricanes are generally more likely, though such storms may form less frequently; ultimately, more research would likely provide greater certainty (USGCRP, 2009).

3.2.14.3. Description of Environmental Concerns

Greenhouse Gas Emissions

Increases in GHG emissions have altered the global climate, leading to generalized temperature increases, weather disruption, increased droughts, and heatwaves, and may have potentially catastrophic long-term consequences for the environment. Although GHGs are not yet regulated by the federal government, many states have set various objectives related to reducing GHG emissions, particularly CO_2 emissions from fossil fuels.

Based on the impact significance criteria presented in Table 3.2.14-1, climate change impacts as a result of GHG emissions could be significant and require a quantitative analysis if FirstNet's deployment of technology was responsible for increased emissions. The GHG emissions resulting from FirstNet activities fall into two categories: short-term and long-term. Short-term emissions could be associated with deployment activities (vehicles and other motorized construction equipment) and would have no long-term or permanent impact on GHG emissions or climate change. Long-term (both temporary and permanent) emission increases could result from operations, including the use of grid-provided electricity by FirstNet equipment such as transmitters and optical fiber, and from the temporary use of portable or onsite electric generators (a less efficient, more carbon-intensive source of electricity), during emergency situations when the electric grid was down, for example after a hurricane.

Climate Change

Climate change may impact Proposed Action-related effects by magnifying or otherwise altering impacts in other resources areas. For example, climate change may impact air quality, water resource availability, or recreation. These effects would vary among states, depending on the resources in question and their relationship to climate change. These impacts will be considered fully in Chapter 18, Cumulative Impacts. No BMPs will be described for this aspect of the resource.

Climate change may expose Connecticut to longer and more intense heat waves, particularly in areas with a significant urban heat island, with negative impacts on human morbidity and mortality, as well as for air quality (USGCRP, 2014d). In areas of Connecticut at risk of flooding, climate change is projected to increase the frequency and severity of torrential downpours, which in turn may increase the potential for flash flooding, with multiple secondary effects including increased runoff to rivers, streams, and other receiving waterbodies (Connecticut Governor's Steering Committee on Climate Change, 2010). Sea level rise and warmer water temperatures are expected to negatively impact coastal ecosystems, with increased rates of wetlands loss as well as beach erosion, and changes in the population and distribution of commercially important shellfish (Connecticut Governor's Steering Committee on Climate Change, 2010).

Climate change impacts on FirstNet installations and infrastructure will vary among states, depending on the placement and vulnerability of the installations and infrastructure, and the impacts that climate change is anticipated to have in that particular location.

FirstNet infrastructure located near the coastal areas of Connecticut, as well as inland floodplains, are at risk from stronger hurricanes as a result of climate change. Sea level rise would increase the height, areal extent, and persistence of coastal flooding during these events. Stronger storms may also increase the potential for damage from high winds and wind-blown debris, and impede the activities of emergency responders (Connecticut Governor's Steering Committee on Climate Change, 2010). Rising temperatures and extended periods of extreme heat may lead to electricity grid overloads as more people use air conditioning (Connecticut Governor's Steering Committee on Climate Change, 2010) (DOE, 2015). Extreme or extended periods of heat may also overwhelm the capacity of onsite equipment needed to keep microwave and other transmitters cool.

3.2.14.4. Potential Impacts of the Preferred Alternative

Project Related Impacts on Climate Change

Given this assessment is programmatic and does not include any site-specific locations or deployment technology, it is impossible to determine the actual GHG emissions associated with any of the action alternatives. This information could only be captured once the site-specific information is determined. However, an assessment of potential impacts is provided in this section based on the potential emissions associated with the various activities that could occur as a result of the implementation of the Preferred Alternative in Connecticut, including deployment and operation activities.

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment and operation of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to GHG emissions, climate impacts in other resource areas, and FirstNet infrastructure and operations, and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of *no impacts to less than significant impacts* at the programmatic level depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action, the following are likely to have *no impacts* to climate change under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions. This would create no perceptible change in GHG emissions.

- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create any perceptible changes in GHG emissions because they would not create any new emissions sources.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

Activities with the Potential to Have Impacts at the Programmatic Level

The deployment and use of energy-consuming equipment as a result of the implementation of the Preferred Alternative would result in GHG emissions whose significance would vary depending on their power requirements, duration and intensity of use, and number. The types of infrastructure deployment scenarios that could be part of the Preferred Alternative and result in potential impacts to GHG emissions and climate change include the following:

- Wireless Projects
  - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
  - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
  - Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities.
  - New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small marine sources would contribute to GHGs.
  - Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.
- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity

requirements of the towers (both grid-provided and backup), and would depend on their size, number, and the frequency and duration of their use.

  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with construction as construction would not take place. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and backup), and would depend on their size, number, and the frequency and duration of their use.

- Deployable Technologies
  - COWs, COLTs, or SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts if operated in large numbers over the long-term. However, this would be highly dependent on their size, number, and the frequency and duration of their use.
  - Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of piloted or unmanned aircraft were used for a sustained period of time (i.e. months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. These emissions would arise from the combustion of fuel used by equipment during construction and operation. The total potential level of GHG emissions would be *less than significant*; although geographically large (all 50 states and 5 territories) any one site would be limited in extent and emit minor levels of GHG emissions as explained in the analysis. Land use related emissions occurring as a result of soil disturbance and loss of vegetation are expected to be *less than significant* at the programmatic level due to the limited and localized nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could, at the programmatic level, be *potentially significant to less than significant with BMPs and mitigation measures incorporated* because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. The coastal areas of Connecticut are at risk for stronger hurricanes as a result of climate change. Sea level rise would increase the height, areal extent, and persistence of coastal flooding during these events. Stronger storms may also increase the potential for damage from high winds and wind-borne debris and impede the activities of emergency responders (State of Connecticut 2010). In inland

areas of Connecticut at risk of flooding, climate change is projected to increase the frequency and severity of torrential downpours, which in turn may increase the potential for flash floods (State of Connecticut 2010). The Northeast U.S. is at risk to increased intensity and duration of heat waves in the warmer months (USGCRP 2014). Areas in or close to an urban heat island, for example in urban areas of Connecticut close to New York City and other urbanized, areas may experience extended periods of extreme heat. This in turn may lead to electricity grid overloads as more people use air conditioning (State of Connecticut 2010). FirstNet installations should be evaluated in the design and planning phase through tiering to this analysis, in the context of their local geography and anticipated climate hazards to ensure they are properly hardened or there is sufficient redundancy to continue operations in a climate-affected environment. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating *adverse effects* of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

3.2.14.5. Alternatives Impact Assessment

The following section assesses potential impacts to climate associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be, at the programmatic level, *less than significant*. based on the defined significance criteria, since activities would be temporary and short-term.

Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be *less than significant* at the programmatic level. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. These activities are expected to be *less than significant* due the limited duration of deployment activities.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be *less than significant* at the programmatic level, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

Climate change effects have the most noticeable impacts over a long period. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to *no impact* at the programmatic level on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. Therefore, there would be *no impacts* to GHG emissions or climate as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.14, Climate Change.

3.2.15. Human Health and Safety

3.2.15.1. Introduction

This section describes potential impacts to human health and safety in Connecticut associated with deployment of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.15.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on human health and safety were evaluated using the significance criteria presented in Table 3.2.15-1. The categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to human health and safety addressed in this section are presented as a range of possible impacts.

Table 3.2.15-1: Impact Significance Rating Criteria for Human Health and Safety at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA	Effect is *potentially significant*, but with mitigation is *less than significant*.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the Proposed Action.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is *potentially significant*, but with mitigation is *less than significant*.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the Proposed Action.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And Manmade Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is *potentially significant*, but with mitigation is *less than significant*.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the Proposed Action.		Rare event	NA

NA = Not Applicable

3.2.15.3. Description of Environmental Concerns

Worksite Physical Hazards, Hazardous Materials, and Hazardous Waste

The human health and safety concern having the greatest likelihood to occur during FirstNet deployment activities is occupational injury to telecommunication workers. The nature of telecommunication work requires workers to execute job responsibilities that are inherently dangerous. Telecommunication work activities present physical and chemical hazards to workers. The physical hazards have the potential to cause acute injury, long-term disabilities, or in the most extreme incidents, death. Other occupational activities such as handling hazardous materials and hazardous waste often do not result in acute injuries, but may compound over multiple exposures, resulting in increased morbidity. Based on the impact significance criteria presented in Table 3.2.15-1, occupational injury impacts could be *potentially significant* if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites. For example, if fuel is spilled from an onsite fuel tank, the spilled fuel could migrate down gradient and infiltrate underground drinking water sources. The public may then be exposed to hazardous chemicals in their drinking water if they utilize the same groundwater aquifer.

To protect occupational workers, the OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2015b).

1. Engineering controls;
2. Work practice controls;
3. Administrative controls; and then
4. Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes, chain locks, bollards, storage containers (for storing equipment and chemicals), or signage and caution tape. Other forms of engineering controls could include machinery designed to manipulate the quality of the work environment, such as ventilation blowers. Whenever practical, engineering controls may result in the complete removal of the hazard from the work site, an example of which would be the transport and offsite disposal of hazardous waste or asbestos containing materials.

Work practice controls could be implemented as abiding by specific OSHA industry standards, such as the Confined Space Entry standard (29 CFR 1910.146) or thru the development of

employer specific workplace rules and operational practices (OSHA, 2015b). To the extent practicable, FirstNet partners would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets (SDS) describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all Proposed Action sites. In addition to HASPs and SDSs, SOPs would be developed and implemented by FirstNet partners for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear step-wise directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (OSHA, 2015b). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks, and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE is the common term used to refer to the equipment worn by employees to minimize exposure to chemical and physical hazards. Examples of PPE include gloves, protective footwear, eye protection, protective hearing devices (earplugs, muffs), hard hats, fall protection, respirators, and full body suits. PPE is the last line of defense to prevent occupational injuries and exposure.

CTDOL is not authorized by U.S. OSHA to administer the state's private sector program for occupational safety or federal employers. Therefore, CTDOL defers all regulatory authority and enforcement for occupational safety relating to FirstNet site work to the leadership and interpretation of U.S. OSHA.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed as a result of site activities. Based on the impact significance criteria presented in Table 3.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties. Prior to FirstNet deployment, potential site locations should be screened for known environmental contamination using federal resources, such as the USEPA Cleanups in My Community database or equivalent commercial resource, such as Environmental Data Resources, Incorporated.

By screening sites for environmental contamination and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination are selected for FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the public, are not unnecessarily exposed to the associated hazards. Additionally, for any FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, Superfund, and applicable Connecticut state laws in order to protect workers and the general public from direct exposure or fugitive contamination.

Exposure assessments identify relevant site characteristics, temporal exposure parameters, and toxicity data to determine the likelihood of adverse health effects. More formally known as a human health risk assessment (HHRA), these studies provide mathematical justification for implementing controls at the site to protect human health. If the HHRA determines the potential for adverse health effects is too great CT DEEP may require FirstNet to perform environmental clean-up actions at the site to lower the existing levels of contamination. HHRAs help determine which level of PPE (i.e., Level D, Level C, Level B, or Level A) is necessary for a work activity. HHRAs take into account all exposure pathways: absorption, ingestion, inhalation, and injection. Therefore, specific protective measures (e.g., controls and PPE) that disrupt the exposure pathways could be identified, prioritized, and implemented.

Natural and Manmade Disasters

The impacts of natural and manmade disasters are likely to present unique health and safety hazards, as well as exacerbate pre-existing hazards, such as degrading occupational work conditions and disturbing existing environmental contamination. The unique hazards presented by natural and manmade disasters may include, fire, weather incidents (e.g., floods, tornadoes, hurricanes, etc.), earthquakes, vandalism, large- or small-scale chemical releases, utility disruption, community evacuations, or any other event that abruptly and drastically denudes the availability or quality of transportation infrastructure, utility infrastructure, medical infrastructure, and sanitation infrastructure. Additionally, such natural and manmade disasters could directly impact public safety communication infrastructure assets through damage or destruction.

Based on the impact significance criteria presented in Table 3.2.15-1, human health impacts could be significant if FirstNet deployment sites are in areas that are directly impacted by natural

and manmade disasters (e.g., coastal regions or areas within the floodplain) that could lead to exposure to hazardous wastes, hazardous materials, and occupational hazards. FirstNet's emphasis on public safety-grade communications infrastructure may result in a *less than significant* beneficial impact, as new infrastructure could be deployed with additional structural hardening, and existing infrastructure may also be hardened as appropriate and feasible, in an effort to reduce the possibility of infrastructure damage or destruction to some degree.

Potential mitigation measures for natural disasters include awareness of weather forecasts, forest fire risk, seismically active areas. Awareness provides time and opportunity to plan evacuation routes, to relocate critical equipment and parts, and to schedule appropriate work activities preceding and after the natural disaster. These mitigation steps reduce the presence of workers and dangerous work activities to reduce the potential for injury or death. Manmade disasters could be more difficult to anticipate due to the unexpected or accidental nature of the disaster. Though some manmade disasters are due to malicious intentions, many manmade disasters result from human error or equipment failure. The incidence of manmade disasters affecting FirstNet deployment sites would be difficult to predict and diminish because the source of such disasters is most likely to originate from sources independent of FirstNet activities. Therefore, FirstNet (or its partners) would likely develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

3.2.15.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and maintenance activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to human health and safety and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of *no impacts* to *less than significant with BMPs and mitigation measures incorporated*, depending on the deployment scenario or site-specific activities.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to human health and safety under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: the pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this

work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be *no impacts* to human health and safety at the programmatic level.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to human health and safety at the programmatic level because there would be no ground disturbance or heavy equipment used.

- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact human health and safety resources, it is anticipated that this activity would have *no impact* at the programmatic level on those resources.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines would require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to

collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in limited nearshore and inland bodies of water requires workers to operate over aquatic and/or marine environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shore to accept submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event

of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance in land-based deployables occur in unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes,noise and vibrations. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in

sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, and environmental contamination, and mine lands), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure and release of hazardous chemicals and hazardous waste. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be *less than significant* at the programmatic level due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be *less than significant* impacts to human health and safety at the programmatic level associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be *less than significant* due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

3.2.15.5. Alternatives Impact Assessment

The following section assesses potential impacts to human health and safety associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable land-based infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to human health and safety as a result of implementation of this Alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source were an electrical generator, then there would also likely be a need to manage fuel onsite. These activities could result in *less than significant* impacts to human health and safety at the programmatic level. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be *less than significant* at the programmatic level due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *no impacts* to human health and safety at the programmatic level associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures may be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. These impacts would be *less than significant* at the programmatic level because of the small-scale of likely FirstNet activities; activities associated would routine

maintenance, inspection, and deployment of deployable technologies would be temporary and often of limited duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. Therefore, there would be *no impacts* to human health and safety at the programmatic level as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 3.1.15, Human Health and Safety.

CT APPENDIX A – WATER RESOURCES

Table A-1: Characteristics of Connecticut's Watersheds, as defined by CT DEEP

Watershed/Size Land Area within CT (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
Connecticut (1,436)	Connecticut River Eightmile River Farmington River Hockanum River Mattabesset River Salmon River Bashan Lake Colebrook Reservoir Lake Hayward Moodus Reservoir Lake Pocotopaug Rainbow Reservoir	• Bacteria • Pathogens • Polychlorinated Biphenyls (PCBs)
Housatonic (1,235)	Aspetuck River Bantam River Eightmile Brook Housatonic River Naugatuck River Pootatuck River Tenmile River Steele Brook Candlewood Lake Indian Lake Lake Housatonic Lake Lillinonah Lake Quassapaug Lake Waramaug Lake Washining Lake Wononscopomuc Lake Zoar	• Pathogens • PCBs • Heavy metals
Hudson (223)	Titicus River Mamanasco Lake	• Pathogens
Pawcatuck (57)	Ashaway River Green Fall River Pawcatuck River Shunock River Wood River Green Falls Reservoir Spalding Pond Wyassup Lake	• Pathogens
South Central Coast (512)	Oyster River Quinnipiac River Wepawaug River Community Lake Hanover Pond	• Low dissolved oxygen • Bacteria • Pathogens • Urban stormwater and combined sewer overflows

Watershed/Size Land Area within CT (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
Southeast Coast (163)	Anguilla Brook Great Brook Latimer Brook Mystic River Williams Brook Buddington Pond Groton Reservoir Hyde Pond	• Bacteria • Pathogens • Excess nutrients (nitrogen/phosphorus) • Urban stormwater and combined sewer overflows
Southwest Coast (392)	Booth Hill Brook Byram River Norwalk River Pequannock River Rippowam River Saugatuck River Derring Pond Lake Forest Lee Pond Pinewood Lake Winnipauk Millpond	• Bacteria • Pathogens • Contaminated sediments • Urban stormwater and combined sewer overflows
Thames (1,162)	French River Little River Moosup River Natchaug River Pattagansett River Quinebaug River Shetucket River Thames River Aspinook Pond Bog Meadow Reservoir Gardner Lake Groton Reservoir Lake Konomoc Mansfield Hollow Lake West Thompson Lake Willimantic Reservoir	• Bacteria • Pathogens • Lead

Sources: (City of Bridgeport, 2010) (CT DEEP, 2002), (CT DEEP, 2015f), (USEPA, 2015s), (USFWS, 2013b) (Nosal, 1997)

ACRONYMS

AGL	Above Ground Level
AML	Abandoned Mine Lands
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act of 1979
ASL	Above Sea Level
ATC	Air Traffic Control
ATO	Air Traffic Organization
B	Billion
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMPs	Best Management Practices
BYA	Billion Years Ago
CAA	Clean Air Act
CAC	Connecticut Archaeology Center
CCMP	Comprehensive Conservation and Management Plan
CEQ	Council On Environmental Quality
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH4	Methane
CIAC	Community Involvement Advisory Council
CIMC	Cleanups In My Community
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLT	Cell On Light Trucks
ConnDOT	Connecticut Department of Transportation
COW	Cell On Wheels
CPCN	Certificate of Public Convenience and Necessity
CRS	Community Rating System
CT	Connecticut
CWA	Clean Water Act
CT DEEP	Connecticut Department of Energy and Environmental Protection
DPH	Division of Public Health
DSHS	Department of Safety and Homeland Security
EFH	Essential Fish Habitats
EIA	Energy Information Agency
EMS	Emergency Medical Services
EOP	Emission Offset Provisions
EPCRA	Community Right To Know Act
FAA	Federal Aviation Administration
FAQ	Frequently Asked Questions
FCC	Federal Communications Commission

FEMA	Federal Emergency Management Agency
FFC	Fossil Fuel Combustion
FGDC	Federal Geographic Data Committee
FLM	Federal Land Manager
FSDO	Flight Standards District Offices
FSS	Flight Service Station
GHG	Greenhouse Gas
GWDS	Ground Water Discharges Section
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
IWWA	Inland Wetlands and Watercourses Act
LBS	Locations-Based Services
LRR	Land Resource Regions
LTE	Long Term Evolution
LULUCF	Land Use Change, and Commercial Forestry
M	Million
MA	Massachusetts
MBTA	Migratory Bird Treaty Act
MHI	Median Household Income
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tons
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MTRs	Military Training Routes
MYA	Million Years Ago
N2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NM	Nautical Miles

NOAA	National Ocean and Atmospheric Administration
NOTAM	Disseminated Via Notices To Airmen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NST	National Institute of Standards and Technology
NWI	National Wetlands Inventory
NY	New York
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OSA	Office of State Archaeology
OSHA	Occupational Safety and Health Act
OTR	Ozone Transport Region
PEM	Palustrine Emergent Wetlands
PFO	Palustrine Forested Wetlands
PGA	Peak Ground Acceleration
PHL	Philadelphia International Airport
POPs	Points of Presence
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSC	Public Service Commission
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PSS	Scrub-Shrub Wetlands
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
RFI	Request For Information
RGGI	Regional Greenhouse Gas Initiative
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SDS	Safety Data Sheets
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SHRI	Statewide Historic Resource Inventory
SIP	State Implementation Plan
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SOW	System On Wheels
SOX	Oxides of Sulfur
SPL	Sound Pressure Level

SSA	Sole Source Aquifer
SUA	Special Use Airspace
SWAP	State Wildlife Action Plan
SWPPP	Storm Water Pollution Prevention Plan
TFRs	Temporary Flight Restrictions
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
TWA	Time Weighted Average
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UCONN	University of Connecticut
UHF	Ultra-High Frequency
USACE	U.S. Army Corps of Engineers
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VFR	Visual Flight Rules
VHF	Very High Frequency
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
VR	Visual Route
WSLS	Wetlands and Subaqueous Lands Section
WWI	World War I
WWII	World War II

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