Appendix E.15 – Climate Change

APPENDIX E.15

CLIMATE CHANGE – ERRATA SHEET

No changes were made to the materials in this appendix. This Volume 2 file contains the same information as was presented in the Tier 1 Draft EIS published November 2015.

NEC FUTURE
A Rail Investment Plan for the Northeast Corridor

Climate Change Effects Assessment Methodology

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Revised Final Version

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Table of Contents

Tables

1. Climate Change Effects Assessment Methodology

1.1 INTRODUCTION

Early in the development of the NEC FUTURE program, a strategy was developed to consider greenhouse gas emissions and climate change *(Methodology for Assessing Greenhouse Gas Emissions and Climate Change Effects in the NEC FUTURE Tier 1 EIS, May 8,* 2013*)*. The strategy provided a general approach to addressing these topics based upon recent policy developments for analysis of these topics in the context of NEPA documentation. *In implementing the strategy, two separate impact assessment methodologies have been developed; one to address greenhouse gas emissions and the other to address the effects of climate change. However, within the Tier 1 EIS, a single section on climate change will be presented that includes the findings of both assessments*.

This methodology document focuses specifically *on identifying those elements of rail service and infrastructure associated with each of the Tier 1 EIS Alternatives potentially vulnerable to climate change and its effects, including sea-level rise and storm surge, increased storm frequency and severity, and more frequent and severe extreme heat and cold events*. As stated above, the Tier 1 EIS will also address the related issue of potential effects of the NEC FUTURE program's greenhouse gas (GHG) emissions on climate change; the approach to quantifying and assessing GHG emissions is described in the separate *Air Quality Effects Assessment Methodology*[1].

This climate change methodology presents the regulatory framework, involved government agencies, expected regulatory and other outcomes of the Tier 1 EIS process, and the relevance to Tier 2, project-level assessments. It also identifies data sources, metrics, and methods to be used to document existing conditions and analyze environmental consequences. New tools or techniques are currently being developed to assist in the identification of and assessment of climate change vulnerabilities, notably those findings or tools developed through the Federal Highway Administration's (FHWA) "Climate Change & Extreme Weather Vulnerability Assessment Framework".[2] As work advances on the NEC FUTURE program, FRA will evaluate opportunities to incorporate these and other findings and tools. Similar updates to relevant topographic or climate data (as shown in Table 5) will be assessed to determine the relevance to the NEC FUTURE analyses. In light of these updates in the approach and data to support climate change assessments, this methodology may be revised as new information is available.

1.2 DEFINITIONS

Topic areas covered in this methodology include:

- ***Climate Change****:* As described by the United States Environmental Protection Agency (EPA), climate change is any significant change in the measures of climate lasting for an extended

[1]NEC Future Tier 1 EIS Air Quality Effects Assessment Methodology,
[2]https://www.fhwa.dot.gov/environment/climate_change/adaptation/publications_and_tools/vulnerability_assessment_framework/

period of time. It includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over a period of several decades or longer.[3]

- ***Global Warming****:* The EPA describes global warming as the measured increases in average temperatures worldwide in recent decades and the continued increases projected to occur throughout this century.[4] The climate change effects associated with this gradual warming trend include rises in sea levels (due to the melting of glaciers and ice caps, and the thermal expansion of ocean water), projected changes in the location, level and frequency of precipitation and the frequency and/or severity of storm events and changes in temperature ranges (e.g., frequency and intensity of maximum and minimum temperature extremes).
- ***Vulnerability****:* For purposes of this Tier 1 EIS, vulnerability is defined as the extent to which elements of existing or proposed rail service and infrastructure would be susceptible to the effects of climate change, such as sea level rise, riverine or coastal flood hazards, or other threats to the transportation network, such as extreme heat and cold effects on tracks.

1.3 RELATED RESOURCES

The existing conditions and effects assessments from floodplains evaluated as part of the Tier 1 EIS will contribute to the assessment of the effects of climate change as identified in Table 1. Note that the effects assessments for floodplains will be based on coordination with the Federal Emergency Management Agency (FEMA) and review of readily available information (existing Flood Insurance Rate Maps [FIRM] and Advisory Base Flood Elevations [ABFE]), and documented within the floodplains subsection of the Tier 1 EIS.

Table 1: Related Resource Inputs to Climate Change

Resource	Input to Climate Change Assessment
Floodplains	▪ Effective and Preliminary Flood Insurance Rate Maps and Advisory Base Flood Elevations, where available, that provide a baseline measure of flood risk for use in climate change assessment. The use of FIRM data will be consistent with the floodplain analysis, as documented in a separate methodology, for the Tier 1 EIS. *
Water Resources	▪ Effects of water resources that overlap with floodplains and thus aggravate flooding conditions/risks
Coastal Zones & Saltwater Wetlands	▪ Effects of coastal zones & saltwater wetlands that overlap with floodplains and thus aggravate flooding conditions/risks

Source: NEC FUTURE JV TEAM, 2014

* FIRM and ABFE data will be reviewed case-by-case to obtain the best available data and to maintain overall consistency across the Study Area.

[3] Available from http://www.epa.gov/climatechange/basics/ (September 2013)

[4] Available from http://www.epa.gov/climatechange/basics/ (September 2013)

1.4 AGENCY AND REGULATORY FRAMEWORK

Multiple federal agencies are responsible for climate change-related guidance and regulations. The study team will consider the legislation, policies and regulations listed in Table 2 that are consistent with a NEC FUTURE Tier 1 level evaluation of climate change impacts.

TABLE 2: CLIMATE CHANGE GUIDANCE

Federal Agency	Regulatory Oversight	Description of Regulation	Regulated/*Applicable* Resource(s)
United States Environmental Protection Agency (EPA)	▪ §1508.7 of Council on Environmental Quality (CEQ) regulations for implementing National Environmental Policy Act (NEPA)	▪ Required assessment of "cumulative impacts [that] can result from individually minor but collectively significant actions taking place over a period of time." ▪ The EPA oversees programs to reduce GHGs and regulate air quality standards and goals; they are also actively involved in establishing climate adaptation guidance.	▪ Environmental impacts of federal actions ▪ Greenhouse gas (GHG) emissions ▪ *Climate adaptation*
	▪ *CEQ, Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*. (February 2010)	▪ Recommends the NEPA "rule of reason" when determining how extensively to consider a project's potential vulnerability to climate change.	▪ GHG emissions
U.S. Federal Highway Administration (FHWA)	▪ *Climate Change – Model Language in Transportation Plans* (Nov. 2010)	▪ Procedures and programs for climate change adaptation for transportation infrastructure, including an extensive ongoing pilot program supporting climate change vulnerability assessment programs with state departments of transportation, metropolitan planning organizations, and other agencies.	▪ Vulnerability to climate change
U.S. Department of Transportation (U.S. DOT)	▪ *Climate Adaptation Plan: Ensuring Transportation Infrastructure and System Resilience* (2012)	▪ Ongoing and planned actions by U.S. DOT and its modal administrations to identify climate change challenges and the policies and technologies to adapt to them.	▪ Vulnerability and adaptation climate change

Source: NEC FUTURE JV Team, 2014

Additionally, Table 3 includes recent Executive Orders that pertain to climate change and adaptation:

TABLE 3: EXECUTIVE ORDERS RELATED TO CLIMATE CHANGE AND ADAPTATION

Federal Agency	Regulatory Oversight	Description of Regulation	Regulated Resource
U.S. Executive Office	▪ Executive Order 13514, *Federal Leadership in Environmental, Energy and Economic Performance*. (October 2009) ▪ Council on Environmental Quality , *Instructions for Implementing Climate Change Adaptation Planning in Accordance with Executive Order 13514*. (March 2011).	▪ Establishes an integrated strategy for sustainability, including an interagency climate change adaptation task force	▪ Climate change adaptation plans ▪ Mitigating vulnerability to climate change
U.S. Executive Office	▪ Executive Order 13653, *Preparing the United States for the Impacts of Climate Change* (November 2013) ▪ *The President's Climate Action Plan*, Executive Office of the President, June 2013	▪ Seven-point Executive Order focused on making federal activities more efficient and to strengthening consideration of climate change in federal investments, and programs and helping state and local governments prepare for climate change impacts; Includes review of federal funding programs to improve their efficiency in this area, work with the Climate Preparedness and Resilience Task Force, review/improve land and water programs and policies in light of climate change, create and exchange available, usable and timely data, web-based portals, etc.	▪ Vulnerability and adaptation to effects of climate change

Source: NEC FUTURE JV Team, 2014

The states within the NEC FUTURE Study Area (Study Area) have implemented a wide variety of legislative mandates and regulatory and policy actions to support public and private sector actions to incorporate climate change and adaptation considerations in their policies, programs and investment decisions. Table 4 includes examples of some of the state-level climate change-related regulatory and programmatic actions within the Study Area. An updated list containing further details of the state-level climate change-related actions in each state within the Study Area will be included in the Tier 1 EIS discussion of existing conditions, along with the relevance of these state-level actions to the proposed NEC FUTURE climate change assessments.

TABLE 4: STATE-LEVEL CLIMATE CHANGE INITIATIVES

State	Regulatory / Programmatic Action	Description
Delaware	▪ Chesapeake Sea Level Rise and Storm Surge: Public Awareness and. Response, Interactive Map of Climate Change in the Chesapeake Bay (2013)	▪ An interactive online map of the Chesapeake Bay including the impacts of sea level rise and storm surge predictions as a result of future climate change.
	▪ Delaware Department of Natural Resources and Environmental Control, Sea Level Rise Inundation Maps (2013)	▪ Aid in planning land use planning and controls, emergency management plans, impacts to the economy, future infrastructure plans and planning for coastal community resiliency by determining hazards and vulnerabilities.
	▪ The Delaware Sea Level Rise Advisory Committee, Preparing for Tomorrow's High Tide: Recommendations for Adapting to Sea Level Rise in Delaware (2013)	▪ Describes Delaware's vulnerability to sea level rise, and provides 55 recommendations for adapting to the effects of sea level rise.
	▪ Wilmington Area Planning Council, *Sea-Level Rise, A Transportation Vulnerability Assessment of the Wilmington*, Delaware Region (2011)	▪ Provides assessment of transportation infrastructure at risk from sea level rise and provides policy recommendations for adaptation planning.
Maryland	▪ *Executive Order 01.01.2012.29: Climate Change and Coast Smart Construction* (December 2012)	▪ Directs that all new and reconstructed state structures, as well as other infrastructure improvements, be planned and constructed to avoid or minimize future flood damage.
	▪ *2011 Maryland State Hazard Mitigation Plan Update* (August 2011)	▪ Prepared by the Maryland Emergency Management Agency, which has incorporated climate change and climate adaptation into the statewide risk assessment and mitigation strategy.
	▪ *Coastal Shorelines Atlas*	▪ A mapping tool, which allows users to access state coastal hazard data including coastal inundation from storms, areas at risk to sea level rise, and shoreline erosion data.
	▪ *CoastSmart Communities Program. Inc, including Climate Change and Coast Smart Construction Infrastructure Siting and Design Guidelines* (January 2014)	▪ An online resource center for financial and technical assistance to address vulnerability to the impacts of sea level rise and climate change.
Pennsylvania	▪ Penn State University, *Pennsylvania Climate Impact Assessment Report* (June 2009)	▪ Assesses impacts of global climate change for Pennsylvania, including the economy, wildlife, fisheries recreation, agriculture and tourism.
	▪ Department of Environmental Protection, *Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations* (January 2011)	▪ Recommendations for climate change adaptation in areas of Infrastructure, Public Health and Safety, Natural Resources, and Tourism and Outdoor Recreation.
New Jersey	▪ Federal Emergency Management Agency, *Advisory Base Flood Elevations Map*	▪ An online mapping tool that shows the ABFEs released by FEMA Region II in 2013 covering areas of New Jersey affected by Hurricane Sandy.
	▪ New Jersey Department of Environmental Protection, *Getting to Resilience: A Coastal Community Resilience Evaluation Tool*	▪ A process to help guide the evaluation of local climate change resiliency plans, particularly in coastal areas.

State	Regulatory / Programmatic Action	Description
	▪ *FHWA Climate Change Vulnerability Assessment Pilot Project – North Jersey Transportation Planning Authority* (NJTPA)	▪ NJTPA participated in a pilot project to test the FHWA climate change vulnerability assessment model. This conceptual model guided transportation agencies through the process of collecting and integrating climate and asset data in order to identify critical vulnerabilities.

TABLE 4: STATE-LEVEL CLIMATE CHANGE INITIATIVES (CONTINUED)

State	Regulatory / Programmatic Action	Description
New York	▪ The New York State Emergency Management Office, *New York State Coastal Counties Hurricane Storm Surge Zones* (September 2005)	▪ Shows hurricane storm surge zones based on National Oceanic and Atmospheric Administration (NOAA) sea rise models.
	▪ Federal Emergency Management Agency (FEMA), *Advisory Base Flood Elevations Map*	▪ As noted under New Jersey above, an online mapping tool showing ABFEs released by FEMA Region II in 2013 covering areas of New York affected by Hurricane Sandy.
	▪ New York State Energy Research and Development Authority, *Responding to Climate Change in New York State: The ClimAID Integrated Assessment for Effective Climate Change Adaptation Strategies in New York State*	▪ Provides information on the state's vulnerability to climate change and on development of adaptation strategies.
	▪ New York City Panel on Climate Change, *Climate Risk Information 2013 Observations, Climate Change Projections, and Maps* and the 2014 web based update of projections[5]	▪ Provides climate projections for NYC.
Connecticut	▪ Connecticut Department of Energy and Environmental Protection (DEEP), Coastal Hazards Mapping Tool, including Sea Level Rise Visualization Data	▪ Depicts estimates of inundation due to sea level rise across all Connecticut towns with direct frontage on Long Island Sound (and Fisher's Island Sound), for use by coastal communities to test inundation scenarios and ways to prepare for them.
	▪ CT DEEP, *Facing Our Future* fact sheet series	▪ Details current observations and provides high-level recommendations for alternative adaptation approaches at the local and regional level. Areas addressed include adaptation related to biodiversity and habitat, fisheries, forestry, infrastructure, natural coastal shoreline environment, outdoor recreation, water resources, and wildlife.
Rhode Island	▪ Rhode Island Climate Risk Reduction Act of 2010	▪ Requires comprehensive community plans to include adaptation provisions for sea level rise and climate change, as well as the creation of a Rhode Island Climate Change Commission.

[5] http://www.nyc.gov/html/sirr/html/about/future.shtml

State	Regulatory / Programmatic Action	Description
	▪ RI Sea Grant, Sea Level Rise in Rhode Island: Trends and Impacts (January 2013)	▪ Provides an overview of the current science from peer-reviewed information as well as impacts and actions compiled by the University of Rhode Island Climate Change Collaborative, scientists, and managers in Rhode Island, and RI Sea Grant, Sea Level Rise Mapping & Data Tools, a statewide digital elevation and bathymetry data tool, Sea Level Affecting Marshes Model, and other sea level rise resources.
Massachusetts	▪ Massachusetts General Law Part I, Title III, Chapter 30, Section 61	▪ Requires respective agencies, departments, boards, commissions, and authorities to consider reasonably foreseeable climate change impacts, including predicted sea level rise, when considering and issuing permits, licenses, and other administrative approvals and decisions.
	▪ Massachusetts Regulation 310 CMR 9.37(2)(b)(2)	▪ Requires new buildings designs intended for human occupancy within a flood zone to incorporate projected sea-level rise during the buildings' design life consistent with projected sea-level rise. Such projections must be based on historical rates of sea level increase in New England coastal areas.

Source: NEC FUTURE JV Team, 2014

1.4.1 Regulatory Compliance

The FRA will not request any formal agency approvals for the Tier 1 EIS; however, the FRA will engage in dialogue with the EPA on methodologies, assumptions, and findings of the Tier 1 EIS analysis of climate change. The Tier 1 EIS will describe the requirements for subsequent Tier 2 evaluations, including compliance with federal and state regulations. During the Tier 1 EIS, the FRA will identify potential opportunities to streamline subsequent Tier 2 environmental reviews (see Section 1.7). Coordination with the EPA will be consistent with the NEC FUTURE Agency Coordination Plan and support the Statement of Principles (SOP) established between the FRA and federal regulatory agencies as part of the Council on Environmental Quality (CEQ) Pilot program.

1.5 METHODOLOGY TO ASSESS EFFECTS

This effects assessment methodology identifies the following:

- The approach and assumptions to be used in the Tier 1 EIS for describing existing and projected future conditions of specific climate hazards most likely to impact transportation infrastructure and services (e.g. sea level rise, increased storm intensity and storm-related flooding, and *maximum and minimum temperature extremes*[6]).
- The consequences of those potential effects of projected climate change on the Tier 1 EIS Alternatives.

[6] http://www.fta.dot.gov/documents/FTA_0001_-_Flooded_Bus_Barns_and_Buckled_Rails.pdf and Transportation Research Board (2008) Special Report 290 Potential Impacts of Climate Change on U.S. Transportation

The methodology identifies data sources, defines the Affected Environment and Context Area considered for climate change, and the approach for evaluating the effects of climate change on service and infrastructure associated with the Tier 1 EIS Alternatives. Effects associated with climate change include exposure of infrastructure to extreme weather events potentially resulting in more significant flooding in areas already prone to flooding and / or extreme heat or cold events that result in problems with train equipment and infrastructure (e.g., warped rail tracks, cracks in tracks, heat kinks)[7]. Effects of such events on transportation facilities and operations result in extensive indirect costs of delays, detours, trip cancellation and disruption of business activity which can be significant.[8]

1.5.1 Existing Conditions

The data sources listed in Table 5 will be used to establish the baseline conditions along the NEC, where infrastructure and services are currently most vulnerable to the impacts of climate change (e.g., sea level rise, increased storm intensity and flooding, and heat events). Actions being taken by states or railroads within the Study Area to address climate change will also be considered and documented to further establish the baseline conditions and to be used as inputs to the climate change effects assessment.

Table 5: Data Sources for the Evaluation of Climate Change Impacts

Resource:	Data Source	Data Application/Input to Analysis
Topographic data	▪ U.S. Geological Survey (USGS), National Geospatial Program (NGP) 5' contour topographic map data, available from the U.S. Department of the Interior.* ▪ NOAA Coastal Services Center topographic database developed in 2013 for recent sea level rise work for the Northeast coast.	▪ Topographic data sets will be used to understand the pontential range ts of flood inundation
Existing Flooding	▪ Digital Flood Insurance Rate Maps (FIRM), and Preliminary FIRMs ▪ Flood Insurance Studies (FIS) ▪ Advisory Base Flood Elevation (ABFE) maps ▪ Preliminary Work Maps ▪ Preliminary FIRMs Data available from and updated by U.S. Department of Homeland Security, Federal Emergency Management Administration (FEMA).	▪ GIS-based maps used to establish a baseline for assessments of potential increases in flooding due to climate change. FEMA map projects consider both existing riverine and coastal flooding. The use of FEMA maps will be consistent with the use established in the floodplain section of the Tier 1 EIS. ▪ This data informs the analysis by providing information regarding current flooding conditions and areas of vulnerability along the existing NEC as well as the representative routes of the proposed Tier 1 EIS Alternatives.

[7] http://www.fta.dot.gov/documents/FTA_0001_-_Flooded_Bus_Barns_and_Buckled_Rails.pdf

[8] For the discussion of the direct vs. indirect effects of climate change, see http://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Chap8_FGDall.pdf

Resource:	Data Source	Data Application/Input to Analysis
Existing Extreme Heat Events	▪ NOAA, National Climatic Data Center, Global Historical Climatology Network-Daily data set. ▪ Information from Amtrak and other NEC Study Area rail operators regarding extreme heat events and ways of responding to those events.	▪ Provide a consistent historical and current (baseline) data set regarding the frequency and duration of extreme heat events within the Study Area. ▪ Use the railroads' understanding of the present frequency and severity of such events to better define how to use the NOAA data going forward as a measure of potential future heat-related, as well as obtain data on the impacts on railroad operations and their capital and operating costs.
Sea Level Rise Projections	▪ IPCC 2013 Climate Change 2013: The Physical Science Basis, Fifth Assessment Report. ▪ Relevant regional and state-level sea level rise projections from sources noted in Table 4.	▪ Select consistent sea level rise scenarios appropriate for the northeast for near-term (e.g., 2050) and long-term (e.g., 2100) planning horizons to be used in the NEC FUTURE analysis.
Sea Level Rise Inundation Maps	▪ NOAA Coastal Services Center Sea Level Rise and Coastal Flooding Impacts Viewer/Data Sets. ▪ Inundation maps (available in 1-foot increments from 1 foot to 6 feet). Data available from NOAA for the entire Study Area.	▪ Data used to identify coastal areas that would be flooded under various levels of sea rise to be established in consultation with NOAA. ▪ Data will support developing near-term and long-term scenarios for sea level rise and storm surge inundation. ▪ This data will be used to further identify areas of vulnerability.
Future Extreme Events (Precipitation and Heat Events)	▪ IPCC 2013 Climate Change 2013: The Physical Science Basis, Fifth Assessment Report. ▪ Coupled Model Intercomparison Project IPCC Fifth Assessment Report (CMIP5) data. ▪ Relevant regional and state-level temperature projections from sources noted in Table 4. ▪ FIMA and FEMA 2013 study: The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100.	▪ Available CMIP5 data and downscaled data will be reviewed to develop reasonable projections for increased precipitation and temperatures with respect to future frequency and duration of extreme events. ▪ CMIP5 processing tools, such as the FHWA USDOT CMIP5 Tool will be leveraged and expanded upon to achieve full coverage of the study area. ▪ Projected changes in Flood Hazard Areas ▪ This data will be used to further identify areas of vulnerability.

Resource:	Data Source	Data Application/Input to Analysis
Adaptation Strategies	▪ U.S. Army Corps of Engineers (USACE), *Climate Change Adaptation Plan and Report* (September 2011) ▪ U.S. DOT, *US DOT Policy Statement On Climate Change Adaptation* (June 2011) ▪ U.S. DOT, *Climate Adaptation, Ensuring Transportation Infrastructure and System Resilience* (2012) ▪ U.S. DOT, FHWA, FHWA Climate Change & Extreme Weather Vulnerability Assessment Framework (December, 2012). ▪ Relevant regional and state-level adaptation plans and strategies noted in Table 4	▪ Reviewed to support developing structural and other measures to improve the resilience of rail infrastructure potentially impacted by climate change. ▪ Data used to develop potential adaptation strategies for proposed infrastructure associated with NEC FUTURE.

Source: NEC FUTURE JV Team, 2014

* Although Lidar-based topographic data is available for some states or jurisdictions within the Study Area, it is not available corridor-wide. Therefore, development of full Lidar-based topographic database was not recommended. However, NOAA sea level rise database (see Table 5) includes the best available topographic data for the Study Area and will be used in the proposed climate change effects assessment.

The Tier 1 EIS will document existing and future conditions in order to characterize the potential climate change impacts for an established Affected Environment and Context Area.

- For the assessment of flood hazards, the Affected Environment is a 2,000-foot swath[9] centered on the Representative Route[10] for each of the Tier 1 EIS Alternatives. This 2,000-foot swath is consistent with the Affected Environment defined for Floodplains and is sufficiently wide to:
  - Encompass and account for the improvements associated with a Representative Route including infrastructure improvements (such as embankments, aerial structures, track improvements), ancillary facilities (such as stations, yards and parking structures), or service changes.
  - Account for contiguous flood risk conditions that may extend beyond the Representative Route.
- For existing flood hazards, acres of 100-year floodplains will be estimated within each state. The total area of the Affected Environment located within these floodplains will be presented in tables and these areas of susceptibility will also be mapped using GIS.
- For purposes of flood hazard analysis, 5-foot contours (based on topographic databases from NOAA and USGS) will be used in the Tier 1 EIS for the Affected Environment. While finer-scale

[9] This 2,000-foot swath is subject to revision based on consultation with resource agencies

[10] Representative Route refers to a proposed route or potential alignment for a Tier 1 EIS Alternative. The Representative Route includes the physical footprint of the improvements associated with the Tier 1 EIS Alternatives. The horizontal and vertical dimensions of the footprint of the Representative Route are based on prototypical cross-sections for these improvements. The Representative Route is used as a proxy for estimating the potential effects of a route whose location could shift during subsequent project-level reviews.

data are available for some portions of the Study Area, only the NOAA and USGS databases provide consistent data for the entire Study Area.

- For the assessment of extreme heat and cold events, the Affected Environment includes the entire Study Area with a focus on the various existing rail lines, which will be characterized utilizing available CMIP5 data and downscaled datasets, as identified in Table 5.

The Context Area is 5 miles wide, centered on the Representative Route for each Tier 1 EIS Alternative. Within the Context Area, (1) existing 100-year floodplains will be mapped, and (2) general characteristics of, and relative size and location of the 100-year floodplain zones will be presented in order to qualitatively characterize areas of current flood risk should the Representative Route shift. This information will be used to supplement the quantitative assessment of effects within the Affected Environment. The assessment of extreme heat and cold events will be conducted at the state level throughout the Study Area, with no separate localized analysis conducted for the Context Area.

1.5.2 Environmental Consequences

Environmental consequences will be evaluated by comparing the existing (baseline) conditions relative to the primary climate change hazards (e.g., sea level rise, increased storm intensity and flooding, and extreme heat and cold events) for projected future conditions to identify areas of vulnerability to climate change (such as projected/future floodplain boundaries). Within the NEC FUTURE Tier 1 EIS, a planning horizon year of 2040 is generally used for alternatives planning and impact assessments. However, climate change studies typically consider longer-term planning horizons (for NEC FUTURE, horizon years such as 2075–2100), because the impacts of climate change are slower to manifest and are expected to worsen over time; sea level rise and related assessments are often done for multiple scenarios that present multiple scales of vulnerability. Thus long-term consideration of climate change impacts is particularly appropriate for the types of large-scale, long-term infrastructure investments being considered under the NEC FUTURE program. Therefore, the FRA will consider two future scenarios in assessing climate change effects:

- **Near-term (mid-century) scenario:** This scenario is not tied to a specific analysis year, but will be equivalent to an approximately 30–50 year horizon scenario (approximately 2040–2060). This approach allows one projection to be selected, and the uncertainty of that projection occurring is placed in the context of time. This approach is more useful for adaptation planning than fixing the year (e.g., 2050), and selecting a range of projections that could occur at that time (e.g., high-end and low-end projections). For example, a 1-foot (12-inch) rise in static sea levels could occur in the 2040 to 2060 timeframe. Similarly, moderate projections related to storm and temperature frequency/severity will be selected based on a review of the available CMIP5 data.
- **Long-term (end-of-century) scenario:** This scenario will account for longer-term impacts that are projected to occur near the end of the century (e.g., 2075–2100+), equivalent to an approximately 60–80 year horizon scenario. For example, a 6-foot (72-inch) rise in static sea levels could to occur in this timeframe. Similarly, more extreme storm and temperature projections will also be considered.

The two-scenario approach will be used to analyze different levels of climate change-related effects (e.g., a sea level rise of 12 inches versus 72 inches) that encompass the range of projections and forecast timeframes used by researchers and regulatory agencies in the northeast. The approximate range of years considered within each scenario will be noted and appropriately vetted with relevant agencies as the uncertainties associated with climate change projections increase with time. Evaluating two scenarios covering two future planning horizons will allow for greater flexibility when considering potential adaptation strategies. More detail on the selection of the sea level rise scenarios is included in the Appendix.

The FRA will not consider the joint probability of extreme weather events and their combined effects (e.g., a 100-year coastal storm surge event occurring simultaneously with a 100-year rainfall event, with a frequency much greater than every 100 years). Such studies are beyond the level of detail warranted for a Tier 1 EIS given the limited level of design. The Tier 1 EIS text will indicate why such low-probability conditions were not analyzed while recommending that such detailed analysis be considered where necessary at the Tier 2 level.

There is greater certainty associated with the near-term (mid-century) scenarios. Therefore, future Tier 2 project reviews could consider the mid-century climate change impacts as part of their detailed design considerations for implementation. The climate change impacts associated with the end-of-century scenario could be considered for future adaptation measures, rather than for immediate implementation, and the adaptation measure could be brought online when a particular climate stressor threshold or trigger is reached.

Together, this two-scenario approach provides a moderate-to-high level estimate of the likely increase in climate change related impacts on the NEC, and the extent to which the Tier 1 EIS alternatives are resilient to those impacts. For each Representative Route, *resiliency may be defined as* the acreage vulnerable to flood risks and the percentage of each route's total acreage subject to flood risks under each scenario and within each state will be calculated and presented in tabular and map formats.

The following steps will be undertaken to evaluate the environmental consequences of climate change within the Affected Environment for Flood Hazard and Extreme Heat and Cold events.

Climate Change-Related Flood Hazard Impact Assessment

As sea levels rise, the number of areas inundated daily at high tide would increase, and infrastructure improvements within those areas could be subject to increased degradation, erosion, and wear and tear. Evaluating inundation associated with future sea level rise alone (without consideration of storm surge) considers areas that will be subjected to future *permanent* inundation, i.e., areas that are not exposed to regular tidal inundation under existing conditions, but will be subject to regular tidal inundation in the future. Storm surge presents a significant, although *periodic*, flood hazard. Infrastructure improvements that are subjected to periodic inundation by storm surge events could be subject to severe damage—particularly if their original design considerations did not account for potential future inundation. Both the mid-century and end-of-century sea level rise scenarios will be evaluated alone and in combination with 100-year storm conditions (the standard FEMA flood risk metric) so that permanent and period inundation can be evaluated along the NEC Representative Routes and within the Context Area.

The future condition inundation maps for extreme storm conditions will account for changes in precipitation, sea level rise, and potential changes in coastal storm intensity and storm surge conditions. The CMIP5 global climate model data, and available downscaled model data, will be used to estimate climate change–related changes in severe storm-related precipitation, and the extent to which these changes would increase rainfall-runoff driven riverine flooding.

NOAA recently developed an approach, in partnership with FEMA, USACE, the United States Global Change Research Program (USGCRP), and the Council on Environmental Quality (CEQ) to develop a set of map services and related tools to help communities, residents, and other stakeholders consider risks from future sea level rise in planning for reconstruction following Hurricane Sandy.[11] Similar to this approach, the Tier 1 climate change assessment will evaluate the future conditions of coastal and inland waterways due to changes in sea level and storm frequency and severity projected to result from climate change using the following steps:

1. Overlay and analyze flood hazard areas using GIS to map the latest available FEMA effective or preliminary FIRMs and/or ABFEs identified in Table 1.
2. Establish the existing flood vulnerability baseline for the Tier 1 EIS Alternatives by calculating the acreage and percentage of each Representative Route that falls within flood hazard areas. Areas within the adjacent Affected Environment where the Representative Route would be close to flood hazard areas would be qualitatively discussed, with references to maps that show this visually.
3. Estimate future flood risk conditions by adding the changes in sea level rise and storm-related conditions under mid-century (near-term) and end-of-century (long-term) scenarios developed in consultation with stakeholders[12] to the FEMA flood insurance rate map baseline.
4. Using the two-scenario approach, identify future effects of climate change on flood vulnerability as follows:
    a. Sea Level Rise Flooding: Overlay and analyze NOAA-based inundation maps (for sea level rise inundation only, not coupled with a storm event) identified in Table 5 to establish the change in the number of acres within the Representative Route that would be newly within inundation zone under the future sea level scenarios.
    b. Coastal Storm Surge Flooding: Add sea level rise to the FEMA effective or preliminary FIRMs and/or ABFEs identified in Table 1. Overlay and analyze the inundation maps (sea level rise coupled with 100-year storm surge) to establish the change in the number of acres within the Representative Route within flood hazard zones relative to FEMA FIRM baseline conditions.
    c. Riverine Flooding: Use the findings of the FIMA/FEMA 2013 report *The Impact Climate Change and Population Growth on the National Flood Insurance Program through 2100* and CMIP5 downscaled model results of projected increases in storm severity and frequency under mid-century and end-of-century scenarios to estimate the change in the number of

[11] See http://www.geoplatform.noaa.gov/home/item.html?id=3097fc32e98f490cbacc5405751938e9
[12] AMTRAK, Delaware DoE, EPA, FHWA, FRA, NOAA and U.S. DoT Volpe

acres of the Affected Environment within flood hazard zones relative to FEMA FIRM baseline conditions.

5. Based on the results of Step 4, evaluate the sensitivity of infrastructure or service characteristics of each Tier 1 EIS Alternative to future inundation and other climate change effects.
6. Define the nature and extent of such impacts, based on the severity of flooding and the sensitivity of certain infrastructure elements to such events. Describe the potential vulnerability of portions of the Representative Routes to either infrastructure or operations (e.g., tunnel segments, major interlocking, etc.).
7. Identify a range of adaptation strategies that could be used to mitigate the climate change effects.

Climate Change-Related Extreme Heat *and Cold Events*

While impacts associated with increased flood hazards have dominated climate change assessments, the potential for other climate change-related impacts will be assessed for the Study Area. These impacts include increased potential for heat-related damage to rail infrastructure (such as warped rails or "sun kinks" due to higher temperatures and heat event frequencies) and the effects of extreme cold.

Extreme Heat Events

The following steps will be taken to assess the potential effects of extreme heat:

1. Use the NOAA GHCN-D dataset identified in Table 5 to establish an existing baseline for the severity and frequency of heat events within the Study Area.
2. Work with Amtrak and other railroad operators in the corridor to assess their experience with the type and frequency of such heat event impacts under current conditions and the actions taken to adapt to such events (e.g., reduced peak speeds, reduced service) or increase their network's resiliency through changes in infrastructure, equipment, etc.
3. Use CMIP5 and available downscaled model data to identify potential worsening of frequency and severity of extreme heat events on a state-by-state basis for the Study Area. These projections would be made for both the mid-century and end-of-century scenarios. These projected changes would be reviewed with NOAA and other involved agencies.
4. Estimate the likely change in extreme heat-related impacts on railroad operations in the Study Area under each of these two climate change scenarios.
5. Identify a range of adaptation strategies that could be used to mitigate the climate change effects.

Extreme Cold Events

In North America, climate change is projected to result in increases in hot days and extended warm spells (i.e. heat waves), reductions in cold days, cold nights and frosts, and more rapid increases in

minimum temperature extremes than maximum temperature extremes (IPCC, 2013). However, the frequency and duration of extreme cold events in the Northern U.S. may be affected by potential increases in 'blocking' events, described by the National Climate Assessment as a large scale weather pattern with little or no movement (NCA, 2014, p43). The NCA acknowledges that there is further research required as conclusions about trends in 'blocking' are currently dependent on the method of analysis. Due to the uncertainty of the climate change related influence on this hazard, a qualitative assessment of the potential effects of extreme cold events (including effects of snow and ice) will be undertaken.

1.5.3 Mitigation Strategies

A menu of potential programmatic adaptation strategies and mitigation measures will be developed for further consideration in Tier 2. Examples of programmatic adaptation strategies and mitigation measures for climate change could include the following:

- Policy recommendations (e.g., climate change adaptation or vulnerability as a factor in prioritizing and/or selecting Tier 2 projects),
- Physical modifications (e.g., raising tracks or adding other structures),
- Design strategies that allow for temporary inundation while avoiding infrastructure damage leading to long service disruption, or
- Design modifications that reduce vulnerability without major route relocation or flood protection structures (e.g., constructing on viaduct over flood-prone areas).

Examples of relevant climate change-related actions at the state level within the Study Area will also be included (see Section 1.6).

1.6 TIER 1 EIS OUTCOMES

This Tier 1 EIS climate change assessment will:

- Provide a comprehensive assessment of the Tier 1 EIS Alternatives' vulnerability to flooding and other effects associated with climate change under near-term/moderate and long-term/severe scenarios.
- Identify those segments or aspects of service of the Tier 1 EIS Alternatives that are most vulnerable to these future climate change impacts based on the types of infrastructure and operations associated with each alternative.
- Provide, at a programmatic level, the types of measures that could be taken to adapt the Tier 1 EIS Alternatives to these projected climate change effects, and present these findings in the context of present climate change and adaptation activities by states and rail operator along the corridor.

- Provide information regarding state-level climate change-related actions in each state within the Study Area as part of the Tier 1 EIS discussion of existing conditions, along with the relevance of these state-level actions to the proposed NEC FUTURE climate change assessments and programmatic adaptation measures.

1.7 APPLICABILITY TO TIER 2 ASSESSMENTS

The Tier 1 analysis will identify aspects of the Tier 1 EIS Alternatives that are most at risk for future near- and longer-term climate change impacts. In future Tier 2 environmental compliance efforts, additional analyses, potentially including a comprehensive climate change vulnerability and risk assessment, will focus on these vulnerable areas to inform the detailed designs of routes in areas identified as vulnerable. Future Tier 2 efforts should also consider updates related to the best available scientific information regarding climate change impacts, including improved global climate models, updated projections, and more advanced modeling methods or tools that may become available.

Additionally, the FRA will identify ways in which agency coordination, during the Tier 1 process could create efficiencies and help streamline subsequent Tier 2 reviews and approvals.

NEC FUTURE
A Rail Investment Plan for the Northeast Corridor

Appendix
Climate Change Assessment Sea Level Rise Scenario Recommendations

October 3, 2014
Version 2.1

Submitted by:

PARSONS BRINCKERHOFF AECOM
A JOINT VENTURE

Table of Contents

Tables

Figures

1. Introduction

This document supports the Climate Change Effects Assessment Methodology that has been developed for the NEC Future Tier 1 EIS. The objective of the climate change affects assessment is to identify those elements of the rail infrastructure within the Tier 1 EIS Alternatives that are most vulnerable to climate change and related factors including flooding related to sea level rise and coastal storm surge. In line with the expectations of a Tier 1 Assessment, and the scale of the study area, this assessment seeks to apply a defensible approach using readily available, existing data. This brief document provides the NEC FUTURE team's recommendation for the appropriate sea level rise scenario(s) to use for the analysis that will be included as part of NEC Future Tier 1 EIS.

2. Summary of the Science

Global sea level has risen approximately 7 inches between 1901 and 2010[13]. However, future sea level rise projections should not be based simply on linear extrapolation of historical sea level rise records. For estimates beyond one or two decades, linear extrapolation of sea level rise based on historical observations is considered inadequate and would likely underestimate the actual sea level rise because of expected nonlinear increases in global temperature and the unpredictability of complex natural system (e.g., how temperature increases will affect ocean warming and ice sheet loss).

There is a large body of research available related to sea level rise, and the processes that contribute to rising sea levels. The Intergovernmental Panel on Climate Change (IPCC, 2013) Fifth Assessment Report (AR5) presents that latest research on sea level rise and reports that global sea level rise rates on the order of 11 to 39 inches are projected by the year 2100, with 11 inches associated with the best-case greenhouse gas concentration scenario (Representative Concentration Pathway (RCP) 2.6)[14] and 39 inches associated with the worst-case greenhouse gas concentration scenario (RCP8.5) (Table 1 and Figure 1). However, it should be noted that these IPCC AR5 global sea level rise estimates do not include contributions from processes that are considered highly uncertain, such as arctic ice sheet melting, and these contributions can result in sea level rise estimates that are much higher. The National Climate Assessment (NCA, 2014) accounts for some of this uncertainty and suggests that 48 inches of sea level rise is plausible by the year 2100, and further states that sea level rise could be as much as 79 inches by the end of the century. The

[13] IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

[14] Representative Concentration Pathway (RCPs) are the future greenhouse gas emissions scenarios used by the IPCC for the AR5. The scenarios (RCPs) are identified by their approximate total radiative forcing in year 2100 relative to 1750. For example "…2.6 W m^{-2} for RCP2.6, 4.5 W m^{-2} for RCP4.5, 6.0 W m^{-2} for RCP6.0, and 8.5 W m^{-2} for RCP8.5" (IPCC, 2013, p29). Four RCPs have been developed including "…one mitigation scenario leading to a very low forcing level (RCP2.6), two stabilization scenarios (RCP4.5 and RCP6), and one scenario with very high greenhouse gas emissions (RCP8.5)." (IPCC, 2013 p29).

projections referred to in NCA 2014, are based on the 2012 NOAA Technical Memo titled *Global Sea Level Rise Scenarios for the United States National Climate Assessment* (NOAA, December 6, 2012).Relative sea level rise along most of the coastal Northeast is expected to exceed the global average rise due to local land subsidence, with the possibility of even greater regional sea level rise if the Gulf Stream weakens as some models suggest (NCA, 2014). Recognizing this, regional sea level rise projections have been developed for states and cities including New York City (refer to Table 2 for an example).

TABLE 1: GLOBAL SEA LEVEL RISE BY THE YEAR 2100 AS PROJECTED BY THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

Scenario	Near-term (mid-century)	Long-term (end-of-century)	Near-term (mid-century)	Long-term (end-of-century)
	Mean	Likely Range (5^{th} – 95^{th} percentile)	Mean	Likely Range (5^{th} – 95^{th} percentile)
RCP2.6 (in.)	9.4	6.7-12.6	17.3	11.0-24.0
RCP4.5 (in.)	10.2	7.5-13.0	20.9	14.2-28.0
RCP6.0 (in.)	9.8	7.1-12.6	21.7	15.0-28.7
RCP8.5 (in.)	11.8	8.7-15.0	29.1	20.5-38.6

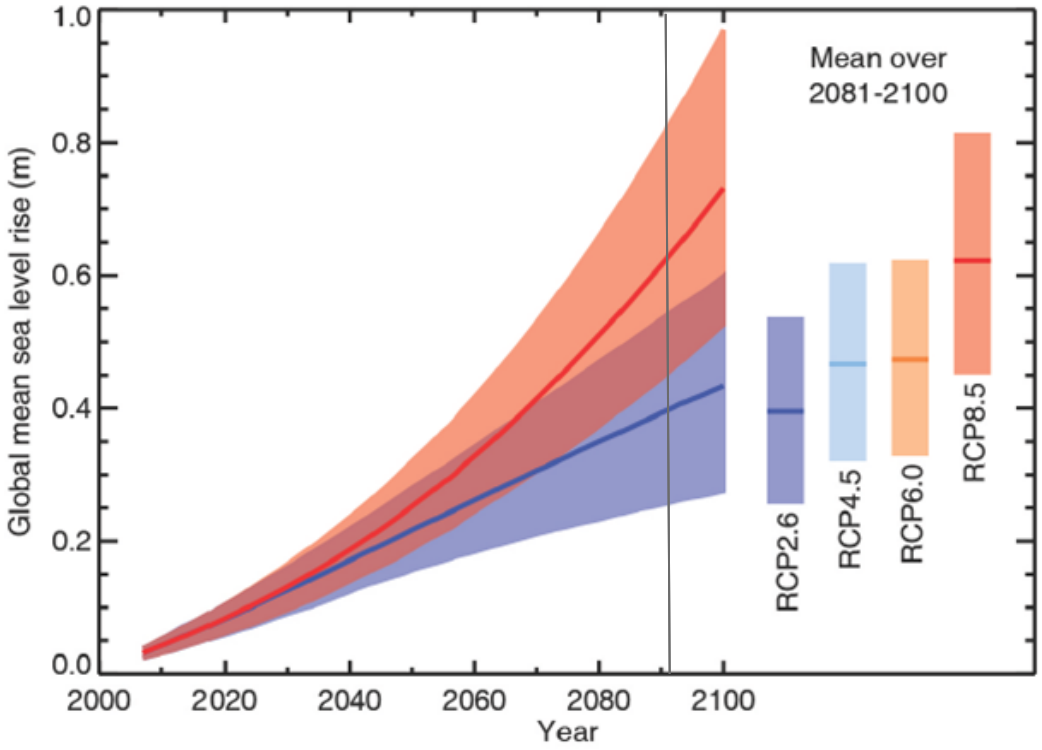
Source: IPCC, 2013. Values are relative to the mean over 1986-2005. Near-term relates to the IPCC timeframe of 2046-2065. Long-term relates to the IPCC timeframe of 2081-2100.

TABLE 2: REGIONAL SEA LEVEL RISE PROJECTIONS FOR NEW YORK CITY

Sea Level Rise	Near-term (mid-century)		Long-term (end-of-century)	
	Middle Range (25^{th} – 75^{th} percentile)	High End (90^{th} percentile)	Middle Range (25^{th} – 75^{th} percentile)	High End (90^{th} percentile)
New York City (in.)	+11 to 21	+30	+22 to 50	+75

Source: NYC 2014 Climate Projections: http://www.nyc.gov/html/sirr/html/about/future.shtml
Baseline period for sea level rise projections is 2000-2004. Near-term relates to the 2050s and the Long-term relates to 2100.

Figure 1: Projected Rise in Global Sea Level until the Year 2100 for Each Representative Concentration Pathway (RCP) Greenhouse Gas Concentration Scenario



Source: IPCC, 2013.

3. Proposed Sea Level Rise Scenarios

In the NEC FUTURE climate change effects assessment methodology, two sea level rise scenarios are proposed for analysis in the Tier 1 EIS – a near-term (mid-century) scenario and a long-term (end-of-century) scenario[15]. Considering two scenarios will enable the assessment of different levels of climate change-related effects that encompass the range of projections and forecast timeframes used by researchers and regulatory agencies in the northeast. The scenarios will be analyzed both on their own (looking at the areas that could be inundated permanently by sea level rise), and in combination with an extreme storm surge scenario *(currently, the 100-year FEMA coastal hazard zone; however, as planning for the program progresses, additional analysis of the 500-year FEMA coastal hazard zone may be undertaken)*. Table 3 lists the sea level rise projections we propose to use for these scenarios, and this section provides the rationale for choosing these

[15] For purposes of the NEC FUTURE program, "mid-century" is defined as approximately 2040-2060 and "end-of-century" is defined as approximately 2075 – 2100+.

projections. Figure 2 illustrates the proposed projections and their relationship to the IPCC, NOAA and state based recommendations.

TABLE 3. PROPOSED SEA LEVEL RISE PROJECTIONS FOR FRA NEC FUTURE TIER 1 EIS

Scenario	Near-term (mid-century)	Long-term (end-of-century)
Sea Level Rise	12 in	72 in

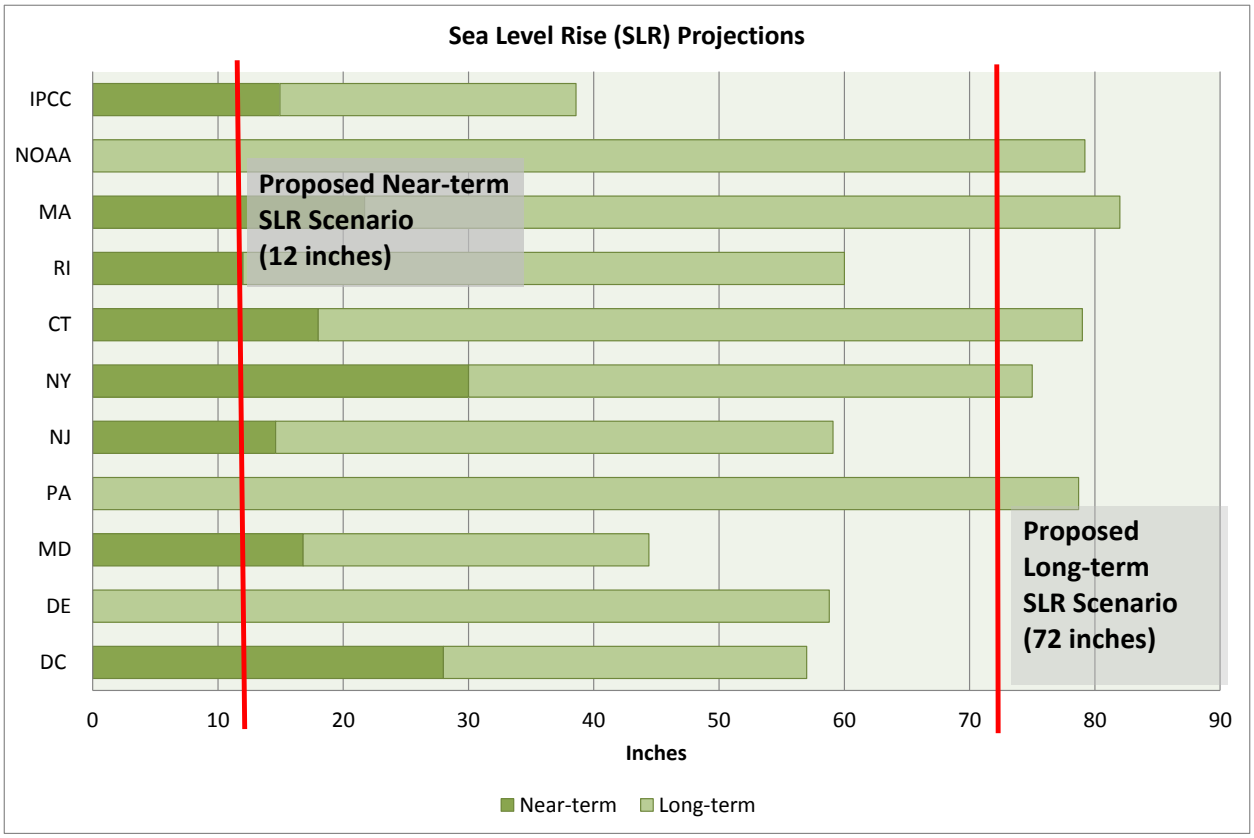


FIGURE 2: STATE BASED SEA LEVEL RISE RECOMMENDATIONS AND THE PROPOSED SEA LEVEL RISE PROJECTIONS FOR FRA NEC FUTURE TIER 1 EIS

- Recognizing the need to use existing, readily available data, the proposed scenarios are one foot increments, as inundation extents for sea level rise inundation for these increments have already been mapped by NOAA.
- Twelve inches of global sea level rise mid-century is projected at the upper end of the likely range of the RCP2.6 greenhouse gas concentration scenario, and at approximately the mean of the RCP8.5 greenhouse gas concentration scenario (Figure 1, IPCC, 2013).

- Twelve inches is consistent with the range of state level recommendations for considering sea level rise in all states (where available) (refer to Figure 2 and Table 4).
- Seventy-two inches of sea level rise is within the highest scenario outlined in the 2012 NOAA Technical Memo (79.2 inches) and four of the state level recommendations (MA, CT, NY and PA (refer to Figure 2 and Table 4.). While considered a lower probability of occurrence (refer to Table 2), consideration of 72 inches of sea level rise will help to determine the greater extent of area that may be vulnerable to sea level rise and storm surge flooding.

TABLE 4: SUMMARY OF STATE-BASED RECOMMENDED SEA LEVEL RISE PROJECTIONS RELEVANT TO THE FRA NEC FUTURE PROGRAM

State	Source	Near-term (mid-century) (inches)	Long-term (end-of-century) (inches)
DC	Adapting to a Changing Climate: Federal Agencies in the Washington, D.C. Metro Area (referenced to IPCC 2007) (2012)	7–28	13–57
DE	The Delaware Sea Level Rise Advisory Committee, Preparing for Tomorrow's High Tide: Recommendations for Adapting to Sea Level Rise in Delaware (2013)	N/A	19.2–58.8
MD	CoastSmart Communities Program. Inc, including Climate Change and Coast Smart Construction Infrastructure Siting and Design Guidelines (January 2014)	16.8	44.4
PA	Department of Environmental Protection (DEP), Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations (January 2011)	N/A	39.4–78.7
NJ	FHWA Climate Change Vulnerability Assessment Pilot Project – North Jersey Transportation Planning Authority (NJTPA) (November 2011)	6.1–14.6	19.7–59.1
NY	2014 web based update of projections presented in the New York City Panel on Climate Change, Climate Risk Information 2013 Observations, Climate Change Projections, and Maps[16]	11–30	22–75
CT	Connecticut Department of Energy and Environmental Protection (DEEP), Coastal Hazards Mapping Tool, including Sea Level Rise Visualization Data (June 2012)	12–18	24–79
RI	Sea Level Rise Trends in Rhode Island: Trends and Impacts (Rhode Island Sea Grant, January 2013)	12	36–60
MA	Sea Level Rise: Understanding and Applying Trends and Future Scenarios for Analysis and Planning (December 2013)	4.7–21.7	9.7–82

* If multiple sea level rise guidance documents were available for a given state, only the most recent sea level rise guidance recommendations was presented in the table.

[16] http://www.nyc.gov/html/sirr/html/about/future.shtml

Application of Effects-Assessment Methodology

15.1 CLIMATE CHANGE: APPLICATION OF EFFECTS-ASSESSMENT METHODOLOGY

15.1.1 Variations to Effects-Assessment Methodology

The following variations from the Effects-Assessment Methodology occurred during the process of developing the Tier 1 Draft EIS analysis:

- The acreage and percentage of the Representative Route for all Action Alternatives that falls within flood hazard areas was calculated. Rather than providing a qualitative discussion of flood areas "close" to the Representative Route, the assessment quantitatively estimated the acreage and percentage of the Affected Environment within each county along the Representative Routes of the Action Alternatives that are at risk of inundation under each climate scenario (i.e., current climate, mid-century, and end-of-century). This method was used to provide a consistent approach across the entire Study Area that has less ambiguity compared to interpreting what may be considered "close to hazard areas."

15.1.2 Data Variations

There were no variations from the identified data sources in the Effects-Assessment Methodology during the development of the Tier 1 Draft EIS analysis.

15.1.3 Criteria for Analysis

Existing Conditions

- The criteria for estimating climate change existing conditions are explained in the Chapter 7.15, Climate Change, of the Tier 1 Draft EIS.

Environmental Consequences

- Environmental Consequences are qualitatively addressed in Chapter 7.15, Climate Change. More specific information is found within the various flooding scenarios discussed in the chapter.

Environmental Consequences – Stations

- Stations were analyzed using the flooding scenarios described in Chapter 7.15, Climate Change.

15.1.4 Data Limitations

The following list provides information relating to the limitations of the assessment of climate change impacts to the existing NEC and Action Alternatives:

- Site-specific modeling of inundation and flood risks was not undertaken. This assessment did not include the development of new, detailed inundation maps for future climate scenarios for all counties within the Study Area.
- The assessment used an extreme coastal storm surge or riverine flood event with a 1-percent annual chance of occurring in any given year (i.e., 100-year event). It should be noted that extreme events with greater return intervals (i.e., 500-year event with a 0.2-percent chance of occurring in a given year) can also occur, and could result in a greater inundated area.

- It is assumed that the bathymetry (i.e., topography of the sea floor) of near-shore coastal areas and the topography of the landward areas, including levees and other flood and shore protection features, would not change in response to sea level rise and increased inundation (i.e., the morphology of the region is constant over time).
- For each flooding resource, the assessment focused on identifying the spatial extent of inundation; the analysis did not consider the elevation of existing assets and therefore the likelihood of assets within a flood hazard area being inundated.
- The inundation and flooding assessment did not consider the potential duration of an inundation event.
- The inundation and flooding assessment relied on topographic data at a 5-meter horizontal elevation leveraged from National Oceanic and Atmospheric Administration (NOAA). Although this data set represents the best available consistent topographic data across the Study Area, and the data have undergone a rigorous quality assurance/quality control process by a third party, the data have not been extensively ground-truthed. Levee crests and other topographic features that affect flood conveyance may be overrepresented or underrepresented in the topographic data. Site-specific topographic information should be field verified as part of Tier 2 environmental compliance processes and project implementation.
- Two sea level rise scenarios (1 foot and 6 feet) were applied consistently across the Study Area. This approach did not account for potential regional variation of projected sea level rise or land subsidence.
- The assessment looked at both potential future permanent flooding (i.e., future increase in MHHW with sea level rise) and potential future temporary flooding (i.e., future increase in flooding associated with an extreme storm surge or riverine flood event).
- The projected changes in riverine flooding are based on a 2013 study titled *The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100*. This study considered changes in climate conditions and estimated how the flood hazard areas across the United States may change. The study was intended to be a national assessment, with cautions provided on the use of the results at a local level. For this reason, the FRA applied the percentage increases in riverine flood hazard area for the Affected Environment only. Detail on the limitations associated with this national study can be found in the study's report.[1]
- A limitation to the approach used in this assessment is that if a county has zero acres at risk of riverine flooding under current climate conditions, it was estimated that it will also have zero acres at risk under mid- and end-of-century climate conditions (for example, a 20 percent increase on zero acres equals zero acres).

[1] Federal Insurance and Mitigation Administration (FIMA) & Federal Emergency Management Agency (FEMA). 2013. *The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100*. *http://www.google.com/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=3&cad=rja&uact=8&ved=0CCwQFjAC&url=http%3A%2F%2Fwww.nfrmp.us%2Ffrmpw%2F2013webinarweek%2Fdocs%2FE3%2520Coastal%2520Climate%2520Change%2FE3_FEMA_MarkCrowell_climate_change3.pdf&ei=mP7kVL6PJ.*

- Due to the use of existing climate information, multiple sources of climate information were used across the resources (i.e., the assessment of extreme temperatures was based on CMIP5[2] climate projections, while the riverine flooding assessment was based on older CMIP3[3] projections that were used in the Federal Insurance & Mitigation Administration (FIMA) and FEMA flood study (2013)).
- The data used to calculate inundation acreage came from two separate sources and therefore some minor differences were found. The sea level rise data came from NOAA's SLR viewer and was calculated using a "bathtub model" where the sea level rise values (i.e., +1 feet, +6 feet) are added to the MHHW surface and subtracted from the terrain values. The 100-year storm surge data is part of FEMA's effective national flood hazard layer (NFHL) and are a result of detailed analysis. In some cases, counterintuitive results appeared in the two datasets where there are areas of greater inundation for MHHW than the 100-year stormwater surface (e.g., Suffolk, MA).
- There is potential overlap in the results of the coastal storm surge assessment and the riverine flooding assessment, since the riverine flooding assessment was based on the data used in the Floodplain analysis, which includes both riverine and coastal floodplains.
- To avoid making false assumptions, the assessment of flood risk for mid-century and end-of century scenarios assumed that no adaptation actions would be taken at a regional level, which may alter the flood risk or lessen the impacts of climate change on infrastructure across the Action Alternatives.
- The inundation and flooding assessment did not account for erosion, subsidence, future development or levee upgrades.

[2] CMIP5 refers to an archive of climate models from which the IPCC drew its climate simulations for the Fifth Assessment Report published in 2014.
[3] CMIP3 refers to an archive of climate models from which the IPCC drew its climate simulations for the Fourth Assessment Report published in 2007.

Data Matrices - Occurrences

1 Affected Environment: Stations at Risk of Inundation by Action Alternative under Current Climate Conditions

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							Central Connecticut	Long Island	Providence	Worcester
MD	Prince George's	2/Existing	New Carrolton	RF	RF	RF				
	Anne Arundel	6/Existing	BWI Airport	RF	RF	RF				
	Anne Arundel	6/New	BWI Airport H.S.			RF				
	Baltimore	7/Existing	Halethorpe	RF	RF	RF				
	Baltimore City	10/Existing	Baltimore Penn Station	RF	RF	RF				
	Baltimore City	13/New	Bayview	RF	RF	RF				
		14/New	Bayview H.S.			RF				
DE	New Castle	26/New	Newport	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
	New Castle	27/Existing	Wilmington Station	SS,RF	SS, RF	SS, RF				
		29/Existing	Claymont	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
PA	Delaware	32/Existing	Chester	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		33/Existing	Eddystone	SS, RF	SS, RF	SS, RF				
	Delaware	34/New	Baldwin	SS,RF	SS, RF	SS, RF				
	Delaware	35/Existing	Crum Lynne	RF	RF	RF				
		41/Existing	Sharon Hill	RF	RF	RF				
		43/Existing	Darby	SS, RF	SS, RF	SS, RF				
	Philadelphia	44/Existing	Philadelphia Airport		SS	SS, RF				
		45/Existing	Philadelphia 30th Street	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		52/Existing	Torresdale	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
	Bucks	55/Existing	Croyton	RF	RF	RF				

(continued)

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							Central Connecticut	Long Island	Providence	Worcester
NJ	Mercer	58/Existing	Trenton	RF	RF	RF				
	Middlesex	63/Existing	Jersey Avenue	RF	RF	RF				
		67/Existing	Metropark	RF	RF	RF				
	Middlesex	68/New	Metropark H.S.			RF				
	Union	69/Existing	Rahway	SS,RF	SS, RF	SS, RF				
		70/Existing	Linden	RF	RF	RF				
	Essex	73/Existing	Newark Airport	SS,RF		SS, RF				
		74/Existing	Newark Penn Station	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		75/Existing	Newark Penn Station H.S.			SLR, SS, RF				
	Hudson	76/Existing	Secaucus	SS, RF	SS, RF	SS, RF				
NY	Bronx	78/New	Hunts Point	RF	RF		RF	RF		
		80/New	Morris Park	RF	RF		RF	RF		
		81/New	Co-op City	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
	Westchester	84/Existing	Mamaroneck	SS, RF	SS, RF		SS, RF	SS, RF		
		85/Existing	Harrison	RF	RF		RF	RF		
		86/Existing	Rye	RF	RF		RF	RF		
	Westchester	87/New	Cross-Westchester	RF	RF		RF	RF		
	Westchester	88/Existing	Port Chester	SS, RF	SS, RF		SS, RF	SS, RF		

(continued)

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							Central Connecticut	Long Island	Providence	Worcester
CT	Fairfield	89/Existing	Greenwich	SS, RF	SS, RF		SS, RF	SS, RF		
		90/Existing	Cos Cob	SS, RF	SS, RF		SS, RF	SS, RF		
		92/Existing	Old Greenwich	SS, RF	SS, RF		SS, RF	SS, RF		
		93/Existing	Stamford	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		97/Existing	Rowayton	SS, RF	SS, RF		SS, RF	SS, RF		
		100/Existing	Westport	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		101/Existing	Greens Farms	SS, RF	SS, RF		SS, RF	SS, RF		
		102/Existing	Southport	SS, RF	SS, RF		SS, RF	SS, RF		
		105/Existing	Bridgeport	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		108/Existing	Stratford	RF	RF		RF	RF		
	New Haven	109/Existing	Milford	SS, RF	SS, RF		SS, RF	SS, RF		
		110/Existing	West Haven	RF	RF		RF	RF		
		111/Existing	New Haven Station	SS, RF	SS, RF		SS, RF	SS, RF		
	New Haven	112/New	New Haven Station H.S.		SS, RF		SS	SS, RF		
	New Haven	113/Existing	New Haven State Street	SS, RF	SS, RF		SS, RF	SS, RF		
		114/Existing	Branford	SS, RF	SS, RF		SS, RF	SS, RF		
		115/Existing	Guilford	SS, RF	SS, RF		SS, RF	SS, RF		
	New Haven	155/New	Waterbury South				RF			
		156/New	Meriden H.S.		RF			RF		
	Hartford	161/New	Newington		RF		RF	RF	RF	RF
	Middlesex	118/Existing	Westbrook	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
	New London	121/Existing	New London	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
		122/Existing	Mystic	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF

(continued)

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							Central Connecticut	Long Island	Providence	Worcester
RI	Washington	123/Existing	Westerly	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
		126/Existing	Wickford Junction	RF	RF				RF	RF
	Providence	128/Existing	Providence Station	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
	Providence	129/New	Providence Station H.S.		SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
MA	Bristol	132/Existing	Attleboro	RF	RF				RF	RF
		133/Existing	Mansfield	RF	RF				RF	RF
	Norfolk	134/Existing	Sharon	RF	RF				RF	RF
		136/Existing	Rte. 128	RF	RF				RF	RF
	Worcester	175/New	Blue Star Hwy (I-495)							RF
	Suffolk	143/Existing	Boston South Station	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
Stations at Risk of Inundation				61	65	30	27	27	13	14
TOTAL New				7	10	6	7	7	2	3
TOTAL Existing				54	55	24	20	20	11	11

Source: FRA, 2015

SLR= Station footprint intersects sea level rise flooding hazard area.

SS = Station footprint intersects coastal storm surge flooding hazard area.

RF= Station footprint intersects riverine flooding hazard area. This is based on assessment undertaken as a part of the Hydrologic/Water Resource (floodplains) effects-assessment methodology.

Affected Environment: Stations at Risk of Inundation by Action Alternative under Mid-Century Climate Conditions

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							via Central Connecticut	via Long Island	via Providence	via Worcester
MD	Prince George's	2/Existing	New Carrolton	RF	RF	RF				
	Anne Arundel	6/Existing	BWI Airport	RF	RF	RF				
	Anne Arundel	6/New	BWI Airport H.S.			RF				
	Baltimore	7/Existing	Halethorpe	RF	RF	RF				
	Baltimore City	10/Existing	Baltimore Penn station	RF	RF	RF				
	Baltimore City	13/New	Bayview	RF	RF	RF				
		14/New	Bayview H.S.			RF				
DE	New Castle	26/New	Newport	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
	New Castle	27/Existing	Wilmington Station	SS, RF	SS, RF	SS, RF				
	New Castle	28/New	Edgemoor	SS	SS	SS				
	New Castle	29/Existing	Claymont	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
PA	Delaware	32/Existing	Chester	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		33/Existing	Eddystone	SS, RF	SS, RF	SS, RF				
	Delaware	34/New	Baldwin	SS, RF	SS, RF	SS, RF				
	Delaware	35/Existing	Crum Lynne	RF	RF	RF				
		41/Existing	Sharon Hill	RF	RF	RF				
		42/Existing	Curtis Park	SS	SS	SS				
		43/Existing	Darby	SS, RF	SS, RF	SS, RF				
	Philadelphia	44/Existing	Philadelphia Airport		SS	SS, RF				
		45/Existing	Philadelphia 30th St.	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		51/Existing	Holmesburg Junction	SS	SS	SS				
		52/Existing	Torresdale	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
	Bucks	52/Existing		SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		55/Existing	Croyton	RF	RF	RF				

(continued)

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							via Central Connecticut	via Long Island	via Providence	via Worcester
NJ	Mercer	58/Existing	Trenton	RF	RF	RF				
	Middlesex	63/Existing	Jersey Avenue	RF	RF	RF				
	Middlesex	68/New	Metropark H.S.			RF				
	Union	69/Existing	Rahway	SS, RF	SS, RF	SS, RF				
		70/Existing	Linden	RF	RF	RF				
		71/Existing	Elizabeth	SS	SS	SS				
	Essex	73/Existing	Newark Airport	SS, RF		SS, RF				
		74/Existing	Newark Penn Station	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		75/Existing	Newark Penn Station H.S.			SLR, SS, RF				
	Hudson	76/Existing	Secaucus	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
NY	Bronx	78/New	Hunts Point	RF	RF		RF	RF		
		80/New	Morris Park	RF	RF		RF	RF		
		81/New	Co-op City	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
	Westchester	84/Existing	Mamaroneck	SS, RF	SS, RF		SS, RF	SS, RF		
		85/Existing	Harrison	RF	RF		RF	RF		
		86/Existing	Rye	RF	RF		RF	RF		
	Westchester	87/New	Cross-Westchester	RF	RF		RF	RF		
	Westchester	88/Existing	Port Chester	SS, RF	SS, RF		SS, RF	SS, RF		

(continued)

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							via Central Connecticut	via Long Island	via Providence	via Worcester
CT	Fairfield	89/Existing	Greenwich	SS, RF	SS, RF		SS, RF	SS, RF		
		90/Existing	Cos Cob	SS, RF	SS, RF		SS, RF	SS, RF		
		92/Existing	Old Greenwich	SS, RF	SS, RF		SS, RF	SS, RF		
		93/Existing	Stamford	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
	Fairfield	94/New	Stamford H.S.	SS						
	Fairfield	97/Existing	Rowayton	SS, RF	SS, RF		SS, RF	SS, RF		
		98/Existing	South Norwalk	SS	SS		SS	SS		
		100/Existing	Westport	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		101/Existing	Greens Farms	SS, RF	SS, RF		SS, RF	SS, RF		
		102/Existing	Southport	SS, RF	SS, RF		SS, RF	SS, RF		
		103/Existing	Fairfield	SS	SS		SS	SS		
		104/Existing	Fairfield Metro	SS	SS		SS	SS		
		105/Existing	Bridgeport	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
	Fairfield	107/New	East Bridgeport				RF			
	Fairfield	108/Existing	Stratford	RF	RF		RF	RF		
	New Haven	109/Existing	Milford	SS, RF	SS, RF		SS, RF	SS, RF		
		110/Existing	West Haven	RF	RF		RF	RF		
		111/Existing	New Haven Station	SS, RF	SS, RF		SS, RF	SS, RF		
	New Haven	112/New	New Haven Station H.S.		SS, RF			SS, RF		
	New Haven	113/Existing	New Haven State Street	SS, RF	SS, RF		SS, RF	SS, RF		
		114/Existing	Branford	SS, RF	SS, RF		SS, RF	SS, RF		
		115/Existing	Guilford	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
	New Haven	155/New	Waterbury South				RF			
		156/New	Meriden H.S.		RF			RF		
	Hartford	161/New	Newington		RF		RF	RF	RF	RF

(continued)

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							via Central Connecticut	via Long Island	via Providence	via Worcester
CT (cont'd)	Middlesex	117/Existing	Clinton	SS	SS				SS	SS
		118/Existing	Westbrook	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
	Middlesex	120/New	Old Saybrook H.S.	SS						
	New London	121/Existing	New London	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
		122/Existing	Mystic	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
RI	Washington	123/Existing	Westerly	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
		126/Existing	Wickford Junction	RF	RF				RF	RF
	Providence	128/Existing	Providence Station	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
	Providence	129/New	Providence Station H.S.		SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
MA	Bristol	132/Existing	Attleboro	RF	RF				RF	RF
		133/Existing	Mansfield	RF	RF				RF	RF
	Norfolk	134/Existing	Sharon	RF	RF				RF	RF
		136/Existing	Rte. 128	RF	RF				RF	RF
	Worcester	175/ New	Blue Star Hwy (I-495)							RF
	Suffolk	138/Existing	Hyde Park	SS	SS				SS	SS
		143/Existing	Boston South Station	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
Total New Stations at risk of inundation				10	12	7	23	23	2	3
Total Existing Stations at risk of inundation				61	61	27	7	7	13	13
Total Stations at risk of inundation				71	73	34	30	30	15	16
Stations at risk of inundation from SLR flooding				20	21	9	5	5	8	8

Source: FRA, 2015

SLR= Station footprint intersects sea level rise flooding hazard area under mid-century climate conditions.

SS = Station footprint intersects coastal storm surge flooding hazard area under mid-century climate conditions.

RF= Station footprint intersects riverine flooding hazard area under current climate conditions. This is based on assessment undertaken as a part of the Hydrologic/Water Resource (floodplains) methodology and does not include an assessment of which additional stations may be at risk from future changes in riverine flood hazard areas.

H.S. = high speed

Affected Environment: Stations at Risk of Inundation by Action Alternative under End-of-Century Climate Conditions

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							via Central Connecticut	via Long Island	via Providence	via Worcester
MD	Prince George's	2/Existing	New Carrolton	RF	RF	RF				
	Anne Arundel	6/Existing	BWI Airport	RF	RF	RF				
	Anne Arundel	6/New	BWI Airport H.S.			RF				
	Baltimore	7/Existing	Halethorpe	RF	RF	RF				
	Baltimore City	10/Existing	Baltimore Penn Station	RF	RF	RF				
	Baltimore City	13/New	Bayview	RF	RF	RF				
		14/New	Bayview H.S.			RF				
DE	New Castle	26/New	Newport	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
	New Castle	27/Existing	Wilmington Station	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
	New Castle	28/New	Edgemoor	SS	SS	SS				
	New Castle	29/Existing	Claymont	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
PA	Delaware	32/Existing	Chester	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		33/Existing	Eddystone	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
	Delaware	34/New	Baldwin	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
	Delaware	35/Existing	Crum Lynne	RF	RF	RF				
		41/Existing	Sharon Hill	RF	RF	RF				
		42/Existing	Curtis Park	SS	SS	SS				
		43/Existing	Darby	SS, RF	SS, RF	SS,RF				
	Philadelphia	44/Existing	Philadelphia Airport		SLR, SS	SLR, SS, RF				
		45/Existing	Philadelphia 30th St	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		51/Existing	Holmesburg Junction	SS	SS	SS				
		52/Existing	Torresdale	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
	Bucks	55/Existing	Croyton	SLR, RF	RF	RF				

(continued)

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							Central Connecticut	Long Island	Providence	Worcester
NJ	Mercer	58/Existing	Trenton	RF	RF	RF				
	Middlesex	63/Existing	Jersey eAven	RF	RF	RF				
		67/Existing	Metropark	RF	RF	RF				
	Middlesex	68/New	Metropark H.S.			RF				
	Union	69/Existing	Rahway	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		70/Existing	Linden	SLR, RF	SLR, RF	SLR, RF				
		71/Existing	Elizabeth	SS	SS	SS				
	Essex	73/Existing	Newark Airport	SLR, SS, RF		SLR, SS, RF				
		74/Existing	Newark Penn Station	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
		75/Existing	Newark Penn Station H.S.			SLR, SS, RF				
	Hudson	76/Existing	Secaucus	SLR, SS, RF	SLR, SS, RF	SLR, SS, RF				
NY	Bronx	78/New	Hunts Point	RF	RF		RF	RF		
		80/New	Morris Park	RF	RF		RF	RF		
		81/New	Co-op city	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
	Westchester	84/Existing	Mamaroneck	SS, RF	SS, RF		SS, RF	SS, RF		
		85/Existing	Harrison	RF	RF		RF	RF		
		86/Existing	Rye	RF	RF		RF	RF		
	Westchester	87/New	Cross-Westchester	RF	RF		RF	RF		
	Westchester	88/Existing	Port Chester	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		

(continued)

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							Central Connecticut	Long Island	Providence	Worcester
CT	Fairfield	89/Existing	Greenwich	SS, RF	SS, RF		SS, RF	SS, RF		
		90/Existing	Cos Cob	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		92/Existing	Old Greenwich	SS, RF	SS, RF		SS, RF	SS, RF		
		93/Existing	Stamford	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
	Fairfield	94/New	Stamford H.S.	SLR, SS						
	Fairfield	97/Existing	Rowayton	SS, RF	SS, RF		SS, RF	SS, RF		
		98/Existing	South Norwalk	SS	SS		SS	SS		
		100/Existing	Westport	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		101/Existing	Greens Farms	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		102/Existing	Southport	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		103/Existing	Fairfield	SS	SS		SS	SS		
		104/Existing	Fairfield Metro	SS	SS		SS	SS		
		105/Existing	Bridgeport	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		108/Existing	Stratford	RF	RF		RF	RF		
	New Haven	109/Existing	Milford	SS, RF	SS, RF		SS, RF	SS, RF		
		110/Existing	West Haven	RF	RF		RF	RF		
		111/Existing	New Haven Station	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
	New Haven	112/New	New Haven Station H.S.		SLR, SS, RF			SLR, SS, RF		
	New Haven	113/Existing	New Haven State Street	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
		114/Existing	Branford	SS, RF	SS, RF		SS, RF	SS, RF		
		115/Existing	Guilford	SLR, SS, RF	SLR, SS, RF		SLR, SS, RF	SLR, SS, RF		
	New Haven	156/New	Meriden H.S.		RF		RF	RF		
	Hartford	161/New	Newington		RF		RF	RF	RF	RF
	Middlesex	117/Existing	Clinton	SS	SS				SS	SS
		118/Existing	Westbrook	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
	Middlesex	120/New	Old Saybrook H.S.	SS						
	New London	121/Existing	New London	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
		122/Existing	Mystic	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF

(continued)

State	County	Station ID/type	Station Name	Alternative 1	Alternative 2	Alternative 3				
						D.C. to NY	New York City to Hartford		Hartford to Boston	
							Central Connecticut	Long Island	Providence	Worcester
RI	Washington	123/Existing	Westerly	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
		126/Existing	Wickford Junction	RF	RF				RF	RF
	Providence	128/Existing	Providence Station	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
	Providence	129/New	Providence Station H.S.		SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
MA	Bristol	132/Existing	Attleboro	RF	RF				RF	RF
		133/Existing	Mansfield	RF	RF				RF	RF
	Norfolk	134/Existing	Sharon	RF	RF				RF	RF
		136/Existing	Rt. 128	RF	RF				RF	RF
	Worcester	175/New	Blue Star Hwy (I-495)							RF
	Suffolk	138/Existing	Hyde Park	SS	SS				SS	SS
		140/Existing	Ruggles Street	SLR	SLR				SLR	SLR
		141/Existing	Back Bay	SLR	SLR				SLR	SLR
	Suffolk	142/New	Back Bay H.S.						SLR	SLR
	Suffolk	143/Existing	Boston south Station	SLR, SS, RF	SLR, SS, RF				SLR, SS, RF	SLR, SS, RF
Total Stations at Risk of Inundation				73	75	33	29	30	18	19
Total New Stations at Risk of Inundation				10	12	7	6	7	2	3
Total Existing Stations at Risk of Inundation				63	63	26	23	23	16	16
Total Stations at Risk of Inundation from SLR Flooding				34	34	14	11	12	7	7

Source: FRA, 2015

SLR= Station footprint intersects sea level rise flooding hazard area under end-of-century climate conditions.

SS = Station footprint intersects coastal storm surge flooding hazard area under end-of-century climate conditions.

RF= Station footprint intersects riverine flooding hazard area under current climate conditions. This is based on assessment undertaken as a part of the Hydrologic/Water Resource (floodplains) methodology and does not include an assessment of which additional stations may be at risk from future changes in riverine flood hazard areas.

H.S. = high speed

Data Matrices – Number of Acres

Current Climate Conditions (Sea Level Rise Flooding): Number of Acres in the Affected Environment at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	30	30	30	35	35	35	35									
3	Anne Arundel	4	4	4	4	4	4	4									
5	Baltimore	20	20	20	35	35	35	35									
6	Baltimore City				1	1	1	1									
7	Harford	110	110	110	190	190	190	190									
8	Cecil	25	25	25	25	25	25	25									
9	New Castle	570	570	775	740	740	740	740									
10	Delaware	15	15	110	65	65	65	65									
11	Philadelphia	185	185	345	325	325	325	325									
12	Bucks	265	265	265	275	275	275	275									
13	Mercer	15	15	15	15	15	15	15									
14	Middlesex	25	25	30	30	30	30	30									
15	Union	5	5	10	10	10	10	10									
16	Essex	40	40	40	40	40	40	40									
17	Hudson	305	325	355	450	450	450	450					35	1	1	1	1
18	New York	95	120	120	140	140	140	140					95	110	105	105	110
19	Queens	15	15	40	40	65	65	40					15	40	60	60	40
20	Kings	3	3	15	15	40	40	15					3	15	40	40	15
21	Bronx	35	35	35	35	35	35	35					35	35			35
22	Westchester	5	5	15	5	5	5	5					5				
24	Suffolk					40	40								40	40	
26	Fairfield	165	200	220	200	200	200	200					165	40	40	40	40
27	New Haven	475	475	505	475	535	535	475			385	55	475		135	135	
28	Middlesex	195	225	195	195	195	195	195	60	90	195		195				
29	New London	725	855	725	725	725	725	725	725	210	725		725				
30	Hartford			70	70	70	70	70				70		70	70	70	70
33	Washington	25	40	25	25	25	25	25	25	25	25		25				
34	Kent	50	50	50	50	50	50	50			50		50				
35	Providence	20	20	55	55	55	20	20			20	45	20	45	45		
38	Middlesex						50	50								50	50
39	Bristol	1	1	1	1	1	1	1			1		1				
41	Suffolk	45	45	45	45	45	90	90					45	45	45	90	90

Mid-Century Climate Conditions (Sea Level Rise Flooding): Number of Acres in the Affected Environment at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Colu	35	35	35	40	40	40	40									
3	Anne Arundel	5	5	5	5	5	5	5									
4	Howard	1	1	1	1	1	1	1									
5	Baltimore	40	40	40	70	70	70	70									
6	Baltimore City				2	2	2	2									
7	Harford	120	120	120	235	235	235	235									
8	Cecil	25	25	25	25	25	25	25									
9	New Castle	620	620	900	915	915	915	915									
10	Delaware	15	15	140	80	80	80	80									
11	Philadelphia	190	190	355	330	330	330	330									
12	Bucks	270	270	270	285	285	285	285									
13	Mercer	15	15	15	15	15	15	15									
14	Middlesex	30	30	30	30	30	30	30									
15	Union	10	10	10	10	10	10	10									
16	Essex	40	40	40	40	40	40	40									
17	Hudson	375	395	425	550	550	550	550					35	1	1	1	1
18	New York	95	120	120	140	140	140	140					95	110	105	105	110
19	Queens	15	15	45	45	65	65	45					15	40	65	65	40
20	Kings	4	4	20	20	40	40	20					4	20	40	40	20
21	Bronx	45	45	45	45	45	45	45					45	45			45
22	Westchester	10	10	15	10	10	10	10					10				
24	Suffolk					40	40								40	40	
26	Fairfield	200	230	255	230	230	230	230					200	45	45	45	45
27	New Haven	735	735	775	735	815	815	735			625	65	735		170	170	
28	Middlesex	380	415	380	380	380	380	380	120	145	380		380				
29	New London	990	1,125	990	990	990	990	990	990	215	990		990				
30	Hartford			70	70	70	70	70				70		70	70	70	70
33	Washington	30	50	30	30	30	30	30	30	25	30		30				
34	Kent	55	55	55	55	55	55	55			55		55				
35	Providence	25	25	60	60	60	25	25			25	45	25	45	45		
38	Middlesex						55	55								55	55
39	Bristol	1	1	1	1	1	1	1			1		1				
41	Suffolk	45	45	45	45	45	95	95					45	45	45	95	95

End-of-Century Climate Conditions (Sea Level Rise Flooding): Number of Acres in the Affected Environment at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	65	65	65	70	70	70	70									
3	Anne Arundel	5	5	5	5	5	5	5									
4	Howard	1	1	1	1	1	1	1									
5	Baltimore	125	125	125	290	290	290	290									
6	Baltimore City				20	20	20	20									
7	Harford	215	215	215	445	445	445	445									
8	Cecil	25	25	25	25	25	25	25									
9	New Castle	1,185	1,185	2,110	1,890	1,890	1,890	1,890									
10	Delaware	65	65	485	435	435	435	435									
11	Philadelphia	220	220	970	690	690	690	690									
12	Bucks	315	315	315	335	335	335	335									
13	Mercer	15	15	15	15	15	15	15									
14	Middlesex	40	40	40	40	40	40	40									
15	Union	40	40	45	45	45	45	45									
16	Essex	445	230	245	240	240	240	240									
17	Hudson	1,175	1,195	1,240	1,680	1,680	1,680	1,680					35	1	1	1	1
18	New York	155	190	195	225	215	215	225					155	175	155	155	175
19	Queens	100	100	165	165	210	210	165					100	140	185	185	140
20	Kings	10	10	50	50	105	105	50					10	50	105	105	50
21	Bronx	190	190	190	195	190	190	195					190	190			190
22	Westchester	20	20	30	20	20	20	20					20				
24	Suffolk					60	60								60	60	
26	Fairfield	680	730	785	730	730	730	730					680	110	110	110	110
27	New Haven	1,455	1,455	1,535	1,455	1,620	1,620	1,455			1,145	120	1,455		425	425	
28	Middlesex	685	725	685	685	685	685	685	150	185	685		685				
29	New London	1,975	2,225	1,975	1,975	1,975	1,975	1,975	1,975	340	1,975		1,975				
30	Hartford			75	75	75	75	75				75		75	75	75	75
33	Washington	45	70	45	45	45	45	45	45	35	45		45				
34	Kent	100	100	100	100	100	100	100			100		100				
35	Providence	35	35	80	80	80	35	35			35	65	35	65	65		
38	Middlesex						70	70								70	70
39	Bristol	1	1	1	1	1	1	1			1		1				
40	Norfolk						5	5								5	5
41	Suffolk	365	365	365	380	380	670	670					365	365	365	510	510

Current Climate Conditions (Storm Surge Flooding): Number of Acres in the Affected Environment at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	110	110	110	115	115	115	115									
2	Prince George's	1	1	1	1	1	1	1									
3	Anne Arundel	55	55	55	60	60	60	60									
4	Howard	5	5	5	10	10	10	10									
5	Baltimore	240	240	240	430	430	430	430									
6	Baltimore City				80	80	80	80									
7	Harford	330	330	335	720	720	720	720									
8	Cecil	25	25	25	25	25	25	25									
9	New Castle	1,445	1,445	2,120	2,145	2,145	2,145	2,145									
10	Delaware	165	165	450	460	460	460	460									
11	Philadelphia	420	420	1,360	1,000	1,000	1,000	1,000									
12	Bucks	405	405	405	425	425	425	425									
13	Mercer	25	25	25	25	25	25	25									
14	Middlesex	60	60	60	60	60	60	60									
15	Union	80	80	85	85	85	85	85									
16	Essex	320	320	330	330	330	330	330									
17	Hudson	1,180	1,180	1,220	1,645	1,645	1,645	1,645									
18	New York	150	165	170	220	175	175	220					150	180	110	110	180
19	Queens	145	145	230	230	290	290	230					145	185	240	240	185
20	Kings	10	10	60	60	145	145	60					10	60	145	145	60
21	Bronx	305	305	305	320	305	305	320					305	315			315
22	Westchester	40	40	55	40	40	40	40					40				
24	Suffolk					65	65								65	65	
26	Fairfield	840	895	970	895	895	895	895					840	105	105	105	105
27	New Haven	1,650	1,650	1,780	1,650	1,865	1,865	1,650			1,300	170	1,650		510	510	
28	Middlesex	750	790	750	750	750	750	750	150	185	750		750				
29	New London	2,355	2,555	2,355	2,355	2,355	2,355	2,355	2,355	295	2,355		2,355				
30	Hartford			90	90	90	90	90				90		90	90	90	90
33	Washington	165	305	165	165	165	165	165	165	200	165		165				
34	Kent	170	170	170	170	170	170	170			170		170				
35	Providence	90	90	155	155	155	90	90			90	100	90	100	100		
38	Middlesex						20	20								20	20
39	Bristol	1	1	1	1	1	1	1			1		1				
41	Suffolk	65	65	65	70	70	120	120					65	70	70	100	100

Mid-Century Climate Conditions (Storm Surge Flooding): Number of Acres in the Affected Environment at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	140	140	140	145	145	145	145									
2	Prince George's	1	1	1	1	1	1	1									
3	Anne Arundel	60	60	60	60	60	60	60									
4	Howard	5	5	5	10	10	10	10									
5	Baltimore	715	715	715	1,085	1,085	1,085	1,085									
6	Baltimore City	4	4	4	125	125	125	125									
7	Harford	585	585	590	1,295	1,295	1,295	1,295									
8	Cecil	25	25	25	25	25	25	25									
9	New Castle	2,320	2,320	3,265	3,195	3,195	3,195	3,195									
10	Delaware	290	290	920	965	965	965	965									
11	Philadelphia	655	655	1,725	1,480	1,480	1,480	1,480									
12	Bucks	770	770	770	800	800	800	800									
13	Mercer	40	40	40	40	40	40	40									
14	Middlesex	95	95	100	100	100	100	100									
15	Union	225	225	235	235	235	235	235									
16	Essex	485	485	505	505	505	505	505									
17	Hudson	1,580	1,580	1,645	2,155	2,155	2,155	2,155					5				
18	New York	285	310	325	455	340	340	455					285	375	195	195	375
19	Queens	250	250	360	360	485	485	360					250	245	365	365	245
20	Kings	10	10	80	80	235	235	80					10	80	235	235	80
21	Bronx	625	625	630	655	625	625	655					625	645			645
22	Westchester	65	65	110	65	65	65	65					65				
24	Suffolk					95	95									95	95
26	Fairfield	1,985	2,125	2,310	2,125	2,125	2,125	2,125					1,985	340	340	340	340
27	New Haven	2,650	2,650	2,880	2,650	3,060	3,060	2,650			1,850	330	2,650		1,080	1,080	
28	Middlesex	1,460	1,510	1,460	1,460	1,460	1,460	1,460	240	280	1,460		1,460				
29	New London	3,460	3,835	3,460	3,460	3,460	3,460	3,460	3,460	500	3,460		3,460				
30	Hartford			145	145	145	145	145				145		145	145	145	145
33	Washington	205	385	205	205	205	205	205	205	255	205		205				
34	Kent	345	345	345	345	345	345	345			345		345				
35	Providence	250	250	395	395	395	250	250			250	275	250	275	275		
38	Middlesex						40	40								40	40
39	Bristol	5	5	5	5	5	5	5			5		5				
40	Norfolk						1	1								1	1
41	Suffolk	195	195	195	205	205	420	420					195	200	200	345	345

End-of-Century Climate Conditions (Storm Surge Flooding): Number of Acres in the Affected Environment at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	140	140	140	145	145	145	145									
3	Anne Arundel	60	60	60	60	60	60	60									
4	Howard	5	5	5	10	10	10	10									
5	Baltimore	740	740	740	1,135	1,135	1,135	1,135									
6	Baltimore City	4	4	4	140	140	140	140									
7	Harford	595	595	600	1,320	1,320	1,320	1,320									
8	Cecil	25	25	25	25	25	25	25									
9	New Castle	2,370	2,370	3,315	3,245	3,245	3,245	3,245									
10	Delaware	330	330	965	1,020	1,020	1,020	1,020									
11	Philadelphia	715	715	1,815	1,550	1,550	1,550	1,550									
12	Bucks	785	785	780	815	815	815	815									
13	Mercer	40	40	40	45	45	45	45									
14	Middlesex	100	100	105	105	105	105	105									
15	Union	235	235	245	245	245	245	245									
16	Essex	485	485	505	505	505	505	505									
17	Hudson	1,595	1,595	1,660	2,170	2,170	2,170	2,170					5				
18	New York	285	315	330	455	340	340	455					285	375	195	195	375
19	Queens	265	265	375	375	510	510	375					265	250	380	380	250
20	Kings	10	10	80	80	245	245	80					10	80	245	245	80
21	Bronx	645	645	650	670	645	645	670					645	660			660
22	Westchester	75	75	125	75	75	75	75					75				
24	Suffolk					100	100								100	100	
26	Fairfield	2,155	2,295	2,500	2,295	2,295	2,295	2,295					2,155	365	365	365	365
27	New Haven	2,780	2,780	3,020	2,780	3,200	3,200	2,780			1,945	345	2,780		1,105	1,105	
28	Middlesex	1,500	1,555	1,500	1,500	1,500	1,500	1,500	245	290	1,500		1,500				
29	New London	3,710	4,105	3,710	3,710	3,710	3,710	3,710	3,710	525	3,710		3,710				
30	Hartford			145	145	145	145	145				145		145	145	145	145
33	Washington	230	420	230	230	230	230	230	230	285	230		230				
34	Kent	370	370	370	370	370	370	370			370		370				
35	Providence	275	275	435	435	435	275	275			275	305	275	305	305		
38	Middlesex						45	45								45	45
39	Bristol	5	5	5	5	5	5	5			5		5				
40	Norfolk						1	1								1	1
41	Suffolk	235	235	235	245	245	485	485					235	245	245	370	370

Current Climate Conditions (Riverine Flooding): Number of Acres in the Affected Environment at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	120	120	120	125	125	125	125									
2	Prince George's	545	545	545	560	560	560	560									
3	Anne Arundel	745	745	745	775	775	775	775									
4	Howard	5	5	5	10	10	10	10									
5	Baltimore County	375	375	375	695	695	695	695									
6	Baltimore City	85	90	90	205	205	205	205									
7	Harford	950	950	945	1500	1500	1500	1500									
8	Cecil	605	605	860	860	860	860	860									
9	New Castle	1645	1645	2340	2370	2370	2370	2370									
10	Delaware	290	290	485	590	590	590	590									
11	Philadelphia	480	480	1410	1055	1055	1055	1055									
12	Bucks	535	535	535	555	555	555	555									
13	Mercer	440	440	440	460	460	460	460									
14	Middlesex	995	995	1035	1065	1065	1065	1065									
15	Union	160	160	160	160	160	160	160									
16	Essex	365	365	375	380	380	380	380									
17	Hudson	1190	1190	1230	1655	1655	1655	1655									
18	New York	265	280	300	490	305	305	490					265	400	170	170	400
19	Queens	160	160	245	245	305	305	245					160	195	250	250	195
20	Kings	10	10	65	65	145	145	65					10	65	145	145	65
21	Bronx	495	495	500	520	495	495	520					495	510			510
22	Westchester	230	230	250	870	230	230	870					230	690			690
23	Nassau					4	4								4	4	
24	Suffolk					220	220								220	220	
25	Putnam				85			85						85			85
26	Fairfield	1290	1395	1550	1790	1395	1395	1790					1290	615	225	225	615
27	New Haven	2015	2015	2580	2395	2805	2805	2395			1560	605	2015	380	1125	1125	380
28	Middlesex	820	860	820	820	820	820	820	165	185	820		820				
29	New London	3330	3755	3330	3330	3330	3330	3330	3330	520	3330		3330				
30	Hartford			880	595	540	525	585				880		595	540	525	585
31	Tolland			235	235	235	390	395				235		235	235	390	395
32	Windham			1	1	1	2	2				1		1	1	2	2
33	Washington	1480	1710	1480	1480	1480	1480	1480	610	450	1480		1480				
34	Kent	490	490	490	490	490	490	490			490		490				
35	Providence	215	215	560	555	555	215	215			215	380	215	375	375		
37	Worcester						980	980								980	980
38	Middlesex						350	350								350	350
39	Bristol	465	465	500	515	515	465	465			95	50	465	425	425		
40	Norfolk	395	395	385	400	400	395	395					395	385	385		
41	Suffolk	85	85	85	90	90	140	140					85	85	85	100	100

Mid-Century Climate Conditions (Riverine Flooding): Number of Acres in the Affected Environment at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	160	160	160	170	170	170	170									
2	Prince George's	720	720	720	740	740	740	740									
3	Anne Arundel	985	985	985	1020	1020	1020	1020									
4	Howard	10	10	10	10	10	10	10									
5	Baltimore County	495	495	495	920	920	920	920									
6	Baltimore City	110	115	115	270	270	270	270									
7	Harford	1250	1250	1250	1975	1975	1975	1975									
8	Cecil	800	800	1135	1140	1140	1140	1140									
9	New Castle	2155	2155	3065	3100	3100	3100	3100									
10	Delaware	435	435	730	885	885	885	885									
11	Philadelphia	715	715	2115	1585	1585	1585	1585									
12	Bucks	800	800	800	830	830	830	830									
13	Mercer	640	640	640	665	665	665	665									
14	Middlesex	1440	1440	1505	1540	1540	1540	1540									
15	Union	230	230	235	235	235	235	235									
16	Essex	530	530	545	550	550	550	550									
17	Hudson	1725	1725	1785	2400	2400	2400	2400									
18	New York	385	410	435	710	445	445	710					385	580	250	250	580
19	Queens	235	235	360	360	445	445	360					235	280	365	365	280
20	Kings	15	15	90	90	215	215	90					15	90	215	215	90
21	Bronx	720	720	730	755	720	720	755					720	745			745
22	Westchester	335	335	365	1260	335	335	1260					335	1000			1000
23	Nassau					5	5								5	5	
24	Suffolk					320	320								320	320	
25	Putnam				125			125						125			125
26	Fairfield	1765	1915	2120	2450	1915	1915	2450					1765	840	305	305	840
27	New Haven	2760	2760	3530	3280	3845	3845	3280			2135	830	2760	520	1545	1545	520
28	Middlesex	1125	1175	1125	1125	1125	1125	1125	230	255	1125		1125				
29	New London	4565	5145	4565	4565	4565	4565	4565	4565	710	4565		4565				
30	Hartford			1210	815	735	720	800				1210		815	735	720	800
31	Tolland			325	325	325	535	540				325		325	325	535	540
32	Windham			1	1	1	2	2				1		1	1	2	2
33	Washington	2040	2365	2040	2040	2040	2040	2040	840	620	2040		2040				
34	Kent	675	675	675	675	675	675	675			675		675				
35	Providence	300	300	770	770	770	300	300			300	525	300	520	520		
37	Worcester						1410	1410								1410	1410
38	Middlesex						505	505								505	505
39	Bristol	670	670	720	740	740	670	670			135	75	670	610	610		
40	Norfolk	565	565	555	575	575	565	565					565	555	555		
41	Suffolk	120	120	120	130	130	200	200					120	120	120	145	145

End-of-Century Climate Conditions (Riverine Flooding): Number of Acres in the Affected Environment at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	190	190	190	200	200	200	200									
2	Prince George's	830	830	830	850	850	850	850									
3	Anne Arundel	1130	1130	1130	1175	1175	1175	1175									
4	Howard	10	10	10	10	10	10	10									
5	Baltimore County	570	570	570	1055	1055	1055	1055									
6	Baltimore City	125	135	135	310	310	310	310									
7	Harford	1440	1440	1440	2275	2275	2275	2275									
8	Cecil	920	920	1305	1310	1310	1310	1310									
9	New Castle	2480	2480	3530	3575	3575	3575	3575									
10	Delaware	530	530	880	1065	1065	1065	1065									
11	Philadelphia	865	865	2555	1915	1915	1915	1915									
12	Bucks	970	970	965	1005	1005	1005	1005									
13	Mercer	765	765	765	800	800	800	800									
14	Middlesex	1730	1730	1805	1850	1850	1850	1850									
15	Union	275	275	280	280	280	280	280									
16	Essex	635	635	655	660	660	660	660									
17	Hudson	2065	2065	2145	2880	2880	2880	2880									
18	New York	455	485	520	845	530	530	845					455	695	295	295	695
19	Queens	280	280	425	430	530	530	430					280	335	435	435	335
20	Kings	20	20	110	110	255	255	110					20	110	255	255	110
21	Bronx	860	860	870	900	860	860	900					860	885			885
22	Westchester	400	400	435	1505	400	400	1505					400	1195			1195
23	Nassau					5	5								5	5	
24	Suffolk					385	385								385	385	
25	Putnam				150			150						150			150
26	Fairfield	2075	2250	2495	2880	2250	2250	2880					2075	990	360	360	990
27	New Haven	3245	3245	4150	3855	4515	4515	3855			2510	975	3245	610	1815	1815	610
28	Middlesex	1320	1385	1320	1320	1320	1320	1320	270	300	1320		1320				
29	New London	5365	6045	5365	5365	5365	5365	5365	5365	835	5365		5365				
30	Hartford			1420	960	865	850	940				1420		960	865	850	940
31	Tolland			380	380	380	630	635				380		380	380	630	635
32	Windham						3	3								3	3
33	Washington	2380	2755	2380	2380	2380	2380	2380	980	725	2380		2380				
34	Kent	785	785	785	785	785	785	785			785		785				
35	Providence	350	350	900	895	895	350	350			350	610	350	605	605		
37	Worcester						1665	1665								1665	1665
38	Middlesex						595	595								595	595
39	Bristol	790	790	850	870	870	790	790			160	85	790	720	720		
40	Norfolk	670	670	655	680	680	670	670					670	655	655		
41	Suffolk	145	145	145	150	150	235	235					145	145	145	170	170

Current Climate Conditions (Sea Level Rise Flooding): Number of Acres in the Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	1	1	1	4	4	4	4									
3	Anne Arundel	1	1	1	1	1	1	1									
5	Baltimore	1	1	1	2	2	2	2									
6	Baltimore City				1	1	1	1									
7	Harford	10	10	10	25	25	25	25									
8	Cecil	2	2	2	5	5	5	5									
9	New Castle	4	4	10	40	40	40	40									
10	Delaware	1	1	20	10	10	10	10									
11	Philadelphia	2	2	25	15	15	15	15									
12	Bucks	3	3	3	10	10	10	10									
13	Mercer	1	1	1	3	3	3	3									
14	Middlesex	2	2	4	5	5	5	5									
15	Union	1	1	1	1	1	1	1									
16	Essex	1	1	1	1	1	1	1									
17	Hudson	15	20	25	60	60	60	60									
18	New York	5	15	15	25	25	25	25					5	20	20	20	20
19	Queens	1	1	5	5	10	10	5					1	5	5	5	5
20	Kings			2	2	4	4	2						2	2	2	2
21	Bronx	1	1	2	4	1	1	4					1	3			3
22	Westchester	1	1	1	1	1	1	1					1				
24	Suffolk					4	4								4	4	
26	Fairfield	5	10	10	10	10	10	10					5				
27	New Haven	5	5	10	5	15	15	5			4	2	5		5	5	
28	Middlesex	5	10	5	5	5	5	5	3	5	5		5				
29	New London	25	40	25	25	25	25	25	25	15	25		25				
30	Hartford			5	5	5	5	5				5		5	5	5	5
33	Washington	1	2	1	1	1	1	1	1	2	1		1				
34	Kent	1	1	1	1	1	1	1			1		1				
35	Providence	1	1	3	4	4	1	1			1	2	1	3	3		
39	Bristol	1	1	1	1	1	1	1			1		1				
41	Suffolk	1	1	1	3	3	2	2					1	2	2	1	1

Mid-Century Climate Conditions (Sea Level Rise Flooding): Number of Acres in the Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Colu	1	1	1	4	4	4	4									
3	Anne Arundel	1	1	1	1	1	1	1									
5	Baltimore	1	1	1	2	2	2	2									
6	Baltimore City				1	1	1	1									
7	Harford	10	10	10	25	25	25	25									
8	Cecil	2	2	2	5	5	5	5									
9	New Castle	5	5	20	70	70	70	70									
10	Delaware	1	1	25	10	10	10	10									
11	Philadelphia	2	2	25	20	20	20	20									
12	Bucks	4	4	4	10	10	10	10									
13	Mercer	1	1	1	3	3	3	3									
14	Middlesex	2	2	4	5	5	5	5									
15	Union	1	1	1	2	2	2	2									
16	Essex	1	1	1	1	1	1	1									
17	Hudson	15	25	25	70	70	70	70									
18	New York	5	15	15	25	25	25	25					5	20	20	20	20
19	Queens	1	1	5	5	10	10	5					1	5	5	5	5
20	Kings			2	2	4	4	2						2	2	2	2
21	Bronx	1	1	2	5	1	1	5					1	4			4
22	Westchester	1	1	1	1	1	1	1					1				
24	Suffolk					4	4								4	4	
26	Fairfield	5	10	10	10	10	10	10					5				
27	New Haven	10	10	15	10	20	20	10			5	3	10		10	10	
28	Middlesex	10	15	10	10	10	10	10	3	10	10		10				
29	New London	35	50	35	35	35	35	35	35	15	35		35				
30	Hartford			5	5	5	5	5				5		5	5	5	5
33	Washington	1	3	1	1	1	1	1	1	2	1		1				
34	Kent	2	2	2	2	2	2	2			2		2				
35	Providence	1	1	4	5	5	1	1			1	2	1	3	3		
39	Bristol	1	1	1	1	1	1	1			1		1				
41	Suffolk	1	1	1	3	3	2	2					1	2	2	1	1

End-of-Century Climate Conditions (Sea Level Rise Flooding): Number of Acres in the Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Colum	2	2	2	10	10	10	10									
3	Anne Arundel	1	1	1	1	1	1	1									
5	Baltimore	2	2	2	10	10	10	10									
6	Baltimore City				1	1	1	1									
7	Harford	10	10	10	45	45	45	45									
8	Cecil	2	2	2	5	5	5	5									
9	New Castle	50	50	110	190	190	190	190									
10	Delaware	1	1	55	50	50	50	50									
11	Philadelphia	3	3	85	60	60	60	60									
12	Bucks	4	4	4	15	15	15	15									
13	Mercer	1	1	1	3	3	3	3									
14	Middlesex	2	2	5	5	5	5	5									
15	Union	1	1	1	2	2	2	2									
16	Essex	20	20	35	55	55	55	55									
17	Hudson	50	70	75	215	215	215	215									
18	New York	10	20	20	40	40	40	40					10	30	30	30	30
19	Queens	10	10	25	25	35	35	25					10	15	10	10	15
20	Kings			4	4	25	25	4						4	25	25	4
21	Bronx	5	5	10	25	5	5	25					5	20			20
22	Westchester	1	1	1	1	1	1	1					1				
24	Suffolk					5	5								5	5	
26	Fairfield	20	25	30	25	25	25	25					20				
27	New Haven	70	70	80	70	100	100	70			50	5	70		30	30	
28	Middlesex	40	50	40	40	40	40	40	5	10	40		40				
29	New London	155	175	155	155	155	155	155	155	20	155		155				
30	Hartford			5	5	5	5	5				5		5	5	5	5
33	Washington	1	3	1	1	1	1	1	1	3	1		1				
34	Kent	4	4	4	4	4	4	4			4		4				
35	Providence	2	2	5	5	5	2	2			2	3	2	4	4		
39	Bristol	1	1	1	1	1	1	1			1		1				
40	Norfolk						3	3								3	3
41	Suffolk	25	25	25	75	75	60	60					25	50	50	35	35

Current Climate Conditions (Storm Surge Flooding): Number of Acres in the Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	5	5	5	25	25	25	25									
3	Anne Arundel	10	10	10	25	25	25	25									
5	Baltimore	10	10	10	40	40	40	40									
6	Baltimore City				10	10	10	10									
7	Harford	15	15	15	70	70	70	70									
8	Cecil	2	2	2	5	5	5	5									
9	New Castle	45	45	105	190	190	190	190									
10	Delaware	5	5	50	50	50	50	50									
11	Philadelphia	25	25	120	110	110	110	110									
12	Bucks	20	20	20	65	65	65	65									
13	Mercer	1	1	1	4	4	4	4									
14	Middlesex	3	3	5	10	10	10	10									
15	Union	1	1	3	5	5	5	5									
16	Essex	25	25	45	65	65	65	65									
17	Hudson	45	60	70	200	200	200	200									
18	New York	10	20	20	35	35	35	35					10	25	20	20	25
19	Queens	15	15	30	30	45	45	30					15	15	15	15	15
20	Kings			4	4	30	30	4						4	30	30	4
21	Bronx	25	25	30	65	25	25	65					25	40			40
22	Westchester	1	1	1	1	1	1	1					1				
24	Suffolk					5	5								5	5	
26	Fairfield	45	50	60	50	50	50	50					45				
27	New Haven	90	90	110	90	135	135	90			70	15	90		45	45	
28	Middlesex	45	55	45	45	45	45	45	10	10	45		45				
29	New London	215	240	215	215	215	215	215	215	25	215		215				
30	Hartford			5	5	5	5	5				5		5	5	5	5
33	Washington	2	15	2	2	2	2	2	2	10	2		2				
34	Kent	15	15	15	15	15	15	15			15		15				
35	Providence	3	3	10	10	10	3	3			3	5	3	10	10		
39	Bristol	1	1	1	1	1	1	1			1		1				
41	Suffolk	1	1	1	3	3	2	2					1	3	3	1	1

Mid-Century Climate Conditions (Storm Surge Flooding): Number of Acres in the Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	10	10	10	35	35	35	35									
3	Anne Arundel	10	10	10	25	25	25	25									
5	Baltimore	60	60	60	140	140	140	140									
6	Baltimore City				15	15	15	15									
7	Harford	50	50	50	175	175	175	175									
8	Cecil	2	2	2	5	5	5	5									
9	New Castle	200	200	305	550	550	550	550									
10	Delaware	10	10	85	120	120	120	120									
11	Philadelphia	45	45	150	170	170	170	170									
12	Bucks	70	70	70	205	205	205	205									
13	Mercer	3	3	3	10	10	10	10									
14	Middlesex	5	5	10	15	15	15	15									
15	Union	10	10	20	35	35	35	35									
16	Essex	35	35	75	105	105	105	105									
17	Hudson	130	155	185	385	385	385	385									
18	New York	20	30	35	60	60	60	60					20	40	35	35	40
19	Queens	20	20	40	40	70	70	40					20	20	30	30	20
20	Kings			4	4	35	35	4						4	30	30	4
21	Bronx	60	60	60	125	60	60	125					60	60			60
22	Westchester	3	3	4	3	3	3	3					3				
24	Suffolk					10	10								10	10	
26	Fairfield	150	170	195	170	170	170	170					150				
27	New Haven	205	205	230	205	300	300	205			140	25	205		95	95	
28	Middlesex	120	140	120	120	120	120	120	15	20	120		120				
29	New London	335	375	335	335	335	335	335	335	40	335		335				
30	Hartford			10	10	10	10	10				10		10	10	10	10
33	Washington	5	20	5	5	5	5	5	5	15	5		5				
34	Kent	55	55	55	55	55	55	55			55		55				
35	Providence	15	15	40	40	40	15	15			15	25	15	25	25		
39	Bristol	1	1	1	1	1	1	1			1		1				
41	Suffolk	10	10	10	30	30	30	30					10	20	20	20	20

End-of-Century Climate Conditions (Storm Surge Flooding): Number of Acres in the Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	10	10	10	35	35	35	35									
3	Anne Arundel	10	10	10	25	25	25	25									
5	Baltimore	60	60	60	145	145	145	145									
6	Baltimore City				20	20	20	20									
7	Harford	55	55	55	180	180	180	180									
8	Cecil	2	2	2	5	5	5	5									
9	New Castle	205	205	315	570	570	570	570									
10	Delaware	15	15	90	135	135	135	135									
11	Philadelphia	55	55	160	185	185	185	185									
12	Bucks	70	70	70	205	205	205	205									
13	Mercer	3	3	3	10	10	10	10									
14	Middlesex	5	5	10	15	15	15	15									
15	Union	10	10	25	35	35	35	35									
16	Essex	35	35	75	105	105	105	105									
17	Hudson	130	155	185	385	385	385	385									
18	New York	20	30	35	60	60	60	60					20	40	35	35	40
19	Queens	25	25	40	40	75	75	40					25	20	35	35	20
20	Kings			4	4	35	35	4						4	30	30	4
21	Bronx	60	60	65	125	60	60	125					60	60			60
22	Westchester	4	4	5	4	4	4	4					4				
24	Suffolk					10	10								10	10	
26	Fairfield	175	195	230	195	195	195	195					175				
27	New Haven	220	220	250	220	320	320	220			155	30	220		100	100	
28	Middlesex	125	145	125	125	125	125	125	15	20	125		125				
29	New London	365	405	365	365	365	365	365	365	40	365		365				
30	Hartford			10	10	10	10	10				10		10	10	10	10
33	Washington	10	25	10	10	10	10	10	10	15	10		10				
34	Kent	60	60	60	60	60	60	60			60		60				
35	Providence	15	15	45	50	50	15	15			15	30	15	35	35		
39	Bristol	1	1	1	1	1	1	1			1		1				
41	Suffolk	20	20	20	50	50	40	40					20	30	30	20	20

Current Climate Conditions (Riverine Flooding): Number of Acres in the Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
1	District of Columbia	5	5	5	25	25	25	25									
2	Prince George's	30	30	30	100	100	100	100									
3	Anne Arundel	50	50	50	160	160	160	160									
5	Baltimore County	10	10	10	70	70	70	70									
6	Baltimore City	15	15	15	30	30	30	30									
7	Harford	60	60	60	180	180	180	180									
8	Cecil	35	35	65	110	110	110	110									
9	New Castle	50	50	115	210	210	210	210									
10	Delaware	5	5	50	50	50	50	50									
11	Philadelphia	25	25	125	115	115	115	115									
12	Bucks	20	20	20	70	70	70	70									
13	Mercer	35	35	35	95	95	95	95									
14	Middlesex	45	45	50	165	165	165	165									
15	Union	5	5	10	20	20	20	20									
16	Essex	25	25	45	65	65	65	65									
17	Hudson	45	60	70	200	200	200	200									
18	New York	25	30	35	65	55	55	65					25	40	30	30	40
19	Queens	20	20	35	35	45	45	35					20	15	15	15	15
20	Kings			4	4	30	30	4						4	30	30	4
21	Bronx	50	50	55	115	50	50	115					50	65			65
22	Westchester	2	2	4	35	2	2	35					2	30			30
24	Suffolk					20	20								20	20	
25	Putnam				4			4						4			4
26	Fairfield	65	70	85	100	70	70	100					65	25			25
27	New Haven	105	105	175	135	220	220	135			165	70	105	35	115	115	35
28	Middlesex	45	60	45	45	45	45	45	10	10	90		45				
29	New London	235	270	235	235	235	235	235	235	35	470		235				
30	Hartford			120	55	75	80	60				120		55	75	80	60
31	Tolland			15	15	15	25	25				15		15	15	25	25
33	Washington	50	70	50	50	50	50	50	25	20	95		50				
34	Kent	15	15	15	15	15	15	15			30		15				
35	Providence	15	15	35	40	40	15	15			30	20	15	25	25		
37	Worcester						55	55								55	55
38	Middlesex						15	15								15	15
39	Bristol	10	10	10	35	35	10	10			5	2	10	25	25		
40	Norfolk	10	10	20	50	50	10	10					10	40	40		
41	Suffolk	2	2	1	5	5	3	3					2	4	4	1	1

Current Climate Conditions (Sea Level Rise Flooding): At Grade and Trench Construction Type - Number of Acres of Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
5	Baltimore	1	1	1	1	1	1	1									
7	Harford	1	1	1	1	1	1	1									
9	New Castle	1	1	3	5	5	5	5									
10	Delaware			15	1	1	1	1									
11	Philadelphia			1													
12	Bucks	1	1	1	2	2	2	2									
17	Hudson				4	4	4	4									
21	Bronx	1	1	1	1	1	1	1					1	1	1		
26	Fairfield	1	1	2	1	1	1	1					1				
27	New Haven	1	1	1	1	1	1	1			1	1	1				
28	Middlesex	1	1	1	1	1	1	1			1		1				
29	New London	5	5	5	5	5	5	5	5	1	5		5				
33	Washington		1							1							
41	Suffolk	1	1	1	1	1	1	1					1				

Mid-Century Climate Conditions (Sea Level Rise Flooding): At Grade and Trench Construction Type - Number of Acres of Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
5	Baltimore	1	1	1	1	1	1	1									
7	Harford	1	1	1	1	1	1	1									
9	New Castle	3	3	5	10	10	10	10									
10	Delaware			20	1	1	1	1									
11	Philadelphia			1													
12	Bucks	1	1	1	2	2	2	2									
17	Hudson				5	5	5	5									
21	Bronx	1	1	1	1	1	1	1					1	1	1		
26	Fairfield	1	1	3	1	1	1	1					1				
27	New Haven	1	1	1	1	1	1	1			1	1	1				
28	Middlesex	1	1	1	1	1	1	1	1	1	1		1				
29	New London	10	10	10	10	10	10	10	10	1	10		10				
33	Washington		1							1							
41	Suffolk	1	1	1	1	1	1	1					1				

End-of-Century Climate Conditions (Sea Level Rise Flooding): At Grade and Trench Construction Type - Number of Acres of Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
3	Anne Arundel			1													
5	Baltimore	1	1	1	1	1	1	1									
7	Harford	1	1	1	1	1	1	1									
9	New Castle	35	35	55	55	55	55	55									
10	Delaware	1	1	30	10	10	10	10									
11	Philadelphia	1	1	40	1	1	1	1									
12	Bucks	1	1	1	3	3	3	3									
16	Essex	15	15	30	45	45	45	45									
17	Hudson	1	1	1	25	25	25	25									
19	Queens	3	3	3	3	3	3	3					3				
21	Bronx	4	4	2	15	4	4	15					4	10			10
26	Fairfield	10	10	15	10	10	10	10					10				
27	New Haven	20	20	20	20	20	20	20			5	1	20		1	1	
28	Middlesex	2	3	2	2	2	2	2	1	1	2		2				
29	New London	90	90	90	90	90	90	90	90	1	90		90				
33	Washington		1							1							
34	Kent	1	1	1	1	1	1	1			1		1				
35	Providence	1	1	1	1	1	1	1			1		1				
40	Norfolk						3	3								3	3
41	Suffolk	20	20	20	20	20	35	35					20			15	15

Current Climate Conditions (Storm Surge Flooding): At Grade and Trench Construction Type - Number of Acres of Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
3	Anne Arundel	5	5	5	5	5	5	5									
5	Baltimore	3	3	3	5	5	5	5									
7	Harford	1	1	1	1	1	1	1									
9	New Castle	35	35	60	55	55	55	55									
10	Delaware	1	1	30	15	15	15	15									
11	Philadelphia	15	15	55	15	15	15	15									
12	Bucks	15	15	15	55	55	55	55									
16	Essex	15	15	40	55	55	55	55									
17	Hudson	1	1	1	25	25	25	25									
19	Queens	4	4	4	4	4	4	4					4				
21	Bronx	15	15	10	30	15	15	30					15	15			15
22	Westchester			1													
26	Fairfield	20	20	25	20	20	20	20					20				
27	New Haven	25	25	35	25	30	30	25			10	10	25		5	5	
28	Middlesex	2	3	2	2	2	2	2	1	1	2		2				
29	New London	125	125	125	125	125	125	125	125	1	125		125				
33	Washington		1							1							
34	Kent	1	1	1	1	1	1	1			1		1				
41	Suffolk	1	1	1	1	1	1	1					1			1	1

Mid-Century Climate Conditions (Storm Surge Flooding): At Grade and Trench Construction Type - Number of Acres of Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
3	Anne Arundel	10	10	10	10	10	10	10									
5	Baltimore	30	30	30	50	50	50	50									
7	Harford	10	10	5	10	10	10	10									
9	New Castle	155	155	195	325	325	325	325									
10	Delaware	1	1	45	35	35	35	35									
11	Philadelphia	25	25	70	25	25	25	25									
12	Bucks	55	55	55	165	165	165	165									
16	Essex	20	20	50	75	75	75	75									
17	Hudson	20	20	20	65	65	65	65									
19	Queens	5	5	5	5	5	5	5					5				
21	Bronx	45	45	30	70	45	45	70					45	25			25
22	Westchester	1	1	1	1	1	1	1					1				
26	Fairfield	65	65	80	65	65	65	65					65				
27	New Haven	50	50	65	50	70	70	50			15	15	50		20	20	
28	Middlesex	25	30	25	25	25	25	25	5	5	25		25				
29	New London	175	180	175	175	175	175	175	175	2	175		175				
33	Washington	1	1	1	1	1	1	1	1	1	1		1				
34	Kent	10	10	10	10	10	10	10			10		10				
35	Providence	5	5	5	5	5	5	5			5		5				
41	Suffolk	10	10	10	10	10	15	15					10			5	5

End-of-Century Climate Conditions (Storm Surge Flooding): At Grade and Trench Construction Type - Number of Acres of Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and Providence)	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
3	Anne Arundel	10	10	10	10	10	10	10									
5	Baltimore	35	35	35	50	50	50	50									
7	Harford	10	10	10	10	10	10	10									
9	New Castle	160	160	200	340	340	340	340									
10	Delaware	2	2	45	40	40	40	40									
11	Philadelphia	25	25	75	25	25	25	25									
12	Bucks	60	60	60	165	165	165	165									
16	Essex	20	20	50	75	75	75	75									
17	Hudson	20	20	20	65	65	65	65									
19	Queens	5	5	5	5	5	5	5					5				
21	Bronx	45	45	30	70	45	45	70					45	25			25
22	Westchester	1	1	1	1	1	1	1					1				
26	Fairfield	75	80	90	80	80	80	80					75				
27	New Haven	50	50	65	50	75	75	50			20	15	50		20	20	
28	Middlesex	25	30	25	25	25	25	25	5	5	25		25				
29	New London	190	195	190	190	190	190	190	190	2	190		190				
33	Washington	1	2	1	1	1	1	1	1	1	1		1				
34	Kent	10	10	10	10	10	10	10			10		10				
35	Providence	5	5	5	5	5	5	5			5		5				
41	Suffolk	15	15	20	15	15	25	25					15			5	5

Current Climate Conditions (Riverine Flooding): At Grade and Trench Construction Type - Number of Acres of Representative Route at Risk

#	County	Existing NEC	Alternative 1	Alternative 2	Alt 3.1 (via Central Connecticut and Providence)	Alt 3.2 (via Long Island and Providence)	Alt 3.3 (via Long Island and Worcester)	Alt 3.4 (via Central Connecticut and Worcester)	Alternative 1: Old Saybrook-Kenyon (Middlesex County, CT, to Washington County, RI)		Alternative 2: New Haven-Hartford-Providence		Alternative 3: New York County, NY, to Suffolk County, MA				
									Existing NEC	Alternative 1	Existing NEC	Alternative 2	Existing NEC	Alternative 3.1 (via Central Connecticut and	Alternative 3.2 (via Long Island and Providence)	Alternative 3.3 (via Long Island and Worcester)	Alternative 3.4 (via Central Connecticut and Worcester)
2	Prince George's	25	25	25	60	60	60	60									
3	Anne Arundel	30	30	30	30	30	30	30									
5	Baltimore County	5	5	5	15	15	15	15									
6	Baltimore City	15	15	15	15	15	15	15									
7	Harford	10	10	20	30	30	30	30									
8	Cecil			1	2	2	2	2									
9	New Castle	40	40	65	65	65	65	65									
10	Delaware	1	1	30	15	15	15	15									
11	Philadelphia	15	15	60	15	15	15	15									
12	Bucks	15	15	15	55	55	55	55									
13	Mercer	30	30	30	65	65	65	65									
14	Middlesex	40	40	40	130	130	130	130									
15	Union	3	3	10	15	15	15	15									
16	Essex	15	15	40	55	55	55	55									
17	Hudson	1	1	1	25	25	25	25									
19	Queens	4	4	4	4	4	4	4					4				
21	Bronx	35	35	30	60	35	35	60					35	25			25
22	Westchester	1	1	2	5	1	1	5					1	5			5
24	Suffolk					5	5								5	5	
26	Fairfield	30	30	35	30	30	30	30					30				
27	New Haven	35	35	65	35	65	65	35			40	30	35		30	30	
28	Middlesex	5	5	5	5	5	5	5	1	1	10		5				
29	New London	135	135	135	135	135	135	135	135	2	265		135				
30	Hartford			105	1	1	1	1				105		1	1	1	1
31	Tolland						5	5								5	5
33	Washington	5	5	5	5	5	5	5	5	1	15		5				
34	Kent	1	1	1	1	1	1	1			1		1				
35	Providence	10	10	15	15	15	10	10			20	2	10	5	5		
37	Worcester						5	5								5	5
39	Bristol	5	5	5	30	30	5	5			2	2	5	25	25		
40	Norfolk	10	10	10	45	45	10	10					10	35	35		
41	Suffolk	1	1	1	3	3	2	2					1	1	1	1	1