



September 15, 2022

L-2022-152
10 CFR 50.4
10 CFR 50, Appendix E, Section IV.4

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Re: Seabrook Station
Docket No. 50-443
Renewed Facility Operating License No. NPF-86

10 CFR 50 Appendix E Evacuation Time Estimate Study for Seabrook Station

Pursuant to Part 50.4 of Title 10 of the Code of Federal Regulations (10 CFR Part 50.4), NextEra Energy Seabrook, LLC (NextEra) hereby submits the evacuation time estimate study (ETE) for Seabrook Station Unit 1 (SBK). This study is submitted in accordance with the requirements of Appendix E, Section IV.4 to Part 50 of Title 10 of the Code of Federal Regulations.

The regulation requires the licensee to submit an updated study “within 365 days of the later of availability of the most recent decennial census data from the U.S. Census Bureau or December 23, 2011.”

The Seabrook ETE was developed in accordance with the federal guidance in NUREG/CR-7002, Rev. 1, “Criteria for Development of Evacuation Time Estimate Studies” published February 2021.

The enclosure contains the Seabrook ETE study. Note that Appendix N of the ETE Study contains the completed NUREG/CR 7002 Appendix B, Table B-1 ETE Review Criteria Checklist for the Seabrook ETE.

This letter contains no new Regulatory Commitments and no revision to existing Regulatory Commitments.

The enclosed ETE study provides the methods used to derive, for planning purposes, the time for public evacuation. The study provides an important part of the bases for development of protective action recommendations in coordination with the applicable offsite state and local emergency response agencies.

Should you have any questions regarding this submittal, please contact Matthew Levander, Regulatory Affairs Manager, at 603-773-7631.

Very truly yours,

A handwritten signature in black ink, appearing to read "D. Strand". The signature is stylized with a large, sweeping "S" and a checkmark-like flourish at the end.

Dianne Strand
General Manager, Regulatory Affairs

Enclosure: 2022 Seabrook Station EPZ ETE Study

cc: USNRC Project Manager, Seabrook Station
USNRC Regional Administrator, Seabrook Station
USNRC Senior Resident Inspector, Seabrook Station

Director Homeland Security and Emergency Management
New Hampshire Department of Safety
Division of Homeland Security and Emergency Management
Bureau of Emergency Management
33 Hazen Drive
Concord, NH 03305

John Viveiros, Senior Nuclear Planner
The Commonwealth of Massachusetts
Emergency Management Agency
400 Worcester Road
Framingham, MA 01702-5399

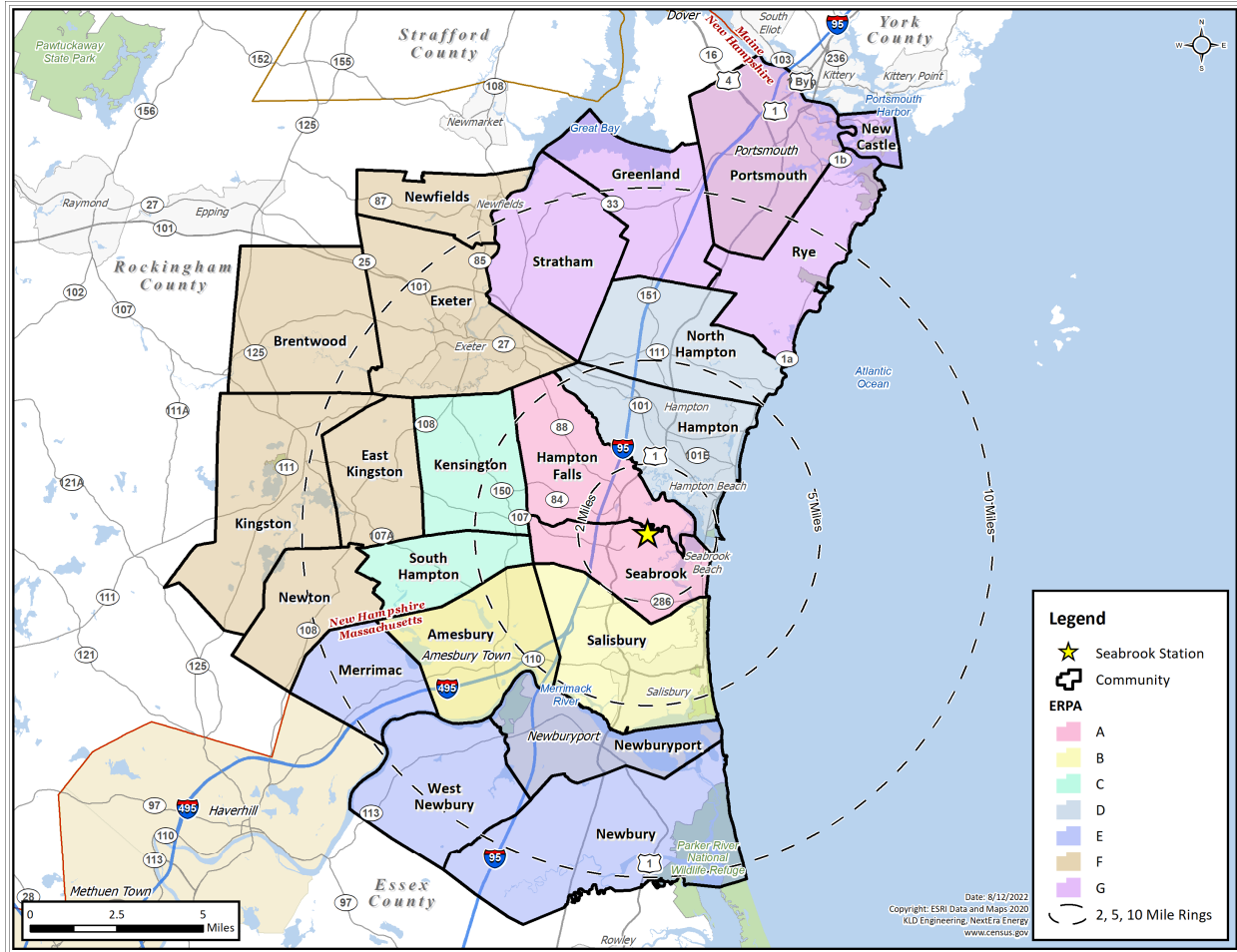
ENCLOSURE

**NEXTERA ENERGY SEABROOK, LLC
SEABROOK STATION, UNIT 1**

**DEVELOPMENT OF EVACUATION TIME ESTIMATES AND
COMPLETED TABLE B-1 EVACUATION TIME ESTIMATES
REVIEW CRITERIA CHECKLIST
*(497 pages follow)***

Seabrook Station

Development of Evacuation Time Estimates



Work performed for NextEra Energy, by:

KLD Engineering, P.C.
 1601 Veterans Memorial Highway, Suite 340
 Islandia, NY 11749
 E-mail: kweinisch@kldcompanies.com

Table of Contents

EXECUTIVE SUMMARY	ES-1
1 INTRODUCTION.....	1-1
1.1 Overview of the ETE Process.....	1-1
1.2 The Seabrook Station Location	1-3
1.3 Preliminary Activities	1-3
1.4 Comparison with Previous ETE Study	1-6
2 STUDY ESTIMATES AND ASSUMPTIONS.....	2-1
2.1 Data Estimates	2-1
2.2 Methodological Assumptions	2-2
2.3 Assumptions on Mobilization Times	2-3
2.4 Transit Dependent Assumptions.....	2-4
2.5 Traffic and Access Control Assumptions	2-5
2.6 Scenarios and Regions	2-6
3 DEMAND ESTIMATION.....	3-1
3.1 Permanent Residents.....	3-2
3.1.1 Boarding Schools.....	3-2
3.2 Shadow Population	3-3
3.3 Transient Population.....	3-3
3.3.1 Seasonal Transient Population.....	3-4
3.4 Employees.....	3-4
3.5 Special Facilities	3-5
3.5.1 Medical Facilities.....	3-5
3.5.2 Correctional Facilities.....	3-6
3.6 Transit Dependent Population.....	3-6
3.7 School Population Demand.....	3-8
3.7.1 Great Bay Community College	3-9
3.8 Special Event	3-9
3.9 Access and/or Functional Needs Population	3-10
3.10 External Traffic	3-10
3.11 Background Traffic	3-11
3.12 Summary of Demand	3-11
4 ESTIMATION OF HIGHWAY CAPACITY.....	4-1
4.1 Capacity Estimations on Approaches to Intersections	4-2
4.2 Capacity Estimation along Sections of Highway	4-4
4.3 Application to the Seabrook Station Study Area	4-6
4.3.1 Two-Lane Roads	4-6
4.3.2 Multilane Highway	4-7
4.3.3 Freeways	4-7
4.3.4 Intersections	4-8
4.4 Simulation and Capacity Estimation	4-8
4.5 Boundary Conditions.....	4-9
5 ESTIMATION OF TRIP GENERATION TIME.....	5-1
5.1 Background	5-1
5.2 Fundamental Considerations	5-2
5.3 Estimated Time Distributions of Activities Preceding Event 5.....	5-4

5.4	Calculation of Trip Generation Time Distribution	5-5
5.4.1	Statistical Outliers	5-5
5.4.2	Staged Evacuation Trip Generation	5-8
5.4.3	Evacuation of Waterways	5-9
6	EVACUATION Cases.....	6-1
7	GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE)	7-1
7.1	Voluntary Evacuation and Shadow Evacuation	7-1
7.2	Staged Evacuation.....	7-1
7.3	Patterns of Traffic Congestion during Evacuation	7-2
7.4	Evacuation Rates.....	7-4
7.5	Evacuation Time Estimate (ETE) Results	7-4
7.6	Staged Evacuation Results	7-6
7.7	Guidance on Using ETE Tables	7-7
8	TRANSIT-DEPENDENT AND SPECIAL FACILITY EVACUATION TIME ESTIMATES	8-1
8.1	ETEs for Schools, Transit Dependent People, and Medical Facilities.....	8-2
8.2	ETE for Access and/or Functional Needs Population.....	8-9
9	TRAFFIC MANAGEMENT STRATEGY	9-1
9.1	Assumptions.....	9-2
9.2	Additional Considerations.....	9-2
10	EVACUATION ROUTES and Reception centers.....	10-1
10.1	Evacuation Routes.....	10-1
10.2	Reception Centers and Host Schools	10-1

List of Appendices

A.	GLOSSARY OF TRAFFIC ENGINEERING TERMS	A-1
B.	DYNAMIC TRAFFIC ASSIGNMENT AND DISTRIBUTION MODEL	B-1
B.1	Overview of Integrated Distribution and Assignment Model.....	B-1
B.2	Interfacing the DYNEV Simulation Model with DTRAD.....	B-2
B.2.1	DTRAD Description	B-2
B.2.2	Network Equilibrium	B-4
C.	DYNEV TRAFFIC SIMULATION MODEL	C-1
C.1	Methodology.....	C-2
C.1.1	The Fundamental Diagram.....	C-2
C.1.2	The Simulation Model.....	C-2
C.1.3	Lane Assignment	C-6
C.2	Implementation	C-6
C.2.1	Computational Procedure.....	C-6
C.2.2	Interfacing with Dynamic Traffic Assignment (DTRAD)	C-7
D.	DETAILED DESCRIPTION OF STUDY PROCEDURE	D-1
E.	FACILITY DATA.....	E-1
F.	DEMOGRAPHIC SURVEY.....	F-1
F.1	Introduction	F-1
F.2	Survey Instrument and Sampling Plan	F-1
F.3	Survey Results	F-2
F.3.1	Household Demographic Results	F-2
F.3.2	Evacuation Response	F-3

F.3.3	Time Distribution Results	F-4
F.3.4	Emergency Communications	F-6
G.	TRAFFIC MANAGEMENT PLAN	G-1
G.1	Manual Traffic Control	G-1
G.2	Analysis of Key TCP/ACP Locations	G-1
H.	EVACUATION REGIONS	H-1
J.	REPRESENTATIVE INPUTS TO AND OUTPUTS FROM THE DYNEV II SYSTEM	J-1
K.	EVACUATION ROADWAY NETWORK	K-1
L.	ERPA BOUNDARIES	L-1
M.	EVACUATION SENSITIVITY STUDIES	M-1
M.1	Effect of Changes in Trip Generation Time	M-1
M.2	Effect of Changes in the Number of People in the Shadow Region Who Relocate	M-1
M.3	Effect of Changes in EPZ Resident Population	M-2
M.4	Effect of Changes in Average Household Size	M-3
M.5	Enhancements in Evacuation Time	M-3
N.	ETE CRITERIA CHECKLIST	N-1

Note: Appendix I intentionally skipped

List of Figures

Figure 1-1.	Seabrook Station Location	1-12
Figure 1-2.	Seabrook Station Link-Node Analysis Network	1-13
Figure 2-1.	Voluntary Evacuation Methodology	2-10
Figure 3-1.	Communities and ERPAs Comprising the Seabrook Station EPZ	3-29
Figure 3-2.	Permanent Resident Population by Sector	3-30
Figure 3-3.	Permanent Resident Vehicles by Sector	3-31
Figure 3-4.	Shadow Population by Sector	3-32
Figure 3-5.	Shadow Vehicles by Sector	3-33
Figure 3-6.	Transient Population by Sector	3-34
Figure 3-7.	Transient Vehicles by Sector	3-35
Figure 3-8.	Employee Population by Sector	3-36
Figure 3-9.	Employee Vehicles by Sector	3-37
Figure 4-1.	Fundamental Diagrams	4-10
Figure 5-1.	Events and Activities Preceding the Evacuation Trip	5-16
Figure 5-2.	Time Distributions for Evacuation Mobilization Activities	5-17
Figure 5-3.	Comparison of Data Distribution and Normal Distribution	5-18
Figure 5-4.	Comparison of Trip Generation Distributions	5-19
Figure 5-5.	Comparison of Staged and Un-staged Trip Generation Distributions in the 2 to 5 Mile Region	5-20
Figure 6-1.	Communities and ERPAs Comprising the Seabrook Station EPZ	6-9
Figure 7-1.	Voluntary Evacuation Methodology	7-16
Figure 7-2.	Seabrook Station Shadow Region	7-17
Figure 7-3.	Congestion Patterns at 1 Hour after the Advisory to Evacuate	7-18
Figure 7-4.	Congestion Patterns at 2 Hours after the Advisory to Evacuate	7-19
Figure 7-5.	Congestion Patterns at 3 Hours after the Advisory to Evacuate	7-20
Figure 7-6.	Congestion Patterns at 4 Hours after the Advisory to Evacuate	7-21

Figure 7-7. Congestion Patterns at 5 Hours after the Advisory to Evacuate	7-22
Figure 7-8. Congestion Patterns at 5 Hours and 30 minutes after the Advisory to Evacuate	7-23
Figure 7-9. Evacuation Time Estimates - Scenario 1 for Region R03	7-24
Figure 7-10. Evacuation Time Estimates - Scenario 2 for Region R03	7-24
Figure 7-11. Evacuation Time Estimates - Scenario 3 for Region R03	7-25
Figure 7-12. Evacuation Time Estimates - Scenario 4 for Region R03	7-25
Figure 7-13. Evacuation Time Estimates - Scenario 5 for Region R03	7-26
Figure 7-14. Evacuation Time Estimates - Scenario 6 for Region R03	7-26
Figure 7-15. Evacuation Time Estimates - Scenario 7 for Region R03	7-27
Figure 7-16. Evacuation Time Estimates - Scenario 8 for Region R03	7-27
Figure 7-17. Evacuation Time Estimates - Scenario 9 for Region R03	7-28
Figure 7-18. Evacuation Time Estimates - Scenario 10 for Region R03	7-28
Figure 7-19. Evacuation Time Estimates - Scenario 11 for Region R03	7-29
Figure 7-20. Evacuation Time Estimates - Scenario 12 for Region R03	7-29
Figure 7-21. Evacuation Time Estimates - Scenario 13 for Region R03	7-30
Figure 7-22. Evacuation Time Estimates - Scenario 14 for Region R03	7-30
Figure 8-1. Chronology of Transit Evacuation Operations	8-52
Figure 10-1. Evacuation Routes	10-16
Figure 10-2. Massachusetts Transit-Dependent Bus Routes	10-17
Figure 10-3. New Hampshire Transit-Dependent Bus Routes (Hampton, Hampton Falls, and Seabrook).....	10-18
Figure 10-4. New Hampshire Transit-Dependent Bus Routes (East Kingston, Kensington, Kingston, Newton, and South Hampton)	10-19
Figure 10-5. New Hampshire Transit-Dependent Bus Routes (Brentwood, Exeter, Newfields, and Stratham).....	10-20
Figure 10-6. New Hampshire Transit-Dependent Bus Routes (Greenland, New Castle, North Hampton, Portsmouth, and Rye).....	10-21
Figure 10-7. Reception Centers and Host Schools	10-22
Figure B-1. Flow Diagram of Simulation-DTRAD Interface.....	B-5
Figure C-1. Representative Analysis Network.....	C-12
Figure C-2. Fundamental Diagrams.....	C-13
Figure C-3. A UNIT Problem Configuration with $t_1 > 0$	C-13
Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3)	C-14
Figure D-1. Flow Diagram of Activities.....	D-5
Figure E-1. Schools within the NH Portion of the EPZ	E-19
Figure E-2. Schools within the MA Portion of the EPZ.....	E-20
Figure E-3. Preschools/Child Care Centers within the NH Portion of the EPZ.....	E-21
Figure E-4. Preschools/Child Care Centers within the NH Portion (Portsmouth) of the EPZ	E-22
Figure E-5. Preschools/Child Care Centers within the MA Portion of the EPZ	E-23
Figure E-6. Day Camps within the EPZ	E-24
Figure E-7. Medical Facilities within the NH Portion of the EPZ	E-25
Figure E-8. Medical Facilities within the MA Portion of the EPZ	E-26
Figure E-9. Major Employers within the EPZ.....	E-27
Figure E-10. Beaches within the EPZ.....	E-28
Figure E-11. Campgrounds within the EPZ.....	E-29
Figure E-12. Golf Courses within the EPZ.....	E-30
Figure E-13. Marinas within the EPZ.....	E-31

Figure E-14. Historical Sites and Other Recreational Facilities within the EPZ.....	E-32
Figure E-15. Lodging Facilities within the EPZ.....	E-33
Figure E-16. Correctional Facilities within the EPZ	E-34
Figure F-1. Household Size in the EPZ.....	F-8
Figure F-2. Household Vehicle Availability.....	F-8
Figure F-3. Vehicle Availability - 1 to 4 Person Households.....	F-9
Figure F-4. Vehicle Availability - 5 to 7 Person Households.....	F-9
Figure F-5. Household Ridesharing Preference	F-10
Figure F-6. Commuters per Households in the EPZ	F-10
Figure F-7. Mode of Travel in the EPZ.....	F-11
Figure F-8. Impact to Commuters due to the COVID-19 Pandemic.....	F-11
Figure F-9. Households with Functional or Transportation Needs.....	F-12
Figure F-10. Number of Vehicles Used for Evacuation	F-12
Figure F-11. Percent of Households that Await Returning Commuter Before Leaving.....	F-13
Figure F-12. Households Evacuating with Pets/Animals.....	F-13
Figure F-13. Shelter in Place Characteristics.....	F-14
Figure F-14. Shelter Then Evacuate Characteristics.....	F-14
Figure F-15. Study Area Evacuation Destinations	F-15
Figure F-16. Time Required to Prepare to Leave Work/College.....	F-15
Figure F-17. Time to Commute Home from Work/College.....	F-16
Figure F-18. Time to Prepare Home for Evacuation	F-16
Figure F-19. Time to Remove 6-8” of Snow from Driveway (2012 Results)	F-17
Figure F-20. Cell Phone Signal Reliability	F-17
Figure F-21. Households Compliance to Given Instruction (by Emergency Management Officials)	F-18
Figure F-22. Emergency Communication Alert.....	F-18
Figure G-1. Traffic and Access Control Points for the Seabrook Station EPZ.....	G-5
Figure H-1. Region R01.....	H-4
Figure H-2. Region R02.....	H-5
Figure H-3. Region R03.....	H-6
Figure H-4. Region R04.....	H-7
Figure H-5. Region R05.....	H-8
Figure H-6. Region R06.....	H-9
Figure H-7. Region R07.....	H-10
Figure H-8. Region R08.....	H-11
Figure H-9. Region R09.....	H-12
Figure H-10. Region R10.....	H-13
Figure H-11. Region R11.....	H-14
Figure H-12. Region R12.....	H-15
Figure H-13. Region R13.....	H-16
Figure H-14. Region R14.....	H-17
Figure H-15. Region R15.....	H-18
Figure H-16. Region R16.....	H-19
Figure H-17. Region R17.....	H-20
Figure H-18. Region R18.....	H-21
Figure H-19. Region R19.....	H-22
Figure J-1. Network Sources/Origins.....	J-6
Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1)	J-7

Figure J-3. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2)	J-7
Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3).....	J-8
Figure J-5. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4)	J-8
Figure J-6. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5)	J-9
Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6)	J-9
Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Rain/Light Snow (Scenario 7)	J-10
Figure J-9. ETE and Trip Generation: Winter, Midweek, Midday, Heavy Snow (Scenario 8).....	J-10
Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 9)	J-11
Figure J-11. ETE and Trip Generation: Winter, Weekend, Midday, Rain/Light Snow (Scenario 10).....	J-11
Figure J-12. ETE and Trip Generation: Winter, Weekend, Midday, Heavy Snow (Scenario 11)	J-12
Figure J-13. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 12)	J-12
Figure J-14. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather, Special Event (Scenario 13)	J-13
Figure J-15. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather, Roadway Impact (Scenario 14)	J-13
Figure K-1. Seabrook Station Link-Node Analysis Network	K-2
Figure K-2. Link-Node Analysis Network – Grid 1	K-3
Figure K-3. Link-Node Analysis Network – Grid 2	K-4
Figure K-4. Link-Node Analysis Network – Grid 3	K-5
Figure K-5. Link-Node Analysis Network – Grid 4	K-6
Figure K-6. Link-Node Analysis Network – Grid 5	K-7
Figure K-7. Link-Node Analysis Network – Grid 6	K-8
Figure K-8. Link-Node Analysis Network – Grid 7	K-9
Figure K-9. Link-Node Analysis Network – Grid 8	K-10
Figure K-10. Link-Node Analysis Network – Grid 9	K-11
Figure K-11. Link-Node Analysis Network – Grid 10	K-12
Figure K-12. Link-Node Analysis Network – Grid 11	K-13
Figure K-13. Link-Node Analysis Network – Grid 12	K-14
Figure K-14. Link-Node Analysis Network – Grid 13	K-15
Figure K-15. Link-Node Analysis Network – Grid 14	K-16
Figure K-16. Link-Node Analysis Network – Grid 15	K-17
Figure K-17. Link-Node Analysis Network – Grid 16	K-18
Figure K-18. Link-Node Analysis Network – Grid 17	K-19
Figure K-19. Link-Node Analysis Network – Grid 18	K-20
Figure K-20. Link-Node Analysis Network – Grid 19	K-21
Figure K-21. Link-Node Analysis Network – Grid 20	K-22
Figure K-22. Link-Node Analysis Network – Grid 21	K-23
Figure K-23. Link-Node Analysis Network – Grid 22	K-24
Figure K-24. Link-Node Analysis Network – Grid 23	K-25
Figure K-25. Link-Node Analysis Network – Grid 24	K-26
Figure K-26. Link-Node Analysis Network – Grid 25	K-27
Figure K-27. Link-Node Analysis Network – Grid 26	K-28
Figure K-28. Link-Node Analysis Network – Grid 27	K-29
Figure K-29. Link-Node Analysis Network – Grid 28	K-30
Figure K-30. Link-Node Analysis Network – Grid 29	K-31

Figure K-31. Link-Node Analysis Network – Grid 30	K-32
Figure K-32. Link-Node Analysis Network – Grid 31	K-33
Figure K-33. Link-Node Analysis Network – Grid 32	K-34
Figure K-34. Link-Node Analysis Network – Grid 33	K-35
Figure K-35. Link-Node Analysis Network – Grid 34	K-36
Figure K-36. Link-Node Analysis Network – Grid 35	K-37
Figure K-37. Link-Node Analysis Network – Grid 36	K-38
Figure K-38. Link-Node Analysis Network – Grid 37	K-39
Figure K-39. Link-Node Analysis Network – Grid 38	K-40
Figure K-40. Link-Node Analysis Network – Grid 39	K-41
Figure K-41. Link-Node Analysis Network – Grid 40	K-42
Figure K-42. Link-Node Analysis Network – Grid 41	K-43
Figure K-43. Link-Node Analysis Network – Grid 42	K-44
Figure K-44. Link-Node Analysis Network – Grid 43	K-45
Figure K-45. Link-Node Analysis Network – Grid 44	K-46
Figure K-46. Link-Node Analysis Network – Grid 45	K-47
Figure K-47. Link-Node Analysis Network – Grid 46	K-48
Figure K-48. Link-Node Analysis Network – Grid 47	K-49
Figure K-49. Link-Node Analysis Network – Grid 48	K-50
Figure K-50. Link-Node Analysis Network – Grid 49	K-51
Figure K-51. Link-Node Analysis Network – Grid 50	K-52
Figure K-52. Link-Node Analysis Network – Grid 51	K-53
Figure K-53. Link-Node Analysis Network – Grid 52	K-54
Figure K-54. Link-Node Analysis Network – Grid 53	K-55
Figure K-55. Link-Node Analysis Network – Grid 54	K-56
Figure K-56. Link-Node Analysis Network – Grid 55	K-57
Figure K-57. Link-Node Analysis Network – Grid 56	K-58
Figure K-58. Link-Node Analysis Network – Grid 57	K-59
Figure K-59. Link-Node Analysis Network – Grid 58	K-60
Figure K-60. Link-Node Analysis Network – Grid 59	K-61
Figure K-61. Link-Node Analysis Network – Grid 60	K-62
Figure K-62. Link-Node Analysis Network – Grid 61	K-63
Figure K-63. Link-Node Analysis Network – Grid 62	K-64
Figure K-64. Link-Node Analysis Network – Grid 63	K-65

List of Tables

Table 1-1. Stakeholder Interaction	1-7
Table 1-2. Highway Characteristics	1-7
Table 1-3. ETE Study Comparisons	1-8
Table 2-1. ERPA Classification by Community	2-8
Table 2-2. Evacuation Scenario Definitions	2-9
Table 2-3. Model Adjustment for Adverse Weather	2-9
Table 3-1. EPZ Permanent Resident Population	3-12
Table 3-2. Permanent Resident Population and Vehicles by Community	3-13
Table 3-3. Shadow Population and Vehicles by Sector	3-14
Table 3-4. Summary of Transients and Transient Vehicles	3-15

Table 3-5. Summary of Employees and Employee Vehicles Commuting into the EPZ.....	3-16
Table 3-6. Medical Facility Transit Demand.....	3-17
Table 3-7. Transit-Dependent Population Estimates.....	3-19
Table 3-8. School Population Demand Estimates.....	3-20
Table 3-9. Preschool/Childcare Center Population Demand Estimates.....	3-22
Table 3-10. Day Camp Population Demand Estimates.....	3-25
Table 3-11. Access and/or Functional Needs Demand Summary.....	3-26
Table 3-12. Seabrook EPZ External Traffic.....	3-26
Table 3-13. Summary of Population Demand.....	3-27
Table 3-14. Summary of Vehicle Demand.....	3-28
Table 5-1. Event Sequence for Evacuation Activities.....	5-11
Table 5-2. Time Distribution for Notifying the Public.....	5-11
Table 5-3. Time Distribution for Employees to Prepare to Leave Work.....	5-11
Table 5-4. Time Distribution for Commuters to Travel Home.....	5-12
Table 5-5. Time Distribution for Population to Prepare to Evacuate.....	5-12
Table 5-6. Time Distribution for Population to Clear 6” – 8” of Snow.....	5-13
Table 5-7. Mapping Distributions to Events.....	5-13
Table 5-8. Description of the Distributions.....	5-13
Table 5-9. Trip Generation Histograms for the EPZ Population for Un-staged Evacuation.....	5-14
Table 5-10. Trip Generation Histograms for the EPZ Population for Staged Evacuation.....	5-15
Table 6-1. ERPA Designations.....	6-4
Table 6-2. Description of Evacuation Regions.....	6-5
Table 6-3. Evacuation Scenario Definitions.....	6-6
Table 6-4. Percent of Population Groups Evacuating for Various Scenarios.....	6-7
Table 6-5. Vehicle Estimates by Scenario.....	6-8
Table 7-1. Time to Clear the Indicated Area of <u>90</u> Percent of the Affected Population.....	7-10
Table 7-2. Time to Clear the Indicated Area of <u>100</u> Percent of the Affected Population.....	7-11
Table 7-3. Time to Clear <u>90 Percent</u> of the <u>2-Mile Region</u> within the Indicated Region.....	7-12
Table 7-4. Time to Clear <u>100 Percent</u> of the <u>2-Mile Region</u> within the Indicated Region.....	7-13
Table 7-5. ERPA Designations.....	7-14
Table 7-6. Description of Evacuation Regions.....	7-15
Table 8-1. Summary of Transportation Resources.....	8-11
Table 8-2. School, Preschool, Childcare Center, and Day Camp Evacuation Time Estimates – Good Weather.....	8-12
Table 8-3. School, Preschool, Childcare Center, and Day Camp Evacuation Time Estimates – Rain/Light Snow.....	8-19
Table 8-4. School, Preschool, Childcare Center, and Day Camp Evacuation Time Estimates – Heavy Snow.....	8-26
Table 8-5. Transit-Dependent Evacuation Time Estimates – Good Weather.....	8-33
Table 8-6. Transit-Dependent Evacuation Time Estimates – Rain/Light Snow.....	8-35
Table 8-7. Transit Dependent Evacuation Time Estimates – Heavy Snow.....	8-37
Table 8-8. Medical Facility Evacuation Time Estimates – Good Weather.....	8-39
Table 8-9. Medical Facility Evacuation Time Estimates – Rain/Light Snow.....	8-43
Table 8-10. Medical Facility Evacuation Time Estimates – Heavy Snow.....	8-47
Table 8-11. Evacuation Time Estimates for Access and/or Functional Needs Population.....	8-51
Table 10-1. Summary of Transit-Dependent Bus Routes.....	10-2
Table 10-2. Bus Route Descriptions.....	10-3

Table 10-3. Host Schools/Reception Centers for Schools, Preschools/Childcare Centers, and Day Camps	10-12
Table A-1. Glossary of Traffic Engineering Terms	A-1
Table C-1. Selected Measures of Effectiveness Output by DYNEV II	C-8
Table C-2. Input Requirements for the DYNEV II Model	C-9
Table C-3. Glossary.....	C-10
Table E-1. Schools within the EPZ	E-2
Table E-2. Preschools/Child Care Centers within the EPZ.....	E-5
Table E-3. Day Camps within the EPZ	E-8
Table E-4. Medical Facilities within the EPZ.....	E-9
Table E-5. Major Employers within the EPZ.....	E-11
Table E-6. Beaches within the EPZ	E-12
Table E-7. Campgrounds within the EPZ.....	E-13
Table E-8. Golf Courses within the EPZ.....	E-14
Table E-9. Marinas within the EPZ	E-15
Table E-10. Historical Sites and Other Recreational Facilities within the EPZ	E-16
Table E-11. Lodging Facilities within the EPZ.....	E-17
Table E-12. Correctional Facilities within the EPZ.....	E-18
Table F-1. Seabrook Station Demographic Survey Sampling Plan and Results.....	F-7
Table G-1. List of Key Manual Traffic Control Locations	G-3
Table G-2. ETE with No MTC	G-4
Table H-1. ERPA Designations by Community	H-2
Table H-2. Percent of ERPA Population Evacuating for Each Region.....	H-3
Table J-1. Sample Simulation Model Input	J-2
Table J-2. Selected Model Outputs for the Evacuation of the Entire EPZ (Region R03)	J-3
Table J-3. Average Speed (mph) and Travel Time (min) for Major Evacuation Routes (Region R03, Scenario 1).....	J-4
Table J-4. Simulation Model Outputs at Network Exit Links for Region R03, Scenario 1	J-5
Table K-1. Summary of Nodes by the Type of Control.....	K-1
Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study	M-4
Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study	M-4
Table M-3. ETE Variation with Population Change	M-5
Table M-4. ETE Results for the Change in Average Household Size	M-5
Table N-1. ETE Review Criteria Checklist	N-1

EXECUTIVE SUMMARY

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Seabrook Station, located in Rockingham County, New Hampshire. This ETE study provides NextEra Energy (NextEra) and state governments with site-specific information needed for Protective Action Decision-making.

In the performance of this effort, guidance is provided by documents published by Federal Governmental agencies. Most important of these are:

- Title 10, Code of Federal Regulations, Appendix E to Part 50 (10CFR50), Emergency Planning and Preparedness for Production and Utilization Facilities, NRC, 2011.
- Revision 1 of the Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, February 2021.
- FEMA, “Radiological Emergency Preparedness Program Manual” (FEMA P-1028), December 2019.

Overview of Project Activities

This project began in January 2021 and extended over 18 months. The major activities performed are briefly described in chronological sequence:

- Attended “kick-off” meetings with NextEra personnel and emergency management personnel representing state governments.
- Accessed the 2020 U.S. Census Bureau data files.
- Employment data was obtained from NextEra, supplemented by Census data.
- Studied Geographic Information Systems (GIS) maps of the area in the vicinity of the plant, then conducted a detailed field survey of the highway network to observe any roadway changes relative to the previous ETE study done in 2014.
- Calibrated the analysis network representing the highway system topology and capacities within the entire Emergency Planning Zone (EPZ), plus a Shadow Region covering the region between the EPZ boundary and approximately 15 miles radially from the plant.
- Conducted an online demographic survey of residents within the study area, to gather focused data needed for this ETE study that were not contained within the census database.
- Special facility data was requested from the states at the kickoff meeting. If updated information was not provided and data could not be obtained from contacting the facilities, the data gathered in the 2014 ETE study was utilized, supplemented by internet searches and aerial imagery.

- The traffic demand and trip-generation rates of evacuating vehicles were estimated from the gathered data. The trip generation rates reflect the estimated mobilization time (i.e., the time required by evacuees to prepare for the evacuation trip) computed using the results of the demographic survey.
- Following federal guidelines, the EPZ is subdivided into 23 Communities. These Communities are grouped into 7 Emergency Response Planning Areas (ERPA) based on the location relative to the plant. These ERPA are then grouped within circular areas or “keyhole” configurations (circles plus radial sectors) that define a total of 19 Evacuation Regions.
- The time-varying external circumstances are represented as Evacuation Scenarios, each described in terms of the following factors: (1) Season (Summer, Winter); (2) Day of Week (Midweek, Weekend); (3) Time of Day (Midday, Evening); and (4) Weather (Good, Rain/Light Snow, Heavy Snow). One special event scenario – 4th of July firework show in Hampton Beach – was considered. One roadway impact scenario was considered wherein one lane was closed westbound on New Hampshire State Highway 101 from the interchange with I-95 to the interchange with SH 107 (Exit 5).
- Staged evacuation was considered for those regions wherein the 2-Mile Region and sectors downwind to 5 miles were evacuated.
- As per NUREG/CR-7002 Rev. 1, the Planning Basis for the calculation of ETE is:
 - A rapidly escalating accident at the plant that quickly assumes the status of General Emergency such that the Advisory to Evacuate (ATE) is virtually coincident with the siren alert, and no early protective actions have been implemented.
 - While an unlikely accident scenario, this planning basis will yield ETE, measured as the elapsed time from the ATE until the stated percentage of the population exits the impacted Region, that represent “upper bound” estimates. This conservative Planning Basis is applicable for all initiating events.
- If the emergency occurs while schools are in session, the ETE study assumes that the children will be evacuated by bus directly to reception centers or school receiving locations located outside the EPZ. Parents, relatives, and neighbors are advised to not pick up their children at school prior to the arrival of the buses dispatched for that purpose. The ETE for schoolchildren are calculated separately.
- Attended “final” meeting with NextEra personnel and state representatives to present results from the study.

Computation of ETE

A total of 266 ETE were computed for the evacuation of the general public. Each ETE quantifies the aggregate evacuation time estimated for the population within one of the 19 Evacuation Regions to evacuate from that Region, under the circumstances defined for one of the 14

Evacuation Scenarios (19 x 14 = 266). Separate ETE are calculated for transit-dependent evacuees, including schoolchildren for applicable scenarios.

Except for Region R03, which is the evacuation of the entire EPZ, only a portion of the people within the EPZ would be advised to evacuate. That is, the ATE applies only to those people occupying the specified impacted region. It is assumed that 100% of the people within the impacted region will evacuate in response to this Advisory. The people occupying the remainder of the EPZ outside the impacted region may be advised to take shelter.

The computation of ETE assumes that 20% of the population within the EPZ but outside the impacted region, will elect to “voluntarily” evacuate. In addition, 20% of the population in the Shadow Region will also elect to evacuate. These voluntary evacuees could impede those who are evacuating from within the impacted region. The impedance that could be caused by voluntary evacuees is considered in the computation of ETE for the impacted region.

Staged evacuation is considered wherein those people within the 2-Mile Region evacuate immediately, while those beyond 2 miles, but within the EPZ, shelter-in-place. Once 90% of the 2-Mile Region is evacuated, those people beyond 2 miles begin to evacuate. As per federal guidance, 20% of people beyond 2 miles will evacuate (non-compliance) even though they are advised to shelter-in-place during a staged evacuation.

The computational procedure is outlined as follows:

- A link-node representation of the highway network is coded. Each link represents a unidirectional length of highway; each node usually represents an intersection or merge point. The capacity of each link is estimated based on the field survey observations and on established traffic engineering procedures.
- The evacuation trips are generated at locations called “zonal centroids” located within the EPZ and Shadow Region. The trip generation rates vary over time reflecting the mobilization process, and from one location (centroid) to another depending on population density and on whether a centroid is within, or outside, the impacted area.
- The evacuation model computes the routing patterns for evacuating vehicles that are compliant with federal guidelines (outbound relative to the location of the plant), then simulates the traffic flow movements over space and time. This simulation process estimates the rate that traffic flow exits the impacted region.

The ETE statistics provide the elapsed times for 90% and 100%, respectively, of the population within the impacted region, to evacuate from within the impacted region. These statistics are presented in tabular and graphical formats. The 90th percentile ETE have been identified as the values that should be considered when making protective action decisions because the 100th percentile ETE are prolonged by those relatively few people who take longer to mobilize. This is referred to as the “evacuation tail” in Section 4.0 of NUREG/CR-7002, Rev. 1. The 100th percentile ETE is when the last vehicle to evacuate crosses the boundary of the area being evacuated.

Traffic Management

This study references the existing comprehensive traffic management plans provided by the Massachusetts Emergency Management Agency and New Hampshire Homeland Security and Emergency Management. As discussed in Section 9 and Appendix G, no changes to these existing plans are identified as a result of this study.

Selected Results

A compilation of selected information is presented on the following pages in the form of figures and tables extracted from the body of the report; these are described below.

- Table 3-1 presents the estimates of permanent resident population in each Community based on the 2020 Census data.
- Table 6-1 defines each ERPA in terms of their respective groups of Communities.
- Table 6-2 defines each of the 19 Evacuation Regions in terms of their respective groups of ERPA.
- Table 6-3 lists the Evacuation Scenarios considered in this study.
- Tables 7-1 and 7-2 are compilations of ETE. These data are the times needed to clear the indicated regions of 90% and 100% of the population occupying these regions, respectively. These computed ETE include consideration of mobilization time and of estimated voluntary evacuations from other regions within the EPZ and from the Shadow Region.
- Tables 7-3 and 7-4 present ETE for the 2-Mile Region when evacuating additional Communities downwind to 5 miles for un-staged and staged evacuations for the 90th and 100th percentiles, respectively.
- Table 8-2 presents ETE for the children at schools, preschools/childcare centers, and day camps in good weather.
- Table 8-5 presents ETE for the transit-dependent population in good weather.
- Table 8-8 presents ETE for medical facilities in good weather.
- Figure 6-1 displays a map of the Seabrook Station EPZ showing the layout of the 23 Communities and 7 ERPA that comprise, in aggregate, the EPZ.
- Figure H-8 presents an example of an Evacuation Region (Region R08) to be evacuated under the circumstances defined in Table 6-2. Maps of all regions are provided in Appendix H.

Conclusions

- General population ETE were computed for 266 unique cases – a combination of 19 unique Evacuation Regions and 14 unique Evacuation Scenarios. Table 7-1 and Table 7-2 document these ETE for the 90th and 100th percentiles. These ETE range from 2:05 (hr:min) to 5:15 at the 90th percentile and 5:00 to 8:05 at the 100th percentile.
- Inspection of Table 7-1 and Table 7-2 indicates that the ETE for the 100th percentile are significantly longer than those for the 90th percentile. This is the result of the significant traffic congestion within the EPZ. When the system becomes congested, traffic exits the EPZ at rates below capacity until some evacuation routes have cleared. As more routes

clear, the aggregate rate of egress slows since many vehicles have already left the EPZ. Towards the end of the process, relatively few evacuees (those with the longest mobilization times) travel freely out of the EPZ. See Figures 7-9 through 7-22.

- Inspection of Table 7-3 and Table 7-4 indicates that a staged evacuation provides no benefit to evacuees from within the 2-Mile Region and adversely impacts evacuees located beyond 2 miles from the plant (compare Regions R14 through R19 and Regions R02 and R04 through R08, respectively, in Tables 7-1 and 7-2). See Section 7.6 for additional discussion.
- Comparison of Scenarios 5 and 13 in Table 7-1 indicates that the Special Event – 4th of July fireworks show at Hampton Beach – has a significant impact on the ETE at the 90th or 100th percentiles. See Section 7.5 for additional discussion.
- Comparison of Scenarios 1 and 14 in Table 7-1 indicates that the roadway closure – one lane westbound on New Hampshire State Highway 101 from the interchange with I-95 to the interchange with SH 107 (Exit 5) – significantly changes the ETE for some regions. Regions that contain ERPA F and G (Brentwood, Exeter, Newfields, and Stratham) are especially impacted. See Section 7.5.
- Most of the congestion in the EPZ is in Portsmouth and Exeter, as well as along SR-101 westbound. All roads in the EPZ (and all congestion) clear(s) at 6 hours and 5 minutes after the ATE. See Section 7.3 and Figures 7-3 through 7-8.
- Separate ETE were computed for schools, preschools, childcare centers, day camps, medical facilities, transit-dependent persons, and access and/or functional needs persons. The average single-wave ETE for some of these population groups exceed the 90th percentile general population ETE and could impact Protective Action Decision making. See Section 8.
- Table 8-1 indicates that there are insufficient wheelchair-accessible vehicles and ambulances to evacuate medical facilities and access and/or functional need persons in a single wave. See Section 8.1 and 8.2, and Table 8-1.
- Compressing the mobilization time of evacuees by one hour reduces the general population ETE at the 90th percentile by 5 minutes. An increase in mobilization time by one hour increases the ETE by 5 minutes at the 90th percentile. Neither of these are significant changes. See Table M-1.
- When the shadow percent is decreased to 0%, the 90th and 100th percentile ETE decrease by 5 minutes and 30 minutes, respectively. When the shadow percent is increased to 100%, the 90th and 100th percentile ETE increases by 15 minutes and 4 hours, respectively. The shadow region is heavily populated outside of the major population centers within the EPZ – Newburyport, Portsmouth, Newfields, and Kingston. Therefore, the ETE is very sensitive to any addition in the number of shadow evacuees. See Table M-2.
- An increase in permanent resident population (EPZ plus Shadow Region) of 17% or greater results in an increase in the longest 90th percentile ETE of 30 minutes, which meets the federal criterion for performing a fully updated ETE study between decennial censuses. See Section M.3.

- A decrease in the average household size from 2.75 people per household to 2.34 people per household will result in 18% more evacuating vehicles and impacts ETE with an increase of at most 25 minutes at the 90th percentile and an increase of at most 45 minutes at the 100th percentile ETE. See Section M.4.

Table 3-1. EPZ Permanent Resident Population

Community	2010 Population	2020 Population
Seabrook	8,569	8,401
Hampton Falls	2,238	2,403
Salisbury	8,372	9,237
Amesbury	16,282	17,366
South Hampton	827	896
Kensington	2,129	2,095
North Hampton	4,304	4,538
Hampton	15,445	16,214
Newbury	6,664	6,716
Newburyport	17,417	18,289
Merrimac	6,361	6,719
West Newbury	4,235	4,500
East Kingston	2,326	2,439
Exeter	14,313	16,055
Kingston	6,117	6,198
Newfields	1,682	1,769
Brentwood	4,490	4,490
Newton	4,572	4,818
New Castle	968	1,000
Greenland	3,554	4,067
Rye	5,320	5,545
Stratham	7,276	7,669
Portsmouth	20,746	21,956
EPZ TOTAL:	164,207	173,380
EPZ Population Growth (2010-2020):		5.59%

Table 6-1. ERPA Designations

Community	ERPA
NEW HAMPSHIRE	
Seabrook	A
Hampton Falls	
Kensington	C
South Hampton	
Hampton	D
North Hampton	
Brentwood	F
East Kingston	
Exeter	
Newfields	
Newton	
Kingston	G
Greenland	
Stratham	
Rye	
New Castle	
Portsmouth	
MASSACHUSETTS	
Amesbury	B
Salisbury	
Merrimac	E
Newburyport	
Newbury	
West Newbury	

Table 6-2. Description of Evacuation Regions

Radial Regions								
Region	Description	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R01	2-Mile Region	X						
R02	5-Mile Region	X	X	X			X	
R03	Full EPZ	X	X	X	X	X	X	X
Evacuate 2-Mile Region and Downwind to 5 Miles								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R04	NW, NNW, N, NNE	X					X	
R05	NE, ENE, E	X	X				X	
R06	ESE	X	X					
R07	SE, SSE	X	X	X				
R08	S, SSW, SW, WSW, W	X		X				
N/A	WNW	Refer to Region R01						
Evacuate 5-Mile Region and Downwind to the EPZ Boundary								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R09	NW, NNW, N, NNE	X	X	X			X	X
R10	NE, ENE, E	X	X	X	X		X	X
R11	ESE	X	X	X	X		X	
R12	SE, SSE, S	X	X	X	X	X	X	
R13	SSW, SW, WSW	X	X	X		X	X	
N/A	W, WNW	Refer to Region R02						
Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5 Miles								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R14	5-Mile Region	X	X	X			X	
R15	NW, NNW, N, NNE	X					X	
R16	NE, ENE, E	X	X				X	
R17	ESE	X	X					
R18	SE, SSE	X	X	X				
R19	S, SSW, SW, WSW, W	X		X				
N/A	WNW	Refer to Region R01						
ERPA(s) Evacuate		ERPAs) Shelter-in-Place			ERPA(s) Shelter-in-Place until 90% ETE for R01, then Evacuate			

Table 6-3. Evacuation Scenario Definitions

Scenario	Season ¹	Day of Week	Time of Day	Weather	Special
1	Summer	Midweek	Midday	Good	None
2	Summer	Midweek	Midday	Rain	None
3	Summer	Weekend	Midday	Good	None
4	Summer	Weekend	Midday	Rain	None
5	Summer	Midweek, Weekend	Evening	Good	None
6	Winter	Midweek	Midday	Good	None
7	Winter	Midweek	Midday	Rain/Light Snow	None
8	Winter	Midweek	Midday	Heavy Snow	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain/Light Snow	None
11	Winter	Weekend	Midday	Heavy Snow	None
12	Winter	Midweek, Weekend	Evening	Good	None
13	Summer	Midweek, Weekend	Evening	Good	July 4th Fireworks Show at Hampton Beach
14	Summer	Midweek	Midday	Good	Lane Closure on New Hampshire State Highway 101 Westbound

¹ Winter assumes that school is in session at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

Table 7-1. Time to Clear the Indicated Area of 90 Percent of the Affected Population

Scenario:	Summer		Summer		Summer		Winter		Winter		Winter		Summer		Summer		
	Midweek		Weekend		Midweek Weekend		Midweek		Weekend		Midweek Weekend		Midweek Weekend		Midweek Weekend		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)			
Region	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Good Weather	Special Event	Roadway Impact	Midweek	Summer
	Midday	Midday	Midday	Midday	Evening	Midday	Midday	Midday	Midday	Midday	Midday	Evening	Evening	Evening	Midday	Midweek	Midweek
	2:10	2:50	2:05	2:10	2:05	2:10	2:10	2:25	2:05	2:10	2:20	2:05	2:05	2:05	2:10	2:05	2:10
R01	2:45	2:35	2:35	2:35	2:40	2:35	3:05	2:20	2:25	2:50	2:30	2:30	4:45	2:45	2:45	2:45	2:45
R02	4:05	4:30	3:30	3:50	3:25	3:45	4:10	4:50	3:10	3:20	3:50	3:10	4:45	4:45	4:45	4:45	4:25
R03	2:40	2:45	2:30	2:35	2:45	2:30	2:35	3:00	2:20	2:25	2:45	2:30	2:45	2:45	2:40	2:40	2:40
R04	2:40	2:45	2:35	2:40	2:45	2:30	2:35	3:00	2:20	2:25	2:45	2:30	2:45	2:45	2:40	2:40	2:40
R05	2:10	2:10	2:05	2:10	2:05	2:10	2:10	2:25	2:05	2:10	2:20	2:05	2:05	2:05	2:10	2:10	2:10
R06	2:20	2:25	2:15	2:15	2:20	2:20	2:25	2:40	2:10	2:15	2:30	2:15	5:15	5:15	2:20	2:20	2:20
R07	2:20	2:25	2:15	2:15	2:20	2:20	2:20	2:35	2:10	2:15	2:30	2:15	5:15	5:15	2:20	2:20	2:20
R08	2:50	2:55	2:35	2:45	2:45	2:40	2:45	3:20	2:25	2:35	3:05	2:30	4:25	4:25	2:50	2:50	2:50
R09	3:20	3:35	3:00	3:15	3:00	3:10	3:20	3:45	2:40	2:55	3:20	2:50	4:40	4:40	3:40	3:40	3:40
R10	3:15	3:35	3:00	3:10	3:00	3:05	3:20	3:40	2:40	2:55	3:20	2:50	4:55	4:55	3:45	3:45	3:45
R11	4:05	4:35	3:30	3:50	3:30	3:50	4:15	4:45	3:10	3:25	4:00	3:10	5:05	5:05	4:30	4:30	4:30
R12	3:55	4:15	3:20	3:40	3:20	3:45	4:00	4:30	3:00	3:15	3:45	3:10	4:40	4:40	4:05	4:05	4:05
R13	3:05	3:10	3:00	3:05	3:10	3:05	3:05	3:35	2:55	3:00	3:30	3:05	5:00	5:00	3:05	3:05	3:05
R14	2:55	3:00	2:55	3:00	3:05	2:55	3:00	3:25	2:45	2:50	3:20	3:00	3:05	3:05	2:55	2:55	2:55
R15	2:55	3:00	2:55	3:00	3:05	2:55	3:00	3:25	2:45	2:50	3:20	3:00	3:05	3:05	2:55	2:55	2:55
R16	2:15	2:15	2:10	2:10	2:15	2:15	2:15	2:35	2:10	2:15	2:25	2:15	2:15	2:15	2:15	2:15	2:15
R17	2:40	2:40	2:35	2:35	2:55	2:45	2:45	3:10	2:40	2:40	3:05	3:00	5:15	5:15	2:40	2:40	2:40
R18	2:40	2:40	2:35	2:35	2:55	2:45	2:45	3:05	2:40	2:40	3:05	3:00	5:15	5:15	2:40	2:40	2:40
R19	2:40	2:40	2:35	2:35	2:55	2:45	2:45	3:05	2:40	2:40	3:05	3:00	5:15	5:15	2:40	2:40	2:40
Entire 2-Mile Region, 5-Mile Region, and EPZ																	
2-Mile Region and Keyhole to 5 Miles																	
5-Mile Region and Keyhole to EPZ Boundary																	
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																	

Table 7-2. Time to Clear the Indicated Area of 100 Percent of the Affected Population

Scenario:	Summer		Summer		Summer		Summer		Summer		Summer		Summer		Summer	
	Midweek		Weekend		Midweek		Weekend		Midweek		Weekend		Midweek		Weekend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		
Region	Midweek	Midday	Midday	Midday	Evening	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Special Event
Entire 2-Mile Region, 5-Mile Region, and EPZ																
R01	5:00	5:00	5:00	5:00	5:00	5:00	5:00	6:05	5:00	5:00	5:00	5:00	6:00	5:00	5:00	5:00
R02	5:05	5:20	5:05	5:05	5:05	5:05	5:20	6:10	5:05	5:05	5:05	5:05	6:05	5:05	7:15	5:05
R03	6:05	6:20	5:10	5:35	5:15	5:15	6:15	6:30	5:10	5:10	5:10	5:10	6:10	5:10	7:30	8:05
2-Mile Region and Keyhole to 5 Miles																
R04	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05
R05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05
R06	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05
R07	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05	6:05	5:05	7:00	5:05
R08	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05	6:05	5:05	7:00	5:05
5-Mile Region and Keyhole to EPZ Boundary																
R09	5:10	5:15	5:10	5:10	5:10	5:10	5:10	6:10	5:10	5:10	5:10	5:10	6:10	5:10	7:15	5:10
R10	5:20	6:20	5:10	5:15	5:10	5:10	5:30	6:25	5:10	5:10	5:10	5:10	6:10	5:10	7:30	7:00
R11	5:20	5:40	5:10	5:10	5:10	5:10	5:30	6:10	5:10	5:10	5:10	5:10	6:10	5:10	7:15	7:00
R12	5:30	6:10	5:10	5:25	5:10	5:15	6:00	6:30	5:10	5:10	5:10	5:10	6:10	5:10	7:30	7:50
R13	5:20	5:45	5:10	5:10	5:10	5:10	5:30	6:30	5:10	5:10	5:10	5:10	6:10	5:10	7:25	5:55
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																
R14	5:05	5:50	5:05	5:30	5:05	5:05	5:40	6:20	5:05	5:05	5:05	5:10	6:10	5:05	7:25	5:05
R15	5:05	5:40	5:05	5:30	5:05	5:05	5:45	6:20	5:05	5:05	5:05	5:10	6:10	5:05	5:05	5:05
R16	5:05	5:40	5:05	5:30	5:05	5:05	5:45	6:20	5:05	5:05	5:05	5:10	6:10	5:05	5:05	5:05
R17	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05
R18	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05	6:05	5:05	7:00	5:05
R19	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05	6:05	5:05	7:00	5:05

Table 7-3. Time to Clear 90 Percent of the 2-Mile Region within the Indicated Region

Scenario:	Summer		Summer		Summer		Winter		Winter		Winter		Summer		Summer	
	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		
Region	Midday	Midday	Midday	Midday	Evening	Midday	Midday	Midday	Midday	Midday	Midday	Evening	Midday	Midday	Midday	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Good Weather	Special Event	Good Weather	Roadway Impact
R01	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R02	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
Entire 2-Mile Region and 5-Mile Region																
Unstaged Evacuation - 2-Mile Region and Keyhole to 5-Miles																
R04	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R05	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R06	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R07	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R08	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
Staged Evacuation - 2-Mile Region and Keyhole to 5-Miles																
R14	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R15	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R16	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R17	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R18	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10
R19	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:05	2:10	2:20	2:05	2:10	2:10	2:10	2:10

Table 7-4. Time to Clear 100 Percent of the 2-Mile Region within the Indicated Region

Scenario:	Summer		Summer		Summer		Winter		Winter		Winter		Summer		Summer	
	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		
Region	Midday	Midday	Midday	Midday	Evening	Evening	Midday	Midday	Midday	Midday	Midday	Evening	Evening	Midday	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Good Weather	Special Event	Good Weather	Roadway Impact
R01	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R02	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
Entire 2-Mile Region and 5-Mile Region																
Unstaged Evacuation - 2-Mile Region and Keyhole to 5-Miles																
R04	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R05	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R06	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R07	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R08	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
Staged Evacuation - 2-Mile Region and Keyhole to 5-Miles																
R14	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R15	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R16	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R17	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R18	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05
R19	5:05	5:05	5:00	5:00	5:00	5:05	5:05	6:05	5:00	5:00	6:00	5:00	5:00	5:05	5:00	5:05

Table 8-2. School, Preschool, Childcare Center, and Day Camp Evacuation Time Estimates – Good Weather

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Massachusetts Schools									
Sparhawk School - Lower School	90	15	6.4	45.0	9	1:55	12.2	16	2:15
Amesbury Elementary School	90	15	6.5	42.4	9	1:55	12.2	16	2:15
Sparhawk School - Upper School	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Amesbury Innovation High School	90	15	5.5	45.0	7	1:55	12.2	16	2:15
Amesbury Middle School	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Amesbury High School	90	15	5.5	45.0	7	1:55	12.2	16	2:15
Cashman School	90	15	5.9	45.0	8	1:55	12.2	16	2:15
Dr. FN Sweetsir School	90	15	2.2	45.0	3	1:50	22.7	30	2:20
Helen R. Donaghue School	90	15	1.1	10.4	6	1:55	22.7	30	2:25
Newbury Elementary School	90	15	3.7	34.1	7	1:55	21.1	28	2:25
The Governor's Academy	90	15	0.6	45.0	1	1:50	24.4	33	2:25
Triton Regional Middle School and High School	90	15	2.6	29.0	5	1:50	21.0	28	2:20
Bresnahan Elementary School	90	15	6.4	30.0	13	2:00	34.1	45	2:45
Newburyport High School	90	15	7.2	30.4	14	2:00	34.1	45	2:45
Immaculate Conception School	90	15	8.2	34.0	14	2:00	34.1	45	2:45
E.G. Molin Upper Elementary School	90	15	6.0	37.1	10	1:55	34.1	45	2:40
Rupert A. Nock Middle School	90	15	6.0	37.1	10	1:55	34.1	45	2:40
River Valley Charter School	90	15	6.0	37.0	10	1:55	34.1	45	2:40
Salisbury Elementary School	90	15	9.9	34.4	17	2:05	15.1	20	2:25
Dr. John C. Page School	90	15	3.5	28.8	7	1:55	24.8	33	2:30
Pentucket Regional High School	90	15	0.1	9.2	1	1:50	24.8	33	2:25
Pentucket Regional Middle School	90	15	0.1	9.2	1	1:50	24.8	33	2:25
Massachusetts Preschools/Childcare Centers									
Amesbury Country Day School	90	15	6.8	41.5	10	1:55	12.2	16	2:15
Leaps & Bounds Preschool	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Little Hands Learning Center	90	15	5.7	45.0	8	1:55	12.2	16	2:15
James Place The Next Generation	90	15	5.6	45.0	7	1:55	12.2	16	2:15
Windmill Country Day School	90	15	5.3	45.0	7	1:55	12.2	16	2:15

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Little Sprouts Daycare	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Amesbury Montessori Preschool and Kindergarten	90	15	5.6	45.0	7	1:55	12.2	16	2:15
Leaps and Bounds Pre-School	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Small Wonders Preschool Program	90	15	2.2	45.0	3	1:50	22.7	30	2:20
Our Secret Garden Nursery and Preschool	90	15	6.7	13.4	30	2:15	21.1	28	2:45
Harmony Natural Learning Center	90	15	6.7	13.4	30	2:15	21.1	28	2:45
Community Action, Inc. Newburyport Head Start	90	15	6.6	27.1	15	2:00	34.1	45	2:45
School's Out @ Bresnahan School	90	15	6.4	30.0	13	2:00	34.1	45	2:45
YWCA - School's Out Program	90	15	8.3	34.0	15	2:00	34.1	45	2:45
Newburyport Montessori School	90	15	8.3	34.0	15	2:00	34.1	45	2:45
Newburyport KinderCare	90	15	10.3	42.7	14	2:00	25.9	35	2:35
Bright Horizons at Newburyport	90	15	5.7	36.9	9	1:55	34.1	45	2:40
Mrs Murray's Nursery School	90	15	6.3	32.1	12	2:00	34.1	45	2:45
KinderCare Learning Center	90	15	6.6	3.6	110	3:35	34.1	45	4:20
Knoll Edge Preschool	90	15	5.7	39.0	9	1:55	34.1	45	2:40
Milestones Childcare and Preschool	90	15	7.4	45.0	10	1:55	12.2	16	2:15
Children's Castle	90	15	3.5	28.8	7	1:55	24.8	33	2:30
Learning Tree Preschool	90	15	2.5	26.1	6	1:55	24.8	33	2:30
Koinonia Preschool Day Care	90	15	1.5	21.9	4	1:50	24.8	33	2:25
Pathways For Learning	90	15	1.1	14.1	5	1:50	24.8	33	2:25
Massachusetts Day Camps									
US Sports Institute	90	15	6.4	45.0	9	1:55	12.2	16	2:15
James Place	90	15	5.6	45.0	7	1:55	12.2	16	2:15
Camp Bauercrest	90	15	3.5	45.0	5	1:50	25.9	35	2:25
Coastal Discoveries Marine	90	15	5.6	16.0	21	2:10	12.2	16	2:30
Governor's Academy	90	15	0.6	36.7	1	1:50	24.4	33	2:25
YWCA Greater Newburyport	90	15	8.3	34.0	15	2:00	34.1	45	2:45
Clipper Girls Basketball Camp	90	15	7.2	30.4	14	2:00	34.1	45	2:45
Mass Audubon Joppa Flats Education Center	90	15	7.5	16.8	27	2:15	34.1	45	3:00
Metro Rock Climbing Camps	90	15	5.6	40.1	8	1:55	34.1	45	2:40
Koinonia Day Camp	90	15	1.5	14.8	6	1:55	24.8	33	2:30

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
New Hampshire Schools									
MA Maximum:	3:35	MA Maximum:	3:35	MA Maximum:	3:35	MA Maximum:	3:35	MA Maximum:	4:20
MA Average:	2:00	MA Average:	2:00	MA Average:	2:00	MA Average:	2:00	MA Average:	2:30
Swasey Central School	90	15	3.6	15.0	14	2:00	24.7	33	2:35
Brentwood Christian Academy	90	15	4.5	32.1	8	1:55	25.6	34	2:30
East Kingston Elementary School	90	15	6.9	34.7	12	2:00	25.6	34	2:35
Great Bay Charter School	90	15	6.3	7.2	52	2:40	24.7	33	3:15
Seacoast School of Technology	90	15	6.3	7.2	52	2:40	24.7	33	3:15
Phillips Exeter Academy	90	15	6.0	12.5	29	2:15	24.7	33	2:50
Main Street School	90	15	5.9	12.3	29	2:15	24.7	33	2:50
Lincoln Street Elementary School	90	15	5.9	7.9	45	2:30	24.7	33	3:05
Exeter High School	90	15	2.8	9.7	17	2:05	24.7	33	2:40
Greenland Central School	90	15	6.1	4.0	91	3:20	8.2	11	3:35
Winnacunnet Regional High School	90	15	13.5	17.1	47	2:35	8.2	11	2:50
Sacred Heart School	90	15	13.2	17.0	47	2:35	8.2	11	2:50
Hampton Academy	90	15	13.3	14.0	57	2:45	8.2	11	3:00
Marston School	90	15	13.3	16.9	47	2:35	8.2	11	2:50
Lincoln Akerman School	90	15	15.3	18.8	49	2:35	8.2	11	2:50
Heronfield Academy	90	15	14.0	6.3	134	4:00	8.2	11	4:15
Kensington Elementary School	90	15	10.3	9.5	65	2:50	24.7	33	3:25
Daniel J. Bakie Elementary School	90	15	3.0	32.7	6	1:55	25.6	34	2:30
Seacoast Charter School	90	15	3.0	32.7	6	1:55	25.6	34	2:30
Sanborn Regional High School	90	15	1.2	45.0	2	1:50	27.5	37	2:30
Maude H. Trefethen School	90	15	5.8	3.7	95	3:20	8.2	11	3:35
Newfields Elementary School	90	15	8.0	12.3	39	2:25	24.7	33	3:00
Memorial Elementary School	90	15	8.6	35.9	14	2:00	25.6	34	2:35
Seacoast Learning Collaborative	90	15	8.6	35.9	14	2:00	25.6	34	2:35
Squamscott River Academy	90	15	10.4	6.1	103	3:30	8.2	11	3:45
North Hampton Elementary School	90	15	10.4	6.1	103	3:30	8.2	11	3:45
Saint Patrick Academy	90	15	2.8	3.6	47	2:35	18.4	25	3:00

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Dondero School	90	15	4.6	3.0	93	3:20	18.4	25	3:45
Robert J. Lister Academy	90	15	3.5	5.8	36	2:25	18.4	25	2:50
Portsmouth Career Technical Center	90	15	3.2	3.5	55	2:40	18.4	25	3:05
Portsmouth High School	90	15	3.2	3.5	55	2:40	18.4	25	3:05
Great Bay Community College	90	15	1.9	2.9	40	2:25	18.4	25	2:50
Little Harbour School	90	15	4.1	3.4	72	3:00	18.4	25	3:25
New Franklin School	90	15	2.3	6.0	23	2:10	18.4	25	2:35
Portsmouth Middle School	90	15	3.5	3.6	59	2:45	18.4	25	3:10
Learning Skills Academy	90	15	7.1	4.1	105	3:30	8.2	11	3:45
Rye Junior High School	90	15	6.9	4.3	96	3:25	8.2	11	3:40
Rye Elementary School	90	15	6.5	3.7	104	3:30	8.2	11	3:45
Seabrook Elementary School	90	15	18.6	14.7	76	3:05	24.7	33	3:40
Seabrook Middle School	90	15	18.6	14.7	76	3:05	24.7	33	3:40
Seventh Day Adventist School	90	15	9.5	38.4	15	2:00	25.6	34	2:35
Barnard School	90	15	9.5	38.4	15	2:00	25.6	34	2:35
Cooperative Middle School	90	15	8.5	6.9	74	3:00	24.7	33	3:35
The Cornerstone School	90	15	11.8	5.0	142	4:10	24.7	33	4:45
Cornerstone Christian Academy	90	15	9.3	8.1	69	2:55	24.7	33	3:30
Stratham Memorial School	90	15	11.9	7.0	103	3:30	24.7	33	4:05
New Hampshire Preschools/Childcare Centers									
Donna Clarke's Family Day Care	90	15	5.9	9.8	36	2:25	24.7	33	3:00
A Place To Grow	90	15	1.2	45.0	2	1:50	23.8	32	2:25
East Kingston Elementary School-Before & After School Program	90	15	6.9	34.7	12	2:00	25.6	34	2:35
KidLogic Early Learning Center	90	15	9.0	11.4	47	2:35	23.8	32	3:10
Appleseeds Day School	90	15	10.2	5.2	117	3:45	24.7	33	4:20
Exeter Day School	90	15	7.9	6.8	70	2:55	24.7	33	3:30
Little Munchkins Learning Center	90	15	7.1	5.9	72	3:00	24.7	33	3:35
Swayse Central School Before & After School Program	90	15	3.6	15.0	14	2:00	24.7	33	2:35

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Harris Family Children's Center	90	15	7.0	7.2	59	2:45	24.7	33	3:20
Great Bay Kids Company	90	15	6.1	12.3	30	2:15	24.7	33	2:50
Exeter Developmental Pre-School	90	15	5.9	7.9	45	2:30	24.7	33	3:05
Montessori School for the Arts & Sciences	90	15	6.2	31.1	12	2:00	24.7	33	2:35
Building Block Commons	90	15	5.9	8.2	43	2:30	24.7	33	3:05
De Colores Children's Center	90	15	5.0	12.3	24	2:10	24.7	33	2:45
Great Bay Kids' Company	90	15	5.0	12.3	24	2:10	24.7	33	2:45
Camp Gundalow	90	15	6.9	4.2	98	3:25	8.2	11	3:40
Greenland Peak Program	90	15	6.1	4.1	89	3:15	8.2	11	3:30
Fun After School & Summer Program	90	15	14.7	14.4	61	2:50	8.2	11	3:05
MPA at Hampton	90	15	14.7	14.4	61	2:50	8.2	11	3:05
Hampton Child & Family Program-DBA Village Preschool	90	15	14.7	14.4	61	2:50	8.2	11	3:05
Lincoln Akerman School After School Program	90	15	15.3	18.8	49	2:35	8.2	11	2:50
Robin's Childs Place	90	15	15.0	18.8	48	2:35	8.2	11	2:50
Seacoast Head Start	90	15	15.0	18.8	48	2:35	8.2	11	2:50
Kensington Elementary School After School Program	90	15	10.3	9.5	65	2:50	24.7	33	3:25
Daniel J. Bakie Elementary School Before & After Childcare Program	90	15	2.7	32.7	5	1:50	25.6	34	2:25
Kingston Children's Center	90	15	2.7	32.7	5	1:50	25.6	34	2:25
Nurture & Nature Children's Center	90	15	7.1	12.7	34	2:20	24.7	33	2:55
Newfields Action Club at Newfields Elementary School	90	15	8.0	12.3	39	2:25	24.7	33	3:00
Newton Learning Center	90	15	2.4	3.2	44	2:30	36.7	49	3:20
Memorial Elementary School - Before & After Program	90	15	8.6	35.9	14	2:00	25.6	34	2:35
North Hampton Elementary School Before and After School Program	90	15	10.4	6.1	103	3:30	8.2	11	3:45
Imprint's Day School	90	15	7.8	4.6	101	3:30	8.2	11	3:45
Krepmpels Center-Brain Injury Program	90	15	4.9	3.1	96	3:25	18.4	25	3:50

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Portsmouth Head Start	90	15	4.9	3.1	96	3:25	18.4	25	3:50
Seacoast Community School	90	15	4.9	3.1	96	3:25	18.4	25	3:50
Place for Friends and Fun	90	15	4.6	3.0	93	3:20	18.4	25	3:45
Dondero Peak Program	90	15	4.6	3.0	93	3:20	18.4	25	3:45
Kindercare Learning Center	90	15	3.7	2.9	77	3:05	18.4	25	3:30
Little Blessings Day Care	90	15	3.5	2.7	78	3:05	18.4	25	3:30
YMCA of the Seacoast	90	15	3.4	3.7	55	2:40	18.4	25	3:05
The Children's Garden	90	15	3.4	3.7	55	2:40	18.4	25	3:05
The Chase Home For Children	90	15	4.0	3.8	64	2:50	18.4	25	3:15
Edgewood Early Learning Center	90	15	3.5	3.5	59	2:45	18.4	25	3:10
Great Bay Kids-PEASE Center	90	15	1.6	2.9	34	2:20	18.4	25	2:45
Little Harbour Peak Program	90	15	4.1	3.4	72	3:00	18.4	25	3:25
Kathleen Tostenon	90	15	2.1	6.9	18	2:05	18.4	25	2:30
Discovery Child Enrichment Center	90	15	1.8	3.1	35	2:20	18.4	25	2:45
New Franklin School PEAK Program	90	15	2.3	6.0	23	2:10	18.4	25	2:35
Early Learning Center at Temple Israel Preschool	90	15	2.5	4.1	37	2:25	18.4	25	2:50
The Treehouse School of Portsmouth	90	15	2.5	4.1	37	2:25	18.4	25	2:50
Seacoast Community School at the Meadows	90	15	0.4	3.2	8	1:55	18.4	25	2:20
Rye Country Day School	90	15	7.1	4.1	105	3:30	8.2	11	3:45
Seabrook Elementary School After School Program	90	15	18.6	14.7	76	3:05	24.7	33	3:40
Seabrook Middle School Adventure Zone After School Program	90	15	18.6	14.7	76	3:05	24.7	33	3:40
Miss Beth's Family Day Care	90	15	18.1	14.4	75	3:00	24.7	33	3:35
Seabrook Head Start	90	15	16.5	13.7	73	3:00	24.7	33	3:35
Bright Horizons at Timberland	90	15	9.7	10.1	58	2:45	24.7	33	3:20
Little Sprouts Childcare & Preschool	90	15	7.1	7.8	55	2:40	24.7	33	3:15
Acorn School	90	15	11.0	4.6	143	4:10	24.7	33	4:45
Stratham Circle Learning Center	90	15	8.4	8.6	58	2:45	24.7	33	3:20
Stratham Memorial School Before & After School Program	90	15	11.9	7.0	103	3:30	24.7	33	4:05

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)	
Richie McFarland Children's Center	90	15	10.9	6.3	104	3:30	24.7	33	4:05	
New Hampshire Day Camps										
Action Kids at Brentwood Commons	90	15	3.7	9.1	25	2:10	23.8	32	2:45	
YMCA Tricklin' Falls Day Camp	90	15	9.2	12.0	46	2:35	23.8	32	3:10	
Long Tree Scout Reservation	90	15	2.6	38.2	4	1:50	26.8	36	2:30	
YMCA Camp Lincoln Kingston	90	15	6.1	9.5	38	2:25	25.6	34	3:00	
Camp Tasker (Boys & Girls Club of Haverhill)	90	15	3.6	36.2	6	1:55	26.8	36	2:35	
Seawood Girl Scout Camp	90	15	4.3	4.9	52	2:40	18.4	25	3:05	
NH Maximum:						4:10	NH Maximum:			4:45
NH Average:						2:45	NH Average:			3:10

Table 8-5. Transit-Dependent Evacuation Time Estimates – Good Weather

Community Served	UNITES Route # ²	Bus Number	One-Wave				Two-Wave								
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R. C. (miles)	Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
Amesbury	17	1-3	135	31.1	37.2	50	30	3:35	8.9	12	5	10	72	30	5:45
		4-6	155	31.1	37.4	50	30	3:55	8.9	12	5	10	70	30	6:05
		7-8	175	31.1	37.4	50	30	4:15	8.9	12	5	10	70	30	6:25
Brentwood	155	1-2	135	35.4	15.9	133	30	5:00	23.7	5	10	93	30	7:50	
East Kingston	156	1-2	135	4.9	30.1	10	30	2:55	25.6	34	5	10	54	30	5:10
		1-3	135	8.4	9.5	53	30	3:40	24.6	33	5	10	58	30	6:00
Exeter	157	4-7	155	8.4	9.9	51	30	4:00	24.6	33	5	10	58	30	6:20
		1-2	135	22.0	8.2	160	30	5:25	8.1	11	5	10	54	30	7:15
Hampton	159	1-3	135	41.0	17.9	137	30	5:05	8.1	11	5	10	79	30	7:20
		4-7	155	41.0	19.5	126	30	5:15	8.1	11	5	10	79	30	7:30
Hampton Beach	160	1-3	135	8.1	10.8	45	30	3:30	24.6	33	5	10	57	30	5:45
Hampton Falls	161	1	135	22.3	10.9	123	30	4:50	8.1	11	5	54	30	6:40	
Kingston	162	1	135	25.8	12.1	128	30	4:55	24.6	33	5	10	81	30	7:35
Kingston	163	1-3	135	46.6	45.0	62	30	3:50	25.6	34	5	10	109	30	7:00
Merrimac	150	1-3	135	17.2	40.0	26	30	3:15	8.9	12	5	51	30	5:05	
New Castle	164	1	135	2.6	3.3	48	30	3:35	8.1	11	5	37	30	5:10	
Newbury	152	1-3	135	22.8	23.3	59	30	3:45	8.9	12	5	58	30	5:40	
		1-3	135	20.8	45.0	28	30	3:15	8.9	12	5	10	53	30	5:05
Newburyport	153	4-6	155	20.8	45.0	28	30	3:35	8.9	12	5	53	30	5:25	
		7-8	175	20.8	45.0	28	30	3:55	8.9	12	5	10	53	30	5:45
Newfields	165	1	135	10.9	3.9	167	30	5:35	28.1	37	5	65	30	8:05	
Newton	166	1-3	135	25.0	13.2	114	30	4:40	25.6	34	5	81	30	7:20	
North Hampton	167	1-2	135	31.3	14.4	130	30	4:55	8.1	11	5	66	30	7:00	
		1-3	135	42.2	12.6	201	30	6:10	18.4	25	5	10	99	30	9:00
Portsmouth	168	4-7	155	42.2	13.7	184	30	6:10	18.4	25	5	99	30	9:00	
		8-10	175	42.2	15.2	167	30	6:15	18.4	25	5	10	99	30	9:05
Rye	169	1-3	135	35.5	17.2	124	30	4:50	8.1	11	5	72	30	7:00	
Salisbury	151	1-4	135	26.2	31.4	50	30	3:35	8.9	12	5	60	30	5:35	
Seabrook	170	1-4	135	21.0	38.6	33	30	3:20	24.6	33	5	75	30	5:55	
Seabrook Beach	171	1-3	135	1.5	15.5	6	30	2:55	34.6	46	5	61	30	5:30	

² See Table 10-2 and Appendix K.

Community Served	UNITES Route # ²	Bus Number	One-Wave				Two-Wave								
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R. C. (miles)	Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
South Hampton	172	1	135	15.4	37.4	25	30	3:10	25.6	34	5	10	68	30	5:40
Stratham	173	1-4	135	34.5	13.9	149	30	5:15	24.6	33	5	10	93	30	8:10
West Newbury	154	1-2	135	21.4	43.1	30	30	3:15	8.9	12	5	10	55	30	5:10
			Maximum ETE:				6:15					Maximum ETE:		9:05	
			Average ETE:				4:20					Average ETE:		6:35	

Table 8-8. Medical Facility Evacuation Time Estimates – Good Weather

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Massachusetts Medical Facilities								
Coastal Connections Inc	Ambulatory	90	1	65	36	7.6	10	2:20
	Wheelchair bound	90	5	17	75	7.6	10	2:55
	Bedridden	90	15	14	30	7.6	10	2:10
Amesbury Residence	Ambulatory	90	1	8	8	5.8	8	1:50
	Ambulatory	90	1	57	36	5.3	7	2:15
Maplewood Center	Wheelchair bound	90	5	48	20	5.3	7	2:00
	Bedridden	90	15	4	30	5.3	7	2:10
Lahey Health Primary Care, Amesbury	Ambulatory	90	1	6	6	5.3	7	1:45
	Ambulatory	90	1	66	36	5.9	8	2:15
Amesbury Village, LLC	Wheelchair bound	90	5	26	20	5.9	8	2:00
	Bedridden	90	15	10	30	5.9	8	2:10
Hillside Rest Home Inc	Ambulatory	90	1	28	28	5.0	7	2:05
	Ambulatory	90	1	10	10	6.0	8	1:50
Elizabeth Calsey House	Wheelchair bound	90	5	2	10	6.0	8	1:50
	Bedridden	90	15	2	30	6.0	8	2:10
Elizabeth Calsey House 2	Ambulatory	90	1	17	15	6.0	8	1:55
	Wheelchair bound	90	5	4	20	6.0	8	2:00
Church Street House	Bedridden	90	15	4	30	6.0	8	2:10
	Ambulatory	90	1	5	5	1.6	2	1:40
Quaker Hill	Ambulatory	90	1	24	15	1.5	4	1:50
	Ambulatory	90	1	18	15	1.5	4	1:50
Byfield Elderly Housing	Wheelchair bound	90	5	4	20	1.5	3	1:55
	Ambulatory	90	1	9	9	9.9	13	1:55
Home for Aged Men (Griffin House)	Ambulatory	90	1	83	36	10.8	14	2:20
	Wheelchair bound	90	5	22	20	10.8	15	2:05
Anna Jaques Hospital	Bedridden	90	15	18	30	10.8	14	2:15

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Newburyport Residence	Ambulatory	90	1	8	8	10.0	15	1:55
	Ambulatory	90	1	75	36	10.0	13	2:20
Constellation Health Services	Wheelchair bound	90	5	20	20	10.0	14	2:05
	Bedridden	90	15	16	30	10.0	13	2:15
Country Center for Health & Rehabilitation	Ambulatory	90	1	19	15	10.0	15	2:00
	Wheelchair bound	90	5	88	20	10.0	14	2:05
	Bedridden	90	15	4	30	10.0	13	2:15
James Steam Mill Elderly Housing	Ambulatory	90	1	79	36	10.9	21	2:30
	Wheelchair bound	90	5	42	20	10.9	28	2:20
	Bedridden	90	15	5	30	10.9	24	2:25
Harborside Adult Health at St. Paul's Church	Ambulatory	90	1	31	31	11.4	15	2:20
	Wheelchair bound	90	5	4	20	11.4	16	2:10
	Ambulatory	90	1	48	36	9.5	13	2:20
Avita of Newburyport	Wheelchair bound	90	5	12	20	9.5	13	2:05
	Bedridden	90	15	10	30	9.5	13	2:15
	Ambulatory	90	1	77	36	9.5	13	2:20
Atria Merrimack Place	Wheelchair bound	90	5	8	20	9.5	13	2:05
	Ambulatory	90	1	80	36	5.7	8	2:15
	Wheelchair bound	90	5	43	20	5.7	9	2:00
Heritage House	Bedridden	90	15	5	30	5.7	8	2:10
	Ambulatory	90	1	8	8	11.7	21	2:00
	Wheelchair bound	90	5	52	20	11.7	18	2:10
Brigham Health and Rehabilitation Center	Bedridden	90	15	4	30	11.7	16	2:20
	Ambulatory	90	1	51	36	6.0	8	2:15
	Ambulatory	90	1	83	36	6.4	10	2:20
Port Healthcare Center	Wheelchair bound	90	5	22	20	6.4	14	2:05
	Bedridden	90	15	18	30	6.4	12	2:15
	Ambulatory	90	1	88	36	5.5	7	2:15
Opportunity Works	Wheelchair bound	90	5	23	20	5.5	8	2:00
	Bedridden	90	15	19	30	5.5	7	2:10

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Assisted Living Center of Salisbury	Ambulatory	90	1	26	15	9.2	15	2:00
	Wheelchair bound	90	5	4	20	9.2	15	2:05
New Hampshire Medical Facilities								
Rockingham County Nursing Home	Ambulatory	90	1	136	36	2.1	11	2:20
	Wheelchair bound	90	5	36	10	2.1	18	2:00
	Bedridden	90	15	30	30	2.1	11	2:15
Langdon Place of Exeter	Ambulatory	90	1	77	36	10.2	105	3:55
	Wheelchair bound	90	5	20	10	10.2	120	3:40
	Bedridden	90	15	17	30	10.2	111	3:55
Exeter Rehab Center-Genesis HealthCare	Ambulatory	90	1	55	36	10.2	105	3:55
	Wheelchair bound	90	5	14	10	10.2	120	3:40
	Bedridden	90	15	12	30	10.2	111	3:55
Exeter Hospital	Ambulatory	90	1	64	36	7.6	53	3:00
	Bedridden	90	15	36	30	7.6	52	2:55
	Ambulatory	90	1	6	6	7.6	83	3:00
Exeter Healthcare	Wheelchair bound	90	5	12	10	7.6	83	3:05
	Bedridden	90	15	8	30	7.6	88	3:30
	Ambulatory	90	1	203	36	7.3	71	3:20
The Woods at Riverwoods	Wheelchair bound	90	5	53	10	7.3	58	2:40
	Bedridden	90	15	44	30	7.3	68	3:10
	Ambulatory	90	1	110	36	7.4	72	3:20
The Ridge at Riverwoods	Wheelchair bound	90	5	29	10	7.4	58	2:40
	Bedridden	90	15	24	30	7.4	68	3:10
	Ambulatory	90	1	118	36	7.4	72	3:20
The Boulders at Riverwoods	Wheelchair bound	90	5	31	10	7.4	58	2:40
	Bedridden	90	15	25	30	7.4	68	3:10
	Ambulatory	90	1	6	6	7.3	107	3:25
Fairweather Lodge Group Home	Wheelchair bound	90	5	1	5	7.3	106	3:25
	Bedridden	90	15	1	15	7.3	100	3:25
	Ambulatory	90	1	162	36	6.5	23	2:30

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Oceanside Skilled Nursing Home & Rehab - Genesis	Ambulatory	90	1	76	36	11.5	87	3:35
	Wheelchair bound	90	5	20	10	11.5	110	3:30
	Bedridden	90	15	16	30	11.5	100	3:40
Cornerstone at Hampton	Ambulatory	90	1	81	36	11.7	109	3:55
	Wheelchair bound	90	5	21	10	11.7	132	3:55
	Bedridden	90	15	18	30	11.7	118	4:00
Portsmouth Regional Hospital	Ambulatory	90	1	100	36	2.7	56	3:05
	Bedridden	90	15	100	30	2.7	57	3:00
	Ambulatory	90	1	69	36	3.5	63	3:10
Clipper Harbor of Portsmouth	Wheelchair bound	90	5	18	10	3.5	58	2:40
	Bedridden	90	15	15	30	3.5	63	3:05
	Ambulatory	90	1	8	8	3.5	58	2:40
The Inn at Edgewood	Wheelchair bound	90	5	2	10	3.5	58	2:40
	Bedridden	90	15	2	30	3.5	63	3:05
	Ambulatory	90	1	105	36	3.5	63	3:10
The Edgewood Centre	Wheelchair bound	90	5	28	10	3.5	58	2:40
	Bedridden	90	15	23	30	3.5	63	3:05
	Ambulatory	90	1	48	36	3.6	55	3:05
Wentworth Senior Living	Wheelchair bound	90	5	13	10	3.6	59	2:40
	Bedridden	90	15	10	30	3.6	60	3:00
	Ambulatory	90	1	22	15	1.5	24	2:10
Northeast Rehabilitation Hospital Network	Wheelchair bound	90	5	6	10	1.5	26	2:10
	Bedridden	90	15	5	30	1.5	22	2:25
	Ambulatory	90	1	44	36	7.6	81	3:30
Evolve at Rye	Wheelchair bound	90	5	11	10	7.6	98	3:20
	Bedridden	90	15	9	30	7.6	85	3:25
	Ambulatory	90	1	100	36	7.6	81	3:30
Webster at Rye	Wheelchair bound	90	5	26	10	7.6	98	3:20
	Bedridden	90	15	21	30	7.6	85	3:25
							Maximum ETE:	
						Average ETE:		2:40

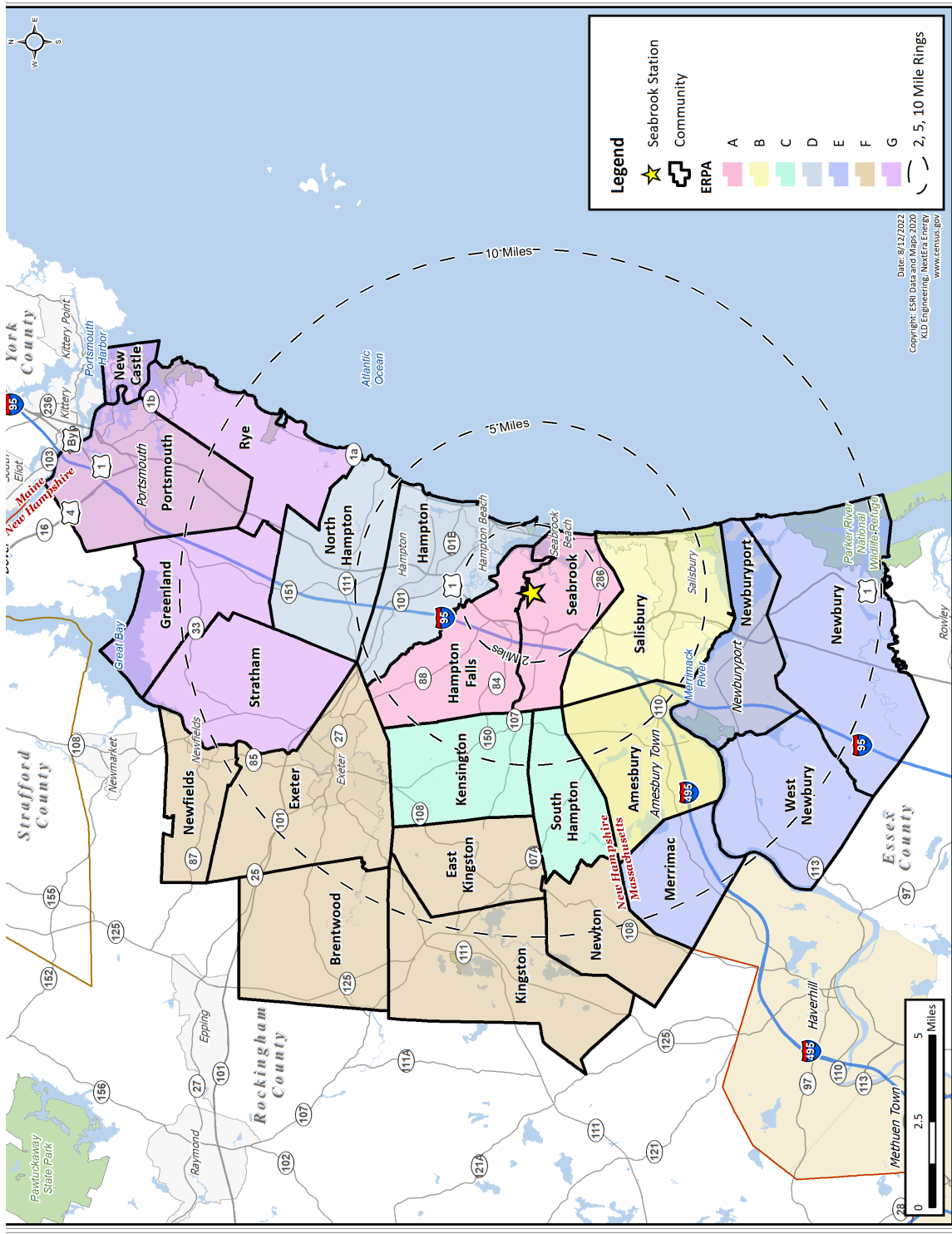


Figure 6-1. ERPAs Comprising the Seabrook Station EPZ

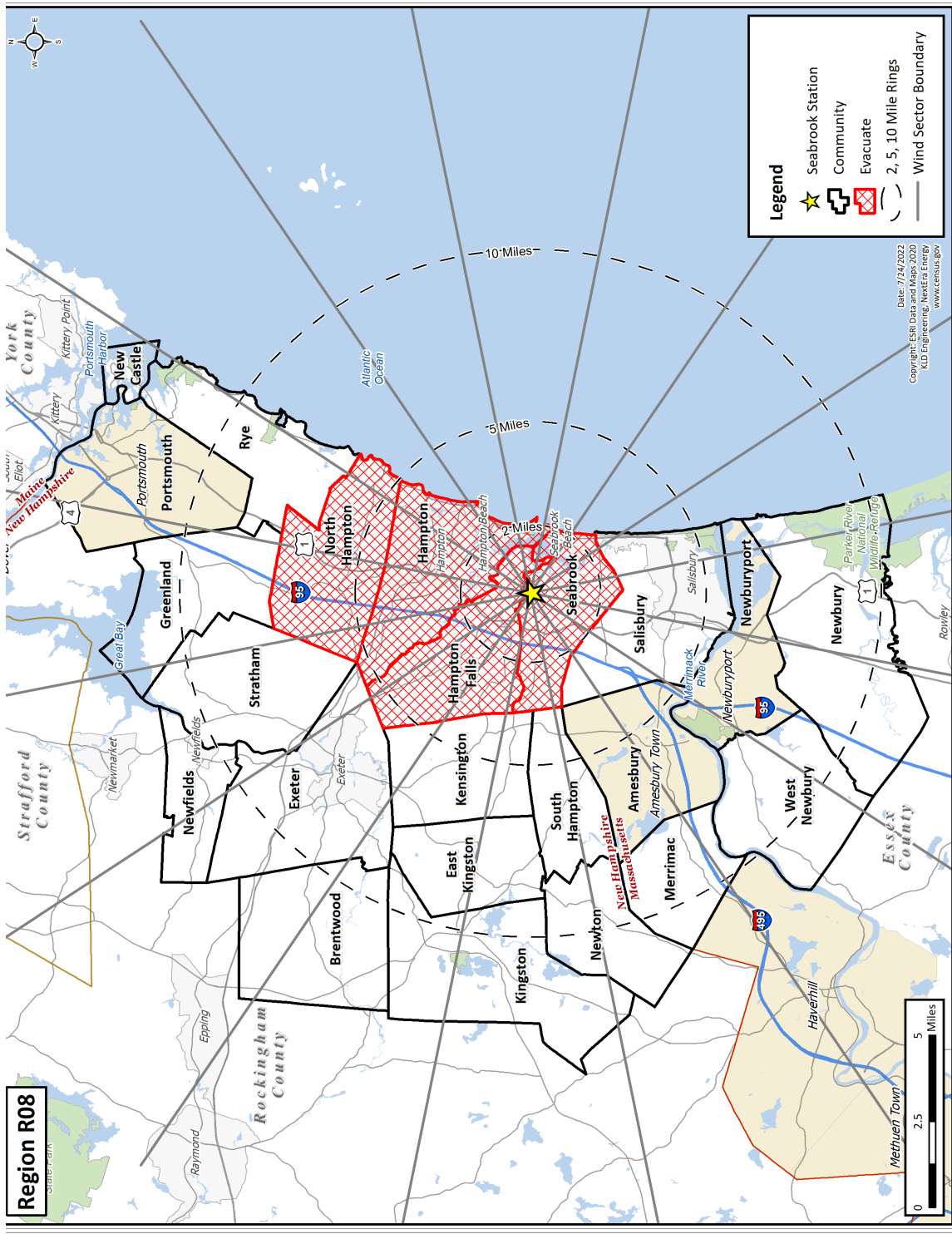


Figure H-8. Region R08

1 INTRODUCTION

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Seabrook Station, located in Rockingham County, New Hampshire. This ETE study provides NextEra Energy (NextEra) and state governments with site-specific information needed for Protective Action Decision-making.

In the performance of this effort, guidance is provided by documents published by Federal Governmental agencies. Most important of these are:

- Title 10, Code of Federal Regulations, Appendix E to Part 50 (10CFR50), Emergency Planning and Preparedness for Production and Utilization Facilities, NRC, 2011.
- Revision 1 of the Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, February 2021.
- FEMA, “Radiological Emergency Preparedness Program Manual” (FEMA P-1028), December 2019.

The work effort reported herein was supported and guided by local stakeholders who contributed suggestions, critiques, and the local knowledge base required. Table 1-1 presents a summary of stakeholders and interactions.

1.1 Overview of the ETE Process

The following outline presents a brief description of the work effort in chronological sequence:

1. Information Gathering:
 - a. Defined the scope of work in discussions with representatives from NextEra.
 - b. Attended meetings with emergency planners from NextEra, Massachusetts Emergency Management Agency (MEMA), New Hampshire Homeland Security and Emergency Management (NH HSEM) to discuss methodology and project assumptions.
 - c. Conducted a detailed field survey of the highway system and of area traffic conditions within the Emergency Planning Zone (EPZ) and Shadow Region (area between the EPZ boundary and 15 miles radially from the plants).
 - d. Obtained demographic data from the 2020 census (see Section 3.1).
 - e. Conducted an online demographic survey of EPZ residents.
 - f. Conducted a data collection effort to identify and describe schools, preschools, childcare centers, day camps, special facilities, major employers, transportation providers, and other important information.

2. Estimated distributions of Trip Generation times representing the time required by various population groups (permanent residents, employees, and transients) to prepare (mobilize) for the evacuation trip. These estimates are primarily based upon the responses to the online demographic survey.
3. Defined Evacuation Scenarios which reflect the variation in demand, in trip generation distribution and in highway capacities associated with different seasons, day of week, time of day and weather conditions.
4. Reviewed the existing Traffic Management Plan (TMP) to be implemented by local and state police in the event of an incident at the plant. Traffic control is applied at specified Traffic Control Points (TCP) and Access Control Points (ACP) located within the study area.
5. Used existing Communities to define Evacuation Regions. The EPZ is partitioned into 23 Communities along jurisdictional and geographic boundaries. Communities are grouped into 7 Emergency Response Planning Areas (ERPA). “Regions” are groups of contiguous ERPA for which ETE are calculated. The configurations of these Regions reflect wind direction and the radial extent of the impacted area. Each Region, other than those that approximate circular areas, approximates a “key-hole section” within the EPZ as recommended by NUREG/CR-7002, Rev. 1.
6. Estimated demand for transit services for persons at special facilities (schools, preschools, childcare centers, day camps, medical facilities, and correctional facilities), for transit-dependent persons at home, and for people with access and/or functional needs at home.
7. Prepared the input streams for the DYNEV II system:
 - a. Estimated the evacuation traffic demand, based on the available information derived from Census data, and from data provided by state agencies, NextEra and from the demographic survey.
 - b. Applied the procedures specified in the 2016 Highway Capacity Manual (HCM¹) to the data acquired during the field survey to estimate the capacity of all highway segments comprising the evacuation routes.
 - c. Updated the link-node representation of the evacuation network, which is used as the basis for the computer analysis that calculates the ETE.
 - d. Calculated the evacuating traffic demand for each Region and for each Scenario.
 - e. Specified selected candidate destinations for each “origin” (location of each “source” where evacuation trips are generated over the mobilization time) to support evacuation travel consistent with outbound movement relative to the location of the plant.

¹ Highway Capacity Manual (HCM 2016), Transportation Research Board, National Research Council, 2016.

8. Executed the DYNEV II system to determine optimal evacuation routing and compute ETE for all residents, transients and employees (“general population”) with access to private vehicles. Generated a complete set of ETE for all specified Regions and Scenarios.
9. Documented ETE in formats in accordance with NUREG/CR-7002, Rev. 1.
10. Calculated the ETE for all transit activities including those for special facilities, for the transit-dependent population and for the access and/or functional needs population.

1.2 The Seabrook Station Location

The Seabrook Station is located along the shores of Swains Creek in Rockingham County, New Hampshire. The site is approximately 40 miles northeast of Boston, MA. The EPZ consists of parts of Massachusetts and New Hampshire. Figure 1-1 displays the area surrounding Seabrook Station, identifying the communities in the area and the major roads.

1.3 Preliminary Activities

These activities are described below.

Field Surveys of the Highway Network

In March 2021, KLD personnel drove the entire highway system within the EPZ and the Shadow Region. The characteristics of each section of highway were recorded. These characteristics are listed in Table 1-2.

Video and audio recording equipment were used to capture a permanent record of the highway infrastructure. No attempt was made to meticulously measure such attributes as lane width and shoulder width; estimates of these measures based on visual observation and recorded images were considered appropriate for the purpose of estimating the capacity of highway sections. For example, Exhibit 15-7 in the HCM 2016 indicates that a reduction in lane width from 12 feet (the “base” value) to 10 feet can reduce free flow speed (FFS) by 1.1 mph – not a material difference – for two-lane highways. Exhibit 15-46 in the HCM 2016 shows little sensitivity for the estimates of Service Volumes at Level of Service (LOS) E (near capacity), with respect to FFS, for two-lane highways.

The data from the audio and video recordings were used to create detailed geographic information systems (GIS) shapefiles and databases of the roadway characteristics and of the traffic control devices observed during the road survey; this information was referenced while preparing the input stream for the DYNEV II System. Roadway types were assigned based on the following criteria:

- Freeway: limited access highway, 2 or more lanes in each direction, high free flow speeds
- Freeway ramp: ramp on to or off of a limited access highway
- Major arterial: 3 or more lanes in each direction
- Minor arterial: 2 or more lanes in each direction

- Collector: single lane in each direction
- Local roadway: single lane in each direction, local road with low free flow speeds

As documented on page 15-6 of the HCM 2016, the capacity of a two-lane highway is 1,700 passenger cars per hour in one direction. For freeway sections, a value of 2,250 vehicles per hour per lane is assigned, as per Exhibit 12-37 of the HCM 2016. The road survey has identified several segments which are characterized by adverse geometrics on two-lane highways which are reflected in reduced values for both capacity and speed. These estimates are consistent with the service volumes for LOS E presented in HCM Exhibit 15-46. Link capacity is an input to DYNEV II which computes the ETE. Further discussion of roadway capacity is provided in Section 4 of this report.

Traffic signals are either pre-timed (signal timings are fixed over time and do not change with the traffic volume on competing approaches) or are actuated (signal timings vary over time based on the changing traffic volumes on competing approaches). Actuated signals require detectors to provide the traffic data used by the signal controller to adjust the signal timings. These detectors are typically magnetic loops in the roadway, or video cameras mounted on the signal masts and pointed toward the intersection approaches. If detectors were observed on the approaches to a signalized intersection during the road survey, detailed signal timings were not collected as the timings vary with traffic volume. TCPs and ACPs at locations which have control devices are represented as actuated signals in the DYNEV II system.

If no detectors were observed, the signal control at the intersection was considered pre-timed, and detailed signal timings were gathered for several signal cycles. These signal timings were input to the DYNEV II system used to compute ETE, as per NUREG/CR-7002, Rev. 1 guidance.

Figure 1-2 presents the link-node analysis network that was constructed to model the evacuation roadway network in the EPZ and Shadow Region. The directional arrows on the links and the node numbers have been removed from Figure 1-2 to clarify the figure. The detailed figures provided in Appendix K depict the analysis network with directional arrows shown and node numbers provided. The observations made during the field survey were used to calibrate the analysis network.

Demographic Survey

An online demographic survey was performed to gather information needed for the ETE study. Appendix F presents the survey instrument, the procedures used, and tabulations of data compiled from the survey responses along with discussion validating the use of the survey results in this study.

These data were utilized to develop estimates of vehicle occupancy to estimate the number of evacuating vehicles during an evacuation and to estimate elements of the mobilization process. This database was also referenced to estimate the number of transit-dependent residents.

Computing the Evacuation Time Estimates

The overall study procedure is outlined in Appendix D. Demographic data were obtained from several sources, as detailed later in this report. These data were analyzed and converted into vehicle demand data. The vehicle demand was loaded onto appropriate “source” links of the

analysis network using GIS mapping software. The DYNEV II system was then used to compute ETE for all Regions and Scenarios.

Analytical Tools

The DYNEV II System that was employed for this study is comprised of several integrated computer models. One of these is the DYNEV (DYnamic Network EVacuation) macroscopic simulation model, a new version of the IDYNEV model that was developed by KLD under contract with the Federal Emergency Management Agency (FEMA).

DYNEV II consists of four sub-models:

- A macroscopic traffic simulation model (for details, see Appendix C).
- A Trip Distribution (TD), model that assigns a set of candidate destination (D) nodes for each “origin” (O) located within the analysis network, where evacuation trips are “generated” over time. This establishes a set of O-D tables.
- A Dynamic Traffic Assignment (DTA), model which assigns trips to paths of travel (routes) which satisfy the O-D tables, over time. The TD and DTA models are integrated to form the DTRAD (Dynamic Traffic Assignment and Distribution) model, as described in Appendix B.
- A Myopic Traffic Diversion model which diverts traffic to avoid intense, local congestion, if possible.

Another software product developed by KLD, named UNITES (UNified Transportation Engineering System) was used to expedite data entry and to automate the production of output tables.

The dynamics of traffic flow over the network are graphically animated using the software product, EVAN (EVacuation ANimator), developed by KLD. EVAN is GIS based, and displays statistics such as LOS, vehicles discharged, average speed, and percent of vehicles evacuated, output by the DYNEV II System. The use of a GIS framework enables the user to zoom in on areas of congestion and query road name, town name and other geographical information.

The procedure for applying the DYNEV II System within the framework of developing ETE is outlined in Appendix D. Appendix A is a glossary of terms.

For the reader interested in an evaluation of the original model, I-DYNEV, the following references are suggested:

- NUREG/CR-4873 – Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code
- NUREG/CR-4874 – The Sensitivity of Evacuation Time Estimates to Changes in Input Parameters for the I-DYNEV Computer Code

The evacuation analysis procedures are based upon the need to:

- Route traffic along paths of travel that will expedite their travel from their respective points of origin to points outside the EPZ.

- Restrict movement toward the plant to the extent practicable and disperse traffic demand so as to avoid focusing demand on a limited number of highways.
- Move traffic in directions that are generally outbound, relative to the location of the plant.

DYNEV II provides a detailed description of traffic operations on the evacuation network. This description enables the analyst to identify bottlenecks and to develop countermeasures that are designed to represent the behavioral responses of evacuees. The effects of these countermeasures may then be tested with the model.

1.4 Comparison with Previous ETE Study

Table 1-3 presents a comparison of the present ETE study with the previous ETE study (Rev. 2 of KLD TR-538, dated June 10, 2014). The 90th percentile ETE for the full EPZ increased by 5 minutes for both a winter, midweek, midday, good weather scenario and a summer, weekend, midday, good weather scenario when compared with the 2014 study. The 100th percentile ETE increased by 5 minutes for a winter, midweek, midday, good weather scenario and decreased by 15 minutes for a summer, weekend, midday, good weather scenario. The major factors contributing to the similarities and differences between the ETE values obtained in this study and those of the previous study are:

- The permanent resident population increased by 5.6% and the number of evacuating vehicles for the permanent resident population increased by 3.6%. More permanent resident evacuating vehicles can cause ETE to increase.
- The number of employees commuting into the EPZ decreased by 20.2% and the number of employee vehicles decreased by 17.9%. (This significant decrease was a result of the change in federal guidance between Rev. 0 and Rev. 1 of NUREG/CR-7002 wherein 50 or more employees working in a single shift was deemed a major employer in Rev. 0 versus 200 or more employees in Rev. 1.) Fewer evacuating employee vehicles could cause 100th percentile ETE to decrease. However, because employee vehicles mobilize much more quickly than resident vehicles, fewer employee vehicles could actually increase 90th percentile ETE as there will be a higher percentage of resident vehicles in an Evacuation Region, which take longer to mobilize.
- The number of transient vehicles and seasonal resident vehicles increased by 10.9%. More evacuating vehicles can cause ETE to increase.
- The percentage of households with commuters increased in this study (76% versus 61% in 2014). Households with commuters take up to an additional hour and 15 minutes to mobilize versus households without commuters. Thus, a higher percentage of households with commuters can increase ETE.
- Access control takes an additional hour to establish. As a result, more traffic originating from outside of the EPZ (external traffic) is able to traverse through the EPZ and take up some of the available roadway capacity. This can cause ETE to increase.

- Trip generation rates remained about the same. Since the 100th percentile ETE is dictated by trip generation time for many regions and scenarios, the minimal changes, if any, in ETE are a result of the relatively consistent time to mobilize in both studies.

Table 1-1. Stakeholder Interaction

Stakeholder	Nature of Stakeholder Interaction
NextEra emergency planning personnel	Meetings to define data requirements and set up contacts with state agencies. Reviewed and approved all project assumptions. Attended final meeting where the ETE study results were presented.
Massachusetts Emergency Management Agency (MEMA) and New Hampshire Homeland Security and Emergency Management (NH HSEM)	Met to discuss project methodology, key project assumptions and to define data needs. Provided state emergency plans, special facility data and existing traffic management plans. Reviewed and approved all project assumptions. Attended final meeting where the ETE study results were presented.

Table 1-2. Highway Characteristics

- Number of lanes
- Lane width
- Shoulder type & width
- Interchange geometries
- Lane channelization & queuing capacity (including turn bays/lanes)
- Geometrics: curves, grades (>4%)
- Unusual characteristics: Narrow bridges, sharp curves, poor pavement, flood warning signs, inadequate delineations, toll booths, etc.
- Posted speed
- Actual free speed
- Abutting land use
- Control devices
- Intersection configuration (including roundabouts where applicable)
- Traffic signal type

Table 1-3. ETE Study Comparisons

Topic	Previous ETE Study	Current ETE Study
Resident Population Basis	ArcGIS Software using 2010 US Census blocks; area ratio method used. Population = 164,207 Vehicles = 85,239	ArcGIS Software using 2020 US Census blocks; area ratio method used. Population = 173,380 Vehicles = 88,268
Resident Population Vehicle Occupancy	2.51 persons/household, 1.31 evacuating vehicles/household yielding: 1.92 persons/vehicle.	2.75 persons/household, 1.42 evacuating vehicles/household yielding: 1.94 persons/vehicle.
Shadow Population	ArcGIS Software using 2010 US Census blocks; area ratio method used. Population = 96,205 Vehicles = 50,242	ArcGIS software using 2020 US Census blocks; area ratio method used. Population = 103,233 Vehicles = 52,561
Percentage of Commuters	Based on responses to the random sample telephone survey. Households with at least 1 commuter = 61%	Based on responses to the online demographic survey. Households with at least 1 commuter = 76%
Commuters	Based on responses to the random sample telephone survey. 41% of households with commuters will await the return of a commuter before beginning their evacuation trip. Therefore, 25% ($61\% \times 41\% = 25\%$) of EPZ households will mobilize according to the households with returning commuters mobilization time distribution.	Based on responses to the online demographic survey. 50% of households with commuters will await the return of a commuter before beginning their evacuation trip. Therefore, 38% ($76\% \times 50\% = 38\%$) of EPZ households will mobilize according to the households with returning commuters mobilization time distribution.
Employee Population	Employee estimates based on 2010 Longitudinal Employer-Household Dynamic Census data, supplemented by phone calls to major employers in MA. 1.06 employees per vehicle based on telephone survey results. Employees = 31,549 Vehicles = 29,762	Employee estimates based on 2020 Census data. 1.03 employees per vehicle based on demographic survey results. Employees = 25,169 Vehicles = 24,434

Topic	Previous ETE Study	Current ETE Study
Transient Population	<p>Transient estimates based upon information provided about transient attractions in EPZ, supplemented by surveys to the facilities and from 2012 aerial photography. Seasonal Residents computed from 2010 Census data.</p> <p>Transients = 30,706 Vehicles = 15,353</p>	<p>Transient estimates based upon information provided by the states, internet searches, and satellite imagery.</p> <p>Transients = 35,087 Vehicles = 17,008</p>
Seasonal Population	<p>Seasonal Residents computed from 2010 Census data.</p> <p>Seasonal Residents = 4,841 Vehicles = 2,501</p>	<p>Seasonal Residents computed from 2020 Census data.</p> <p>Seasonal Residents = 5,454 Vehicles = 2,799</p>
Transit- Dependent Population	<p>Estimates based upon U.S. Census data and the results of the telephone survey.</p> <p>Population = 3,820 Buses = 107</p>	<p>Estimates based upon U.S. Census data and the results of the 2020 online demographic survey.</p> <p>Population = 2,573 Buses = 88</p>
Population with Access and/or Functional Needs	<p>Information provided by the states within the EPZ.</p> <p>Population = N/A Buses = 215 Wheelchair Vans = 116 Ambulances = 30</p>	<p>Information provided by the states within the EPZ</p> <p>Population = 3,099 Buses = 75 Half Buses = 30 Vans = 80 Wheelchair Buses = 12 Wheelchair Vans = 221 Ambulances = 123</p>
Special Facility Population	<p>Medical facility population based on information provided by each state within the EPZ.</p> <p>Medical Facility Population = 3,619 Buses required = 72 Half Buses required = 7 Evacuation Bed Buses required = 27 Wheelchair Vans required = 205 Ambulances required = 147 Correctional Facility Census = 340 Buses = 9</p>	<p>Medical facility population based on information provided by the states and from internet searches, supplemented by data from the previous ETE study (confirmed by the states).</p> <p>Medical Facility Population = 3,990 Buses required = 81 Half Buses required = 0 Vans required = 32 Wheelchair Vans required = 288 Ambulances required = 280 Correctional Facility Census = 210 Buses = 0 (Shelter in place)</p>

Topic	Previous ETE Study	Current ETE Study
School, Preschool, Childcare Center, and Day Camp Population	<p>School population based on information provided by each state within the EPZ.</p> <p>School enrollment = 30,831</p> <p>Preschool/Daycare/Childcare Center enrollment = 4,355</p> <p>Day Camp enrollment = 2,574</p> <p>Buses = 780</p> <p>Wheelchair Vans required = 25</p> <p>Vans required = 31</p>	<p>Information provided by the states and internet searches, supplemented by data from the previous ETE study (confirmed by the states).</p> <p>School enrollment = 25,428</p> <p>Preschool/Daycare/Childcare Center enrollment = 5,167</p> <p>Day Camp enrollment = 3,022</p> <p>Buses = 702</p>
External Traffic	<p>External traffic considered on US-4, I-495, I-95, and SH-101</p> <p>Total vehicles = 11,838</p>	<p>External traffic considered on US-4, I-495, I-95, and SH-101</p> <p>Total vehicles = 25,044</p>
Voluntary evacuation from within EPZ in areas outside region to be evacuated	<p>20% of the population within the EPZ, but not within the Evacuation Region</p>	<p>20% of the population within the EPZ, but not within the Evacuation Region</p>
Shadow Evacuation	<p>20% of people outside of the EPZ within the Shadow Region</p>	<p>20% of people outside of the EPZ within the Shadow Region</p>
Network Size	<p>2,297 links; 1,694 nodes</p>	<p>2,641 Links; 1,920 Nodes</p>
Roadway Geometric Data	<p>Field surveys conducted in February 2010, April 2010 and November 2013. Roads and intersections were video archived.</p> <p>Road capacities based on 2010 HCM.</p>	<p>Field surveys conducted in March 2021. Roads and intersections were video archived.</p> <p>Road capacities based on 2016 HCM.</p>
School Evacuation	<p>Direct evacuation to designated Reception Center/Host School.</p>	<p>Direct evacuation to designated Reception Center/Host School.</p>
Ridesharing	<p>50% of transit-dependent persons will evacuate with a neighbor or friend as per federal guidance.</p>	<p>61.7% of transit-dependent persons will evacuate with a neighbor or friend as per the demographic survey results.</p>

Topic	Previous ETE Study	Current ETE Study
Trip Generation for Evacuation	<p>Based on residential telephone survey of specific pre-trip mobilization activities:</p> <p>Residents with commuters returning leave between 45 and 300 minutes.</p> <p>Residents without commuters returning leave between 5 and 240 minutes.</p> <p>Employees and transients leave between 5 and 105 minutes.</p> <p>All times measured from the Advisory to Evacuate.</p>	<p>Based on residential online demographic survey of specific pre-trip mobilization activities:</p> <p>Residents with commuters returning leave between 60 and 300 minutes (longer in snow).</p> <p>Residents without commuters returning leave between 5 and 225 minutes (longer in snow).</p> <p>Employees and transients leave between 5 and 105 minutes.</p> <p>All times measured from the Advisory to Evacuate.</p>
Weather	<p>Good, Rain, or Snow. The capacity and free flow speed of all links in the network are reduced by 10% in the event of rain and 20% for snow.</p>	<p>Good, Rain, or Snow. The capacity of all links in the network is reduced by 10% in the event of rain/light snow and 25% for heavy snow. The free flow speed of all links in the network is reduced by 10% in the event of rain/light snow and 15% for heavy snow.</p>
Modeling	DYNEV II System – Version 4.0.18.0	DYNEV II System – Version 4.0.21.0
Special Events	<p>4th of July Fireworks Show at Hampton Beach</p> <p>Special Event Population = 75,989 additional transients</p> <p>Vehicles = 30,375</p>	<p>4th of July Fireworks Show at Hampton Beach</p> <p>Special Event Population = 70,974 additional transients</p> <p>Vehicles = 24,792</p>
Evacuation Cases	<p>19 Regions (central sector wind direction and each adjacent sector technique used) and 14 Scenarios producing 266 unique cases.</p>	<p>19 Regions (central sector wind direction and two adjacent sectors on each side technique used) and 14 Scenarios producing 266 unique cases.</p>
Evacuation Time Estimates Reporting	<p>ETE reported for 90th and 100th percentiles. Results presented by Region and Scenario.</p>	<p>ETE reported for 90th and 100th percentiles. Results presented by Region and Scenario.</p>
Evacuation Time Estimates for the entire EPZ, 90th percentile	<p>Winter Midweek MIDDAY, Good Weather (Scenario 6): 3:40</p> <p>Summer Weekend, MIDDAY, Good Weather (Scenario 3): 3:25</p>	<p>Winter Midweek MIDDAY, Good Weather (Scenario 6): 3:45</p> <p>Summer Weekend, MIDDAY, Good Weather (Scenario 3): 3:30</p>
Evacuation Time Estimates for the entire EPZ, 100th percentile	<p>Winter Midweek MIDDAY, Good Weather (Scenario 6): 5:10</p> <p>Summer Weekend, MIDDAY, Good Weather (Scenario 3): 5:25</p>	<p>Winter Midweek MIDDAY, Good Weather (Scenario 6): 5:15</p> <p>Summer Weekend, MIDDAY, Good Weather (Scenario 3): 5:10</p>

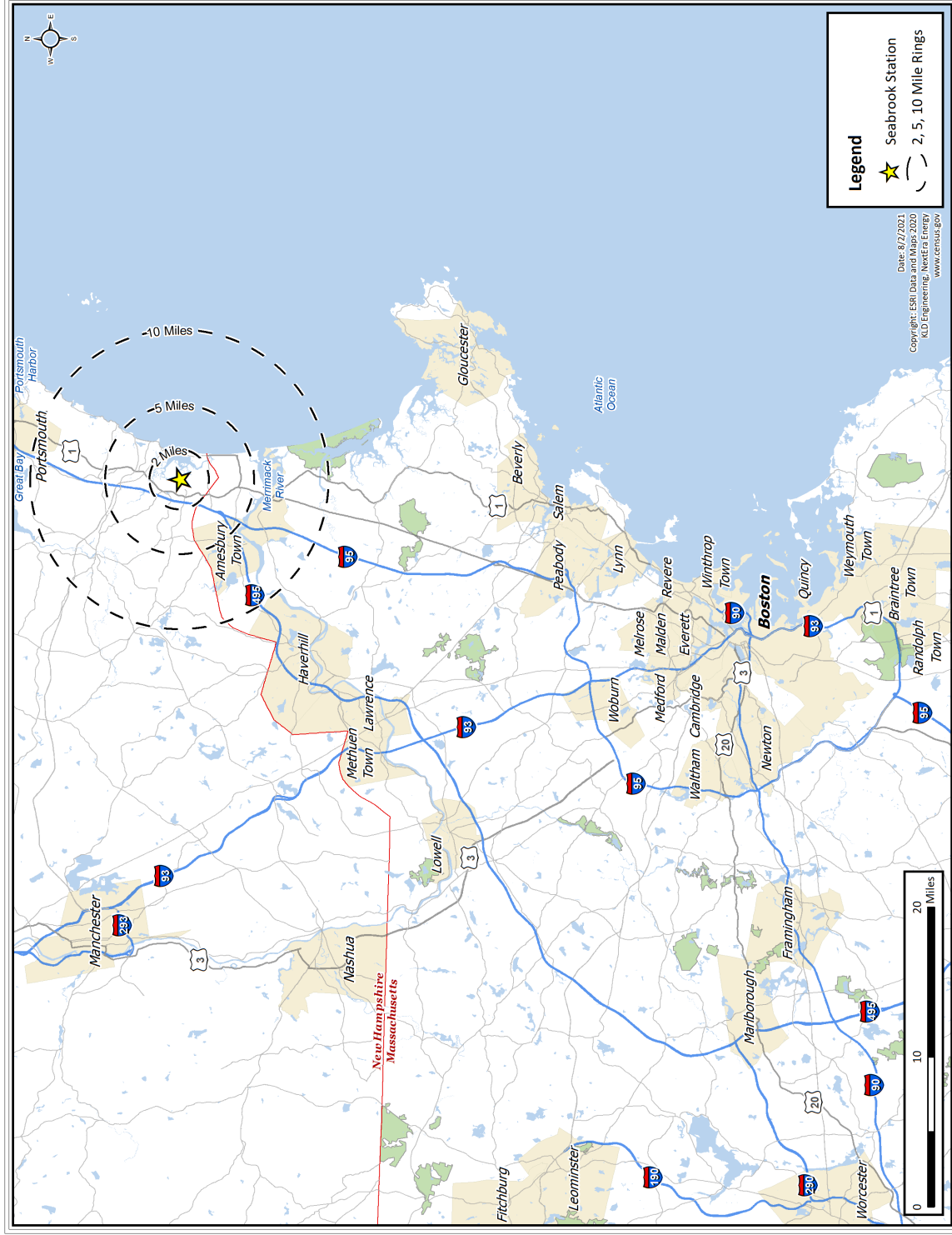


Figure 1-1. Seabrook Station Location

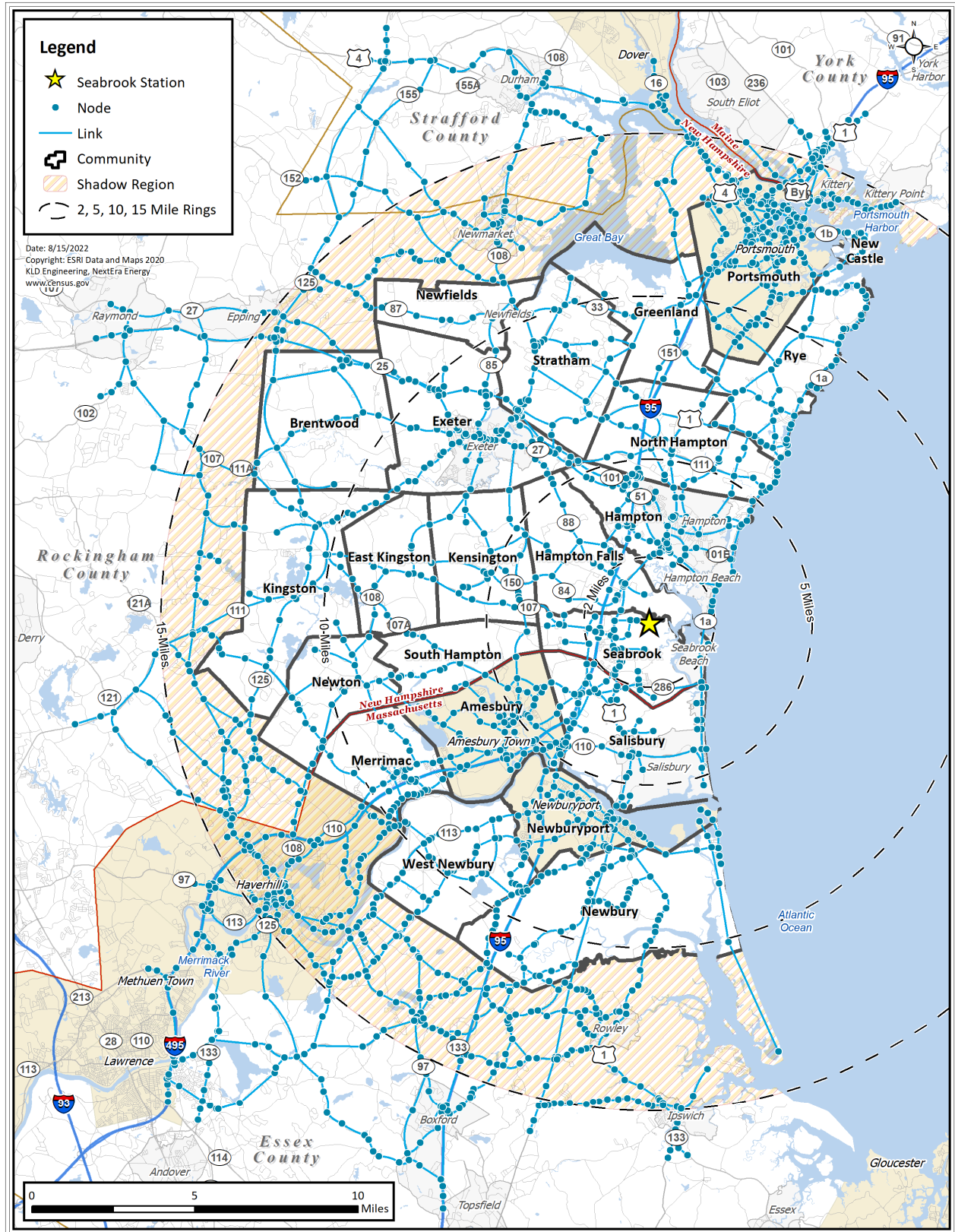


Figure 1-2. Seabrook Station Link-Node Analysis Network

2 STUDY ESTIMATES AND ASSUMPTIONS

This section presents the estimates and assumptions utilized in the development of the ETE.

2.1 Data Estimates

1. The permanent resident population is based on the 2020 U.S. Census population from the Census Bureau website¹. A methodology, referred to as the “area ratio method”, was employed to estimate the population within portions of census blocks that are divided by Community/ERPA boundaries. It is assumed that the population is evenly distributed across a census block in order to employ the area ratio method. (See Section 3.1.)
2. Estimates of employees who reside outside the EPZ and commute to work within the EPZ are based upon data from the US Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool². Plant employment data is based on data provided by NextEra. (See Section 3.4.)
3. Population estimates at transient and special facilities is based on data received from the state emergency management agencies, the National Center for Education Statistics website³, data from the previous ETE study confirmed still accurate by the state agencies, phone calls to individual facilities, satellite imagery, and internet searches where data was not readily obtained.
4. The relationship between permanent resident population and evacuating vehicles is based on the results of the demographic survey (see Appendix F, sub-sections F.3.1 and F.3.2). Values of 2.75 persons per household and 1.42 evacuating vehicles per household are used for the permanent resident population.
5. Where data was not provided, the average household size was assumed to be the vehicle occupancy rate for transient facilities and for the special event.
6. Employee vehicle occupancies are based on the results of the demographic survey; 1.03 employees per vehicle is used in the study. In addition, it is assumed there are two people per carpool, on average. (See Appendix F, sub-section F.3.1 and Figure F-7.)
7. The maximum bus speed within the EPZ is 45 mph based on state laws and the posted speed limits on major roadways within the EPZ.
8. Roadway capacity estimates are based on field surveys performed in March 2021 (verified by aerial imagery) and the application of the Highway Capacity Manual 2016.

¹ www.census.gov

² <http://onthemap.ces.census.gov/>

³ <https://nces.ed.gov/ccd/schoolsearch/index.asp>

2.2 Methodological Assumptions

1. The Planning Basis Assumption for the calculation of ETE is a rapidly escalating accident that requires evacuation, and includes the following⁴ (as per NRC guidance):
 - a. Advisory to Evacuate (ATE) is announced coincident with the siren notification.
 - b. Mobilization of the general population will commence within 15 minutes after the siren notification.
 - c. The ETE are measured relative to the ATE.
2. The center-point of the plant is located at the center of the containment building at 42° 53' 55.46" N, 70° 51' 5.92"W.
3. The DYNEV II⁵ system is used to compute ETE in this study.
4. Evacuees will drive safely, travel radially away from the plant to the extent practicable given the highway network, and obey all traffic control devices and traffic guides. All major evacuation routes are used in the analysis.
5. The existing EPZ and Community/ERPA boundaries are used. (See Figure 3-1.)
6. The existing ERPA classification (groupings of communities) are used. (See Table 2-1.)
7. The Shadow Region extends to 15 miles radially from the plant or approximately 5 miles radially from the EPZ boundary, as per NRC guidance. See Figure 7-2.
8. Shadow population characteristics (household size, evacuating vehicles per household, and mobilization time) are assumed to be the same as that of the permanent resident population within the EPZ.
9. The ETE are presented at the 90th and 100th percentiles in graphical and tabular format, as per NRC guidance. The percentile ETE is defined as the elapsed time from the ATE issued to a specific Region of the EPZ, to the time that Region is clear of the indicated percentile of evacuees.
10. One hundred percent (100%) of the people within the impacted keyhole will evacuate. Twenty percent (20%) of the population within the Shadow Region and within Communities of the EPZ not advised to evacuate will voluntarily evacuate, as shown in Figure 2-1, as per NRC guidance. Sensitivity studies explore the effect on ETE of increasing the percentage of voluntary evacuees in the Shadow Region (see Appendix M).

⁴ It is emphasized that the adoption of this planning basis is not a representation that these events will occur within the indicated time frame. Rather, these assumptions are necessary in order to:

1. Establish a temporal framework for estimating the Trip Generation distribution in the format recommended in Section 2.13 of NUREG/CR-6863.
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

It is likely that a longer time will elapse between the various stages of an emergency. See Section 5.1 for more detail.

⁵ The models of the I-DYNEV System were recognized as state of the art by the Atomic Safety & Licensing Board (ASLB) in past hearings. (Sources: Atomic Safety & Licensing Board Hearings on Seabrook and Shoreham; Urbanik). The models have continuously been refined and extended since those hearings and were independently validated by a consultant retained by the NRC. The DYNEV II model incorporates the latest technology in traffic simulation and in dynamic traffic assignment.

11. This study does not assume that roadways are empty at the start of the evacuation. Rather, there will be an initialization period (often referred to as “fill time” in traffic simulation) wherein the anticipated traffic volumes from the beginning of the evacuation are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of the evacuation depends on the scenario and the region being evacuated. (See Section 3.11).
12. To account for boundary conditions (roadway conditions outside the study area that are not specifically modeled due to the limited radius of the study area) beyond the study area, this study assumes a 25% reduction in capacity on two-lane roads and multilane highways for roadways that have traffic signals downstream. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the study area and the fact that the evacuating (“main street”) traffic volume will be more significant than the competing (“side street”) traffic volume at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time. There is no reduction in capacity for freeways due to boundary conditions.
13. The ETE also includes consideration of “through” (External-External traffic that originates its trip outside of the study area and has its destination outside of the study area) trips during the time that such traffic is permitted to enter the evacuated Region. (See Section 3.10).
14. The Protective Action Recommendation (PAR) for Seabrook Station indicate that the beaches in New Hampshire will always evacuate in the event of an emergency and the beaches in Massachusetts will be closed. As such, all beach facilities are assumed to evacuate for all cases.

2.3 Assumptions on Mobilization Times

1. Trip generation time (also known as mobilization time, or the time required by evacuees to prepare for the evacuation) is based upon the results of the recent, random-sample online demographic survey as well as the results from a telephone survey conducted for the previous ETE study. It is assumed that stated events take place in sequence such that all preceding events must be completed before the current event can occur.
2. One hundred percent (100%) of the EPZ population can be notified within 45 minutes, in accordance with the 2019 Federal Emergency Management Agency (FEMA) Radiological Emergency Preparedness Program Manual.
3. Commuter percentages (and the percentage of residents awaiting the return of a commuter) are based on the results of the demographic survey. According to the survey results, 76% of the households in the EPZ have at least 1 commuter (see Appendix F, sub-section F.3.1.); approximately 50% of those households with commuters will await the return of a commuter before beginning their evacuation trip (see Appendix F, sub-section F.3.2.). Therefore, 38% ($76\% \times 50\% = 38\%$) of EPZ households will await the return of a commuter, prior to beginning their evacuation trip.

2.4 Transit Dependent Assumptions

1. The percentage of transit-dependent people (permanent residents who do not own or have access to a private vehicle) who will rideshare with a neighbor or friend are based on the results of the demographic survey. According to the survey results, approximately 67% of the transit-dependent population will rideshare (see Appendix F, sub-section F.3.1).
2. Transit vehicles are used to transport those without access to private vehicles:
 - a. Schools, preschools/child care centers, and day camps
 - i. If these facilities are in session, transport (buses) will evacuate students directly to the host schools/school reception centers.
 - ii. For the facilities that are evacuated via buses, it is assumed no children will be picked up by their parents prior to the arrival of the buses.
 - iii. Children at these facilities, if in session, are given priority in assigning transit vehicles.
 - a. Medical Facilities
 - i. Buses, half buses, vans, wheelchair buses, wheelchair vans, and ambulances will evacuate patients at medical facilities and at any senior facilities within the EPZ, as needed.
 - ii. The percent breakdown of ambulatory, wheelchair bound and bedridden patients from the 2014 study was used to determine the number of ambulatory (67.7%), wheelchair bound (17.7%) and bedridden (14.6%) patients at the medical facilities wherein updated data was not provided.
 - b. Correctional Facilities
 - i. Rockingham County Jail will shelter in place in the event of an emergency.
 - c. Transit-dependent (do not own or have access to a private vehicle) permanent residents:
 - i. Transit-dependent general population are evacuated to reception centers.
 - ii. Access and/or functional needs population may require assistance (ambulance, bus or wheelchair transport) to evacuate. This is considered separately from the general population ETE, as per NRC guidance.
 - iii. Households with 3 or more vehicles were assumed to have no need for transit vehicles.
 - d. Analysis of the number of required roundtrips (“waves”) of evacuating transit vehicles is presented.
 - e. Transport of transit-dependent evacuees from reception centers to congregate care centers is not considered in this study.

3. Transit vehicle capacities:
 - a. School buses:
 - i. Massachusetts – 60 students and staff per bus for elementary schools and 50 students and staff per bus for middle and high schools
 - ii. New Hampshire – 60 students and staff per bus for elementary schools and 45 students and staff per bus for middle and high schools
 - b. Half buses = 12 passengers
 - c. Ambulatory transit-dependent persons and medical facility patients = 36 persons per bus
 - d. Vans = 15 persons
 - e. Ambulances = 2 bedridden persons (includes advanced and basic life support)
 - f. Wheelchair vans = 4 wheelchair bound persons for Massachusetts, 2 wheelchair bound persons for New Hampshire
4. Transit vehicle mobilization times:
 - a. Buses evacuating schools, pre-schools/childcare centers, and day camps will arrive at these facilities to be evacuated within 90 minutes of the ATE.
 - b. Transit dependent buses are mobilized when approximately 90% of residents with no commuters have completed their mobilization at 135 minutes after the ATE. If necessary, multiple waves of buses will be utilized to gather transit dependent people who mobilize more slowly. (See Section 5).
 - c. Vehicles will arrive at medical facilities (also includes hospitals and senior living facilities) to be evacuated within 90 minutes of the ATE.
5. Transit Vehicle loading times:
 - a. Concurrent loading on multiple buses/transit vehicles is assumed.
 - b. School buses are loaded in 15 minutes.
 - c. Transit Dependent buses will require 1 minute of loading time per passenger.
 - d. Buses for medical facilities which also includes hospitals and senior living facilities will require 1 minute of loading time per ambulatory passenger.
 - e. Wheelchair transport vehicles will require 15 minutes of loading time per passenger.
 - f. Ambulances are loaded in 30 minutes per bedridden passenger.
6. Drivers for all transit vehicles are available.

2.5 Traffic and Access Control Assumptions

1. Traffic Control Points (TCP) and Access Control Points (ACP) as defined in the approved county and state emergency plans will be considered in the ETE analysis, as per NRC guidance. (See Appendix G.)
2. TCP and ACP are assumed to be staffed approximately 120 minutes after the ATE, as per NRC guidance. It is assumed that no through traffic will enter the EPZ after this 120-minute time period.

3. All transit vehicles and other responders entering the EPZ to support the evacuation are unhindered by personnel manning TCPs and ACPs.

2.6 Scenarios and Regions

1. A total of 14 “Scenarios” representing different temporal variations (season, time of day, day of week) and weather conditions are considered. Scenarios to be considered are defined in Table 2-2:
 - a. The Fourth of July Fireworks Show at Hampton Beach, located on the shoreline of the Hampton Community, is considered as the special event (single or multi-day event that attracts a significant population into the EPZ; recommended by NRC guidance) for Scenario 13. This event brings in an additional 70,974 transients in 24,792 vehicles at peak times.
 - b. As per NRC guidance, one segment of one of the highest volume roadways will be out of service or one lane outbound on a freeway must be closed for a roadway impact scenario. This study considers the closure of a single lane westbound on New Hampshire State Highway 101 (SH-101) from the interchange with Interstate 95 (I-95) to the interchange with SH-107 (Exit 5) for the roadway impact scenario – Scenario 14.
2. Two types of adverse weather scenarios are considered. Rain may occur for either winter or summer scenarios; snow occurs in winter scenarios only. It is assumed that the rain or snow begins at about the same time the evacuation advisory is issued. Thus, no weather-related reduction in the number of transients who may be present in the EPZ is assumed. It is further assumed that snow removal equipment is available, the appropriate agencies are clearing/treating the roads as they would normally during snow, and the roads are passable albeit at lower speeds and capacities.
3. Adverse weather affects roadway capacity and the free flow roadway speeds. Transportation research indicates capacity and speed reductions of about 10% for rain and a range of 10% to 25% for snow. In accordance with Table 3-1 of Revision 1 to NUREG/CR-7002, this study assumes a 10% reduction in speed and capacity for rain and light snow and a speed and capacity reduction of 15% and 25%, respectively, for heavy snow. The factors are shown in Table 2-3.
4. Some evacuees will need additional time to clear their driveways and access the public roadway system. The distribution of time for this activity was determined from a telephone survey of the public conducted in 2012 and takes up to 180 minutes (see Appendix F, Figure F-19). It is assumed that the time needed by evacuees to remove snow from their driveways is sufficient time for snow removal crews to mobilize and clear/treat the public roadway system. It is also assumed that the current snowfall and snow removal times are similar to the those in 2012.

5. Mobilization and loading times for transit vehicles are slightly longer in adverse weather. It is assumed that mobilization times are 10 minutes and 20 minutes longer in rain/light snow and heavy snow, respectively. It is assumed that loading times for school buses are 5 minutes and 10 minutes longer in rain/light snow and heavy snow, respectively. It is assumed that loading times for transit buses are 10 minutes and 20 minutes longer in rain/light snow and heavy snow, respectively. Refer to Table 2-3.
6. Based on discussions with the states, employment is not reduced in the summer for vacation due to an influx of seasonal jobs that counteract the workers who take vacations.
7. Regions are defined by the underlying “keyhole” or circular configurations as specified in Section 1.4 of NUREG/CR-7002, Rev. 1. These Regions, as defined, display irregular boundaries reflecting the geography of the ERPAs included within these underlying configurations. All 16 cardinal and intercardinal wind direction keyhole configurations are considered. Regions to be considered are defined in Table 6-2. It is assumed that everyone within the group of ERPAs forming a Region that is issued an ATE will, in fact, respond and evacuate in general accord with the planned routes.
8. Based on the Seabrook Station PAR Procedure, the New Hampshire beaches evacuate while the Massachusetts beaches are closed for all wind directions.
9. Due to the irregular shapes of the ERPAs, there are instances where a small portion of an ERPA (a “sliver”) is within the keyhole and the population within that small portion is low (less than 500 people or 10% of the ERPA population, whichever is less). Under those circumstances, the ERPA is not included in the Region so as to not evacuate large numbers of people outside of the keyhole for a small number of people that are actually in the keyhole, unless otherwise stated in the PAR document.
10. Staged evacuation is considered as defined in NUREG/CR-7002, Rev. 1 – those people between 2 and 5 miles will shelter-in-place until 90% of the 2-Mile Region has evacuated, then they will evacuate. See Regions R14 through R19 in Table 6-2.

Table 2-1. ERPA Classification by Community

Community	ERPA
New Hampshire	
Seabrook	A
Hampton Falls	
Kensington	C
South Hampton	
Hampton	D
North Hampton	
Brentwood	F
East Kingston	
Exeter	
Newfields	
Newton	
Kingston	G
Greenland	
Stratham	
Rye	
New Castle	
Portsmouth	
Massachusetts	
Amesbury	B
Salisbury	
Merrimac	E
Newburyport	
Newbury	
West Newbury	

Table 2-2. Evacuation Scenario Definitions

Scenario	Season ⁶	Day of Week	Time of Day	Weather	Special
1	Summer	Midweek	Midday	Good	None
2	Summer	Midweek	Midday	Rain	None
3	Summer	Weekend	Midday	Good	None
4	Summer	Weekend	Midday	Rain	None
5	Summer	Midweek, Weekend	Evening	Good	None
6	Winter	Midweek	Midday	Good	None
7	Winter	Midweek	Midday	Rain/Light Snow	None
8	Winter	Midweek	Midday	Heavy Snow	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain/Light Snow	None
11	Winter	Weekend	Midday	Heavy Snow	None
12	Winter	Midweek, Weekend	Evening	Good	None
13	Summer	Midweek, Weekend	Evening	Good	July 4 th Fireworks Show at Hampton Beach
14	Summer	Midweek	Midday	Good	Roadway Impact – Single Lane Closure on New Hampshire SH-101 Westbound

Table 2-3. Model Adjustment for Adverse Weather

Scenario	Highway Capacity*	Free Flow Speed*	Mobilization Time for General Population	Mobilization Time for Transit Vehicles	Loading Time for School Buses	Loading Time for Transit Buses ⁷
Rain/Light Snow	90%	90%	No Effect	10-minute increase	5-minute increase	10-minute increase
Heavy Snow	75%	85%	See Section 5	20-minute increase	10-minute increase	20-minute increase

*Adverse weather capacity and speed values are given as a percentage of good weather conditions. Roads are assumed to be passable.

⁶ Winter means that school is in session at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

⁷ Does not apply to medical facilities and those with access and/or functional needs as loading times for these people are already conservative.

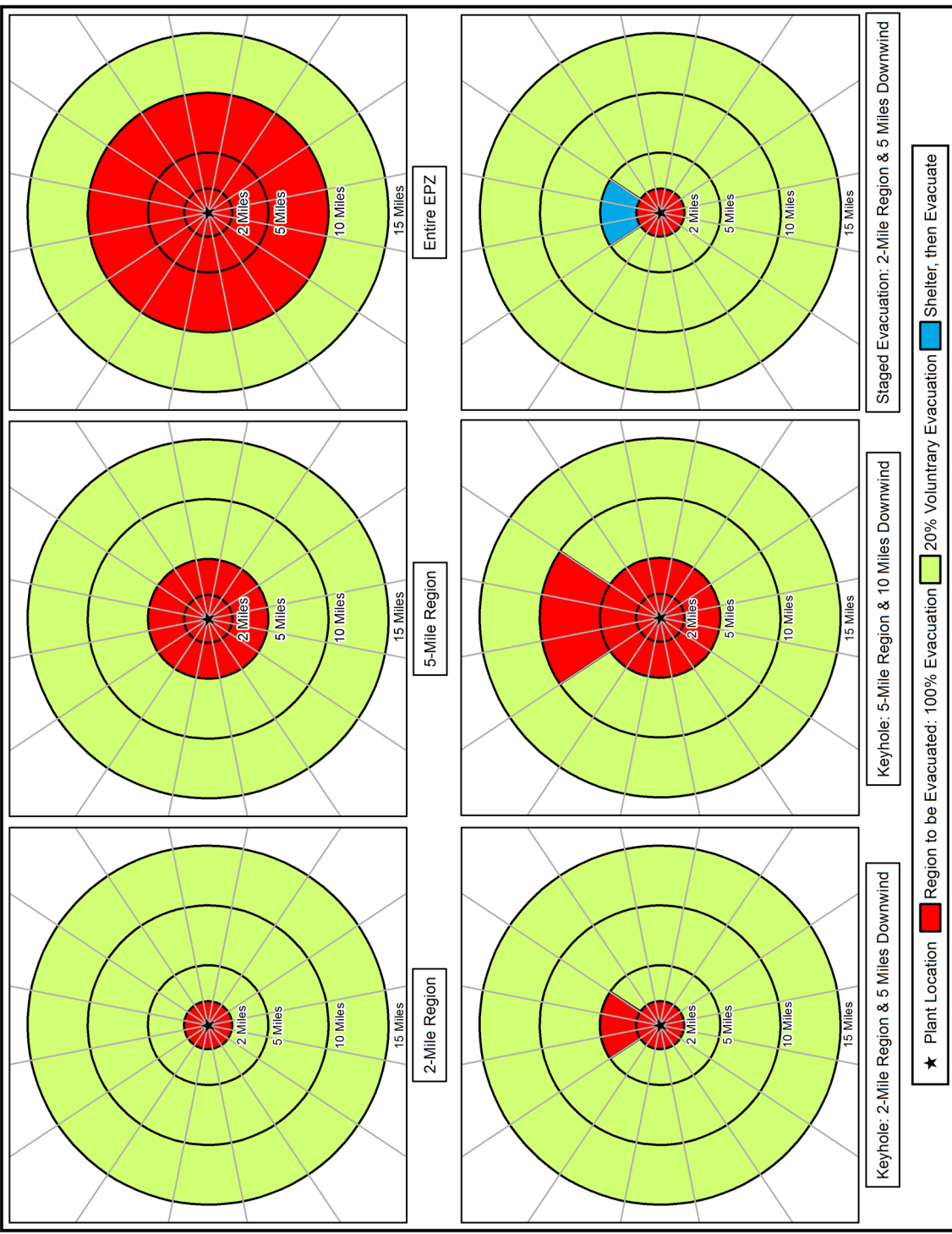


Figure 2-1. Voluntary Evacuation Methodology

3 DEMAND ESTIMATION

The estimates of demand, expressed in terms of people and vehicles, constitute a critical element in developing an evacuation plan. These estimates consist of three components:

1. An estimate of population within the EPZ, stratified into groups (resident, employee, transient).
2. An estimate, for each population group, of mean occupancy per evacuating vehicle. This estimate is used to determine the number of evacuating vehicles.
3. An estimate of potential double-counting of vehicles.

Appendix E presents much of the source material for the population estimates. Our primary source of population data, the 2020 Census, is not adequate for directly estimating some transient groups.

Throughout the year, vacationers and tourists enter the EPZ. These non-residents may dwell within the EPZ for a short period (e.g., a few days or one or two weeks), or may enter and leave within one day. Estimates of the size of these population components must be obtained, so that the associated number of evacuating vehicles can be ascertained.

The potential for double-counting people and vehicles must be addressed. For example:

- A resident who works and camps within the EPZ could be counted as a resident, again as an employee and once again as a camper.
- A visitor who stays at a hotel and spends time at a park, then goes camping could be counted three times.

Furthermore, the number of vehicles at a location depends on time of day. For example, motel parking lots may be full at dawn and empty at noon. Similarly, parking lots at area parks, which are full at noon, may be almost empty at dawn. Estimating counts of vehicles by simply adding up the capacities of different types of parking facilities will tend to overestimate the number of transients and can lead to ETE that are too conservative.

Analysis of the population characteristics of the Seabrook Station EPZ indicates the need to identify three distinct groups:

- Permanent residents - people who are year-round residents of the EPZ.
- Transients - people who reside outside of the EPZ who enter the area for a specific purpose (camping, recreation) and then leave the area. Also includes seasonal residents who may spend several weeks or months in the EPZ.
- Employees - people who reside outside of the EPZ and commute to work within the EPZ on a daily basis.

Estimates of the population and number of evacuating vehicles for each of the population groups are presented for each Community and by polar coordinate representation (population rose). The Seabrook Station EPZ is subdivided into 23 Communities. The Communities comprising the EPZ are shown in Figure 3-1.

3.1 Permanent Residents

The primary source for estimating permanent population is the 2020 U.S. Census data with an availability date of September 16, 2021. The average household size (2.75 persons/household – See Appendix F, Sub-section F.3.1) and the number of evacuating vehicles per household (1.42 vehicles/household – See Appendix F, Sub-section F.3.2) were adapted from the demographic survey.

The permanent resident population is estimated by cutting the census block polygons by the Community and EPZ boundaries using GIS software. A ratio of the original area of each census block and the updated area (after cutting) is multiplied by the total block population to estimate the population within the EPZ. The methodology (referred to as the “area ratio method”) assumes that the population is evenly distributed across a census block. Table 3-1 provides the permanent resident population within the EPZ, by Community, for 2010 and 2020 (based on the methodology above). As indicated, the permanent resident population within the EPZ has increased by 5.59% since the 2010 Census.

To estimate the number of vehicles, the year 2020 permanent resident population is divided by the average household size and then multiplied by the average number of evacuating vehicles per household. Permanent resident population and vehicle estimates are presented in Table 3-2. Figure 3-2 and Figure 3-3 present the permanent resident population and permanent resident vehicle estimates by sector and distance from Seabrook Station. This “rose” was constructed using GIS software. Note, the 2020 Census includes residents living in group quarters, such as skilled nursing facilities, boarding schools, on-campus student housing, group homes, prisons, etc. These people are transit dependent (will not evacuate in personal vehicles) and are included in the special facility evacuation demand estimates. To avoid double counting vehicles, the vehicle estimates for these people have been removed. The resident vehicles in Table 3-2 and Figure 3-3 have been adjusted accordingly.

3.1.1 Boarding Schools

There are two boarding schools within the EPZ: The Governor’s Academy and Phillips Exeter Academy. The enrollment data for these two schools were provided by the Commonwealth of Massachusetts and the State of New Hampshire emergency management agencies.

The Governor's Academy is located in Community Newbury, 10.5 miles south-southwest of Seabrook Station, while Phillips Exeter Academy is located in Community Exeter, 7.7 miles northwest of Seabrook Station. Both schools have boarding students who live on campus and are included in the Census as discussed above. These students are transit dependent and are included in the school population in Section 3.7. As such, the resident students are included as part of the EPZ resident population but no vehicles are considered for these two schools.

3.2 Shadow Population

A portion of the population living outside the evacuation area extending to 15 miles radially from the Seabrook Station may elect to evacuate without having been instructed to do so. This area is called the Shadow Region. Based upon NUREG/CR-7002, Rev. 1 guidance, it is assumed that 20% of the permanent resident population, based on U.S. Census Bureau data, in the Shadow Region will elect to evacuate.

Shadow population characteristics (household size, evacuating vehicles per household, mobilization time) are assumed to be the same as that for the EPZ permanent resident population. Table 3-3, Figure 3-4, and Figure 3-5 present estimates of the shadow population and vehicles, by sector. Similar to the EPZ resident vehicle estimates, resident vehicles at group quarters have been removed from the shadow population vehicle demand in Table 3-3 and Figure 3-5.

3.3 Transient Population

Transient population groups are defined as those people (who are not permanent residents, nor commuting employees) who enter the EPZ for a specific purpose (camping, recreation). Transients may spend less than one day or stay overnight at camping facilities, hotels and motels. Data for transient facilities were provided by the Commonwealth of Massachusetts and the State of New Hampshire emergency management agencies. When data could not be provided, the number of transient vehicles was estimated based on the parking lot capacity or accommodation capacity obtained from aerial imagery and facility websites. It is assumed that transients would travel to the recreational areas and facilities as a family/household. As such, the average household size (2.75 – See Section 3.1) was used to estimate the transient population for those facilities in which exact data could not be obtained. The transient attractions within the Seabrook Station EPZ are summarized as follows:

- Beaches – 7,514 transients and 2,995 vehicles; 2.51 transients per vehicle
- Campgrounds – 9,106 transients and 6,345 vehicles; 1.44 transients per vehicle (NOTE: Recreational Vehicles (RVs) are modeled as 2 vehicles in DYNEV due to their larger size and more sluggish operating characteristics.)
- Golf Courses – 1,311 transients and 618 vehicles; 2.12 transients per vehicle
- Historical Sites – 119 transients and 60 vehicles; 1.98 transients per vehicle
- Marinas – 2,810 transients and 1,044 vehicles; 2.69 transients per vehicle
- Other Recreational Facilities – 5,500 transients and 2,797 vehicles; 1.97 transients per vehicle
- Lodging Facilities – 8,727 transients and 3,149 vehicles; 2.77 transients per vehicle

Appendix E summarizes the transient data that was estimated for the EPZ. Table E-6 through Table E-10 present the number of transients visiting recreational areas, while Table E-11 presents the number of transients at lodging facilities within the EPZ.

3.3.1 Seasonal Transient Population

The Seabrook Station EPZ has a second category of transient population which is seasonal residents. These people will enter the area during the summer months and may stay considerably longer (several weeks or the entire season) than the average transients using a hotel or motel. The seasonal population use other lodging facilities such as condos, beach houses, and summer rentals that otherwise would not be captured in a typical lodging population.

The 2020 Census block data is used to estimate the seasonal resident population. Each census block includes information regarding the number of vacant and occupied households. An average vacant household percentage was calculated for the entire EPZ (10.3%) using this data.

It is assumed that seasonal residents will be renting homes near the Atlantic Ocean shoreline. Using only those census blocks that are within a half mile of the shoreline, the number of seasonal homes was calculated. It is further assumed that 10.3% (EPZ average) of the vacant homes within these census blocks are not rental homes and are in fact vacant homes. The remaining households were considered to be seasonal households. An average household size of 2.75 persons per household is used to determine the seasonal transient population from the number of vacant homes, and 1.42 evacuating vehicles per seasonal household is used to determine the number of seasonal transient vehicles from the number of vacant homes.

Using this methodology, it is estimated that there is a seasonal population of 5,454 transients and 2,799 transient vehicles within the Seabrook Station EPZ.

In total, there are 40,541 transients in the EPZ at peak times, evacuating in 19,807 vehicles (an average vehicle occupancy of 2.05 transients per vehicle). Table 3-4 presents transient population and transient vehicle estimates by Community. Figure 3-6 and Figure 3-7 present these data by sector. Transient population estimates presented here define the maximum number of transients expected in each category. The transient population in the EPZ varies by season, by day of the week, and by time of day. These variations are presented in Section 6.

3.4 Employees

The estimate of employees commuting into the EPZ is based on the 2019 Workplace Area Characteristic (WAC) provided by the U.S. Census Bureau's OnTheMap Census analysis tool¹ extrapolated to 2020 using the short-term employment projection for the Commonwealth of Massachusetts² and the State of New Hampshire³, supplemented by data provided by NextEra Energy.

The WAC data provides the employee counts by industry sector for each census block within the Seabrook EPZ. The employee count of each industry sector was then extrapolated 2020 for

¹<http://onthemap.ces.census.gov/> OnTheMap is an interactive map displaying workplace and residential distributions by user-defined geographies at census block level detail. It also reports the work characteristics detail on age, and earnings industry groups.

²<https://lmi.dua.eol.mass.gov/LMI/ShortTermIndustryProjections/STIPResultState?A=01&GA=000025&Cmd=Go&Type=shor&Dopt=TEXT#>

³<https://www.nhes.nh.gov/elmi/products/proj.htm>

each census block using the statewide short-term employment projections. Since not all employees are working at facilities within the EPZ at one time, a maximum shift reduction was applied to each census block. Assuming maximum shift employment occurs Monday through Friday between 9 AM and 5 PM, the following jobs take place outside the typical 9-5 workday:

- Manufacturing – takes place in shifts over 24 hours
- Arts, Entertainment, and Recreation – takes place in evenings and on weekends
- Accommodations and Food Services – peaks in the evenings

Therefore, the number of extrapolated employees working in these three industry sectors was subtracted from the total number for each census block to represent the maximum number of employees present in the EPZ at any one time. As per the NUREG/CR-7002, Rev. 1, employers with 200 or more employees working in a single shift are considered as the major employers. As such, the census blocks with less than 200 extrapolated employees (during the maximum shift) are not included in this study.

Employees who work within the EPZ fall into two categories:

- Those who live and work in the EPZ
- Those who live outside of the EPZ and commute to jobs within the EPZ

Those of the first category are already counted as part of the permanent resident population. To avoid double counting, we focus only on those employees commuting from outside the EPZ who will evacuate along with the permanent resident population. The 2019 LEHD (Longitudinal Employer-Household Dynamics) Origin-Destination Employment Statistics (LODES) data⁴ from OnTheMap website was then used to estimate the percent of employees that work within the EPZ but live outside. This value, 62.0%, was applied to the maximum shift employee values to compute the number of employees commuting into the EPZ at peak times. Note, the plant employment data was provided by NextEra Energy and supplemented for the census block in Community Seabrook. As such, the plant employment data is reflected in the New Hampshire employment subtotal in Appendix E, Table E-5.

There are a total of 25,169 employees commuting into the EPZ on a daily basis. To estimate the evacuating employee vehicles, a vehicle occupancy of 1.03 employees per vehicle obtained from the demographic survey (see Appendix F, Sub-section F.3.1) was used for the major employers. Table 3-5 presents the estimates of employees and vehicles commuting into the EPZ by Community. Figure 3-8 and Figure 3-9 present these data by sector.

3.5 Special Facilities

3.5.1 Medical Facilities

Medical facility data were provided by the New Hampshire and Massachusetts emergency management agencies, supplemented by data from the previous ETE study that was confirmed to be accurate by the state emergency management agencies where data was not provided.

⁴ The LODES data is part of the LEHD data products from the U.S. Census Bureau. This dataset provides detailed spatial distributions of workers' employment and residential locations and the relation between the two at the census block level. For detailed information, please refer to this site: <https://lehd.ces.census.gov/data/>

Internet searches were conducted to gather data for the new facilities identified in the EPZ wherein data was not provided. Table E-4 in Appendix E and Table 3-6 present the census of medical facilities in the EPZ. A total of 3,990 persons have been identified as living in, or being treated in, these facilities. The percent breakdown of ambulatory (67.7%), wheelchair bound (17.7%), and bedridden patients (14.6%) from the previous ETE study was used to estimate the number of ambulatory, wheelchair bound and bedridden patients at the newly identified medical facilities wherein updated data was not provided.

The transportation requirements for the medical facility population are also presented in Table 3-6. The number of ambulance runs is determined by assuming that 2 patients can be accommodated per ambulance trip; the number of wheelchair van runs assumes 4 wheelchairs per trip for facilities in Massachusetts and 2 wheelchairs per trip for facilities in New Hampshire; the number of vans assumes 15 persons per van; and the number of bus runs estimated assumes 36 ambulatory patients per trip. Buses evacuating medical facilities are modeled as 2 vehicles in DYNEV due to their larger size and more sluggish operating characteristics.

3.5.2 Correctional Facilities

As shown in Table E-12, there is one correctional facility within the EPZ – Rockingham County Jail. According to discussions with New Hampshire Homeland Security and Emergency Management, this facility will shelter-in-place in the event of an emergency. As shown in this table, there are as many as 210 inmates at this facility.

3.6 Transit Dependent Population

The demographic survey (see Appendix F) results were used to estimate the portion of the population requiring transit service:

- Those persons in households that do not have a vehicle available.
- Those persons in households that do have vehicle(s) that would not be available at the time the evacuation is advised.

In the latter group, the vehicle(s) may be used by a commuter(s) who does not return (or is not expected to return) home to evacuate the household.

Table 3-7 presents estimates of transit-dependent people. Note:

- Estimates of persons requiring transit vehicles include schoolchildren. For those evacuation scenarios where children are at school when an evacuation is ordered, separate transportation is provided for the schoolchildren. The actual need for transit vehicles by residents is thereby less than the given estimates. However, estimates of transit vehicles are not reduced when schools are in session.
- It is reasonable and appropriate to consider that many transit-dependent persons will evacuate by ridesharing with neighbors, friends or family. For example, nearly 80% of those who evacuated from Mississauga, Ontario⁵ who did not use their own

⁵ Institute for Environmental Studies, University of Toronto, THE MISSISSAUGA EVACUATION FINAL REPORT, June 1981. The

cars, shared a ride with neighbors or friends. Other documents report that approximately 70% of transit dependent persons were evacuated via ride sharing. **Based on the results of the demographic survey, approximately 67.1% of the transit-dependent population will rideshare (see Appendix F, sub-section F.3.1).**

The estimated number of bus trips needed to service transit-dependent persons is based on an estimate of average bus occupancy of 36 persons at the conclusion of the bus run. Transit vehicle seating capacities typically equal or exceed 60 children on average (roughly equivalent to 36 adults). If transit vehicle evacuees are two thirds adults and one third children, then the number of “adult seats” taken by 36 persons is $24 + (2/3 \times 12) = 32$. On this basis, the average load factor anticipated is $(32/36) \times 100 = 89\%$. Thus, if the actual demand for service exceeds the estimates of Table 3-7 by 12.5%, the demand for service can still be accommodated by the available bus seating capacity.

$$\left[24 + \left(\frac{2}{3} \times 12 \right) \right] \div 36 \times 1.125 = 1.00$$

Table 3-7 indicates that transportation must be provided for 2,573 people. Therefore, a total of 72 bus runs are required from a capacity standpoint. In order to service all of the transit dependent population and have at least one bus drive through each of the Communities, **88 buses** are used in the ETE calculations. The annual public information brochure supplied by both states identifies bus routes in each community to pick up transit dependent people as well as a list of bus pickup locations for visitors of Hampton Beach and Seabrook Beach. See Section 8 and Section 10 for further discussion.

To illustrate this estimation procedure, we calculate the number of persons, P, requiring public transit or ride-share, and the number of buses, B, required for the EPZ:

$$P = \text{No. of HH} \times \sum_{i=0}^n \{ (\% \text{ HH with } i \text{ vehicles}) \times [(\text{Average HH Size}) - i] \} \times A^i C^i$$

Where:

A = Percent of households with commuters

C = Percent of households who will not await the return of a commuter

$$P = 63,047 \times [0.0029 \times (1.00) + 0.234 \times (1.66 - 1) \times 0.76 \times 0.50 + 0.515 (2.84 - 2) \times (0.76 \times 0.50)^2] = 7,821$$

$$B = [(1 - 0.671) \times P] \div 36 = [(0.329 \times 7,821) = 2,573] \div 36 = 72 \text{ (rounded up to the nearest bus)}$$

These calculations, based on the demographic survey results, are explained as follows:

- The total number of persons requiring public transit is the sum of such people in HH with no vehicles, or with 1 or 2 vehicles that are away from home.

report indicates that 6,600 people of a transit-dependent population of 8,600 people shared rides with other residents; a ride share rate of 77% (Page 5-10).

- The number of households (HH) is computed by dividing the EPZ population by the average household size ($173,380 \div 2.75$) and is 63,047.
- All members (1.00 avg.) of households (HH) with no vehicles (0.29%) will evacuate by public transit or ride-share. The term $63,047$ (number of households) $\times 0.0029 \times 1.00$, accounts for these people.
- The members of HH with 1 vehicle away (23.4%), who are at home, equal $(1.66 - 1)$. The number of HH where the commuter will not return home is equal to $(63,047 \times 0.234 \times 0.66 \times 0.76 \times 0.50)$, as 76% of EPZ households have a commuter, 50% of which would not return home in the event of an emergency. The number of persons who will evacuate. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms.
- The members of HH with 2 vehicles that are away (51.5%), who are at home, equal $(2.84 - 2)$. The number of HH where neither commuter will return home is equal to $[63,047 \times 0.515 \times 0.84 \times (0.76 \times 0.50)^2]$. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms (the last term is squared to represent the probability that neither commuter will return).
- Households with 3 or more vehicles are assumed to have no need for transit vehicles.
- The number of buses is computed based on 67.1% of the transit-dependent population ridesharing with a neighbor or friend and a capacity of 36 people per bus.

Buses evacuating the transit-dependent population are modeled as 2 vehicles in DYNEV due to their larger size and more sluggish operating characteristics.

3.7 School Population Demand

Table 3-8 through Table 3-10 presents the school, preschool/childcare center, and day camp population and transportation requirements, respectively, for the 2020 to 2021 school year. The column in Table 3-8 through Table 3-10 entitled “Buses Required” specifies the number of buses required for each facility under the following set of assumptions and estimates:

- No students will be picked up by their parents prior to the arrival of the buses.
- There are several after school programs listed in Table 3-9. These programs are hosted in elementary schools within the EPZ. To avoid double counting these students, evacuation buses were not considered for these programs.
- While many high school students commute to school using private automobiles (as discussed in Section 2.4 of NUREG/CR-7002, Rev. 1), the estimate of buses required for school evacuation does not consider the use of these private vehicles.
- Bus capacity, expressed in students per bus, is set to 60 for elementary schools. For middle and high schools bus capacity is set to 50 and 45 for Massachusetts schools and New Hampshire schools, respectively, based on discussions with the state emergency management agencies.
- Those staff members who do not accompany the students will evacuate in their private vehicles.

- No allowance is made for student absenteeism, which is typically 3% daily.

Implementation of a process to confirm individual school transportation needs prior to bus dispatch may improve bus utilization. In this way, the number of buses dispatched to the schools will reflect the actual number needed. The need for buses would be reduced by any high school students who have evacuated using private automobiles (if permitted by school authorities). Those buses originally allocated to evacuate schoolchildren that are not needed due to children being picked up by their parents, can be gainfully assigned to service other facilities or those persons who do not have access to private vehicles or to ride-sharing.

Buses evacuating schoolchildren are modeled as 2 vehicles in DYNEV due to their larger size and more sluggish operating characteristics.

Table 10-3 presents a list of the host schools and reception centers for each school in the EPZ. Students will be transported to these facilities where they will be subsequently retrieved by their respective families.

3.7.1 Great Bay Community College

There is one commuter college within the EPZ, Great Bay Community College, located in Community Portsmouth, approximately 12.2 miles north-northeast of Seabrook Station. Based on the data obtained from the National Center for Education Statistics⁶ database (as of Fall 2019), Great Bay Community College has 576 full-time students. Since this college does not provide on-campus student housing, all the students are considered as commuter students who would be evacuated in personal vehicles or ridesharing with fellow classmates. The commuter students have similar travel patterns as the commuters; therefore, the commuter vehicle occupancy rate of 1.03 commuters per vehicle (see Appendix F, Sub-section F.3.1) was used to estimate the evacuating vehicles. As a result, 559 ($576 \div 1.03$) evacuating vehicles were assigned to Great Bay Community College.

3.8 Special Event

A special event can attract large numbers of transients to the EPZ for short periods of time, creating a temporary surge in demand as per Section 2.5.1 of NUREG/CR-7002, Rev. 1. The state emergency management agencies were polled regarding the potential special events in the EPZ. The only potential special event identified by the state agencies that attracts transients from outside the EPZ is the 4th of July fireworks show at Hampton Beach (Scenario 13). The fireworks show commences after sundown at Hampton Beach on the 4th of July. Data from the previous ETE study was confirmed to still be accurate by the state emergency management personnel. According to New Hampshire emergency management personnel, approximately 150,000 people are at the beach at peak times. Approximately 45% of beach visitors are local residents. As such, 55% of these beach visitors, or 82,500 transients, come from outside the EPZ. It is assumed that families travel to the event as a family in a single vehicle; therefore, the average household size of 2.75 was used for vehicle occupancy. The 82,500 transients would evacuate in 30,000 vehicles.

⁶ <https://nces.ed.gov/collegenavigator/>

Transients already counted at the beaches, marinas, campgrounds, and lodging facilities within the Hampton Beach area were assumed to also attend the event, as well as seasonal residents. For this reason, 11,526 transients and seasonal residents and 5,208 vehicles were subtracted from the non-EPZ special event demand to prevent double counting. A total of 70,974 transients evacuating in 24,792 vehicles were incorporated at various parking locations for this special event. The special event vehicle trips were generated utilizing the same mobilization distributions as transients. Public transportation is not provided for this event and was not considered in the special event analysis.

3.9 Access and/or Functional Needs Population

The state emergency management agencies have a registration for access and/or functional needs persons. The current number (3,099) of registered access and/or functional needs people was provided by the states. The registration does not track what type of transportation (bus, wheelchair transport, ambulance) the population needs. To determine the type of transportation needed for the access and/or functional residents, the same distribution (61% ambulatory, 31% wheelchair bound, and 8% bedridden) from the previous ETE study was used. Thus, of the 3,099 registered people, 1,902 are ambulatory, 952 are wheelchair-bound, and 245 are bedridden. Given the large number of registered access and/or functional needs people, it is likely many of these people are counted within the transit dependent population calculation discussed in Section 3.6. As such, only the wheelchair bound and ambulatory access and/or functional needs population was considered in the analysis to avoid double counting buses for the transit dependent/ambulatory access and/or functional needs populations. Table 3-11 summarizes the total number of people registered for access and/or functional needs by type of vehicle needed assuming a range of 2 to 10 wheelchair-bound persons per wheelchair bus (based on information provided by the states), 4 and 2 wheelchair-bound persons per wheelchair van for Massachusetts and New Hampshire transportation providers, respectively, 2 bedridden persons per ambulance, 30 ambulatory persons per bus, 12 ambulatory persons per half bus, and 14 ambulatory persons per van. The table also estimates the number of transportation resources needed to evacuate these people in a timely manner.

3.10 External Traffic

Vehicles will be traveling through the EPZ (external-external trips) at the time of an emergency event. After the Advisory to Evacuate (ATE) is announced, these through-travelers will also evacuate. These through vehicles are assumed to travel on the major routes traversing the study area – Interstate 95 (I-95), US-4, I-495, and New Hampshire State Highway 101 (SH-101). Emergency management agencies indicated that this traffic would continue to enter the study during the first 120 minutes following the ATE.

Average Annual Daily Traffic (AADT) data was obtained from the New York State Department of Transportation (NYSDOT) to estimate the number of vehicles per hour on the aforementioned route. The AADT was multiplied by the K-Factor, which is the proportion of the AADT on a roadway segment or link during the design hour, resulting in the design hour volume (DHV). The

design hour is usually the 30th highest hourly traffic volume of the year, measured in vehicles per hour (vph). The DHV is then multiplied by the D-Factor, which is the proportion of the DHV occurring in the peak direction of travel (also known as the directional split). The resulting values are the directional design hourly volumes (DDHV) and are presented in Table 3-12, for the route considered. The DDHV is then multiplied by 2 hours (Access Control Points – ACP – are activated at 120 minutes after the ATE) to estimate the total number of external vehicles loaded on the analysis network.

As indicated in Table 3-12, there are 25,044 vehicles entering the study area as external-external trips prior to the activation of the ACP and the diversion of this traffic. This number is reduced by 60% for evening scenarios (Scenarios 5 and 12) as discussed in Section 6.

3.11 Background Traffic

Section 5 discusses the time needed for the people in the EPZ to mobilize and begin their evacuation trips. As shown in Table 5-9, there are 15 time periods during which traffic is loaded on to roadways in the study area to model the mobilization time of people in the EPZ. Note, there is no traffic generated during the 15th time period, as this time period is intended to allow traffic that has already begun evacuating to clear the study area boundaries.

This study does not assume that roadways are empty at the start of the evacuation. Rather, there is an initialization time period (often referred to as “fill time” in traffic simulation) wherein the anticipated traffic volumes at the start of the evacuation (Time Period 1) are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of the evacuation depends on the scenario and the region being evacuated (see Section 6). There are approximately 7,710 vehicles on the roadways in the study area at the end of fill time for an evacuation of the entire EPZ (Region R03) under Scenario 6 (winter, midweek, midday, good weather) conditions.

3.12 Summary of Demand

A summary of the population and vehicle demand in the study area is provided in Table 3-13 and Table 3-14, respectively. This summary includes all population groups described in this section. A total of 371,677 people and 195,758 vehicles are considered in this study.

Table 3-1. EPZ Permanent Resident Population

Community	2010 Population	2020 Population
Seabrook	8,569	8,401
Hampton Falls	2,238	2,403
Salisbury	8,372	9,237
Amesbury	16,282	17,366
South Hampton	827	896
Kensington	2,129	2,095
North Hampton	4,304	4,538
Hampton	15,445	16,214
Newbury	6,664	6,716
Newburyport	17,417	18,289
Merrimac	6,361	6,719
West Newbury	4,235	4,500
East Kingston	2,326	2,439
Exeter	14,313	16,055
Kingston	6,117	6,198
Newfields	1,682	1,769
Brentwood	4,490	4,490
Newton	4,572	4,818
New Castle	968	1,000
Greenland	3,554	4,067
Rye	5,320	5,545
Stratham	7,276	7,669
Portsmouth	20,746	21,956
EPZ TOTAL:	164,207	173,380
EPZ Population Growth (2010-2020):		5.59%

Table 3-2. Permanent Resident Population and Vehicles by Community

Community	2020 Population	Resident Vehicles
Seabrook	8,401	4,325
Hampton Falls	2,403	1,241
Salisbury	9,237	4,727
Amesbury	17,366	8,831
South Hampton	896	462
Kensington	2,095	1,082
North Hampton	4,538	2,346
Hampton	16,214	8,308
Newbury	6,716	3,414
Newburyport	18,289	9,232
Merrimac	6,719	3,464
West Newbury	4,500	2,319
East Kingston	2,439	1,260
Exeter	16,055	8,028
Kingston	6,198	3,202
Newfields	1,769	917
Brentwood	4,490	2,154
Newton	4,818	2,491
New Castle	1,000	518
Greenland	4,067	2,094
Rye	5,545	2,791
Stratham	7,669	3,962
Portsmouth	21,956	11,100
EPZ TOTAL:	173,380	88,268

Table 3-3. Shadow Population and Vehicles by Sector

Sector	Population	Evacuating Vehicles
N	1,130	583
NNE	6,456	3,202
NE	82	42
ENE	0	0
E	0	0
ESE	0	0
SE	0	0
SSE	339	175
S	8,293	4,234
SSW	10,179	5,249
SW	33,885	17,185
WSW	21,687	10,979
W	5,685	2,936
WNW	2,670	1,379
NW	3,131	1,618
NNW	9,696	4,979
TOTAL:	103,233	52,561

Table 3-4. Summary of Transients and Transient Vehicles

Community	Transients	Transient Vehicles	Seasonal Residents	Seasonal Resident Vehicles	Total Transients	Total Transient Vehicles
Seabrook	1,556	496	513	265	2,069	761
Hampton Falls	1,004	800	0	0	1,004	800
Salisbury	5,752	3,539	1,117	573	6,869	4,112
Amesbury	2,972	1,131	0	0	2,972	1,131
South Hampton	798	636	0	0	798	636
Kensington	0	0	0	0	0	0
North Hampton	810	539	50	25	860	564
Hampton	6,637	2,566	2,805	1,443	9,442	4,009
Newbury	453	188	172	88	625	276
Newburyport	1,714	631	121	63	1,835	694
Merrimac	0	0	0	0	0	0
West Newbury	0	0	0	0	0	0
East Kingston	25	13	0	0	25	13
Exeter	1,942	855	0	0	1,942	855
Kingston	663	506	0	0	663	506
Newfields	238	190	0	0	238	190
Brentwood	0	0	0	0	0	0
Newton	165	120	0	0	165	120
New Castle	815	393	28	14	843	407
Greenland	270	132	0	0	270	132
Rye	1,700	663	414	209	2,114	872
Stratham	20	11	0	0	20	11
Portsmouth	7,553	3,599	234	119	7,787	3,718
EPZ TOTAL:	35,087	17,008	5,454	2,799	40,541	19,807

Table 3-5. Summary of Employees and Employee Vehicles Commuting into the EPZ

Community	Employees	Employee Vehicles
Seabrook	1,554	1,509
Hampton Falls	0	0
Salisbury	413	401
Amesbury	522	506
South Hampton	0	0
Kensington	0	0
North Hampton	505	490
Hampton	1,686	1,637
Newbury	433	420
Newburyport	2,427	2,355
Merrimac	0	0
West Newbury	144	140
East Kingston	0	0
Exeter	4,257	4,131
Kingston	0	0
Newfields	0	0
Brentwood	446	433
Newton	0	0
New Castle	0	0
Greenland	325	316
Rye	183	178
Stratham	834	810
Portsmouth	11,440	11,108
EPZ TOTAL:	25,169	24,434

Table 3-6. Medical Facility Transit Demand

Community	Facility Name	Current Census	Ambulatory	Wheel-chair Bound	Bed-ridden	Buses	Vans	Wheel-chair Vans	Ambulances
MASSACHUSETTS MEDICAL FACILITIES									
Amesbury	Coastal Connections Inc	96	65	17	14	2	0	5	7
Amesbury	Amesbury Residence	8	8	0	0	0	1	0	0
Amesbury	Maplewood Center	109	57	48	4	2	0	12	2
Amesbury	Lahey Health Primary Care, Amesbury	6	6	0	0	0	1	0	0
Amesbury	Amesbury Village, LLC	102	66	26	10	2	0	7	5
Amesbury	Hillside Rest Home Inc	28	28	0	0	1	0	0	0
Amesbury	Elizabeth Calsey House	14	10	2	2	0	1	1	1
Amesbury	Elizabeth Calsey House 2	25	17	4	4	0	2	1	2
Merrimac	Church Street House	5	5	0	0	0	1	0	0
Newbury	Quaker Hill	24	24	0	0	0	2	0	0
Newbury	Byfield Elderly Housing	22	18	4	0	0	2	1	0
Newburyport	Home for Aged Men (Griffin House)	9	9	0	0	0	1	0	0
Newburyport	Anna Jaques Hospital	123	83	22	18	3	0	6	9
Newburyport	Newburyport Residence	8	8	0	0	0	1	0	0
Newburyport	Constellation Health Services	111	75	20	16	3	0	5	8
Newburyport	Country Center for Health & Rehabilitation	111	19	88	4	0	2	22	2
Newburyport	James Steam Mill Elderly Housing	126	79	42	5	3	0	11	3
Newburyport	Harborside Adult Health at St. Paul's Church	35	31	4	0	1	0	1	0
Newburyport	Avita of Newburyport	70	48	12	10	1	1	3	5
Newburyport	Atria Merrimack Place	85	77	8	0	3	0	2	0
Newburyport	Heritage House	128	80	43	5	3	0	11	3
Newburyport	Brigham Health and Rehabilitation Center	64	8	52	4	0	1	13	2
Newburyport	Turning Point Inc.	51	51	0	0	2	0	0	0
Newburyport	Port Healthcare Center	123	83	22	18	3	0	6	9

Community	Facility Name	Current Census	Ambulatory	Wheel-chair Bound	Bed-ridden	Buses	Vans	Wheel-chair Vans	Ambulances
Newburyport	Opportunity Works	130	88	23	19	3	0	6	10
Salisbury	Assisted Living Center of Salisbury	30	26	4	0	0	2	1	0
	<i>MA Subtotal:</i>	1,643	1,069	441	133	32	18	114	68
NEW HAMPSHIRE MEDICAL FACILITIES									
Brentwood	Rockingham County Nursing Home	202	136	36	30	4	0	18	15
Exeter	Langdon Place of Exeter	114	77	20	17	3	0	10	9
Exeter	Exeter Rehab Center-Genesis HealthCare	81	55	14	12	2	0	7	6
Exeter	Exeter Hospital	100	64	0	36	2	0	0	18
Exeter	Exeter Healthcare	26	6	12	8	0	1	6	4
Exeter	The Woods at Riverwoods	300	203	53	44	6	0	27	22
Exeter	The Ridge at Riverwoods	163	110	29	24	4	0	15	12
Exeter	The Boulders at Riverwoods	174	118	31	25	4	0	16	13
Greenland	Fairweather Lodge Group Home	8	6	1	1	0	1	1	1
Hampton	Partridge House	162	162	0	0	5	0	0	0
Hampton	Oceanside Skilled Nursing Home & Rehab - Genesis	112	76	20	16	3	0	10	8
Hampton	Cornerstone at Hampton	120	81	21	18	3	0	11	9
Portsmouth	Portsmouth Regional Hospital	200	100	0	100	3	0	0	50
Portsmouth	Clipper Harbor of Portsmouth	102	69	18	15	2	0	9	8
Portsmouth	The Inn at Edgewood	12	8	2	2	0	1	1	1
Portsmouth	The Edgewood Centre	156	105	28	23	3	0	14	12
Portsmouth	Wentworth Senior Living	71	48	13	10	1	1	7	5
Portsmouth	Northeast Rehabilitation Hospital Network	33	22	6	5	0	2	3	3
Rye	Evolve at Rye	64	44	11	9	1	1	6	5
Rye	Webster at Rye	147	100	26	21	3	7	13	11
	<i>NH Subtotal:</i>	2,347	1,590	341	416	49	14	174	212
	TOTAL:	3,990	2,659	782	549	81	32	288	280

Table 3-7. Transit-Dependent Population Estimates

2020 EPZ Population	Survey Average HH Size with Indicated No. of Vehicles			Estimated No. of Households	Survey Percent HH with Indicated No. of Vehicles			Survey Percent HH with Commuters	Survey Percent HH with Non-Returning Commuters	Total People Requiring Transport	Estimated Ridesharing Percentage	People Requiring Public Transit	Percent Population Requiring Public Transit
	0	1	2		0	1	2						
173,380	1.00	1.66	2.84	63,047	0.29%	23.4%	51.5%	76%	50%	7,821	67.1%	2,573	1.5%

Table 3-8. School Population Demand Estimates

Community	School Name	Enrollment	Buses Required
MASSACHUSETTS			
Amesbury	Sparhawk School - Lower School	61	2
Amesbury	Amesbury Elementary School	346	6
Amesbury	Sparhawk School - Upper School	89	2
Amesbury	Amesbury Innovation High School	50	1
Amesbury	Amesbury Middle School	668	14
Amesbury	Amesbury High School	529	11
Amesbury	Cashman School	416	7
Merrimac	Dr. FN Sweetsir School	223	4
Merrimac	Helen R. Donaghue School	230	4
Newbury	Newbury Elementary School	392	7
Newbury	The Governor's Academy	401	9
Newbury	Triton Regional Middle School and High School	1,030	21
Newburyport	Bresnahan Elementary School	640	11
Newburyport	Newburyport High School	816	17
Newburyport	Immaculate Conception School	235	4
Newburyport	E.G. Molin Upper Elementary School	298	5
Newburyport	Rupert A. Nock Middle School	557	12
Newburyport	River Valley Charter School	288	5
Salisbury	Salisbury Elementary School	519	9
West Newbury	Dr. John C. Page School	329	6
West Newbury	Pentucket Regional High School	749	15
West Newbury	Pentucket Regional Middle School	393	8
<i>MA Subtotal:</i>		<i>9,259</i>	<i>180</i>
NEW HAMPSHIRE			
Brentwood	Swasey Central School	305	6
Brentwood	Brentwood Christian Academy	120	3
East Kingston	East Kingston Elementary School	130	3
Exeter	Great Bay Charter School	155	4
Exeter	Seacoast School of Technology	275	7
Exeter	Phillips Exeter Academy	1,060	24
Exeter	Main Street School	500	9
Exeter	Lincoln Street Elementary School	480	8
Exeter	Exeter High School	1,600	36
Greenland	Greenland Central School	410	7
Hampton	Winnacunnet Regional High School	1,140	26
Hampton	Sacred Heart School	223	4
Hampton	Hampton Academy	365	9

Community	School Name	Enrollment	Buses Required
Hampton	Marston School	297	5
Hampton Falls	Lincoln Akerman School	222	4
Hampton Falls	Heronfield Academy	100	3
Kensington	Kensington Elementary School	140	3
Kingston	Daniel J. Bakie Elementary School	388	7
Kingston	Seacoast Charter School	170	3
Kingston	Sanborn Regional High School	646	15
New Castle	Maude H. Trefethen School	37	1
Newfields	Newfields Elementary School	113	2
Newton	Memorial Elementary School	275	5
Newton	Seacoast Learning Collaborative	70	2
North Hampton	Squamscott River Academy	15	1
North Hampton	North Hampton Elementary School	321	6
Portsmouth	Saint Patrick Academy	220	4
Portsmouth	Dondero School	300	5
Portsmouth	Robert J. Lister Academy	20	1
Portsmouth	Portsmouth Career Technical Center ⁷	0	0
Portsmouth	Portsmouth High School	1,079	24
Portsmouth	Great Bay Community College ⁸	576	0
Portsmouth	Little Harbour School	411	7
Portsmouth	New Franklin School	260	5
Portsmouth	Portsmouth Middle School	545	13
Rye	Learning Skills Academy	60	2
Rye	Rye Junior High School	170	4
Rye	Rye Elementary School	196	4
Seabrook	Seabrook Elementary School	400	7
Seabrook	Seabrook Middle School	315	7
South Hampton	Seventh Day Adventist School	15	1
South Hampton	Barnard School	84	2
Stratham	Cooperative Middle School	1,218	28
Stratham	The Cornerstone School	170	3
Stratham	Cornerstone Christian Academy	10	1
Stratham	Stratham Memorial School	563	10
<i>NH Subtotal:</i>		16,169	331
EPZ Total:		25,428	511

⁷ Students at this facility are included in the Portsmouth High School enrollment to avoid double counting.

⁸ Commuter only school. No buses required.

Table 3-9. Preschool/Childcare Center Population Demand Estimates

Community	Preschool/Childcare Center Name ⁹	Enrollment	Buses Required
MASSACHUSETTS			
Amesbury	Amesbury Country Day School	20	1
Amesbury	Leaps & Bounds Preschool	24	1
Amesbury	Little Hands Learning Center	40	1
Amesbury	James Place The Next Generation	37	1
Amesbury	Windmill Country Day School	45	1
Amesbury	Little Sprouts Daycare	60	1
Amesbury	Amesbury Montessori Preschool and Kindergarten	20	1
Amesbury	Leaps and Bounds Pre-School	24	1
Merrimac	Small Wonders Preschool Program	15	1
Newbury	Our Secret Garden Nursery and Preschool	29	1
Newbury	Harmony Natural Learning Center	44	1
Newburyport	Community Action, Inc. Newburyport Head Start	54	1
Newburyport	School's Out @ Bresnahan School	120	0
Newburyport	YWCA - School's Out Program	65	2
Newburyport	Newburyport Montessori School	118	2
Newburyport	Newburyport KinderCare	71	2
Newburyport	Bright Horizons at Newburyport	70	2
Newburyport	Mrs. Murray's Nursery School	33	1
Newburyport	Kindercare Learning Center	80	2
Newburyport	Knoll Edge Preschool	20	1
Salisbury	Milestones Childcare and Preschool	26	1
West Newbury	Children's Castle	110	2
West Newbury	Learning Tree Preschool	15	1
West Newbury	Koinonia Preschool Day Care	30	1
West Newbury	Pathways For Learning	20	1
<i>MA Subtotal:</i>		<i>1,190</i>	<i>30</i>
NEW HAMPSHIRE			
Brentwood	Donna Clarke's Family Day Care	9	1
Brentwood	A Place To Grow	52	1
East Kingston	East Kingston Elementary School-Before & After School Program	45	0
East Kingston	KidLogic Early Learning Center	59	1
Exeter	Appleseeds Day School	120	2
Exeter	Exeter Day School	82	2
Exeter	Little Munchkins Learning Center	22	1

⁹ Several of the facilities listed are after school programs hosted at EPZ schools. There were no buses considered for these programs to avoid double counting.

Community	Preschool/Childcare Center Name ⁹	Enrollment	Buses Required
Exeter	Swasey Central School Before & After School Program	50	0
Exeter	Harris Family Children's Center	68	2
Exeter	Great Bay Kids Company	65	2
Exeter	Exeter Developmental Pre-School ¹⁰	-	0
Exeter	Montessori School for the Arts & Sciences	80	2
Exeter	Building Block Commons	56	1
Exeter	De Colores Children's Center	13	1
Exeter	Great Bay Kids' Company	143	3
Greenland	Camp Gundalow	200	4
Greenland	Greenland Peak Program	29	1
Hampton	Fun After School & Summer Program	99	2
Hampton	MPA at Hampton	22	1
Hampton	Hampton Child & Family Program-DBA Village Preschool	25	1
Hampton Falls	Lincoln Akerman School After School Program	40	1
Hampton Falls	Robin's Childs Place	166	3
Hampton Falls	Seacoast Head Start	37	1
Kensington	Kensington Elementary School After School Program	25	1
Kingston	Daniel J. Bakie Elementary School Before & After Childcare Program	30	0
Kingston	Kingston Children's Center	68	2
Newfields	Nurture & Nature Children's Center	52	1
Newfields	Newfields Action Club at Newfields Elementary School	25	1
Newton	Newton Learning Center	80	2
Newton	Memorial Elementary School - Before & After Program	21	0
North Hampton	North Hampton Elementary School Before and After School Program	55	0
North Hampton	Imprint's Day School	188	4
Portsmouth	Krepfels Center-Brain Injury Program	40	1
Portsmouth	Portsmouth Head Start	18	1
Portsmouth	Seacoast Community School	219	4
Portsmouth	Place for Friends and Fun	9	1
Portsmouth	Dondero Peak Program	45	1
Portsmouth	Kindercare Learning Center	142	3
Portsmouth	Little Blessings Day Care	71	2
Portsmouth	YMCA of the Seacoast	30	1
Portsmouth	The Children's Garden	30	1
Portsmouth	The Chase Home For Children	25	1
Portsmouth	Edgewood Early Learning Center	38	1

¹⁰ Student enrollment for this facility is included in Main Street School

Community	Preschool/Childcare Center Name ⁹	Enrollment	Buses Required
Portsmouth	Great Bay Kids-PEASE Center	270	5
Portsmouth	Little Harbour Peak Program	45	1
Portsmouth	Kathleen Tostenson	6	1
Portsmouth	Discovery Child Enrichment Center	143	3
Portsmouth	New Franklin School PEAK Program	12	1
Portsmouth	Early Learning Center at Temple Israel Preschool	24	1
Portsmouth	The Treehouse School of Portsmouth	27	1
Portsmouth	Seacoast Community School at the Meadows	22	1
Rye	Rye Country Day School	99	2
Seabrook	Seabrook Elementary School After School Program	90	2
Seabrook	Seabrook Middle School Adventure Zone After School Program	80	2
Seabrook	Miss Beth's Family Day Care	17	1
Seabrook	Seabrook Head Start	18	1
Stratham	Bright Horizons at Timberland	110	2
Stratham	Little Sprouts Childcare & Preschool	98	2
Stratham	Acorn School	54	1
Stratham	Stratham Circle Learning Center	66	2
Stratham	Stratham Memorial School Before & After School Program	90	0
Stratham	Richie McFarland Children's Center	13	1
<i>NH Subtotal:</i>		3,977	91
EPZ Total:		5,167	121

Table 3-10. Day Camp Population Demand Estimates

Community	Day Camp Name	Enrollment	Buses Required
MASSACHUSETTS			
Amesbury	US Sports Institute	196	4
Amesbury	James Place	46	1
Amesbury	Camp Bauercrest	250	5
Newbury	Coastal Discoveries Marine	24	1
Newbury	Governor's Academy	117	3
Newburyport	YWCA Greater Newburyport	65	2
Newburyport	Clipper Girls Basketball Camp	196	4
Newburyport	Mass Audubon Joppa Flats Education Center	196	4
Newburyport	Metro Rock Climbing Camps	196	4
West Newbury	Koinonia Day Camp	196	4
<i>MA Subtotal:</i>		1,482	32
NEW HAMPSHIRE			
Brentwood	Action Kids at Brentwood Commons	250	6
East Kingston	YMCA Tricklin' Falls Day Camp	300	7
Kingston	Long Tree Scout Reservation	100	3
Kingston	YMCA Camp Lincoln Kingston	600	14
Newton	Camp Tasker (Boys & Girls Club of Haverhill)	140	4
Portsmouth	Seawood Girl Scout Camp	150	4
<i>NH Subtotal:</i>		1,540	38
EPZ Total:		3,022	70

Table 3-11. Access and/or Functional Needs Demand Summary

Population Group	Transportation Needed	Population	Vehicles Deployed
Ambulatory	Bus	1,902	75
	Half Bus		30
	Van		80
Wheelchair bound	Wheelchair Bus	952	12
	Wheelchair Van		221
Bedridden	Ambulance	245	123
	Total:		3,099

Table 3-12. Seabrook EPZ External Traffic

Up Node	Dn Node	Road Name	Direction	AADT ¹¹	K-Factor ¹²	D-Factor ¹²	Hourly Volume	External Traffic
8051	51	US-4	Eastbound	57,457	0.091	0.25	1,307	2,614
8090	90	I-495	Northbound	65,460	0.091	0.25	1,489	2,978
8061	1669	SH-101	Eastbound	39,101	0.107	0.25	1,046	2,092
8003	3	I-95	Northbound	95,378	0.091	0.5	4,340	8,680
8050	1653	I-95	Southbound	95,378	0.091	0.5	4,340	8,680
TOTAL:							25,044	25,044

¹¹ NHDOT Transportation Data Management System Map 2021 and MassDOT Transportation Data Management System Map 2021

¹² HCM 2016

Table 3-13. Summary of Population Demand¹³

Community	Residents	Transit-Dependent	Transients	Seasonal	Employees	Special Facilities	Great Bay Community College Commuters	Schools, Preschools/Child Care Centers, and Day Camps	Special Event	Shadow Population ¹⁴	External Traffic	Total
Seabrook	8,401	125	1,556	513	1,554	0	0	920	0	0	0	13,069
Hampton Falls	2,403	36	1,004	0	0	0	0	565	0	0	0	4,008
Salisbury	9,237	137	5,752	1,117	413	30	0	545	0	0	0	17,231
Amesbury	17,366	258	2,972	0	522	388	0	2,921	0	0	0	24,427
South Hampton	896	13	798	0	0	0	0	99	0	0	0	1,806
Kensington	2,095	31	0	0	0	0	0	165	0	0	0	2,291
North Hampton	4,538	67	810	50	505	0	0	579	0	0	0	6,549
Hampton	16,214	240	6,637	2,805	1,686	394	0	2,171	70,974	0	0	101,121
Newbury	6,716	100	453	172	433	46	0	2,037	0	0	0	9,957
Newburyport	18,289	271	1,714	121	2,427	1,174	0	4,118	0	0	0	28,114
Merrimac	6,719	100	0	0	0	5	0	468	0	0	0	7,292
West Newbury	4,500	67	0	0	144	0	0	1,842	0	0	0	6,553
East Kingston	2,439	36	25	0	0	0	0	534	0	0	0	3,034
Exeter	16,055	238	1,942	0	4,257	958	0	4,769	0	0	0	28,219
Kingston	6,198	92	663	0	0	0	0	2,002	0	0	0	8,955
Newfields	1,769	26	238	0	0	0	0	190	0	0	0	2,223
Brentwood	4,490	67	0	0	446	412	0	736	0	0	0	6,151
Newton	4,818	72	165	0	0	0	0	586	0	0	0	5,641
New Castle	1,000	15	815	28	0	0	0	37	0	0	0	1,895
Greenland	4,067	60	270	0	325	8	0	639	0	0	0	5,369
Rye	5,545	82	1,700	414	183	211	0	525	0	0	0	8,660
Stratham	7,669	114	20	0	834	0	0	2,392	0	0	0	11,029
Portsmouth	21,956	326	7,553	234	11,440	574	576	4,777	0	0	0	47,436
Shadow Region	0	0	0	0	0	0	0	0	0	20,647	0	20,647
EPZ TOTAL:	173,380	2,573	35,087	5,454	25,169	4,200	576	33,617	70,974	20,647	0	371,677

¹³ Since the spatial distribution of the access and/or functional needs population is unknown, they are not included in this table.

¹⁴ Shadow population has been reduced to 20%. Refer to Figure 2-1 for additional information.

Table 3-14. Summary of Vehicle Demand

Community	Residents	Transit-Dependent ¹⁵	Transients	Seasonal	Employees	Special Facilities ¹⁵	Great Bay Community College Commuters	Schools, Preschools/Child Care Centers, and Day Camps ¹⁵	Special Event	Shadow Population ¹⁶	External Traffic	Total
Seabrook	4,325	24	496	265	1,509	0	0	40	0	0	0	6,659
Hampton Falls	1,241	2	800	0	0	0	0	24	0	0	0	2,067
Salisbury	4,727	8	3,539	573	401	3	0	20	0	0	0	9,271
Amesbury	8,831	16	1,131	0	506	62	0	122	0	0	0	10,668
South Hampton	462	2	636	0	0	0	0	6	0	0	0	1,106
Kensington North	1,082	2	0	0	0	0	0	8	0	0	0	1,092
Hampton	2,346	4	539	25	490	0	0	22	0	0	0	3,426
Hampton Newbury	8,308	14	2,566	1,443	1,637	60	0	96	24,792	0	0	38,916
Newburyport	3,414	6	188	88	420	5	0	86	0	0	0	4,207
Merrimac	9,232	16	631	63	2,355	193	0	162	0	0	0	12,652
West Newbury	3,464	6	0	0	0	1	0	18	0	0	0	3,489
East Kingston	2,319	4	0	0	140	0	0	76	0	0	0	2,539
Exeter	1,260	2	13	0	0	0	0	22	0	0	0	1,297
Kingston	8,028	14	855	0	4,131	208	0	208	0	0	0	13,444
Newfields	3,202	6	506	0	0	0	0	88	0	0	0	3,802
Brentwood	917	2	190	0	0	0	0	8	0	0	0	1,117
Newton	2,154	4	0	0	433	41	0	34	0	0	0	2,666
New Castle	2,491	4	120	0	0	0	0	26	0	0	0	2,641
Greenland	518	2	393	14	0	0	0	2	0	0	0	929
Rye	2,094	4	132	0	316	3	0	24	0	0	0	2,573
Stratham	2,791	6	663	209	178	51	0	24	0	0	0	3,922
Portsmouth	3,962	8	11	0	810	0	0	100	0	0	0	4,891
Shadow Region	11,100	20	3,599	119	11,108	135	559	188	0	0	0	26,828
EPZ TOTAL:	88,268	176	17,008	2,799	24,434	762	559	1,404	24,792	10,512	25,044	195,758

¹⁵ Buses for the transit-dependent population, special facility population, and schools are represented as two passenger vehicles. Refer to Sections 3.5, 3.6, 3.7 and 8 for additional information.

¹⁶ Shadow vehicles have been reduced to 20%. Refer to Figure 2-1 for additional information.

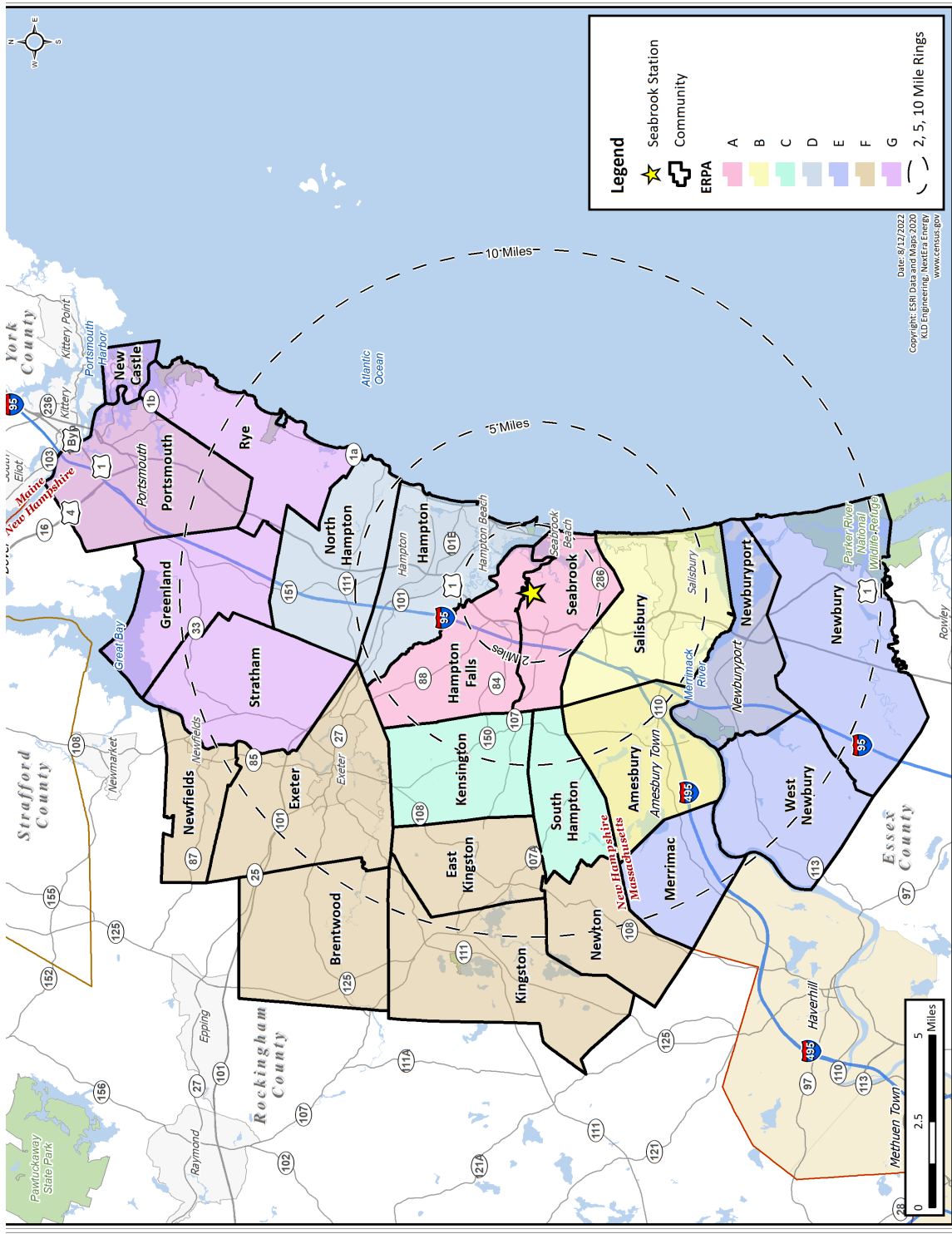
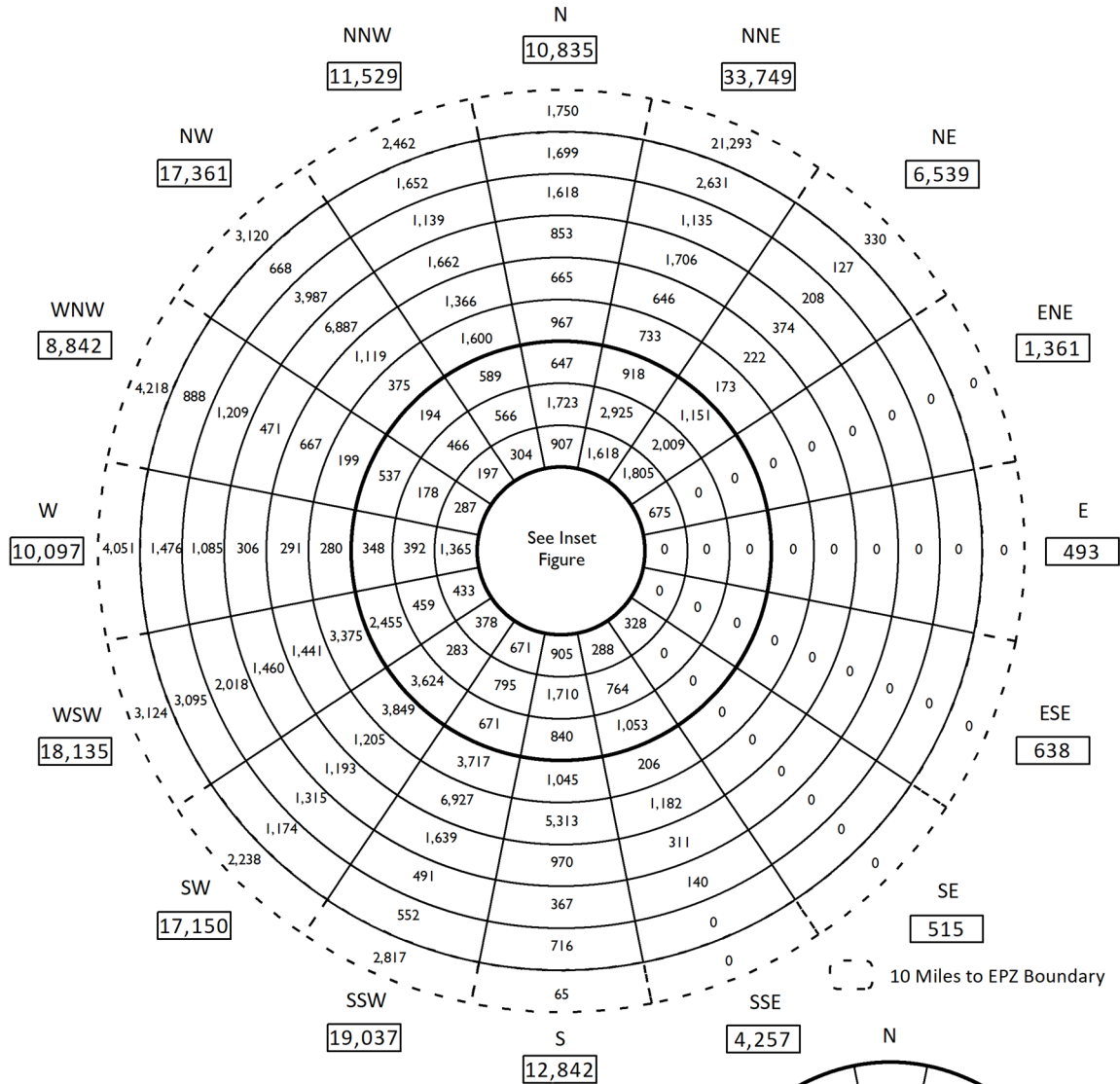


Figure 3-1. Communities and ERPAs Comprising the Seabrook Station EPZ



2020 Permanent Resident Population

Miles	Subtotal by Ring	Cumulative Total
0 - 1	776	776
1 - 2	6,893	7,669
2 - 3	10,161	17,830
3 - 4	12,270	30,100
4 - 5	13,027	43,127
5 - 6	16,519	59,646
6 - 7	21,044	80,690
7 - 8	17,832	98,522
8 - 9	14,712	113,234
9 - 10	14,678	127,912
10 - EPZ	45,468	173,380
Total:		173,380

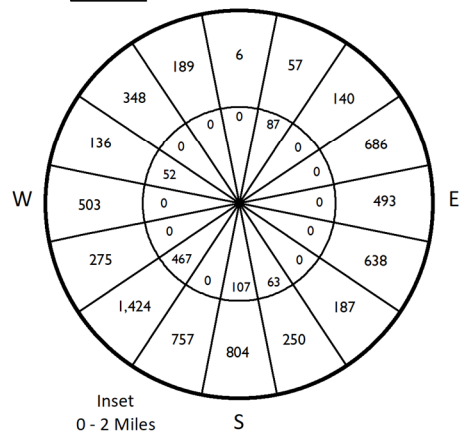
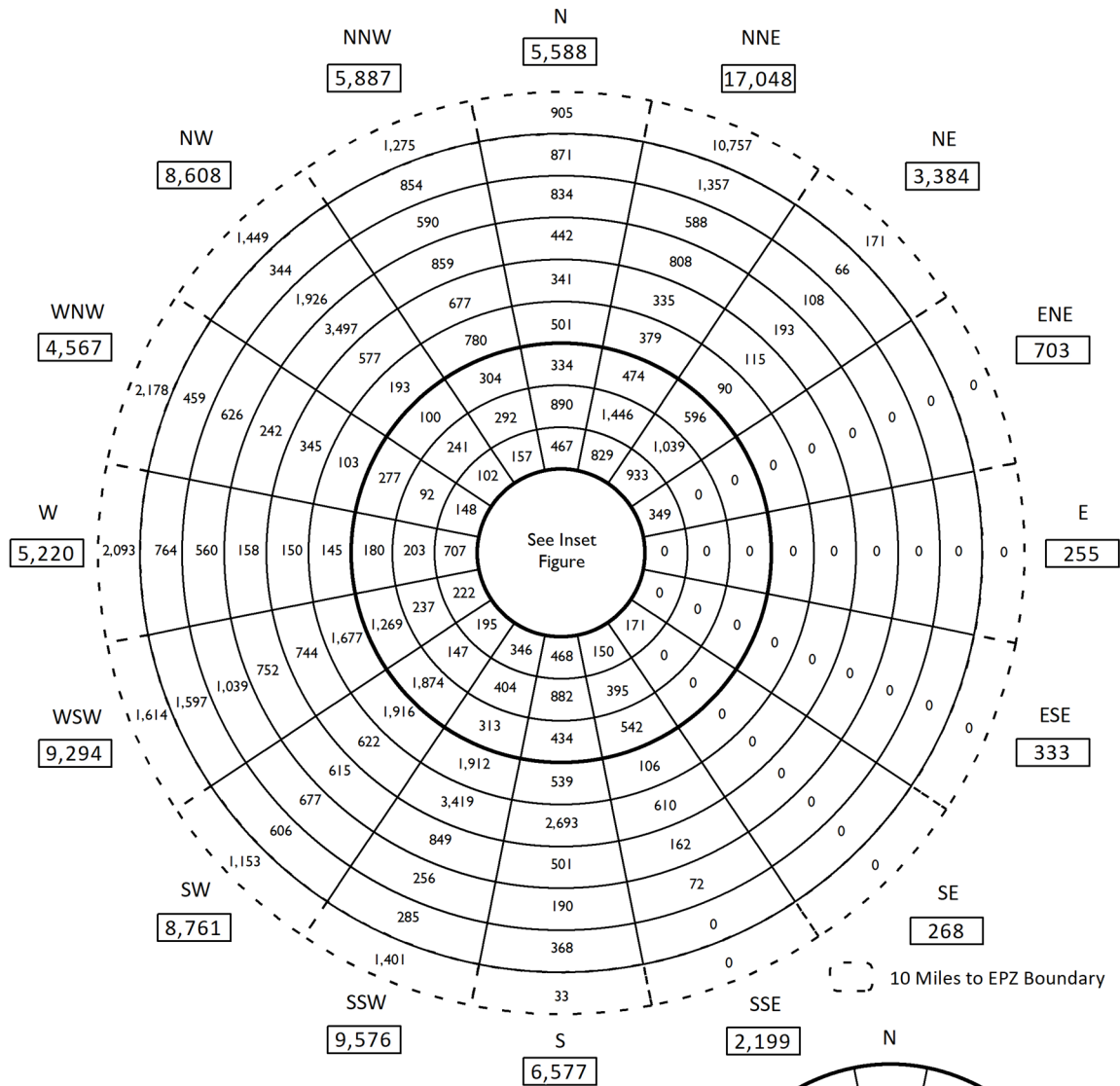


Figure 3-2. Permanent Resident Population by Sector



Resident Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	401	401
1 - 2	3,545	3,946
2 - 3	5,244	9,190
3 - 4	6,268	15,458
4 - 5	6,697	22,155
5 - 6	8,341	30,496
6 - 7	10,628	41,124
7 - 8	9,078	50,202
8 - 9	7,466	57,668
9 - 10	7,571	65,239
10 - EPZ	23,029	88,268
Total:		88,268

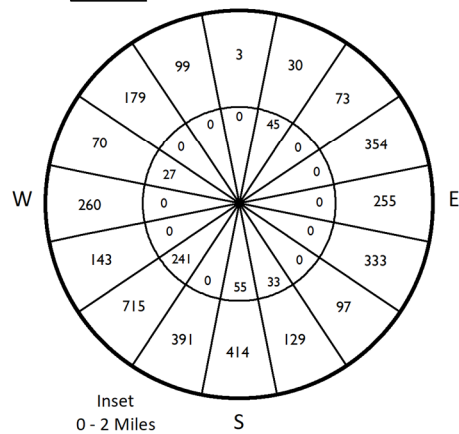
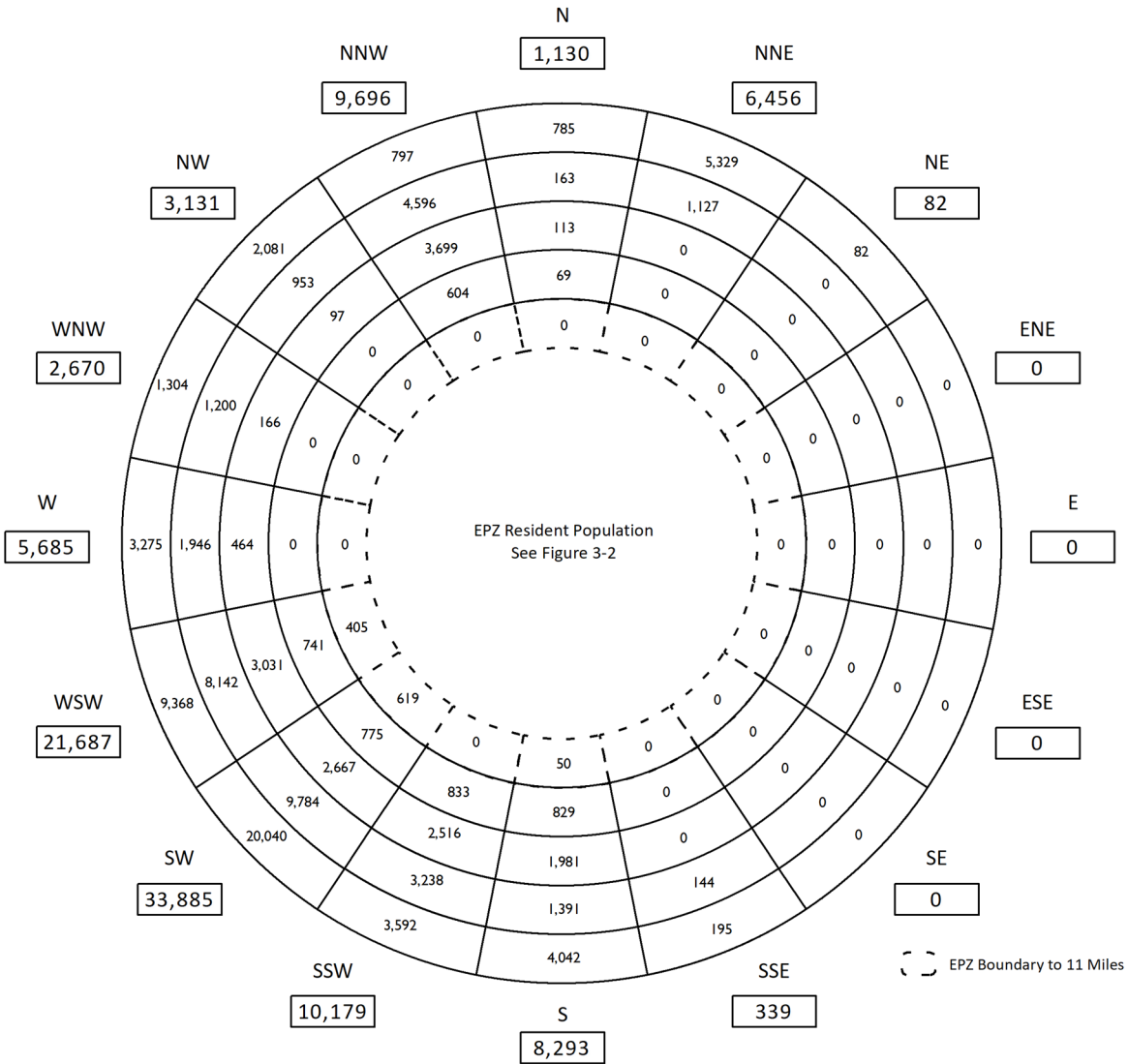


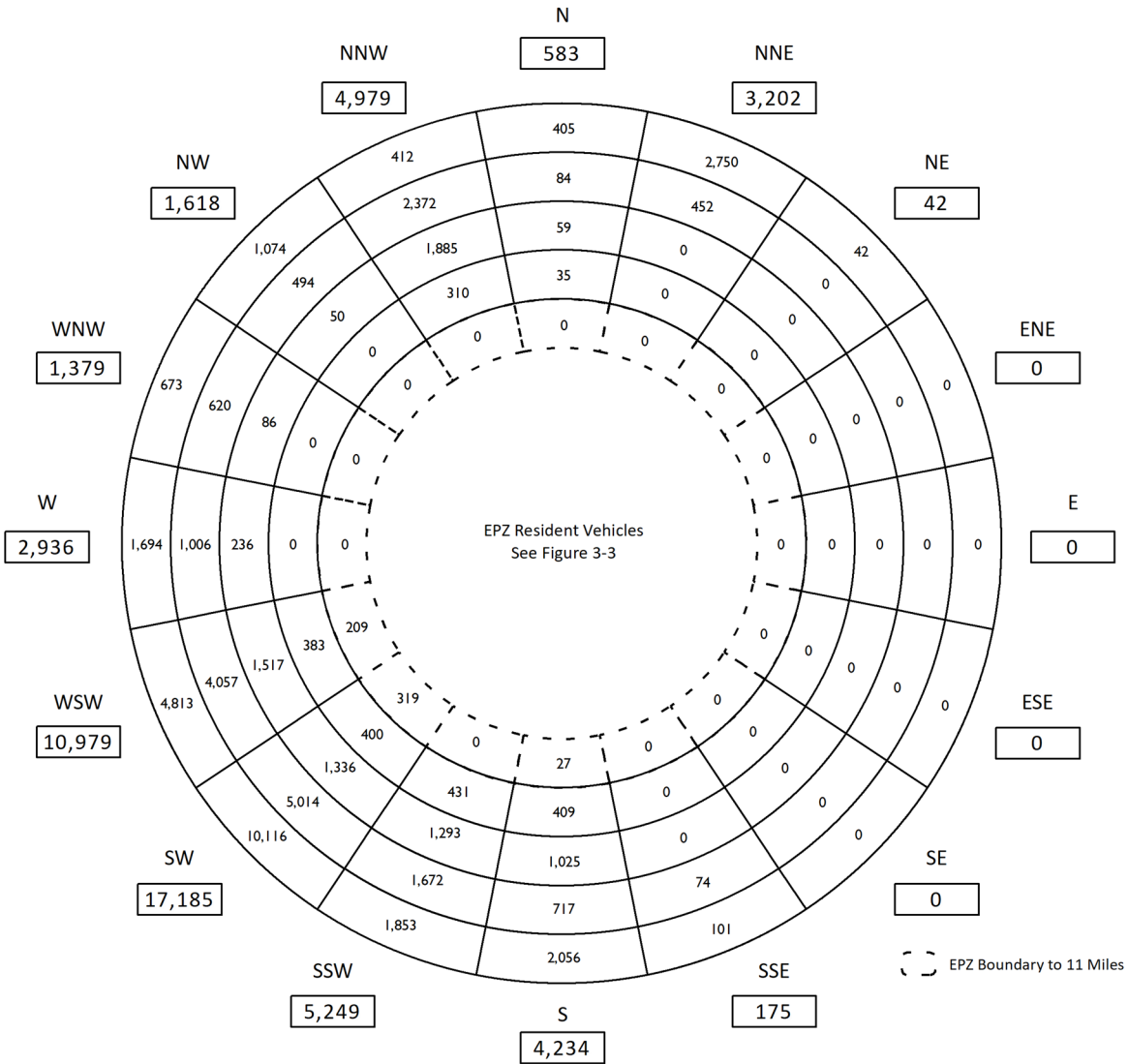
Figure 3-3. Permanent Resident Vehicles by Sector



2020 Shadow Population

Miles	Subtotal by Ring	Cumulative Total
EPZ - 11	1,074	1,074
11 - 12	3,851	4,925
12 - 13	14,734	19,659
13 - 14	32,684	52,343
14 - 15	50,890	103,233
Total:		103,233

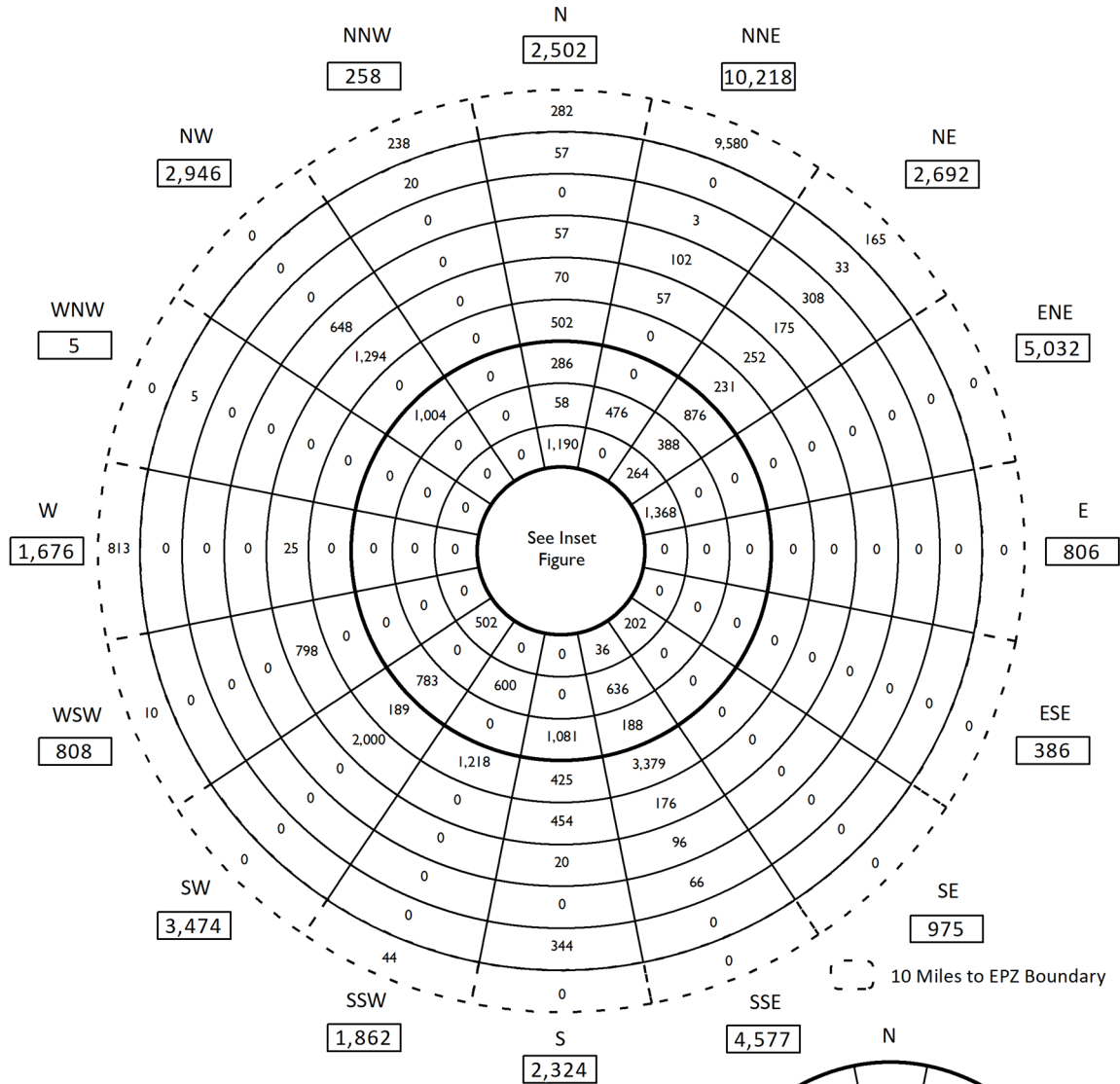
Figure 3-4. Shadow Population by Sector



Shadow Vehicles

Miles	Subtotal by Ring	Cumulative Total
EPZ - 11	555	555
11 - 12	1,968	2,523
12 - 13	7,487	10,010
13 - 14	16,562	26,572
14 - 15	25,989	52,561
Total:		52,561

Figure 3-5. Shadow Vehicles by Sector



Transients

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	6,467	6,467
2 - 3	3,562	10,029
3 - 4	2,158	12,187
4 - 5	4,218	16,405
5 - 6	5,944	22,349
6 - 7	5,126	27,475
7 - 8	1,098	28,573
8 - 9	377	28,950
9 - 10	459	29,409
10 - EPZ	11,132	40,541
Total:		40,541

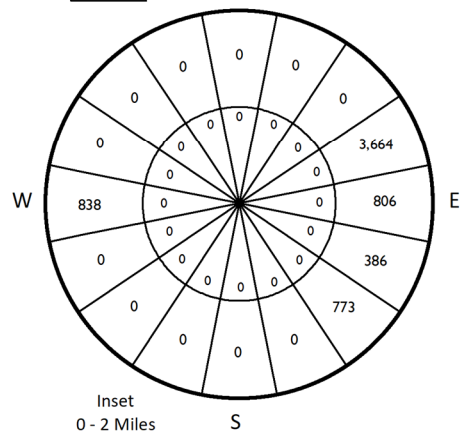
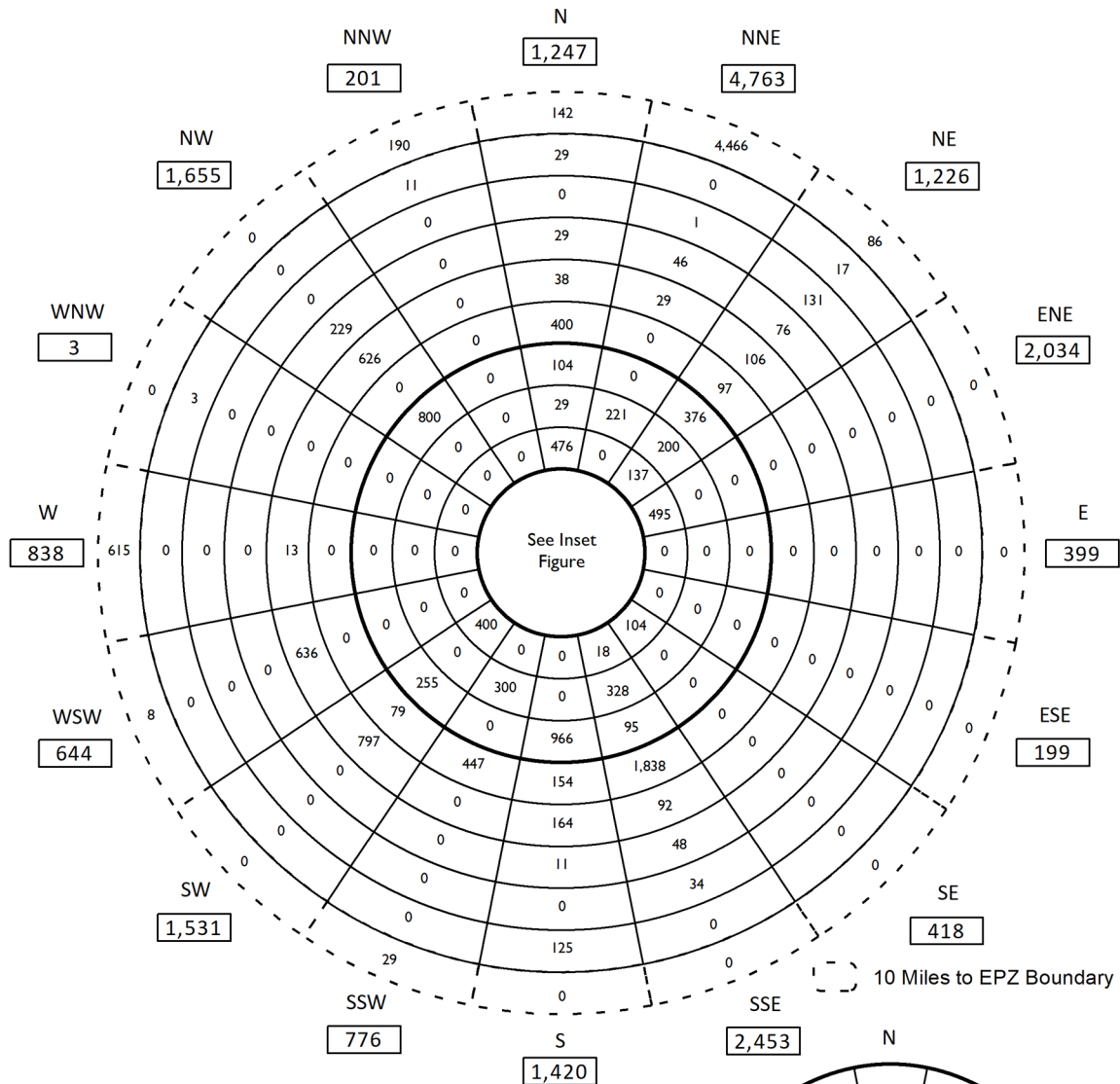


Figure 3-6. Transient Population by Sector



Transient Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	2,661	2,661
2 - 3	1,630	4,291
3 - 4	1,078	5,369
4 - 5	2,596	7,965
5 - 6	3,015	10,980
6 - 7	2,501	13,481
7 - 8	439	13,920
8 - 9	166	14,086
9 - 10	185	14,271
10 - EPZ	5,536	19,807
Total:		19,807

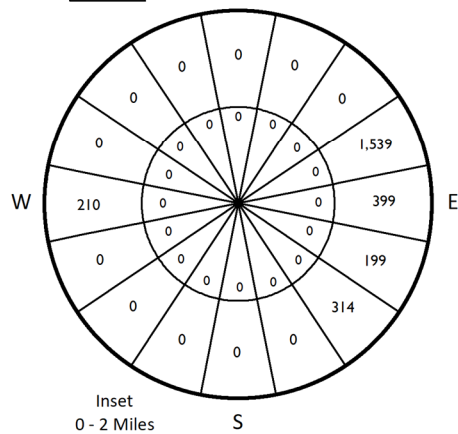
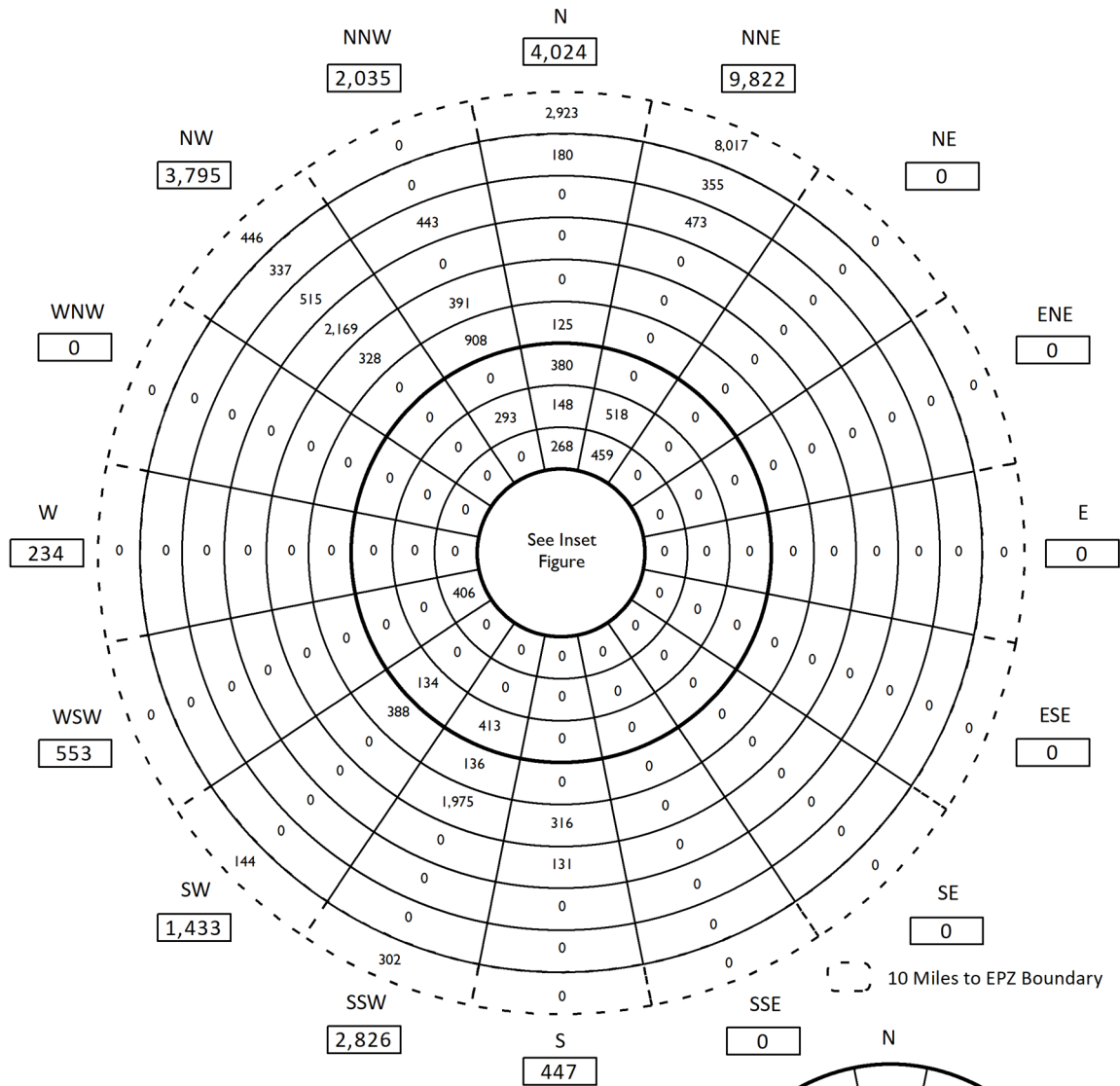


Figure 3-7. Transient Vehicles by Sector



Employees

Miles	Subtotal by Ring	Cumulative Total
0 - 1	234	234
1 - 2	914	1,148
2 - 3	1,133	2,281
3 - 4	959	3,240
4 - 5	927	4,167
5 - 6	1,557	5,724
6 - 7	3,010	8,734
7 - 8	2,300	11,034
8 - 9	1,431	12,465
9 - 10	872	13,337
10 - EPZ	11,832	25,169
Total:		25,169

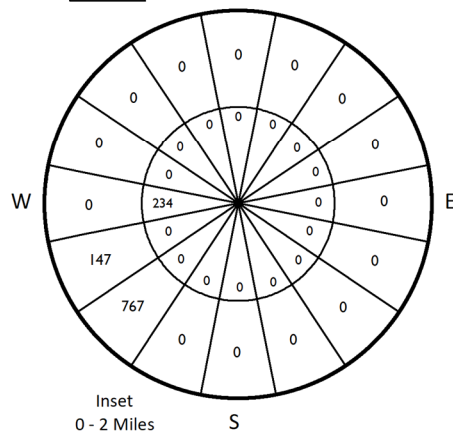
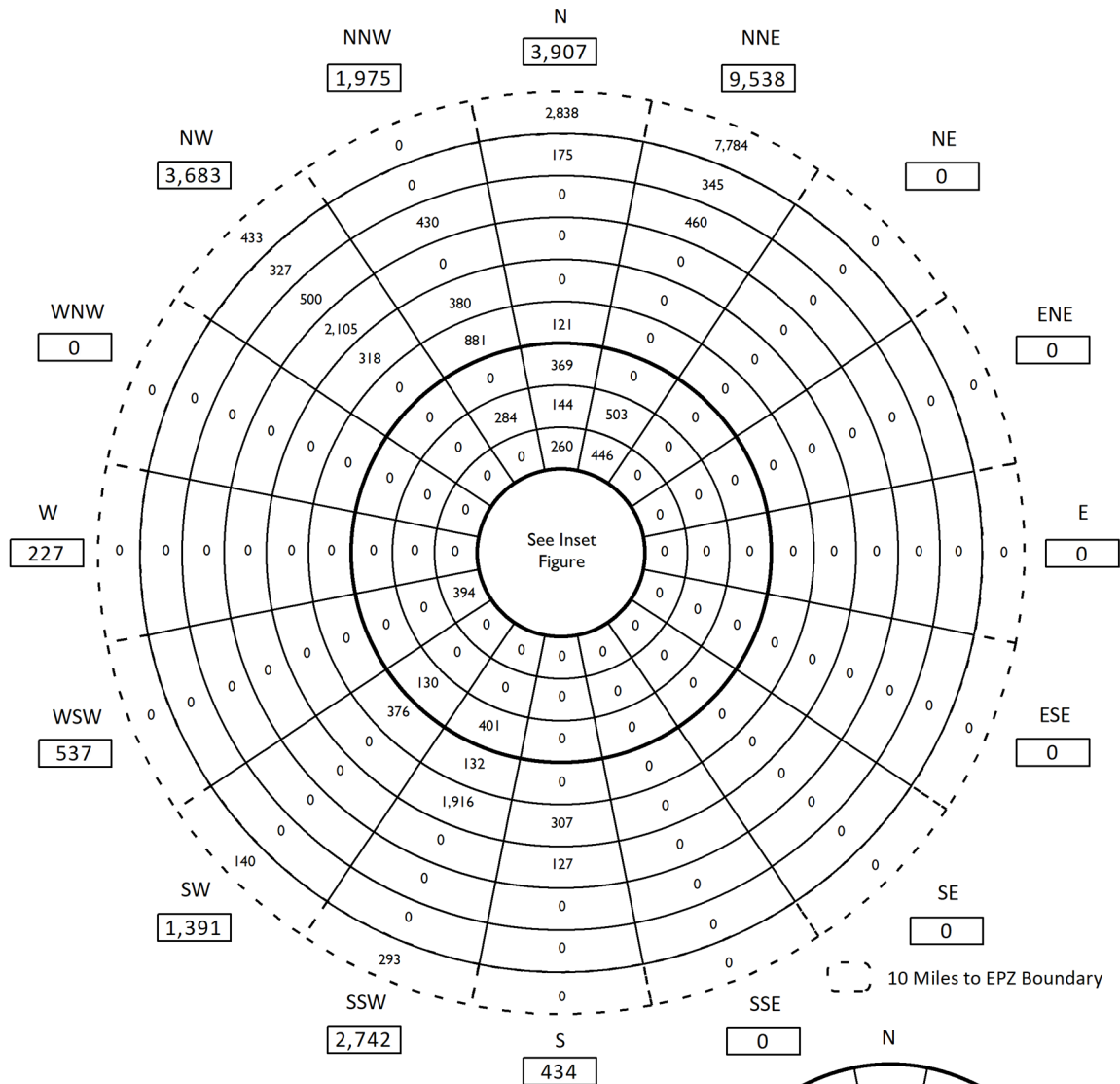


Figure 3-8. Employee Population by Sector



Employee Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	227	227
1 - 2	888	1,115
2 - 3	1,100	2,215
3 - 4	931	3,146
4 - 5	900	4,046
5 - 6	1,510	5,556
6 - 7	2,921	8,477
7 - 8	2,232	10,709
8 - 9	1,390	12,099
9 - 10	847	12,946
10 - EPZ	11,488	24,434
Total:		24,434

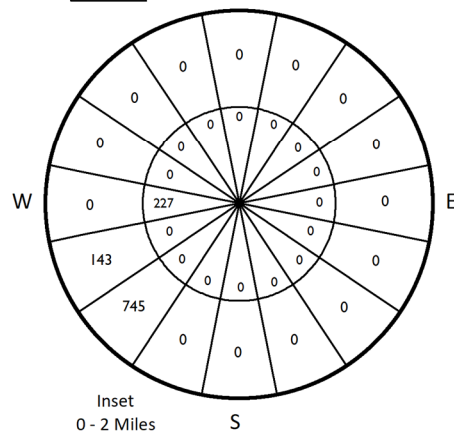


Figure 3-9. Employee Vehicles by Sector

4 ESTIMATION OF HIGHWAY CAPACITY

The ability of the road network to service vehicle demand is a major factor in determining how rapidly an evacuation can be completed. The capacity of a road is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane of roadway during a given time period under prevailing roadway, traffic and control conditions, as stated in the 2016 Highway Capacity Manual (HCM 2016). This section discusses how the capacity of the roadway network was estimated.

In discussing capacity, different operating conditions have been assigned alphabetical designations, A through F, to reflect the range of traffic operational characteristics. These designations have been termed "Levels of Service" (LOS). For example, LOS A connotes free-flow and high-speed operating conditions; LOS F represents a forced flow condition. LOS E describes traffic operating at or near capacity.

Another concept, closely associated with capacity, is "Service Volume". Service volume (SV) is defined as "The maximum hourly rate at which vehicles, bicycles or persons reasonably can be expected to traverse a point or uniform section of a roadway during an hour under specific assumed conditions while maintaining a designated level of service." This definition is similar to that for capacity. The major distinction is that values of SV vary from one LOS to another, while capacity is the service volume at the upper bound of LOS E, only.

Thus, in simple terms, SV is the maximum traffic that can travel on a road and still maintain a certain perceived level of quality to a driver based on the A, B, C, rating system (LOS). Any additional vehicles above the SV would drop the rating to a lower letter grade.

This distinction is illustrated in Exhibit 12-37 of the HCM 2016. As indicated there, the SV varies with Free Flow Speed (FFS), and LOS. The SV is calculated by the DYNEV II simulation model, based on the specified link attributes, FFS, capacity, control device and traffic demand.

Other factors also influence capacity. These include, but are not limited to:

- Lane width
- Shoulder width
- Pavement condition
- Horizontal and vertical alignment (curvature and grade)
- Percent truck traffic
- Control device (and timing, if it is a signal)
- Weather conditions (rain, snow, fog, wind speed, ice)

These factors are considered during the road survey and in the capacity estimation process; some factors have greater influence on capacity than others. For example, lane and shoulder width have only a limited influence on Base Free Flow Speed (BFFS¹) according to Exhibit 15-7 of the HCM 2016. Consequently, lane and shoulder widths at the narrowest points were observed during the road survey and these observations were recorded, but no detailed

¹ A very rough estimate of BFFS might be taken as the posted speed limit plus 10 mph (HCM 2016 Page 15-15).

measurements of lane or shoulder width were taken. Horizontal and vertical alignment can influence both FFS and capacity. The estimated FFS were measured using the survey vehicle's speedometer and observing local traffic, under free flow conditions. Free flow speeds ranged from 15 to 75 mph within the study area. Capacity is estimated from the procedures of the HCM 2016. For example, HCM Exhibit 7-1(b) shows the sensitivity of SV at the upper bound of LOS D to grade (capacity is the Service Volume at the upper bound of LOS E).

The amount of traffic that can flow on a roadway is effectively governed by vehicle speed and spacing. The faster that vehicles can travel when closely spaced, the higher the amount of flow. As discussed in Section 2.6, it is necessary to adjust capacity figures to represent the prevailing conditions during inclement weather tend to slow traffic down and often, also increases vehicle-to-vehicle separation, thus decreasing the amount of traffic flow. Based on limited empirical data, weather conditions such as rain reduce the values of free-flow speed and of highway capacity by approximately 10%. Over the last decade new studies have been made on the effects of rain and snow on traffic capacity. These studies indicate a range of effects between 10% and 25% depending on wind speed and precipitation rates. As indicated in Section 2.6, we employ a reduction in free speed and in highway capacity of 10% for rain/light snow and a 15% reduction in free speed and 25% reduction in highway capacity for heavy snow.

Since congestion arising from evacuation may be significant, estimates of roadway capacity must be determined with great care. Because of its importance, a brief discussion of the major factors that influence highway capacity is presented in this section.

Rural highways generally consist of: (1) one or more uniform sections with limited access (driveways, parking areas) characterized by "uninterrupted" flow; and (2) approaches to at-grade intersections where flow can be "interrupted" by a control device or by turning or crossing traffic at the intersection. Due to these differences, separate estimates of capacity must be made for each section. Often, the approach to the intersection is widened by the addition of one or more lanes (turn pockets or turn bays), to compensate for the lower capacity of the approach due to the factors there that can interrupt the flow of traffic. These additional lanes are recorded during the field survey and later entered as input to the DYNEV II system.

4.1 Capacity Estimations on Approaches to Intersections

At-grade intersections are apt to become the first bottleneck locations under local heavy traffic volume conditions. This characteristic reflects the need to allocate access time to the respective competing traffic streams by exerting some form of control. During evacuation, control at critical intersections will often be provided by traffic control personnel assigned for that purpose, whose directions may supersede traffic control devices. The existing traffic management plans documented in the county emergency plans are extensive and were adopted without change. See Appendix G for more information.

The per-lane capacity of an approach to a signalized intersection can be expressed (simplistically) in the following form:

$$Q_{cap,m} = \left(\frac{3600}{h_m}\right) \times \left(\frac{G - L}{C}\right)_m = \left(\frac{3600}{h_m}\right) \times P_m$$

where:

- $Q_{cap,m}$ = Capacity of a single lane of traffic on an approach, which executes movement, m , upon entering the intersection; vehicles per hour (vph)
- h_m = Mean queue discharge headway of vehicles on this lane that are executing movement, m ; seconds per vehicle
- G = Mean duration of GREEN time servicing vehicles that are executing movement, m , for each signal cycle; seconds
- L = Mean "lost time" for each signal phase servicing movement, m ; seconds
- C = Duration of each signal cycle; seconds
- P_m = Proportion of GREEN time allocated for vehicles executing movement, m , from this lane. This value is specified as part of the control treatment.
- m = The movement executed by vehicles after they enter the intersection: through, left-turn, right-turn, and diagonal.

The turn-movement-specific mean discharge headway h_m , depends in a complex way upon many factors: roadway geometrics, turn percentages, the extent of conflicting traffic streams, the control treatment, and others. A primary factor is the value of "saturation queue discharge headway", h_{sat} , which applies to through vehicles that are not impeded by other conflicting traffic streams. This value, itself, depends upon many factors including motorist behavior. Formally, we can write,

$$h_m = f_m(h_{sat}, F_1, F_2, \dots)$$

where:

- h_{sat} = Saturation discharge headway for through vehicles; seconds per vehicle
- F_1, F_2 = The various known factors influencing h_m
- $f_m()$ = Complex function relating h_m to the known (or estimated) values of h_{sat} , F_1 , F_2 , ...

The estimation of h_m for specified values of h_{sat} , F_1 , F_2 , ... is undertaken within the DYNEV II simulation model by a mathematical model². The resulting values for h_m always satisfy the condition:

$$h_m \geq h_{sat}$$

That is, the turn-movement-specific discharge headways are always greater than, or equal to the saturation discharge headway for through vehicles. These headways (or its inverse equivalent, "saturation flow rate"), may be determined by observation or using the procedures of the HCM 2016.

The above discussion is necessarily brief given the scope of this ETE report and the complexity of the subject of intersection capacity. In fact, Chapters 19, 20 and 21 in the HCM 2016 address this topic. The factors, F_1 , F_2 , ..., influencing saturation flow rate are identified in equation (19-8) of the HCM 2016.

The traffic signals within the EPZ and Shadow Region are modeled using representative phasing plans and phase durations obtained as part of the field data collection. Traffic responsive signal installations allow the proportion of green time allocated (P_m) for each approach to each intersection to be determined by the expected traffic volumes on each approach during evacuation circumstances. The amount of green time (G) allocated is subject to maximum and minimum phase duration constraints; 2 seconds of yellow time are indicated for each signal phase and 1 second of all-red time is assigned between signal phases, typically. If a signal is pre-timed, the yellow and all-red times observed during the road survey are used. A lost time (L) of 2.0 seconds is used for each signal phase in the analysis.

4.2 Capacity Estimation along Sections of Highway

The capacity of highway sections -- as distinct from approaches to intersections -- is a function of roadway geometrics, traffic composition (e.g., percent heavy trucks and buses in the traffic stream) and, of course, motorist behavior. There is a fundamental relationship which relates SV (i.e., the number of vehicles serviced within a uniform highway section in a given time period) to traffic density. The top curve in Figure 4-1 illustrates this relationship.

As indicated, there are two flow regimes: (1) Free Flow (left side of curve); and (2) Forced Flow (right side). In the Free Flow regime, the traffic demand is fully serviced; the SV increases as demand volume and density increase, until the SV attains its maximum value, which is the capacity of the highway section. As traffic demand and the resulting highway density increase beyond this "critical" value, the rate at which traffic can be serviced (i.e., the SV) can actually decline below capacity ("capacity drop"). Therefore, in order to realistically represent traffic performance during congested conditions (i.e., when demand exceeds capacity), it is necessary to estimate the service volume, V_F , under congested conditions.

²Lieberman, E., "Determining Lateral Deployment of Traffic on an Approach to an Intersection", McShane, W. & Lieberman, E., "Service Rates of Mixed Traffic on the far Left Lane of an Approach". Both papers appear in Transportation Research Record 772, 1980. Lieberman, E., Xin, W., "Macroscopic Traffic Modeling For Large-Scale Evacuation Planning", presented at the TRB 2012 Annual Meeting, January 22-26, 2012.

The value of V_F can be expressed as:

$$V_F = R \times Capacity$$

where:

R = Reduction factor which is less than unity

We have employed a value of $R=0.90$. The advisability of such a capacity reduction factor is based upon empirical studies that identified a fall-off in the service flow rate when congestion occurs at “bottlenecks” or “choke points” on a freeway system. Zhang and Levinson³ describe a research program that collected data from a computer-based surveillance system (loop detectors) installed on the Interstate Highway System, at 27 active bottlenecks in the twin cities metro area in Minnesota over a 7-week period. When flow breakdown occurs, queues are formed which discharge at lower flow rates than the maximum capacity prior to observed breakdown. These queue discharge flow (QDF) rates vary from one location to the next and also vary by day of week and time of day based upon local circumstances. The cited reference presents a mean QDF of 2,016 passenger cars per hour per lane (pcphpl). This figure compares with the nominal capacity estimate of 2,250 pcphpl estimated for the ETE for freeway links. The ratio of these two numbers is 0.896 which translates into a capacity reduction factor of 0.90.

Since the principal objective of evacuation time estimate analyses is to develop a “realistic” estimate of evacuation times, use of the representative value for this capacity reduction factor ($R=0.90$) is justified. This factor is applied only when flow breaks down, as determined by the simulation model.

Rural roads, like freeways, are classified as “uninterrupted flow” facilities. (This is in contrast with urban street systems which have closely spaced signalized intersections and are classified as “interrupted flow” facilities.) As such, traffic flow along rural roads is subject to the same effects as freeways in the event traffic demand exceeds the nominal capacity, resulting in queuing and lower QDF rates. As a practical matter, rural roads rarely break down at locations away from intersections. Any breakdowns on rural roads are generally experienced at intersections where other model logic applies, or at lane drops which reduce capacity there. Therefore, the application of a factor of 0.90 is appropriate on rural roads, but rarely, if ever, activated.

The estimated value of capacity is based primarily upon the type of facility and on roadway geometrics. Sections of roadway with adverse geometrics are characterized by lower free-flow speeds and lane capacity. Exhibit 15-46 in the HCM 2016 was referenced to estimate saturation flow rates. The impact of narrow lanes and shoulders on free-flow speed and on capacity is not material, particularly when flow is predominantly in one direction as is the case during an evacuation.

³Lei Zhang and David Levinson, “Some Properties of Flows at Freeway Bottlenecks,” Transportation Research Record 1883, 2004.

The procedure used here was to estimate "section" capacity, V_E , based on observations made traveling over each section of the evacuation network, based on the posted speed limits and travel behavior of other motorists and by reference to the HCM 2016. The DYNEV II simulation model determines for each highway section, represented as a network link, whether its capacity would be limited by the "section-specific" service volume, V_E , or by the intersection-specific capacity. For each link, the model selects the lower value of capacity.

4.3 Application to the Seabrook Station Study Area

As part of the development of the link-node analysis network for the study area, an estimate of roadway capacity is required. The source material for the capacity estimates presented herein is contained in:

2016 Highway Capacity Manual (HCM 2016)
Transportation Research Board
National Research Council
Washington, D.C.

The highway system in the study area consists primarily of three categories of roads and, of course, intersections:

- Two-Lane roads: Local, State
- Multilane Highways (at-grade)
- Freeways

Each of these classifications will be discussed below.

4.3.1 Two-Lane Roads

Ref: HCM 2016 Chapter 15

Two lane roads comprise the majority of highways within the study area (EPZ and Shadow Region). The per-lane capacity of a two-lane highway is estimated at 1,700 passenger cars per hour (pc/h). This estimate is essentially independent of the directional distribution of traffic volume except that, for extended distances, the two-way capacity will not exceed 3,200 pc/h. The HCM 2016 procedures then estimate LOS and Average Travel Speed. The DYNEV II simulation model accepts the specified value of capacity as input and computes average speed based on the time-varying demand: capacity relations.

Based on the field survey and on expected traffic operations associated with evacuation scenarios:

- Most sections of two-lane roads within the study area are classified as "Class I", with "level terrain"; some are "rolling terrain".
- "Class II" highways are mostly those within urban and suburban centers.

4.3.2 Multilane Highway

Ref: HCM Chapter 12

Exhibit 12-8 of the HCM 2016 presents a set of curves that indicate a per-lane capacity ranging from approximately 1,900 to 2,300 pc/h, for free-speeds of 45 to 70 mph, respectively. Based on observation, the multilane highways outside of urban areas within the study area service traffic with free-speeds in this range. The actual time-varying speeds computed by the simulation model reflect the demand and capacity relationship and the impact of control at intersections. A conservative estimate of per-lane capacity of 1,900 pc/h is adopted for this study for multilane highways outside of urban areas.

4.3.3 Freeways

Ref: HCM 2016 Chapters 10, 12, 13, 14

Chapter 10 of the HCM 2016 describes a procedure for integrating the results obtained in Chapters 12, 13 and 14, which compute capacity and LOS for freeway components. Chapter 10 also presents a discussion of simulation models. The DYNEV II simulation model automatically performs this integration process.

Chapter 12 of the HCM 2016 presents procedures for estimating capacity and LOS for "Basic Freeway Segments". Exhibit 12-37 of the HCM 2016 presents capacity vs. free speed estimates, which are provided below.

Free Speed (mph):	55	60	65	70+
Per-Lane Capacity (pc/h):	2,250	2,300	2,350	2,400

The inputs to the simulation model are highway geometrics, free-speeds and capacity based on field observations. The simulation logic calculates actual time-varying speeds based on demand: capacity relationships. A conservative estimate of per-lane capacity of 2,250 pc/h is adopted for this study for freeways.

Chapter 13 of the HCM 2016 presents procedures for estimating capacity, speed, density and LOS for freeway weaving sections. The simulation model contains logic that relates speed to demand volume: capacity ratio. The value of capacity obtained from the computational procedures detailed in Chapter 13 depends on the "Type" and geometrics of the weaving segment and on the "Volume Ratio" (ratio of weaving volume to total volume).

Chapter 14 of the HCM 2016 presents procedures for estimating capacities of ramps and of "merge" areas. There are three significant factors to the determination of capacity of a ramp-freeway junction: The capacity of the freeway immediately downstream of an on-ramp or immediately upstream of an off-ramp; the capacity of the ramp roadway; and the maximum flow rate entering the ramp influence area. In most cases, the freeway capacity is the controlling factor. Values of this merge area capacity are presented in Exhibit 14-10 of the HCM

2016 and depend on the number of freeway lanes and on the freeway free speed. Ramp capacity is presented in Exhibit 14-12 and is a function of the ramp FFS. The DYNEV II simulation model logic simulates the merging operations of the ramp and freeway traffic in accord with the procedures in Chapter 14 of the HCM 2016. If congestion results from an excess of demand relative to capacity, then the model allocates service appropriately to the two entering traffic streams and produces LOS F conditions (The HCM 2016 does not address LOS F explicitly).

4.3.4 Intersections

Ref: HCM 2016 Chapters 19, 20, 21, 22

Procedures for estimating capacity and LOS for approaches to intersections are presented in Chapter 19 (signalized intersections), Chapters 20, 21 (un-signalized intersections) and Chapter 22 (roundabouts). The complexity of these computations is indicated by the aggregate length of these chapters. The DYNEV II simulation logic is likewise complex.

The simulation model explicitly models intersections: Stop/yield controlled intersections (both 2-way and all-way) and traffic signal controlled intersections. Where intersections are controlled by fixed time controllers, traffic signal timings are set to reflect average (non-evacuation) traffic conditions. Actuated traffic signal settings respond to the time-varying demands of evacuation traffic to adjust the relative capacities of the competing intersection approaches.

The model is also capable of modeling the presence of manned traffic control. At specific locations where it is advisable or where existing plans call for overriding existing traffic control to implement manned control, the model will use actuated signal timings that reflect the presence of traffic guides. At locations where a special traffic control strategy (continuous left-turns, contra-flow lanes) is used, the strategy is modeled explicitly. A list that includes the total number of intersections modeled that are unsignalized, signalized, or manned by response personnel is included in Appendix K.

4.4 Simulation and Capacity Estimation

Chapter 6 of the HCM 2016 is entitled, “HCM and Alternative Analysis Tools.” The chapter discusses the use of alternative tools such as simulation modeling to evaluate the operational performance of highway networks. Among the reasons cited in Chapter 6 to consider using simulation as an alternative analysis tool is:

“The system under study involves a group of different facilities or travel modes with mutual interactions involving several HCM chapters. Alternative tools are able to analyze these facilities as a single system.”

This statement succinctly describes the analyses required to determine traffic operations across an area encompassing a study area operating under evacuation conditions. The model utilized for this study, DYNEV II, is further described in Appendix C. It is essential to recognize that simulation models do not replicate the methodology and procedures of the HCM 2016 – they *replace* these procedures by describing the complex interactions of traffic flow and computing

Measures of Effectiveness (MOE) detailing the operational performance of traffic over time and by location. The DYNEV II simulation model includes some HCM 2016 procedures only for the purpose of estimating capacity.

All simulation models must be calibrated properly with field observations that quantify the performance parameters applicable to the analysis network. Two of the most important of these are: (1) FFS; and (2) saturation headway, h_{sat} . The first of these is estimated by direct observation during the road survey; the second is estimated using the concepts of the HCM 2016, as described earlier.

It is important to note that simulation is a mathematical representation of an assumed set of conditions using the best available knowledge and understanding of traffic flow and available inputs. Simulation should not be assumed to be a prediction of what will happen under any event because a real evacuation can be impacted by an infinite number of things – many of which will differ from these test cases – and many others cannot be taken into account with the tools available.

4.5 Boundary Conditions

As illustrated in Figure 1-2 and in Appendix K, the link-node analysis network used for this study is finite. The analysis network extends well beyond the 15-mile radial study area in some locations in order to model intersections with other major evacuation routes beyond the study area. However, the network does have an end at the destination (exit) nodes as discussed in Appendix C. Beyond these destination nodes, there may be signalized intersections or merge points that impact the capacity of the evacuation routes leaving the study area. Rather than neglect these “boundary conditions,” this study assumes a 25% reduction in capacity on two-lane roads (Section 4.3.1 above) and multilane highways (Section 4.3.2 above). There is no reduction in capacity for freeways due to boundary conditions. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the study area and the fact that the evacuating traffic (“main street”) volume will be more significant than the competing traffic (“side street”) volume at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time.

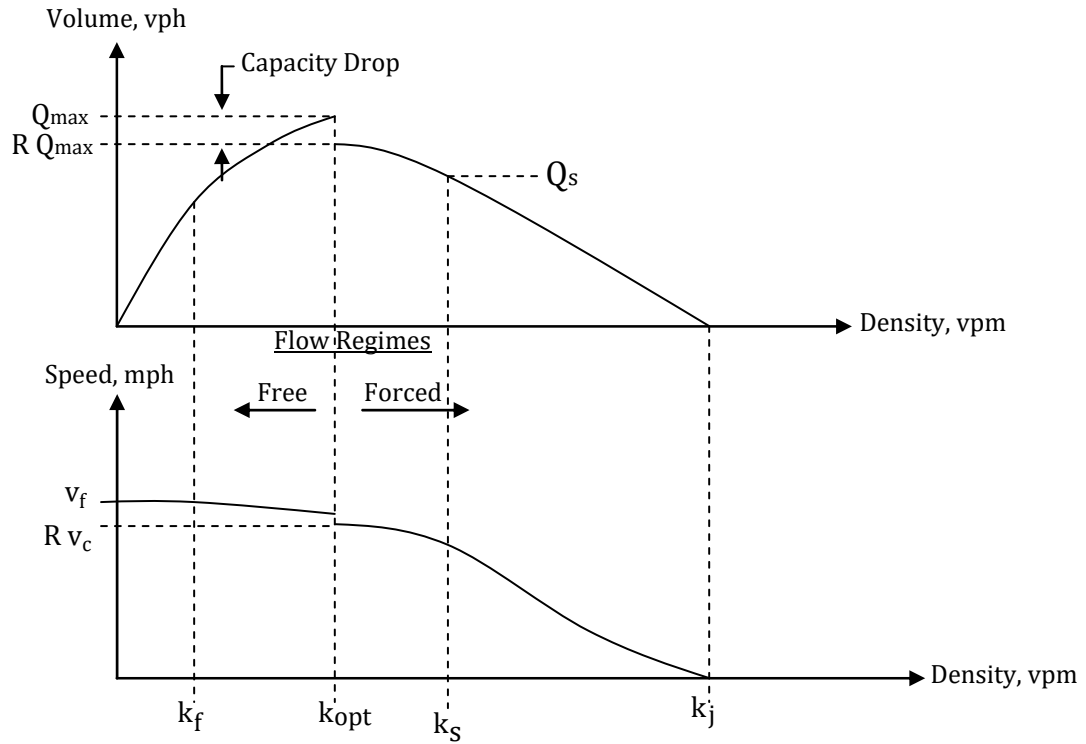


Figure 4-1. Fundamental Diagrams

5 ESTIMATION OF TRIP GENERATION TIME

Federal guidance (see NUREG/CR-7002, Rev. 1) recommends that the ETE study estimate the distributions of elapsed times associated with mobilization activities undertaken by the public to prepare for the evacuation trip. The elapsed time associated with each activity is represented as a statistical distribution reflecting differences between members of the public. The quantification of these activity-based distributions relies largely on the results of the demographic survey. We define the sum of these distributions of elapsed times as the Trip Generation Time Distribution.

5.1 Background

In general, an accident at a nuclear power plant is characterized by the following Emergency Classification Levels (see Section C of Part IV of Appendix E of 10 CFR 50 for details):

1. Unusual Event
2. Alert
3. Site Area Emergency
4. General Emergency

At each level, the Federal guidelines specify a set of Actions to be undertaken by the licensee and by the state and local offsite authorities. As a Planning Basis, we will adopt a conservative posture, in accordance with Section 1.2 of NUREG/CR-7002, Rev. 1, that a rapidly escalating accident at the plant wherein evacuation is ordered promptly, and no early protective actions have been implemented will be considered in calculating the Trip Generation Time. We will assume:

1. The Advisory to Evacuate (ATE) will be announced coincident with the siren notification.
2. Mobilization of the general population will commence within 15 minutes after the siren notification.
3. The ETE are measured relative to the ATE.

We emphasize that the adoption of this planning basis is not a representation that these events will occur within the indicated time frame. Rather, these assumptions are necessary in order to:

1. Establish a temporal framework for estimating the Trip Generation distribution in the format recommended in Section 2.13 of NUREG/CR-6863.
2. Identify temporal points of reference that uniquely define "Clear Time" and ETE.

It is likely that a longer time will elapse between the various classes of an emergency.

For example, suppose one-hour elapses from the siren alert to the ATE. In this case, it is reasonable to expect some degree of spontaneous evacuation by the public during this one-hour period. As a result, the population within the EPZ will be lower when the ATE is announced, than at the time of the siren alert. In addition, many will engage in preparation activities to evacuate, in anticipation that an Advisory will be broadcasted. Thus, the time needed to complete the mobilization activities and the number of people remaining to evacuate the EPZ after the ATE, will both be somewhat less than the estimates presented in this

report. Consequently, the ETE presented in this report are higher than the actual evacuation time, if this hypothetical situation were to take place.

The notification process consists of two events:

1. Transmitting information using the alert and notification systems (ANS) available within the EPZ (e.g., sirens, tone alerts, EAS broadcasts, marine radios, loudspeakers).
2. Receiving and correctly interpreting the information that is transmitted.

The population within the EPZ is dispersed over an area of approximately 160 square miles and is engaged in a wide variety of activities. It must be anticipated that some time will elapse between the transmission and receipt of the information advising the public of an event.

The amount of elapsed time will vary from one individual to the next depending on where that person is, what that person is doing, and related factors. Furthermore, some persons who will be directly involved with the evacuation process may be outside the EPZ at the time the emergency is declared. These people may be commuters, shoppers and other travelers who reside within the EPZ and who will return to join the other household members upon receiving notification of an emergency.

As indicated in Section 2.13 of NUREG/CR-6863, the estimated elapsed times for the receipt of notification can be expressed as a distribution reflecting the different notification times for different people within, and outside, the EPZ. By using time distributions, it is also possible to distinguish between different population groups and different day-of-week and time-of-day scenarios, so that accurate ETE may be computed.

For example, people at home or at work within the EPZ will be notified by siren, and/or tone alert and/or radio (if available). Those well outside the EPZ will be notified by telephone, radio, TV and word-of-mouth, with potentially longer time lags. Furthermore, the spatial distribution of the EPZ population will differ with time of day - families will be united in the evenings but dispersed during the day. In this respect, weekends will differ from weekdays.

As indicated in Section 4.3 of NUREG/CR-7002, Rev. 1, the information required to compute trip generation times is typically obtained from a demographic survey of EPZ permanent residents. Such a demographic survey was conducted in support of this ETE study. Appendix F discusses the survey sampling plan, the number of completed surveys obtained, documents the survey instrument utilized and provides the survey results. The remaining discussion will focus on the application of the trip generation data obtained from the demographic survey to the development of the ETE documented in this report.

5.2 Fundamental Considerations

The environment leading up to the time that people begin their evacuation trips consists of a sequence of events and activities. Each event (other than the first) occurs at an instant in time and is the outcome of an activity.

Activities are undertaken over a period of time. Activities may be in "series" (i.e., to undertake an activity implies the completion of all preceding events) or may be in parallel (two or more activities may take place over the same period of time). Activities conducted in series are functionally dependent on the completion of prior activities; activities conducted in parallel are functionally independent of one another. The relevant events associated with the public's preparation for evacuation are:

<u>Event Number</u>	<u>Event Description</u>
1	Notification
2	Awareness of Situation
3	Depart Work
4	Arrive Home
5	Depart on Evacuation Trip

Associated with each sequence of events are one or more activities, as outlined in Table 5-1.

These relationships are shown graphically in Figure 5-1.

- An Event is a 'state' that exists at a point in time (e.g., depart work, arrive home)
- An Activity is a 'process' that takes place over some elapsed time (e.g., prepare to leave work, travel home)

As such, a completed Activity changes the 'state' of an individual (i.e., the activity, 'travel home' changes the state from 'depart work' to 'arrive home'). Therefore, an Activity can be described as an 'Event Sequence'; the elapsed times to perform an event sequence vary from one person to the next and are described as statistical distributions on the following pages.

An employee who lives outside the EPZ will follow sequence (c) of Figure 5-1. A household within the EPZ that has one or more commuters at work and will await their return before beginning the evacuation trip will follow the first sequence of Figure 5-1(a). A household within the EPZ that has no commuters at work, or that will not await the return of any commuters, will follow the second sequence of Figure 5-1(a), regardless of day of week or time of day.

Households with no commuters on weekends or in the evening/night-time, will follow the applicable sequence in Figure 5-1(b). Transients will always follow one of the sequences of Figure 5-1(b). Some transients away from their residence could elect to evacuate immediately without returning to the residence, as indicated in the second sequence.

It is seen from Figure 5-1, that the Trip Generation time (the total elapsed time from Event 1 to Event 5) depends on the scenario and will vary from one household to the next. Furthermore, Event 5 depends, in a complicated way, on the time distributions of all activities preceding that event. That is, to estimate the time distribution of Event 5, we must obtain estimates of the time distributions of all preceding events. For this study, we adopt the conservative posture that all activities will occur in sequence.

In some cases, assuming certain events occur strictly sequential (for instance, commuter returning home before beginning preparation to leave) can result in rather *conservative* (that is, longer) estimates of mobilization times. It is reasonable to expect that at least some parts of these events will overlap for many households, but that assumption is not made in this study.

5.3 Estimated Time Distributions of Activities Preceding Event 5

The time distribution of an event is obtained by "summing" the time distributions of all prior contributing activities. (This "summing" process is quite different than an algebraic sum since it is performed on distributions – not scalar numbers).

Time Distribution No. 1, Notification Process: Activity 1 → 2

Federal regulations (10CFR50 Appendix E, Item IV.D.3) stipulate, "[t]he design objective of the prompt public alert and notification system shall be to have the capability to essentially complete the initial alerting and initiate notification of the public within the plume exposure pathway EPZ within about 15 minutes." Furthermore, 2019 FEMA REP Program Manual Part V Section B.1 Bullet 3 states that arrangements will be made to assure 100% coverage within 45 minutes of the population who may not have received the initial notification within the entire plume exposure EPZ."

Given the federal regulations and guidance, and the assumed presence of sirens within the EPZ, it is assumed that 100% of those within the EPZ will be aware of the accident within 45 minutes. The distribution for notifying the EPZ population is provided in Table 5-2. The distribution is plotted in Figure 5-2.

Distribution No. 2, Prepare to Leave Work: Activity 2 → 3

It is reasonable to expect that the vast majority of business enterprises within the EPZ will elect to shut down following notification and most employees would leave work quickly. Commuters, who work outside the EPZ could, in all probability, also leave quickly since facilities outside the EPZ would remain open and other personnel would remain. Personnel or farmers responsible for equipment/livestock would require additional time to secure their facility. The distribution of Activity 2 → 3 shown in Table 5-3 reflects data obtained by the demographic survey for employees working inside or outside of the EPZ who returns home prior to evacuating. This distribution is also applicable for residents to leave stores, restaurants, parks and other locations within the EPZ. This distribution is plotted in Figure 5-2.

Distribution No. 3, Travel Home: Activity 3 → 4

These data are provided directly by those households which responded to the demographic survey. This distribution is plotted in Figure 5-2 and listed in Table 5-4.

Distribution No. 4, Prepare to Leave Home: Activity 2, 4 → 5

These data are provided directly by those households which responded to the demographic survey. This distribution is plotted in Figure 5-2 and listed in Table 5-5.

Distribution No. 5, Snow Clearance Time Distribution

Inclement weather scenarios involving snowfall must address the time lags associated with snow clearance. It is assumed that snow equipment is mobilized and deployed during the snowfall to maintain passable roads. The general consensus is that the snow-plowing efforts are generally successful for all but the most extreme blizzards when the rate of snow accumulation exceeds that of snow clearance over a period of many hours (Note – evacuation may not be a prudent protective action under such blizzard conditions).

Consequently, it is reasonable to assume that the highway system will remain passable – albeit at a lower capacity – under the vast majority of snow conditions. Nevertheless, for the vehicles to gain access to the highway system, it may be necessary for driveways and employee parking lots to be cleared to the extent needed to permit vehicles to gain access to the roadways. These clearance activities take time; this time must be incorporated into the trip generation time distributions. This distribution is plotted in Figure 5-2 and listed in Table 5-6.

The data in Table 5-6 are adapted from the telephone survey conducted of households in the previous study performed in 2012. It is assumed that the current snowfall and snow removal times are comparable to the previous study.

5.4 Calculation of Trip Generation Time Distribution

The time distributions for each of the mobilization activities presented herein must be combined to form the appropriate Trip Generation Distributions. As discussed above, this study assumes that the stated events take place in sequence such that all preceding events must be completed before the current event can occur. For example, if a household awaits the return of a commuter, the work-to-home trip (Activity 3 → 4) must precede Activity 4 → 5.

To calculate the time distribution of an event that is dependent on two sequential activities, it is necessary to “sum” the distributions associated with these prior activities. The distribution summing algorithm is applied repeatedly to form the required distribution. As an outcome of this procedure, new time distributions are formed; we assign “letter” designations to these intermediate distributions to describe the procedure. Table 5-7 presents the summing procedure to arrive at each designated distribution.

Table 5-8 presents a description of each of the final trip generation distributions achieved after the summing process is completed.

5.4.1 Statistical Outliers

As already mentioned, some portion of the survey respondents answer “I would rather not answer” to some questions or choose to not respond to a question. The mobilization activity distributions are based upon actual responses. But it is the nature of surveys that a few numeric responses are inconsistent with the overall pattern of results. An example would be a case in which for 500 responses, almost all of them estimate less than two hours for a given answer, but 3 say “four hours” and 4 say “six or more hours”.

These “outliers” must be considered: are they valid responses, or so atypical that they should be dropped from the sample?

In assessing outliers, there are three alternatives to consider:

- 1) Some responses with very long times may be valid but reflect the reality that the respondent really needs to be classified in a different population subgroup, based upon access and/or functional needs for example.
- 2) Other responses may be unrealistic (6 hours to return home from commuting distance, or 2 days to prepare the home for departure).
- 3) Some high values are representative and plausible, and one must not cut them as part of the consideration of outliers.

The issue of course is how to make the decision that a given response or set of responses are to be considered “outliers” for the component mobilization activities, using a method that objectively quantifies the process.

There is considerable statistical literature on the identification and treatment of outliers singly or in groups, much of which assumes the data is normally distributed and some of which uses non-parametric methods to avoid that assumption. The literature cites that limited work has been done directly on outliers in sample survey responses.

In establishing the overall mobilization time/trip generation distributions, the following principles are used:

- 1) It is recognized that the overall trip generation distributions are conservative estimates, because they assume a household will do the mobilization activities sequentially, with no overlap of activities;
- 2) The individual mobilization activities (prepare to leave work, travel home, prepare home, clear light snow/ice) are reviewed for outliers, and then the overall trip generation distributions are created (see Figure 5-1, Table 5-7, Table 5-8);
- 3) Outliers can be eliminated either because the response reflects a special population (e.g., access and/or functional needs, transit dependent) or lack of realism, because the purpose is to estimate trip generation patterns for personal vehicles;
- 4) To eliminate outliers,
 - a) the mean and standard deviation of the specific activity are estimated from the responses,
 - b) the median of the same data is estimated, with its position relative to the mean noted,
 - c) the histogram of the data is inspected, and
 - d) all values greater than 3.5 standard deviations are flagged for attention, taking special note of whether there are gaps (categories with zero entries) in the histogram display.

In general, only flagged values more than 3.7 standard deviations from the mean are allowed to be considered outliers, with small gaps in the histogram expected. Due to large gaps in the dataset, the distribution of time to prepare to leave home was truncated for values more than 3.5 standard deviations from the mean.

When flagged values are classified as outliers and dropped, steps “a” to “d” are repeated.

- 5) As a practical matter, even with outliers eliminated by the above, the resultant histogram, viewed as a cumulative distribution, is not a normal distribution. A typical situation that results is shown in Figure 5-3.
- 6) In particular, the cumulative distribution differs from the normal distribution in two key aspects, both very important in loading a network to estimate evacuation times:
 - a) Most of the real data is to the left of the “normal” curve above, indicating that the network loads faster for the first 80-85% of the vehicles, potentially causing more (and earlier) congestion than otherwise modeled;
 - b) The last 10-15% of the real data “tails off” slower than the comparable “normal” curve, indicating that there is significant traffic still loading at later times.

Because these two features are important to preserve, it is the histogram of the data that is used to describe the mobilization activities, not a “normal” curve fit to the data. One could consider other distributions, but using the shape of the *actual* data curve is unambiguous and preserves these important features;

- 7) With the mobilization activities each modeled according to Steps 1-6, including preserving the features cited in Step 6, the overall (or total) mobilization times are constructed.

This is done by using the data sets and distributions under different scenarios (e.g., commuter returning, no commuter returning). In general, these are additive, using weighting based upon the probability distributions of each element; Figure 5-4 presents the combined trip generation distributions designated for each population group considered. These distributions are presented on the same time scale. (As discussed earlier, the use of strictly additive activities is a conservative approach, because it makes all activities sequential – preparation for departure follows the return of the commuter, and so forth. In practice, it is reasonable that some of these activities are done in parallel, at least to some extent – for instance, preparation to depart begins by a household member at home while the commuter is still on the road.)

The mobilization distributions results are used in their tabular/graphical form as direct inputs to later computations that lead to the ETE.

The DYNEV II simulation model is designed to accept varying rates of vehicle trip generation for each origin centroid, expressed in the form of histograms. These histograms, which represent Distributions A, C, D, E and F, properly displaced with respect to one another, are tabulated in Table 5-9 (Distribution B, Arrive Home, omitted for clarity).

The final time period (15) is 600 minutes long. This time period is added to allow the analysis network to clear, in the event congestion persists beyond the trip generation period. Note that there are no trips generated during this final time period.

5.4.2 Staged Evacuation Trip Generation

As defined in NUREG/CR-7002, Rev. 1, staged evacuation consists of the following:

1. Communities comprising the 2-Mile Region are advised to evacuate immediately
2. Communities comprising regions extending from 2 to 5 miles downwind are advised to shelter in-place while the 2-Mile Region is cleared
3. As vehicles evacuate the 2-Mile Region, sheltered people from 2 to 5 miles downwind continue preparation for evacuation
4. The population sheltering in the 2 to 5-Mile Region are advised to begin evacuating when approximately 90% of those originally within the 2-Mile Region evacuate across the 2-Mile Region boundary
5. Non-compliance with the shelter recommendation is the same as the shadow evacuation percentage of 20%

Assumptions

1. The EPZ population in Communities beyond 5 miles will shelter-in-place. A non-compliance voluntary evacuation percentage of 20% is assumed for this population.
2. The population in the shadow region beyond the EPZ boundary, extending to approximately 15 miles radially from the plant, will react as they do for all non-staged evacuation scenarios. That is 20% of these households will elect to evacuate with no shelter delay.
3. The transient population will not be expected to stage their evacuation because of the limited sheltering options available to people who may be at parks, on a beach, or at other venues. Also, notifying the transient population of a staged evacuation would prove difficult.
4. Employees will also be assumed to evacuate without first sheltering.

Procedure

1. Trip generation for population groups in the 2-Mile Region will be as computed based upon the results of the demographic survey and analysis.
2. Trip generation for the population subject to staged evacuation will be formulated as follows:
 - a. Identify the 90th percentile evacuation time for the Communities comprising the 2-Mile Region. This value, T_{scen}^* , is obtained from the simulation results is scenario specific. It will become the time at which the region being sheltered will be told to evacuate for each scenario.

- b. The resultant trip generation curves for staging are then formed as follows:
 - i. The non-shelter trip generation curve is followed until a maximum of 20% of the total trips are generated (to account for shelter non-compliance).
 - ii. No additional trips are generated until time T_{Scen}^*
 - iii. Following time T_{Scen}^* , the balance of trips are generated:
 - 1. by stepping up and then following the non-shelter trip generation curve (if T_{Scen}^* is \leq max trip generation time) or
 - 2. by stepping up to 100% (if T_{Scen}^* is $>$ max trip generation time)
 - c. Note: This procedure implies that there may be different staged trip generation distributions for different scenarios. NUREG/CR-7002, Rev. 1 uses the statement “approximately 90th percentile” as the time to end staging and begin evacuating. The value of T_{Scen}^* is 2:00 in good weather/rain/light snow and 2:15 in heavy snow.
3. Staged trip generation distributions are created for the following population groups:
- a. Residents with returning commuters
 - b. Residents without returning commuters
 - c. Residents with returning commuters with heavy snow
 - d. Residents without returning commuters with heavy snow

Figure 5-5 and Table 5-10 presents the staged trip generation distributions for both residents with and without returning commuters and employees. At T_{Scen}^* , 20% of the permanent resident population (who normally would have completed their mobilization activities for an un-staged evacuation) advised to shelter has nevertheless departed the area. These people do not comply with the shelter advisory. Also included on the plot are the trip generation distributions for these groups as applied to the regions advised to evacuate immediately.

Since the 90th percentile evacuation time occurs before the end of the trip generation time, after the sheltered region is advised to evacuate, the shelter trip generation distribution rises to meet the balance of the non-staged trip generation distribution. Following time T_{Scen}^* , the balance of staged evacuation trips that are ready to depart are released within the next time interval. After $T_{Scen}^* + 15$ minutes (in non-heavy snow cases) or +30 minutes (in heavy snow cases), the remainder of evacuation trips are generated in accordance with the un-staged trip generation distribution.

5.4.3 Evacuation of Waterways

The New Hampshire Radiological Emergency Response for Nuclear Facilities – Incident Annex, dated 2017 states that the United States Coast Guard will be requested at a Site Area Emergency or earlier to establish a marine safety zone. This zone will be in a 5 or 10 mile radius from Seabrook Station, depending on emergency conditions, and will serve as an area for the alerting and restriction of marine traffic. The Massachusetts Radiological Emergency Response Plan, dated June 2019, states that EPZ Community harbormasters will assist in clearing the waterway EPZ at the Alert level. Notification to boaters will be by broadcast over marine radio

and by patrol craft equipped with PA systems. The US Coast Guard will also assist in the evacuation waterways.

As discussed in Section 2.2 this study assumes a rapidly escalating general emergency. As indicated in Table 5-2, this study assumes 100% notification in 45 minutes. Table 5-9 indicates that all transients will have mobilized within 105 minutes. It is assumed that this timeframe is sufficient time for boaters, campers and other transients to return to their vehicles or lodging facilities, pack their belongings and begin their evacuation trip.

Table 5-1. Event Sequence for Evacuation Activities

Event Sequence	Activity	Distribution
1 → 2	Receive Notification	1
2 → 3	Prepare to Leave Work	2
2,3 → 4	Travel Home	3
2,4 → 5	Prepare to Leave to Evacuate	4
N/A	Snow Clearance	5

Table 5-2. Time Distribution for Notifying the Public

Elapsed Time (Minutes)	Percent of Population Notified
0	0.0%
5	7.1%
10	13.3%
15	26.5%
20	46.9%
25	66.3%
30	86.7%
35	91.8%
40	96.9%
45	100%

Table 5-3. Time Distribution for Employees to Prepare to Leave Work

Elapsed Time (Minutes)	Cumulative Percent Employees Leaving Work	Elapsed Time (Minutes)	Cumulative Percent Employees Leaving Work
0	0.0%	45	93.6%
5	23.1%	50	94.4%
10	45.8%	55	94.6%
15	64.9%	60	97.6%
20	75.4%	65	98.4%
25	78.2%	70	99.2%
30	89.3%	75	100%
35	91.2%		
40	92.1%		

NOTE: The survey data was normalized to distribute the "I would rather not answer" response. That is, the sample was reduced in size to include only those households who responded to this question. The underlying assumption is that the distribution of this activity for the "I would rather not answer" responders, if the event takes place, would be the same as those responders who provided estimates.

Table 5-4. Time Distribution for Commuters to Travel Home

Elapsed Time (Minutes)	Cumulative Percent Returning Home	Elapsed Time (Minutes)	Cumulative Percent Returning Home
0	0.0%	45	78.8%
5	8.9%	50	83.2%
10	16.8%	55	84.6%
15	27.1%	60	89.3%
20	39.0%	75	94.3%
25	50.1%	90	97.6%
30	60.8%	105	99.0%
35	67.7%	120	100%
40	71.9%		

NOTE: The survey data was normalized to distribute the "I would rather not answer" response.

Table 5-5. Time Distribution for Population to Prepare to Evacuate

Elapsed Time (Minutes)	Cumulative Percent Ready to Evacuate
0	0.0%
15	8.2%
30	30.7%
45	45.3%
60	67.8%
75	79.3%
90	84.8%
105	87.5%
120	91.2%
135	96.4%
150	97.3%
165	97.9%
180	98.8%
195	99.7%
210	100%

NOTE: The survey data was normalized to distribute the "I would rather not answer" response.

Table 5-6. Time Distribution for Population to Clear 6" – 8" of Snow

Elapsed Time (Minutes)	Cumulative Percent Ready to Evacuate
0	46.6%
15	55.9%
30	78.2%
45	83.2%
60	89.8%
75	92.7%
90	95.0%
105	95.6%
120	97.3%
135	97.9%
150	98.1%
165	98.1%
180	100%

NOTE: The survey data was normalized to distribute the "I would rather not answer" response

Table 5-7. Mapping Distributions to Events

Apply "Summing" Algorithm To:	Distribution Obtained	Event Defined
Distributions 1 and 2	Distribution A	Event 3
Distributions A and 3	Distribution B	Event 4
Distributions B and 4	Distribution C	Event 5
Distributions 1 and 4	Distribution D	Event 5
Distributions C and 5	Distribution E	Event 5
Distributions D and 5	Distribution F	Event 5

Table 5-8. Description of the Distributions

Distribution	Description
A	Time distribution of commuters departing place of work (Event 3). Also applies to employees who work within the EPZ who live outside, and to Transients within the EPZ.
B	Time distribution of commuters arriving home (Event 4).
C	Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip (Event 5).
D	Time distribution of residents without commuters returning home, leaving home to begin the evacuation trip (Event 5).
E	Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip, after snow clearance activities (Event 5).
F	Time distribution of residents with no commuters returning home, leaving to begin the evacuation trip, after snow clearance activities (Event 5).

Table 5-9. Trip Generation Histograms for the EPZ Population for Un-staged Evacuation¹

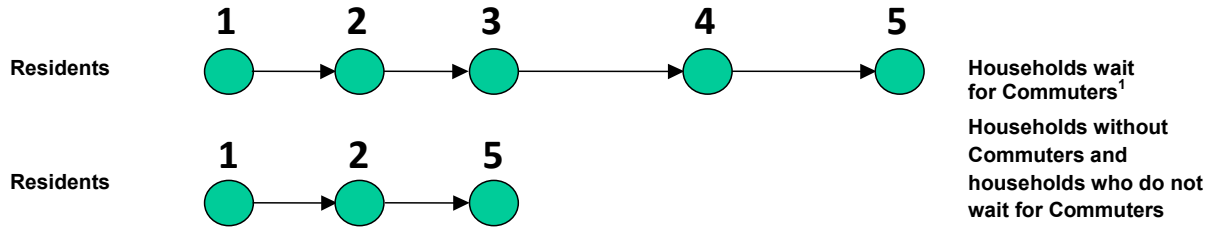
Time Period	Duration (Min)	Percent of Total Trips Generated Within Indicated Time Period					
		Employees (Distribution A)	Transients (Distribution A)	Residents with Commuters (Distribution C)	Residents Without Commuters (Distribution D)	Residents with Commuters (Snow) (Distribution E)	Residents without Commuters (Snow) (Distribution F)
1	15	5%	5%	0%	1%	0%	0%
2	15	28%	28%	0%	4%	0%	3%
3	30	56%	56%	4%	32%	2%	19%
4	30	9%	9%	17%	35%	10%	29%
5	15	2%	2%	14%	9%	10%	12%
6	15	0%	0%	14%	5%	11%	8%
7	15	0%	0%	12%	3%	12%	7%
8	30	0%	0%	18%	7%	20%	10%
9	30	0%	0%	11%	2%	14%	5%
10	30	0%	0%	6%	2%	9%	4%
11	30	0%	0%	2%	0%	6%	2%
12	30	0%	0%	1%	0%	3%	0%
13	15	0%	0%	1%	0%	1%	1%
14	60	0%	0%	0%	0%	2%	0%
15	600	0%	0%	0%	0%	0%	0%

¹ Shadow vehicles are loaded onto the analysis network (Figure 1-2) using Distribution C and E for good weather/rain/light snow and heavy snow. Special event vehicles are loaded using Distribution A.

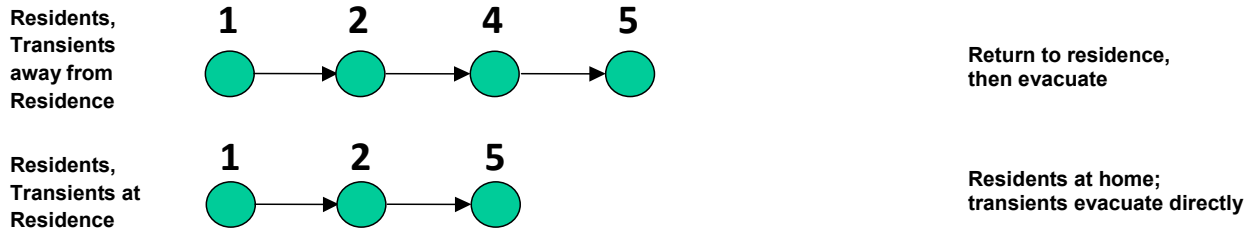
Table 5-10. Trip Generation Histograms for the EPZ Population for Staged Evacuation

Time Period	Duration (Min)	Percent of Total Trips Generated Within Indicated Time Period ²			
		Residents with Commuters (Distribution C)	Residents Without Commuters (Distribution D)	Residents with Commuters (Snow) (Distribution E)	Residents without Commuters (Snow) (Distribution F)
1	15	0%	0%	0%	0%
2	15	0%	1%	0%	1%
3	30	1%	6%	0%	3%
4	30	3%	7%	2%	6%
5	15	3%	2%	2%	3%
6	15	3%	1%	3%	1%
7	15	51%	72%	2%	2%
8	30	18%	7%	56%	72%
9	30	11%	2%	14%	5%
10	30	6%	2%	9%	4%
11	30	2%	0%	6%	2%
12	30	1%	0%	3%	0%
13	15	1%	0%	1%	1%
14	60	0%	0%	2%	0%
15	600	0%	0%	0%	0%

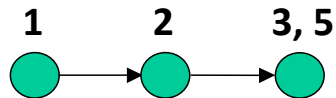
² Trip Generation for Employees and Transients (see Table 5-9) is the same for Un-staged and Staged Evacuation.



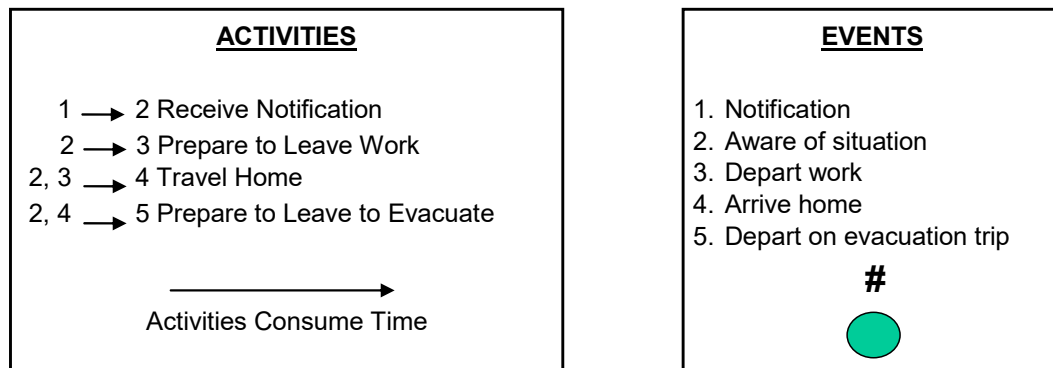
(a) Accident occurs during midweek, at midday; year round



(b) Accident occurs during weekend or during the evening²



(c) Employees who live outside the EPZ



¹ Applies for evening and weekends also if commuters are at work.

² Applies throughout the year for transients.

Figure 5-1. Events and Activities Preceding the Evacuation Trip

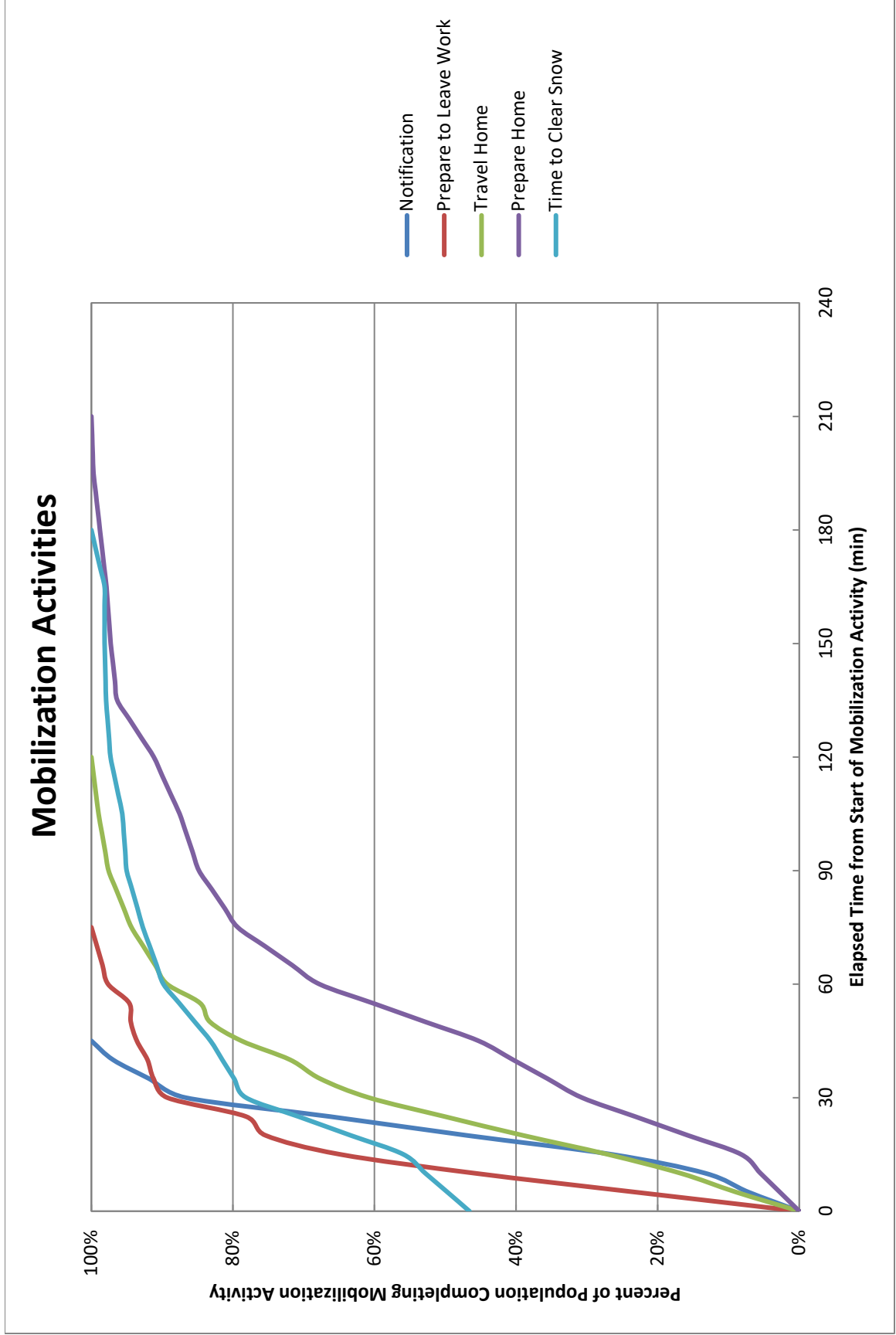


Figure 5-2. Time Distributions for Evacuation Mobilization Activities

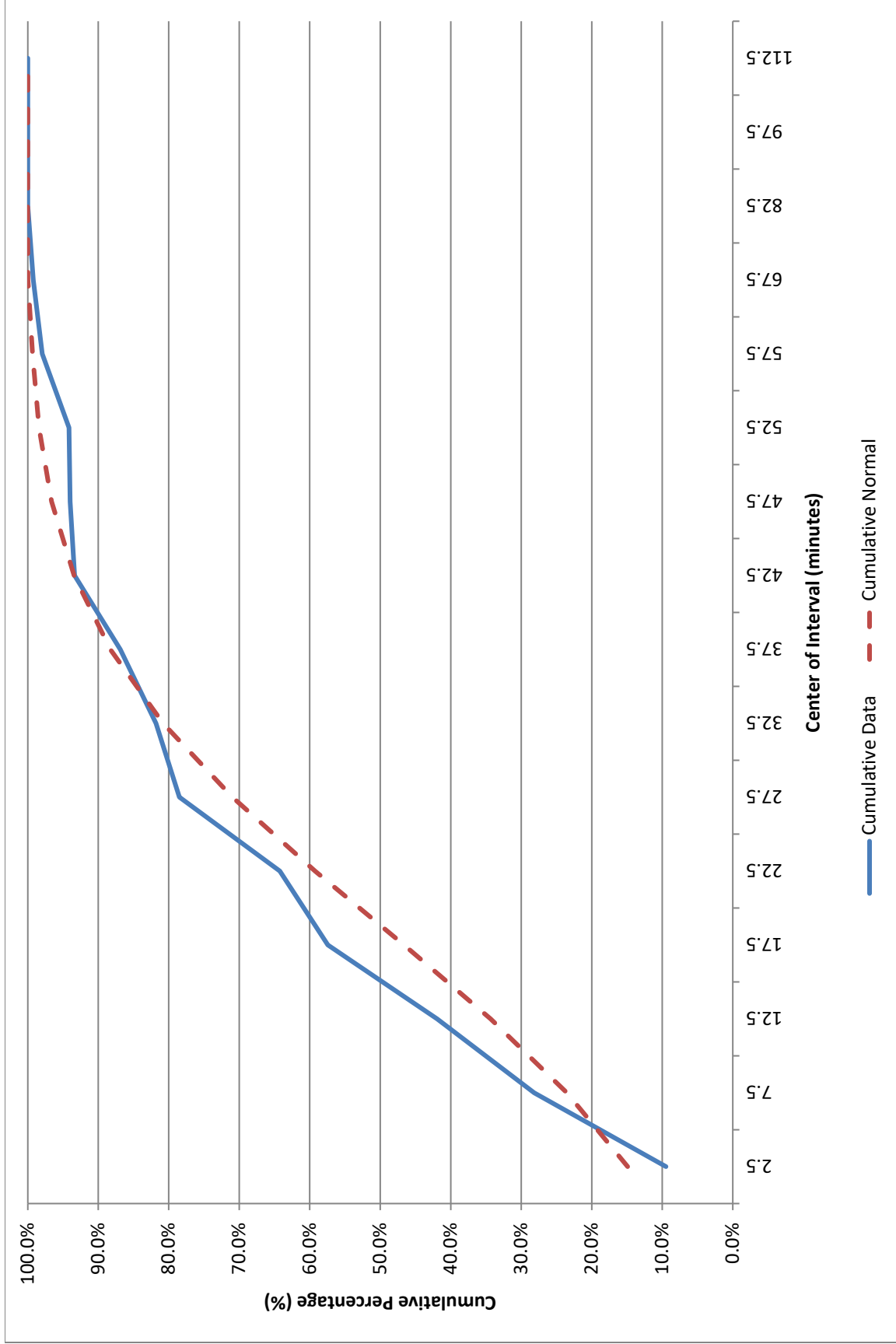


Figure 5-3. Comparison of Data Distribution and Normal Distribution

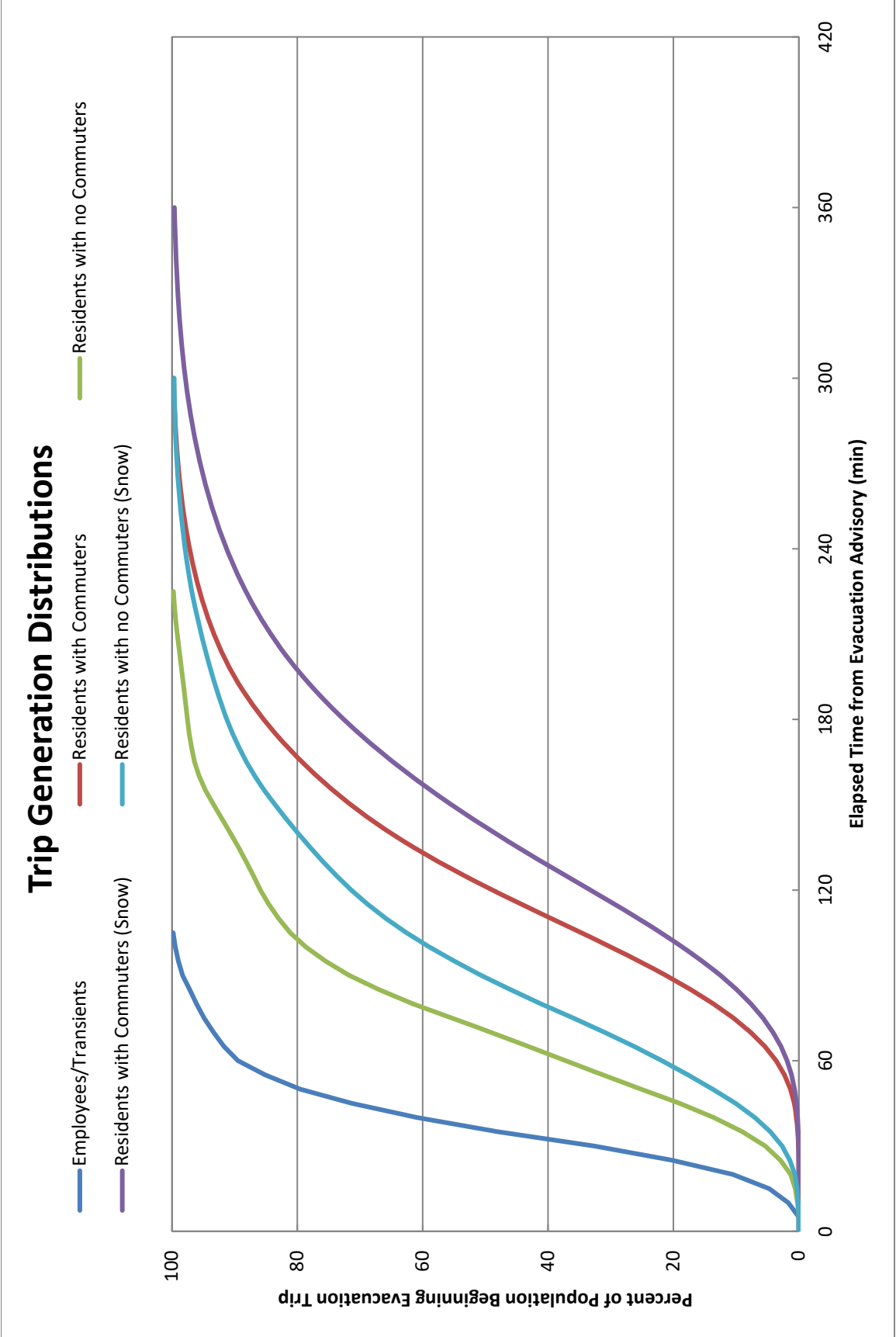


Figure 5-4. Comparison of Trip Generation Distributions

Staged and Un-staged Evacuation Trip Generation

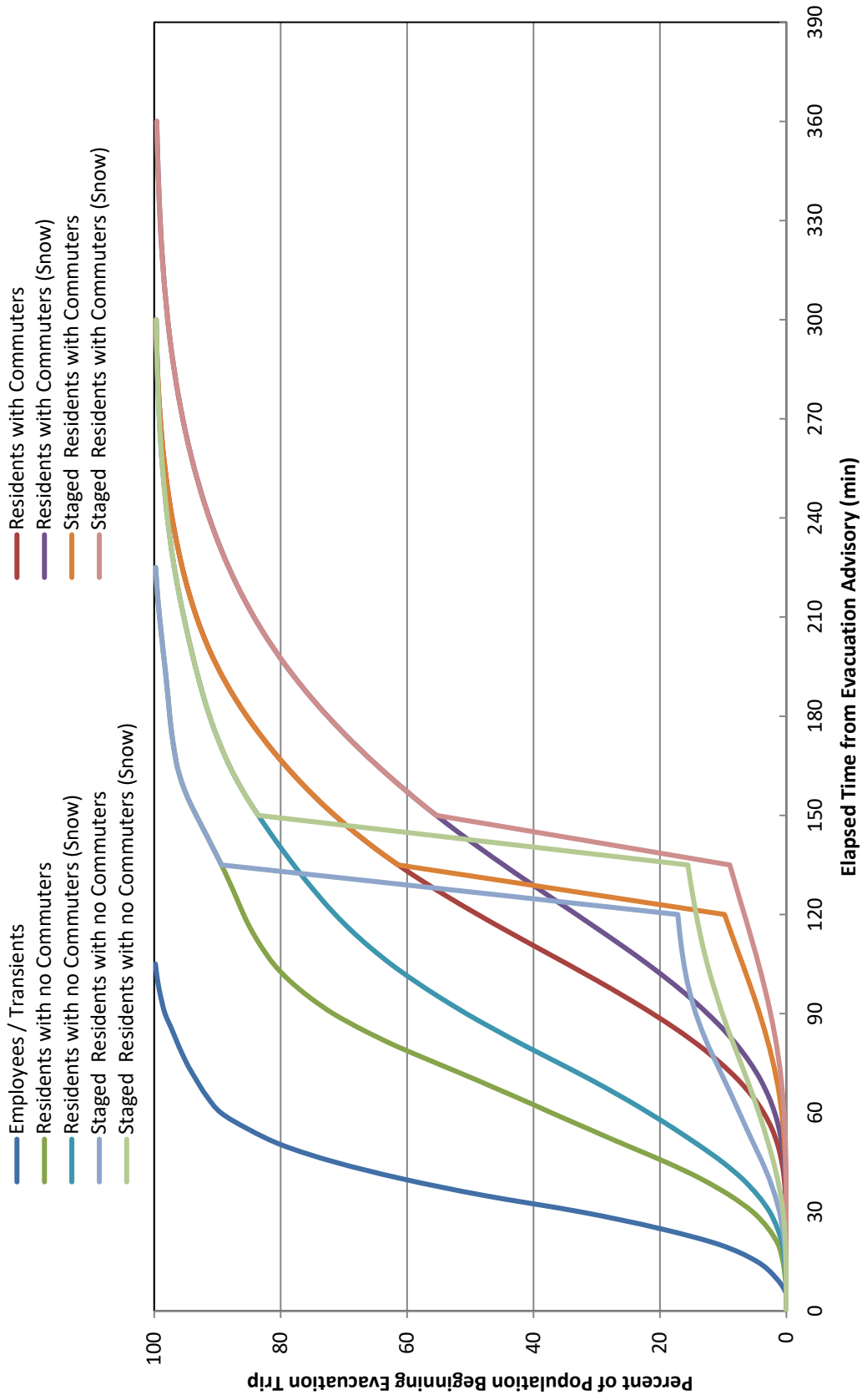


Figure 5-5. Comparison of Staged and Un-staged Trip Generation Distributions in the 2 to 5 Mile Region

6 EVACUATION CASES

An evacuation “case” defines a combination of Evacuation Region and Evacuation Scenario. The definitions of “Region” and “Scenario” are as follows:

Region A grouping of contiguous evacuating ERPAs that forms either a “keyhole” sector-based area, or a circular area within the EPZ, that must be evacuated in response to a radiological emergency. ERPA are groupings of contiguous Communities that evacuate concurrently. Table 6-1 indicates which Communities are within each ERPA.

Scenario A combination of circumstances, including time of day, day of week, season, and weather conditions. Scenarios define the number of people in each of the affected population groups and their respective mobilization time distributions.

A total of 19 Regions were defined which encompass all the groupings of ERPAs considered. These Regions are defined in Table 6-2. The Community and ERPA configurations are identified in Figure 6-1. Each keyhole sector-based area consists of a central circle centered at the power plant, and three adjoining sectors, each with a central angle of 22.5 degrees, as per NUREG/CR-7002, Rev. 1 guidance. The central sector coincides with the wind direction. These sectors extend to 5 miles from the plant (Regions R04 through R08) or to the EPZ boundary (Regions R09 through R13).

Regions R01, R02 and R03 represent evacuations of circular areas with radii of 2, 5 and 10 miles, respectively. Regions R14 through R19 are identical to Regions R02 and R04 through R08, respectively; however, those ERPAs between 2 miles and 5 miles are staged until 90% of the 2-mile region (Region R01) has evacuated. The Protective Action Recommendation (PAR) for Seabrook Station indicate that the beaches in New Hampshire will always evacuate in the event of an emergency and the beaches in Massachusetts will be closed. As such, all beach facilities are assumed to evacuate for all cases.

Each ERPA that intersects the keyhole is included in the Region; however, there are instances wherein a small portion (a “sliver”) of an ERPA is within the keyhole and the population within that small portion is low (500 people or 10% of the ERPA population, whichever is less). Under those circumstances, the ERPA would not be included in the Region so as to not evacuate large numbers of people outside of the keyhole for a small number of people that are actually in the keyhole. For example, for wind direction from 281.5° to 302.9° with an evacuation of the 2-mile region downwind to 5 miles, there is a very small area (about 0.2 square miles) of the Community of Salisbury (ERPA B) within the keyhole. There are only 75 residents within the small area of ERPA B within the keyhole, versus 26,603 residents living in all of ERPA B. ERPA B is not evacuated in this case because it would not be prudent to evacuate 26,528 residents that are not within the keyhole for less than 1% of the ERPA population that is within the plume.

A total of 14 Scenarios were evaluated for all Regions. Thus, there are a total of $14 \times 19 = 266$ evacuation cases. Table 6-3 provides a description of all Scenarios.

Each combination of region and scenario implies a specific population to be evacuated. The population and vehicle estimates presented in Section 3 and in Appendix E are peak values. These peak values are adjusted depending on the scenario and region being considered, using scenario and region-specific percentages, such that the average population is considered for each evacuation case. The scenario percentages are presented in Table 6-4, while the regional percentages are provided in Table H-1. The percentages presented in Table 6-5 were determined as follows:

The number of residents with commuters during the week (when the workforce is at its peak) is equal to 38%, which is the product of 76% (the number of households with at least one commuter) and 50% (the number of households with a commuter that would await the return of the commuter prior to evacuating). See assumption 3 in Section 2.3. It is estimated for weekend and evening scenarios that 10% of households with returning commuters will have a commuter at work during those times.

It can be argued that the estimate of permanent residents overstates, somewhat, the number of evacuating vehicles, especially during the summer. It is certainly reasonable to assert that some portion of the population would be on vacation during the summer and would travel elsewhere. A rough estimate of this reduction can be obtained as follows:

- Assume 50% of all households vacation for a period over the summer.
- Assume these vacations, in aggregate, are uniformly dispersed over 10 weeks, i.e., 10% of the population is on vacation during each two-week interval.
- Assume half of these vacationers leave the area.

On this basis, the permanent resident population would be reduced by 5% in the summer and by a lesser amount in the off-season. Given the uncertainty in this estimate, we elected to apply no reductions in permanent resident population for the summer scenarios to account for residents who may be out of the area.

Employment is assumed to be at its peak (100%) during the midweek, midday scenarios¹. It is estimated that only 10% of the employees are working in the evenings and during the weekends.

Transient activity is estimated to be at its peak (90%) during summer weekends and less during the week (65%). As shown in Appendix E, there are a large number of lodging and campgrounds offering overnight accommodations in the EPZ; thus, transient activity is estimated to be 70% for summer evenings. Due to the number of campgrounds that are closed during the cold winter months, it is estimated transient activity is low (35%) during winter evenings. Transient activity on winter weekdays and weekends is estimated to be 15% and 25%, respectively, due to significantly less transients who would be visiting the beaches during the winter months.

Seasonal residents are present in the summer months. As such, the scenario percentages are set to 100% during summer scenarios and 0% during weekend scenarios.

¹ As per discussions with the states within the EPZ, employment is not reduced in the summer for vacation due to an influx of seasonal jobs that offset the workers who take vacations during the summer.

As noted in the shadow footnote to Table 6-4, the shadow percentages are computed using a base of 20% (see assumption 10 in Section 2.2); to include the employees within the Shadow Region who may choose to evacuate, the voluntary evacuation is multiplied by a scenario-specific proportion of employees to permanent residents in the Shadow Region. For example, using the values provided in Table 6-5 for Scenario 6, the shadow percentage is computed as follows:

$$20\% \times \left(1 + \frac{24,434}{33,260 + 55,008}\right) = 26\%$$

One special event – 4th of July Fireworks Show at Hampton Beach – was considered as Scenario 13. Thus, the special event traffic is 100% evacuated for Scenario 13, and 0% for all other scenarios.

As discussed in the footnote to Table 2-2, schools are in session during the winter season, midweek, midday and 100% of buses will be needed under those circumstances. It is estimated that summer school enrollment is approximately 10% of enrollment during the regular school year for summer, midweek, midday scenarios. School is not in session during weekends and evenings, thus no buses (0%) for school children are needed under those circumstances. Commuter students at Great Bay Community College share the same evacuation percentages by scenario as the school population.

Transit buses, wheelchair transport vehicles, and ambulances for the transit-dependent population and medical facility population are set to 100% for all scenarios as it is assumed that the transit-dependent and medical facility population are present in the EPZ at all times.

External traffic is estimated to be 40% during evening scenarios and is 100% for all other scenarios.

Table 6-1. ERPA Designations

Community	ERPA
NEW HAMPSHIRE	
Seabrook	A
Hampton Falls	
Kensington	C
South Hampton	
Hampton	D
North Hampton	
Brentwood	F
East Kingston	
Exeter	
Newfields	
Newton	
Kingston	G
Greenland	
Stratham	
Rye	
New Castle	
Portsmouth	
MASSACHUSETTS	
Amesbury	B
Salisbury	
Merrimac	E
Newburyport	
Newbury	
West Newbury	

Table 6-2. Description of Evacuation Regions

Radial Regions								
Region	Description	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R01	2-Mile Region	X						
R02	5-Mile Region	X	X	X			X	
R03	Full EPZ	X	X	X	X	X	X	X
Evacuate 2-Mile Region and Downwind to 5 Miles								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R04	NW, NNW, N, NNE	X					X	
R05	NE, ENE, E	X	X				X	
R06	ESE	X	X					
R07	SE, SSE	X	X	X				
R08	S, SSW, SW, WSW, W	X		X				
N/A	WNW	Refer to Region R01						
Evacuate 5-Mile Region and Downwind to the EPZ Boundary								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R09	NW, NNW, N, NNE	X	X	X			X	X
R10	NE, ENE, E	X	X	X	X		X	X
R11	ESE	X	X	X	X		X	
R12	SE, SSE, S	X	X	X	X	X	X	
R13	SSW, SW, WSW	X	X	X		X	X	
N/A	W, WNW	Refer to Region R02						
Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5 Miles								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R14	5-Mile Region	X	X	X			X	
R15	NW, NNW, N, NNE	X					X	
R16	NE, ENE, E	X	X				X	
R17	ESE	X	X					
R18	SE, SSE	X	X	X				
R19	S, SSW, SW, WSW, W	X		X				
N/A	WNW	Refer to Region R01						
ERPA(s) Evacuate		ERPAs) Shelter-in-Place			ERPA(s) Shelter-in-Place until 90% ETE for R01, then Evacuate			

Table 6-3. Evacuation Scenario Definitions

Scenario	Season ²	Day of Week	Time of Day	Weather	Special
1	Summer	Midweek	Midday	Good	None
2	Summer	Midweek	Midday	Rain	None
3	Summer	Weekend	Midday	Good	None
4	Summer	Weekend	Midday	Rain	None
5	Summer	Midweek, Weekend	Evening	Good	None
6	Winter	Midweek	Midday	Good	None
7	Winter	Midweek	Midday	Rain/Light Snow	None
8	Winter	Midweek	Midday	Heavy Snow	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain/Light Snow	None
11	Winter	Weekend	Midday	Heavy Snow	None
12	Winter	Midweek, Weekend	Evening	Good	None
13	Summer	Midweek, Weekend	Evening	Good	July 4th Fireworks Show at Hampton Beach
14	Summer	Midweek	Midday	Good	Lane Closure on New Hampshire State Highway 101 Westbound

² Winter assumes that school is in session at normal enrollment levels (also applies to spring and autumn). Summer means that school is in session at summer school enrollment levels (lower than normal enrollment).

Table 6-4. Percent of Population Groups Evacuating for Various Scenarios

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Transients	Seasonal Residents	Shadow	Special Event	Medical Vehicles	Great Bay Community College Commuters	School Buses	Transit Buses	External Through Traffic
1	38%	62%	100%	65%	100%	26%	0%	100%	10%	10%	100%	100%
2	38%	62%	100%	65%	100%	26%	0%	100%	10%	10%	100%	100%
3	4%	96%	10%	90%	100%	21%	0%	100%	0%	0%	100%	100%
4	4%	96%	10%	90%	100%	21%	0%	100%	0%	0%	100%	100%
5	4%	96%	10%	70%	100%	21%	0%	100%	0%	0%	100%	40%
6	38%	62%	100%	15%	0%	26%	0%	100%	100%	100%	100%	100%
7	38%	62%	100%	15%	0%	26%	0%	100%	100%	100%	100%	100%
8	38%	62%	100%	15%	0%	26%	0%	100%	100%	100%	100%	100%
9	4%	96%	10%	25%	0%	21%	0%	100%	0%	0%	100%	100%
10	4%	96%	10%	25%	0%	21%	0%	100%	0%	0%	100%	100%
11	4%	96%	10%	25%	0%	21%	0%	100%	0%	0%	100%	100%
12	4%	96%	10%	35%	0%	21%	0%	100%	0%	0%	100%	40%
13	4%	96%	10%	70%	100%	21%	100%	100%	0%	0%	100%	40%
14	38%	62%	100%	65%	100%	26%	0%	100%	10%	10%	100%	100%

Households with Returning Commuters Households of EPZ residents who await the return of commuters prior to beginning the evacuation trip.

Households without Returning Commuters..... Households of EPZ residents who do not have commuters or will not await the return of commuters prior to beginning the evacuation trip.

Employees..... EPZ employees who live outside the EPZ.

Transients..... People who are in the EPZ at the time of an accident for recreational or other (non-employment) purposes.

Seasonal Residents People who visit the EPZ and stay considerably longer than the average transient using condos, beach houses, or rentals.

Shadow Residents and employees in the shadow region (outside of the EPZ) who will spontaneously decide to relocate during the evacuation. The

basis for the values shown is a 20% relocation of shadow residents along with a proportional percentage of shadow employees.

Special Event Additional vehicles in the EPZ due to the identified special event.

Medical Vehicles, School, and Transit Buses.... Vehicle-equivalents present on the road during evacuation servicing schools and transit-dependent people (1 bus is equivalent to 2

passenger vehicles).

Great Bay Community College Commuters..... Students who commute to Great Bay Community College.

External Through Traffic..... Traffic on interstates/freeways and major arterial roads at the start of the evacuation. This traffic is stopped by ACPs approximately 2 hours

after the evacuation begins.

Table 6-5. Vehicle Estimates by Scenario

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Transients	Seasonal Residents	Shadow	Special Events	Medical Vehicles	Great Bay Community College Commuters	School Buses	Transit Buses	External Through Traffic	Total Scenario Vehicles ³
1	33,260	55,008	24,434	11,055	2,799	13,422	0	762	56	140	176	25,044	166,156
2	33,260	55,008	24,434	11,055	2,799	13,422	0	762	56	140	176	25,044	166,156
3	3,326	84,942	2,443	15,307	2,799	10,803	0	762	0	0	176	25,044	145,602
4	3,326	84,942	2,443	15,307	2,799	10,803	0	762	0	0	176	25,044	145,602
5	3,326	84,942	2,443	11,906	2,799	10,803	0	762	0	0	176	10,018	127,175
6	33,260	55,008	24,434	2,551	0	13,422	0	762	559	1,404	176	25,044	156,620
7	33,260	55,008	24,434	2,551	0	13,422	0	762	559	1,404	176	25,044	156,620
8	33,260	55,008	24,434	2,551	0	13,422	0	762	559	1,404	176	25,044	156,620
9	3,326	84,942	2,443	4,252	0	10,803	0	762	0	0	176	25,044	131,748
10	3,326	84,942	2,443	4,252	0	10,803	0	762	0	0	176	25,044	131,748
11	3,326	84,942	2,443	4,252	0	10,803	0	762	0	0	176	25,044	131,748
12	3,326	84,942	2,443	5,953	0	10,803	0	762	0	0	176	10,018	118,423
13	3,326	84,942	2,443	11,906	2,799	10,803	24,792	762	0	0	176	10,018	151,967
14	33,260	55,008	24,434	11,055	2,799	13,422	0	762	56	140	176	25,044	166,156

³ Vehicle estimates are for an evacuation of the entire EPZ (Region R03)

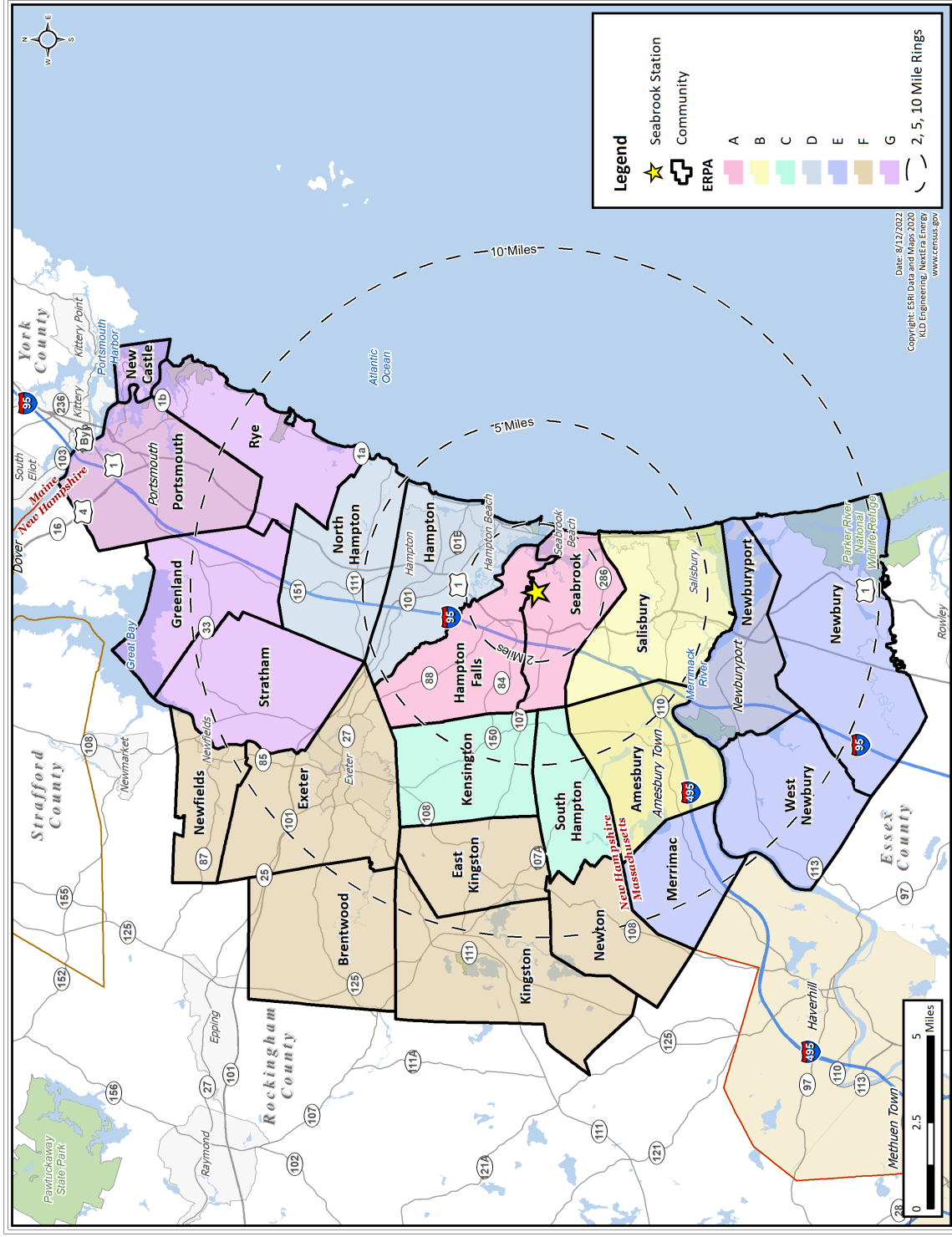


Figure 6-1. Communities and ERPAs Comprising the Seabrook Station EPZ

7 GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE)

This section presents the ETE results of the computer analyses using the DYNEV II System described in Appendices B, C and D. These results cover the 19 Evacuation Regions within the Seabrook Station EPZ and the 14 Evacuation Scenarios discussed in Section 6.

The ETE for all evacuation cases are presented in Table 7-1 and Table 7-2. These tables present the estimated times to clear the indicated population percentages from the Evacuation Regions for all Evacuation Scenarios. The ETE for the 2-mile region in both staged and un-staged regions are presented in Table 7-3 and Table 7-4. Table 7-5 identifies the Communities within each ERPA, while Table 7-6 defines the Evacuation Regions considered. The tabulated values of ETE are obtained from the DYNEV II System outputs which are generated at 5-minute intervals.

7.1 Voluntary Evacuation and Shadow Evacuation

“Voluntary evacuees” are permanent residents within the EPZ in Communities for which an Advisory to Evacuate (ATE) has not been issued, yet who elect to evacuate. “Shadow evacuation” is the voluntary outward movement of some permanent residents and employees from the Shadow Region (outside the EPZ) for whom no protective action recommendation has been issued. Both voluntary and shadow evacuations are assumed to take place over the same time frame as the evacuation from within the impacted Evacuation Region.

The ETE for the Seabrook Station EPZ addresses the issue of voluntary evacuees in the manner shown in Figure 7-1. Within the EPZ, 20% of permanent residents located in Communities outside of the evacuation region who are not advised to evacuate, are assumed to elect to evacuate. Similarly, it is assumed that 20% of those permanent residents in the Shadow Region will choose to leave the area.

Figure 7-2 presents the area identified as the Shadow Region. This region extends radially from the plant to cover a region between the EPZ boundary and 15 miles radially from the Seabrook Station. The population and number of evacuating vehicles in the Shadow Region were estimated using the same methodology that was used for permanent residents within the EPZ (see Section 3.1). As discussed in Section 3.2 (and shown in Table 3-3), it is estimated that 103,233 people reside in the Shadow Region; 20% of them would evacuate. See Table 6-5 for the number of evacuating vehicles from the Shadow Region.

Traffic generated within this Shadow Region (including external-external traffic), traveling away from the Seabrook Station, has the potential for impeding evacuating vehicles from within the Evacuation Region. All ETE calculations include this shadow traffic movement.

7.2 Staged Evacuation

As defined in NUREG/CR-7002 Rev. 1, staged evacuation consists of the following:

1. Communities comprising the 2-mile region are advised to evacuate immediately.

2. Communities comprising regions extending from 2 to 5 miles downwind are advised to shelter in-place while the 2-mile region is cleared.
3. As vehicles evacuate the 2-mile region, people from 2 to 5 miles downwind continue preparation for evacuation while they shelter.
4. The populations sheltering in the 2 to 5-mile region are advised to begin evacuating when approximately 90% of those originally within the 2-mile region evacuate across the 2-mile region boundary.
5. The population in the 5 to 10-Mile Region (to the EPZ boundary) shelters in place.
6. Non-compliance with the shelter recommendation is the same as the shadow evacuation percentage of 20%.

See Section 5.4.2 for additional information on staged evacuation.

7.3 Patterns of Traffic Congestion during Evacuation

Figure 7-3 through Figure 7-8 illustrate the patterns of traffic congestion that arise for the case when the entire EPZ (Region R03) is advised to evacuate during the summer, midweek, midday period under good weather conditions (Scenario 1).

Traffic congestion, as the term is used here, is defined as Level of Service (LOS) F. LOS F is defined as follows (HCM 2016, page 5-5):

The HCM uses LOS F to define operations that have either broken down (i.e., demand exceeds capacity) or have reached a point that most users would consider unsatisfactory, as described by a specified service measure value (or combination of service measure values). However, analysts may be interested in knowing just how bad the LOS F condition is, particularly for planning applications where different alternatives may be compared. Several measures are available for describing individually, or in combination, the severity of a LOS F condition:

- *Demand-to-capacity ratios* describe the extent to which demand exceeds capacity during the analysis period (e.g., by 1%, 15%).
- *Duration of LOS F* describes how long the condition persists (e.g., 15 min, 1 h, 3 h).
- *Spatial extent measures* describe the areas affected by LOS F conditions. They include measures such as the back of queue and the identification of the specific intersection approaches or system elements experiencing LOS F conditions.

All highway "links" which experience LOS F are delineated in these figures by a thick red line; all others are lightly indicated. Congestion develops rapidly around population centers and traffic bottlenecks.

Figure 7-3 displays traffic congestion patterns within the study area at 1 hour after the ATE. There is already significant congestion in the Communities of Portsmouth, Newburyport, and Exeter. US-4 northbound that connects Portsmouth to the town of Dover experiences LOS F conditions,

as well as I-95 and US-1 northbound leaving Portsmouth. US-1 southbound from the MA-NH state line to the EPZ boundary is operating at LOS F. Congestion can be observed (varying LOS D to LOS F conditions) on SR-101 westbound from the interchange of SR-27/SR-111 to the end of the network near the town of Raymond. The roads that are being used by the evacuees from the coastline in Hampton Beach and Seabrook Beach (SR-1A, SR-27, SR-286, and SR-110) are also experiencing LOS F conditions. The only congestion observed in the 2-mile radius of the plant is on I-95, which is a combination of evacuating vehicles and external traffic. At this time, about 44% of vehicles have mobilized and 23% of vehicles have evacuated the EPZ.

Figure 7-4 displays peak traffic congestion within the study area at 2 hours after the ATE. All roads leading to the major evacuation routes in Portsmouth are exhibiting LOS E and LOS F. US-4, I-95, and US-1 northbound still have severe congestion. The entire length of SR-101 westbound is operating at LOS F. Because of this, evacuees in the Communities surrounding SR-101, including Exeter, utilize alternate evacuation routes such as SR-87, SR-111A, SR-111, and SR-108; LOS F conditions are observed on these roads as well. Traffic volume (LOS C and LOS D) is observed on I-495 southbound from the interchange with I-95 to the EPZ boundary. However, LOS F conditions are observed on I-495 southbound just beyond the EPZ boundary in the shadow region as evacuees from Newton and Merrimac evacuating along SR-108 and SR-110 converge with the interstate in this area. There is still congestion on I-95 within the 2-mile radius of the plant. At this time, ACPs are established which help to open some of the roadway capacity and eliminate any external traffic from entering the EPZ. Congestion within the 2-mile region remains within Hampton. At this time, about 80% of vehicles have mobilized and 53% of vehicles have evacuated the EPZ.

Figure 7-5 displays traffic congestion patterns within the study area at 3 hours after the ATE. Congestion is dissipating and moving radially away from the plant. All congestion within the 2-mile radius of the plant has cleared by this time; the last bit of congestion within the 2-mile region remains on Timber Swamp Rd, Mary Batchelder Rd and SR-27 which clears 35 min later at 3:35 after the ATE. Most of the congestion within the 5-mile radius of the plant has cleared with the exception of the aforementioned parts of Hampton and parts of SR-1A and SR-110 and US-1 in Salisbury. Amesbury and Newburyport are mostly clear of congestion, but severe congestion is still present in the major population centers of Exeter and Portsmouth. US-4, I-95, and US-1 northbound leaving Portsmouth all remain severely congested. SR-101 westbound is still experiencing mostly LOS F conditions throughout the length of the highway. SR-111 and SR-108 also exhibit LOS F conditions within the EPZ as well. At this time, about 96% of vehicles have mobilized and 74% of vehicles have evacuated the EPZ.

Figure 7-6 displays the congestion patterns at 4 hours after the ATE. Congestion continues to dissipate. There is no longer any congestion observed within a 5-mile radius of the Seabrook Station; the last remnant of congestion within the 5-mile region is along Winnicutt Rd in North Hampton which clears this Community boundary 5 min later at 4:05 after the ATE. In MA, the only remaining congestion in the EPZ is along SR-110, School St/Central St, and Orchard St. The only congestion still present in Exeter is on SR-85 northbound and SR-101 westbound, which is still at LOS F conditions from the interchange with SR-85 through the end of the network. Congestion within Portsmouth has started to lessen, but many of the roads leading to the major

evacuation routes are still experiencing LOS F conditions. At this time, about 99% of vehicles have mobilized and 89% of vehicles have evacuated the EPZ. The 90% of evacuees successfully leave the area 5 minutes later at 4:05 after the ATE.

Figure 7-7 displays the traffic congestion patterns at 5 hours after the ATE. The only congestion present in the EPZ at this time is in the heart of Portsmouth, along Newington Rd in Greenland, and on SR-87 westbound in Newfields. SR-101 is operating at LOS A within the EPZ; however, LOS F conditions are observed on SR-101 westbound from the shadow region to the end of the network near the town of Raymond. I-495 southbound and I-95 southbound are operating at LOS A. I-95 northbound has congestion in Portsmouth and extends over the border into Maine. US-4 is clear of congestion in the EPZ and shadow region, but LOS F conditions can be seen just beyond the shadow region boundary where it meets with Newington Rd. At this time, all vehicles in the EPZ have mobilized and 98% of vehicles have successfully evacuated the EPZ.

Figure 7-8 shows the traffic congestion patterns at 5 hours and 30 minutes after the ATE. The last bit of congestion within the EPZ is observed along SR-87 in Newfields since SR-87 hits a stop sign with SR-125 at the boundary of the shadow region. All congestion within the EPZ clears 35 minutes later at 6 hours and 5 minutes after the ATE.

7.4 Evacuation Rates

Evacuation is a continuous process, as implied by Figure 7-9 through Figure 7-22. These figures display the rate at which traffic flows out of the indicated areas for the case of an evacuation of the full EPZ (Region R03) under the indicated conditions. One figure is presented for each scenario considered.

As indicated in Figure 7-9, there is typically a long "tail" to these distributions. Vehicles begin to evacuate an area slowly at first, as people respond to the ATE at different rates. Then traffic demand builds rapidly (slopes of curves increase). When the system becomes congested, traffic exits the EPZ at rates somewhat below capacity until some evacuation routes have cleared. As more routes clear, the aggregate rate of egress slows since many vehicles have already left the EPZ. Towards the end of the process, relatively few evacuation routes service the remaining demand.

This decline in aggregate flow rate, towards the end of the process, is characterized by these curves flattening and gradually becoming horizontal. Ideally, it would be desirable to fully saturate all evacuation routes equally so that all will service traffic near capacity levels and all will clear at the same time. For this ideal situation, all curves would retain the same slope until the end of mobilization time – thus minimizing evacuation time. In reality, this ideal is generally unattainable reflecting the spatial variation in population density, mobilization rates and in highway capacity over the EPZ.

7.5 Evacuation Time Estimate (ETE) Results

Table 7-1 through Table 7-2 present the ETE values for all 19 Evacuation Regions and all 14 Evacuation Scenarios. Table 7-3 through Table 7-4 present the ETE values for the 2-mile region

for both staged and un-staged keyhole regions downwind to 5 miles. They are organized as follows:

Table	Contents
7-1	ETE represents the elapsed time required for 90% of the population within a Region, to evacuate from that Region. All Scenarios are considered, as well as Staged Evacuation scenarios.
7-2	ETE represents the elapsed time required for 100% of the population within a Region, to evacuate from that Region. All Scenarios are considered, as well as Staged Evacuation scenarios.
7-3	ETE represents the elapsed time required for 90% of the population within the 2-mile Region, to evacuate from the 2-mile Region with both Concurrent and Staged Evacuations of additional Communities downwind in the keyhole Region.
7-4	ETE represents the elapsed time required for 100% of the population within the 2-mile Region, to evacuate from the 2-mile Region with both Concurrent and Staged Evacuations of additional Communities downwind in the keyhole Region.

The animation snapshots described above reflect the ETE statistics for the concurrent (un-staged) evacuation scenarios and regions, which are displayed in Figure 7-3 through Figure 7-8. Most of the congestion is located beyond 2 miles of the Seabrook Station. This is reflected in the ETE statistics:

- There is no congestion within the 2-Mile Region (R01) when it evacuates alone which means that ETE is dictated by the time it takes to establish ACPs along I-95 and US-1. ACPs are established at 2 hours after the ATE, it then takes about 10 minutes, or less, for the last bit of external traffic to flow through the 2-mile region. As such, the 90th percentile ETE for this region ranges from 2:05 (hr:min) to 2:10 for all non-snow scenarios (up to 2:25 for snow).
- The 5-Mile Region (R02) experiences slight congestion in the population centers of Hampton and Salisbury. As a result, the 90th percentile ETE for Region R02 are longer than R01 and range between 2:20 and 2:50 for non-snow and non-special scenarios (up to 3:05 for snow scenarios).
- The full EPZ (Region R03) experiences significant congestion, specifically in Portsmouth and Exeter. The major evacuation routes exiting the EPZ also experience significant congestion throughout the entire evacuation. As a result, the 90th percentile ETE for Region R03 are at most 1 hour and 45 minutes longer than the 90th percentile ETE for Region R02. The 90th percentile ETE range between 3:10 and 4:50 for all scenarios.
- The 100th percentile ETE for all regions and scenarios reflects the congestion present within the EPZ throughout the evacuation process. The ETE for many of the evacuation cases is longer than the mobilization time indicating that there is significant congestion on the evacuation routes even after 100% of the residents have mobilized.

Comparison of Scenarios 5 and 13 in Table 7-1 and Table 7-2 indicates that the Special Event – 4th of July fireworks show at Hampton Beach – has a significant impact on the 90th and 100th percentile ETE. The additional 24,792 vehicles at Hampton Beach increase ETE by as much as 2

hours and 55 minutes at the 90th percentile for regions involving the evacuation of Hampton and North Hampton (ERPA D). These additional transients oversaturate the major evacuation routes for these Communities, increase congestion, and prolong ETE. The 100th percentile ETE increases by as much as 2 hours and 35 minutes.

Comparison of Scenarios 1 and 14 in Table 7-1 and Table 7-2 indicates that the roadway closure – one lane westbound on New Hampshire State Highway 101 from the interchange with I-95 to the interchange with SR-107 (Exit 5) – has a significant impact on the 90th and 100th percentile ETE for keyhole regions with wind from the east and evacuations out to the EPZ boundary (Regions R10 through R12). The 90th and 100th percentile ETE increase by up to 30 minutes and 2 hours and 20 minutes, respectively. Wind from the east carries the plume over ERPA F and G (Brentwood, Exeter, Newfields, and Stratham) which routes traffic onto SR-101 westbound. With a lane closed on SR-101 westbound in this area, the capacity of SR-101 is significantly reduced, increasing congestion and prolonging ETE.

7.6 Staged Evacuation Results

Table 7-3 and Table 7-4 present a comparison of the ETE compiled for the concurrent (un-staged) and staged evacuation cases. Note that Regions R23 through R30 are the same geographic areas as Regions R02 and R04 through R10, respectively. The times shown in Table 7-3 and Table 7-4 are when the 2-mile region is 90% clear and 100% clear, respectively.

The objective of a staged evacuation strategy is to ensure the ETE for the 2-mile region is not significantly increased (30 minutes or 25%, whichever is less) when evacuating areas beyond 2-miles. Additionally, staged evacuation should not significantly increase the ETE for people evacuating beyond 2-miles. In all cases, as shown in these tables, the ETE for the 2-mile region is unchanged at the 90th and 100th percentiles when a staged evacuation is implemented for all scenarios.

As discussed in Section 7.3, there is minimal congestion within the 2-mile region. In addition, the congestion beyond 5 miles does not extend upstream to the extent that it penetrates within 2 miles of the Seabrook Station, such that evacuees from within the 2-mile region are not impeded. Therefore, staging the evacuation provides no benefits to evacuees from within the 2-mile region, as evidenced by the lack of change in ETE.

To determine the effect of staged evacuation on residents beyond the 2-mile region, the ETE for Regions R02 and R04 through R08 are compared to Regions R14 through R19, respectively, in Table 7-1 and Table 7-2. A comparison of ETE between these similar regions reveals that staging increases the 90th percentile ETE for those in the 2 to 5-mile area by up to 45 minutes (see Table 7-1). Staging increases the 100th percentile ETE for those evacuees beyond the 2-mile region by up to 40 minutes (see Table 7-2.)

The increase in the 90th percentile and 100th percentile ETE is due to evacuating vehicles, beyond the 2-mile region, sheltering and delaying the start of their evacuation. As shown in Figure 5-5, staging the evacuation causes a significant “spike” (sharp increase) in mobilization (trip-generation rate) of evacuating vehicles.

In summary, the staged evacuation option provides no benefit to evacuees from within the 2-mile region, and adversely impacts some evacuees located beyond 2 miles from the plant. Staged evacuation is not beneficial for this EPZ.

7.7 Guidance on Using ETE Tables

The user first determines the percentile of population for which the ETE is sought (the NRC guidance calls for the 90th percentile). The applicable value of ETE within the chosen table may then be identified using the following procedure:

1. Identify the applicable **Scenario**:

- Season
 - Summer
 - Winter (also Autumn and Spring)
- Day of Week
 - Midweek
 - Weekend
- Time of Day
 - Midday
 - Evening
- Weather Condition
 - Good Weather
 - Rain/Light Snow
 - Heavy Snow
- Special Event
 - 4th of July Fireworks Show at Hampton Beach
- Roadway Impact
 - Lane Closure on SR-101 westbound
- Evacuation Staging
 - No, Staged Evacuation is not considered
 - Yes, Staged Evacuation is considered

While these Scenarios are designed, in aggregate, to represent conditions throughout the year, some further clarification is warranted:

- The conditions of a summer evening (either midweek or weekend) and rain are not explicitly identified in the tables. For these conditions, Scenarios (2) and (4) apply.
- The conditions of a winter evening (either midweek or weekend) and rain/light snow are not explicitly identified in the tables. For these conditions, Scenarios (7) and (10) for rain/light snow apply.
- The conditions of a winter evening (either midweek or weekend) and heavy snow are not explicitly identified in the tables. For these conditions, Scenarios (8) and (11) for heavy snow apply.
- The seasons are defined as follows:
 - Summer assumes school is in session at summer school enrollment levels (lower than normal enrollment).

- Winter (includes Spring and Autumn) considers that public schools are in session at normal enrollment levels.
 - Time of Day: Midday implies the time over which most commuters are at work or are travelling to/from work.
- 2. With the desired percentile ETE and Scenario identified, now identify **the Evacuation Region**:
 - Determine the projected azimuth direction of the plume (coincident with the wind direction). This direction is expressed in terms of compass orientation – from N, NNE, NE.
 - Determine the distance that the Evacuation Region will extend from the nuclear power plant. The applicable distances and their associated candidate Regions are given below:
 - 2 Miles (Region R01)
 - To 5 Miles (Region R02, R04 through R08)
 - To EPZ Boundary (Regions R03, R09 through R13)
 - Enter Table 7-6 and identify the applicable group of candidate Regions based on the distance that the selected Region extends from the Seabrook Station. Select the Evacuation Region identifier in that row, based on the azimuth direction of the plume, from the first column of the Table.
- 3. Determine the ETE Table based on the percentile selected. Then, for the Scenario identified in Step 1 and the Region identified in Step 2, proceed as follows:
 - The columns of Table 7-1 through Table 7-4 are labeled with the Scenario numbers. Identify the proper column in the selected Table using the Scenario number defined in Step 1.
 - Identify the row in this table that provides ETE values for the Region identified in Step 2.
 - The unique data cell defined by the column and row so determined contains the desired value of ETE expressed in Hours:Minutes.

Example

It is desired to identify the ETE for the following conditions:

- Sunday, August 10th at 10:00 PM.
- It is raining.
- Wind direction is from the NE.
- Wind speed is such that the distance to be evacuated is judged to be the 5-Mile Region and downwind to 10 miles (to the EPZ boundary).
- The desired ETE is the value needed to evacuate 90% of the population from within the impacted Region.
- A staged evacuation is not desired.

Table 7-1 is applicable because the 90th percentile ETE is desired. Proceed as follows:

1. Identify the Scenario as summer, weekend, evening and raining. Entering Table 7-1, it is seen that there is no match for these descriptors. However, the clarification given above assigns this combination of circumstances to **Scenario 4**.
2. Enter Table 7-6 and locate the Region described as “Evacuate 5-Mile Region and

Downwind to the EPZ Boundary” for wind direction from NE and read **Region R10** in the first column of that row.

3. Enter Table 7-1 to locate the data cell containing the value of ETE for Scenario 4 and Region R10. This data cell is in column (4) and in the row for Region R10; it contains the ETE value of **3:15**.

Table 7-1. Time to Clear the Indicated Area of 90 Percent of the Affected Population

Scenario:	Summer		Summer		Summer		Winter		Winter		Winter		Summer		Summer	
	Region	Weather	Rain	Good Weather	Weekend		Midweek		Midweek		Weekend		Midweek		Midweek	
					Good Weather	Rain	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Evening
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		
	Midday		Midday		Evening		Midday		Midday		Evening		Evening		Midday	
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Special Event	Roadway Impact
Entire 2-Mile Region, 5-Mile Region, and EPZ																
R01	2:10	2:10	2:05	2:10	2:10	2:10	2:10	2:25	2:05	2:10	2:20	2:05	2:05	2:05	2:05	2:10
R02	2:45	2:50	2:35	2:35	2:40	2:35	2:40	3:05	2:20	2:25	2:50	2:30	4:45	2:45	2:45	2:45
R03	4:05	4:30	3:30	3:50	3:25	3:45	4:10	4:50	3:10	3:20	3:50	3:10	4:45	4:45	4:45	4:25
2-Mile Region and Keyhole to 5 Miles																
R04	2:40	2:45	2:30	2:35	2:45	2:30	2:35	3:00	2:20	2:25	2:45	2:30	2:45	2:45	2:45	2:40
R05	2:40	2:45	2:35	2:40	2:45	2:30	2:35	3:00	2:20	2:25	2:45	2:30	2:45	2:45	2:45	2:40
R06	2:10	2:10	2:05	2:10	2:05	2:10	2:10	2:25	2:05	2:10	2:20	2:05	2:05	2:05	2:10	2:10
R07	2:20	2:25	2:15	2:15	2:20	2:20	2:25	2:40	2:10	2:15	2:30	2:15	5:15	5:15	2:20	2:20
R08	2:20	2:25	2:15	2:15	2:20	2:20	2:20	2:35	2:10	2:15	2:30	2:15	5:15	5:15	2:20	2:20
5-Mile Region and Keyhole to EPZ Boundary																
R09	2:50	2:55	2:35	2:45	2:45	2:40	2:45	3:20	2:25	2:35	3:05	2:30	4:25	4:25	2:50	2:50
R10	3:20	3:35	3:00	3:15	3:00	3:10	3:20	3:45	2:40	2:55	3:20	2:50	4:40	4:40	3:40	3:40
R11	3:15	3:35	3:00	3:10	3:00	3:05	3:20	3:40	2:40	2:55	3:20	2:50	4:55	4:55	3:45	3:45
R12	4:05	4:35	3:30	3:50	3:30	3:50	4:15	4:45	3:10	3:25	4:00	3:10	5:05	5:05	4:30	4:30
R13	3:55	4:15	3:20	3:40	3:20	3:45	4:00	4:30	3:00	3:15	3:45	3:10	4:40	4:40	4:05	4:05
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																
R14	3:05	3:10	3:00	3:05	3:10	3:05	3:05	3:35	2:55	3:00	3:30	3:05	5:00	5:00	3:05	3:05
R15	2:55	3:00	2:55	3:00	3:05	2:55	3:00	3:25	2:45	2:50	3:20	3:00	3:05	3:05	2:55	2:55
R16	2:55	3:00	2:55	3:00	3:05	2:55	3:00	3:25	2:45	2:50	3:20	3:00	3:05	3:05	2:55	2:55
R17	2:15	2:15	2:10	2:10	2:15	2:15	2:15	2:35	2:10	2:15	2:25	2:15	2:15	2:15	2:15	2:15
R18	2:40	2:40	2:35	2:35	2:55	2:45	2:45	3:10	2:40	2:40	3:05	3:00	5:15	5:15	2:40	2:40
R19	2:40	2:40	2:35	2:35	2:55	2:45	2:45	3:05	2:40	2:40	3:05	3:00	5:15	5:15	2:40	2:40

Table 7-2. Time to Clear the Indicated Area of 100 Percent of the Affected Population

Scenario:	Summer		Summer		Summer		Winter		Winter		Winter		Summer		Summer	
	Midweek	Good Weather	Rain	Midday	Good Weather	Evening	Midweek		Midweek		Weekend		Midweek Weekend	Special Event	Evening	Midweek Weekend
							(1)	(2)	(3)	(4)	(5)	(6)				
R01	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00
	5:05	5:20	5:05	5:05	5:05	5:05	5:20	6:10	6:05	5:05	5:05	6:05	5:05	7:15	5:05	5:05
	6:05	6:20	5:10	5:35	5:15	5:15	6:15	6:30	6:30	5:10	5:10	6:10	5:10	7:30	5:10	8:05
2-Mile Region and Keyhole to 5 Miles																
R04	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	6:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05
R05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	6:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05
R06	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	6:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05
R07	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	6:05	5:05	5:05	6:05	5:05	7:00	5:05	5:05
R08	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	6:05	5:05	5:05	6:05	5:05	7:00	5:05	5:05
5-Mile Region and Keyhole to EPZ Boundary																
R09	5:10	5:15	5:10	5:10	5:10	5:10	5:10	6:10	6:10	5:10	5:10	6:10	5:10	7:15	5:10	5:10
R10	5:20	6:20	5:10	5:15	5:10	5:10	5:30	6:25	6:25	5:10	5:10	6:10	5:10	7:30	5:10	7:00
R11	5:20	5:40	5:10	5:10	5:10	5:10	5:30	6:10	6:10	5:10	5:10	6:10	5:10	7:15	5:10	7:00
R12	5:30	6:10	5:10	5:25	5:10	5:10	6:00	6:30	6:30	5:10	5:10	6:10	5:10	7:30	5:10	7:50
R13	5:20	5:45	5:10	5:10	5:10	5:10	5:30	6:30	6:30	5:10	5:10	6:10	5:10	7:25	5:10	5:55
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																
R14	5:05	5:50	5:05	5:30	5:05	5:05	5:40	6:20	6:20	5:05	5:05	6:10	5:05	7:25	5:05	5:05
R15	5:05	5:40	5:05	5:30	5:05	5:05	5:45	6:20	6:20	5:05	5:05	6:10	5:05	5:05	5:05	5:05
R16	5:05	5:40	5:05	5:30	5:05	5:05	5:45	6:20	6:20	5:05	5:05	6:10	5:05	5:05	5:05	5:05
R17	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	6:05	5:05	5:05	6:05	5:05	5:05	5:05	5:05
R18	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	6:05	5:05	5:05	6:05	5:05	7:00	5:05	5:05
R19	5:05	5:05	5:05	5:05	5:05	5:05	5:05	6:05	6:05	5:05	5:05	6:05	5:05	7:00	5:05	5:05

Table 7-3. Time to Clear 90 Percent of the 2-Mile Region within the Indicated Region

Scenario:	Summer (1)		Summer (2)		Summer (3)		Summer (4)		Summer (5)		Summer (6)		Summer (7)		Summer (8)		Summer (9)		Summer (10)		Summer (11)		Summer (12)		Summer (13)		Summer (14)					
	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend	Midweek	Weekend		
Region	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow	Good Weather	Rain/Light Snow	Heavy Snow
	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:30	2:30	2:30	2:30	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R01	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R02	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
Entire 2-Mile Region and 5-Mile Region																																
Unstaged Evacuation - 2-Mile Region and Keyhole to 5-Miles																																
R04	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R05	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R06	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R07	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R08	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
Staged Evacuation - 2-Mile Region and Keyhole to 5-Miles																																
R14	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R15	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R16	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R17	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R18	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	
R19	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:10	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	2:10	2:10	2:20	2:20	2:05	2:05	

Table 7-4. Time to Clear 100 Percent of the 2-Mile Region within the Indicated Region

Scenario:	Summer		Summer		Summer		Winter		Winter		Winter		Summer		Summer	
	Midweek	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	Midweek Weekend	Midweek Weekend	Midweek Weekend
Region	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek	Midweek
R01	Good Weather	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
	Rain	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R02	Good Weather	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
	Rain	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
Entire 2-Mile Region and 5-Mile Region																
Unstaged Evacuation - 2-Mile Region and Keyhole to 5-Miles																
R04	Good Weather	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R05	Rain	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R06	Good Weather	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R07	Rain	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R08	Good Weather	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
Staged Evacuation - 2-Mile Region and Keyhole to 5-Miles																
R14	Good Weather	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R15	Rain	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R16	Good Weather	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R17	Rain	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R18	Good Weather	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05
R19	Rain	5:05	5:05	5:00	5:00	5:05	5:05	5:05	6:05	6:05	5:00	5:00	5:00	5:00	5:00	5:05

Table 7-5. ERPA Designations

Community	ERPA
NEW HAMPSHIRE	
Seabrook	A
Hampton Falls	
Kensington	C
South Hampton	
Hampton	D
North Hampton	
Brentwood	F
East Kingston	
Exeter	
Newfields	
Newton	
Kingston	G
Greenland	
Stratham	
Rye	
New Castle	
Portsmouth	
MASSACHUSETTS	
Amesbury	B
Salisbury	
Merrimac	E
Newburyport	
Newbury	
West Newbury	

Table 7-6. Description of Evacuation Regions

Radial Regions								
Region	Description	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R01	2-Mile Region	X						
R02	5-Mile Region	X	X	X			X	
R03	Full EPZ	X	X	X	X	X	X	X
Evacuate 2-Mile Region and Downwind to 5 Miles								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R04	NW, NNW, N, NNE	X					X	
R05	NE, ENE, E	X	X				X	
R06	ESE	X	X					
R07	SE, SSE	X	X	X				
R08	S, SSW, SW, WSW, W	X		X				
N/A	WNW	Refer to Region R01						
Evacuate 5-Mile Region and Downwind to the EPZ Boundary								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R09	NW, NNW, N, NNE	X	X	X			X	X
R10	NE, ENE, E	X	X	X	X		X	X
R11	ESE	X	X	X	X		X	
R12	SE, SSE, S	X	X	X	X	X	X	
R13	SSW, SW, WSW	X	X	X		X	X	
N/A	W, WNW	Refer to Region R02						
Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5 Miles								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R14	5-Mile Region	X	X	X			X	
R15	NW, NNW, N, NNE	X					X	
R16	NE, ENE, E	X	X				X	
R17	ESE	X	X					
R18	SE, SSE	X	X	X				
R19	S, SSW, SW, WSW, W	X		X				
N/A	WNW	Refer to Region R01						
ERPA(s) Evacuate		ERPAs) Shelter-in-Place			ERPA(s) Shelter-in-Place until 90% ETE for R01, then Evacuate			

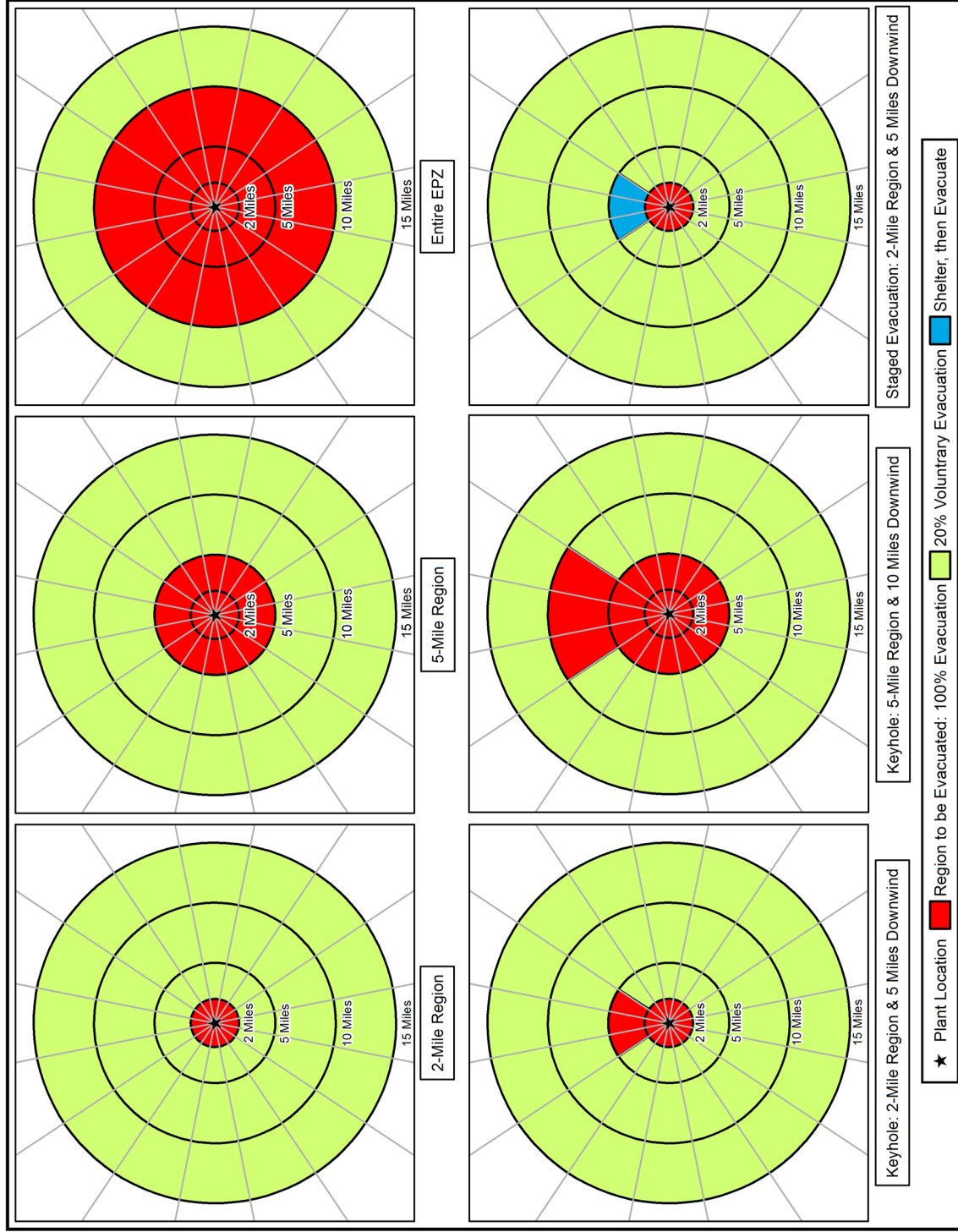


Figure 7-1. Voluntary Evacuation Methodology

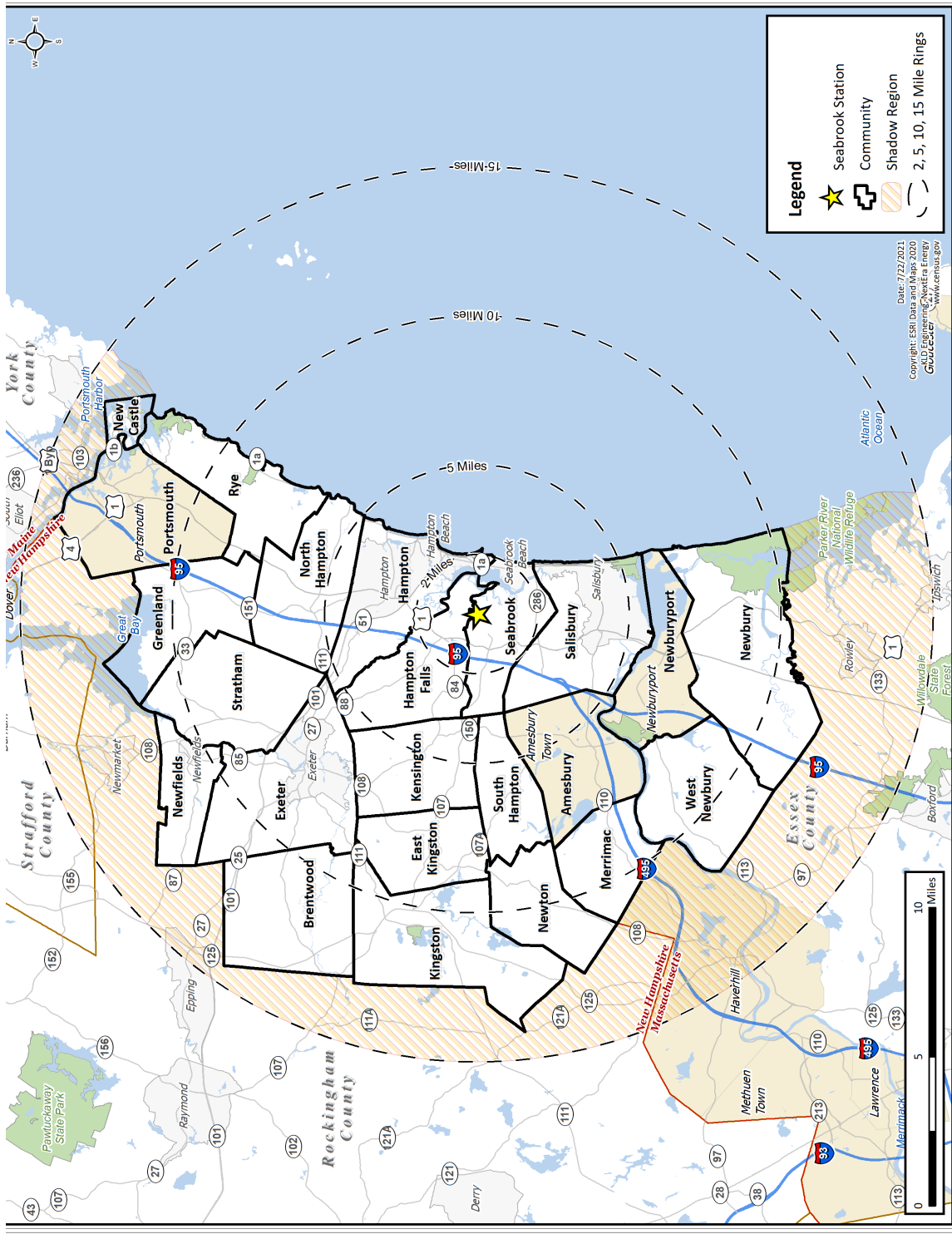


Figure 7-2. Seabrook Station Shadow Region

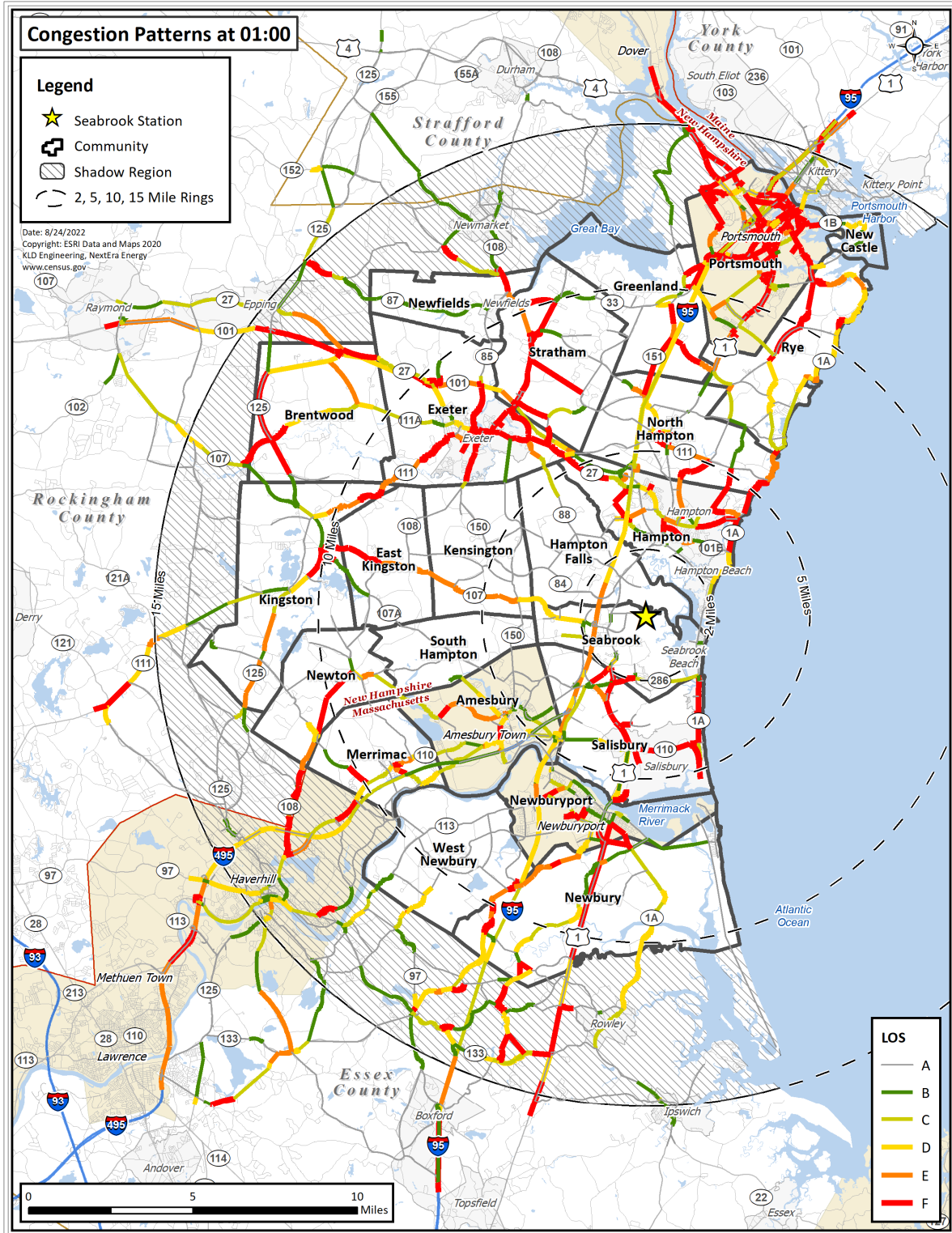


Figure 7-3. Congestion Patterns at 1 Hour after the Advisory to Evacuate

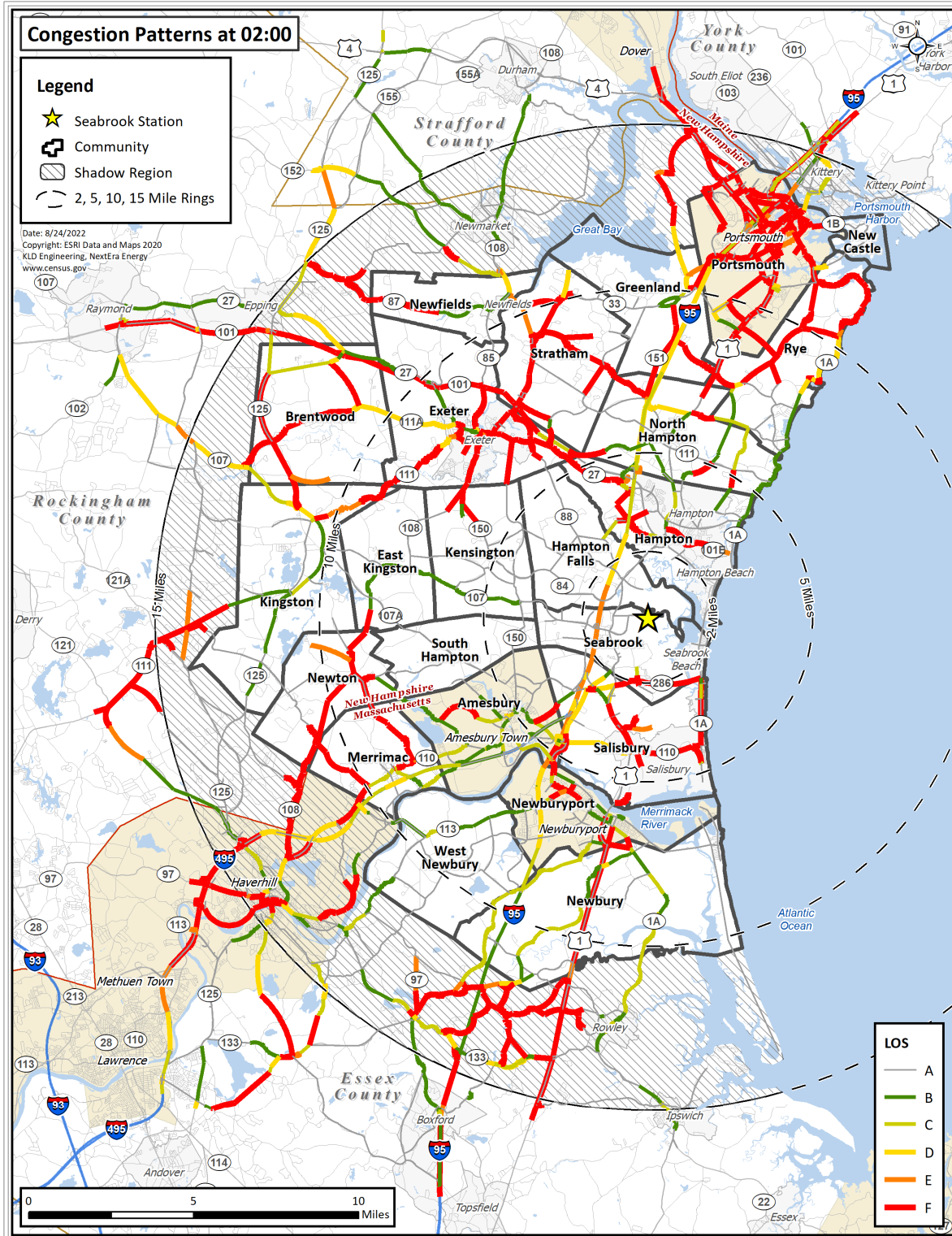


Figure 7-4. Congestion Patterns at 2 Hours after the Advisory to Evacuate

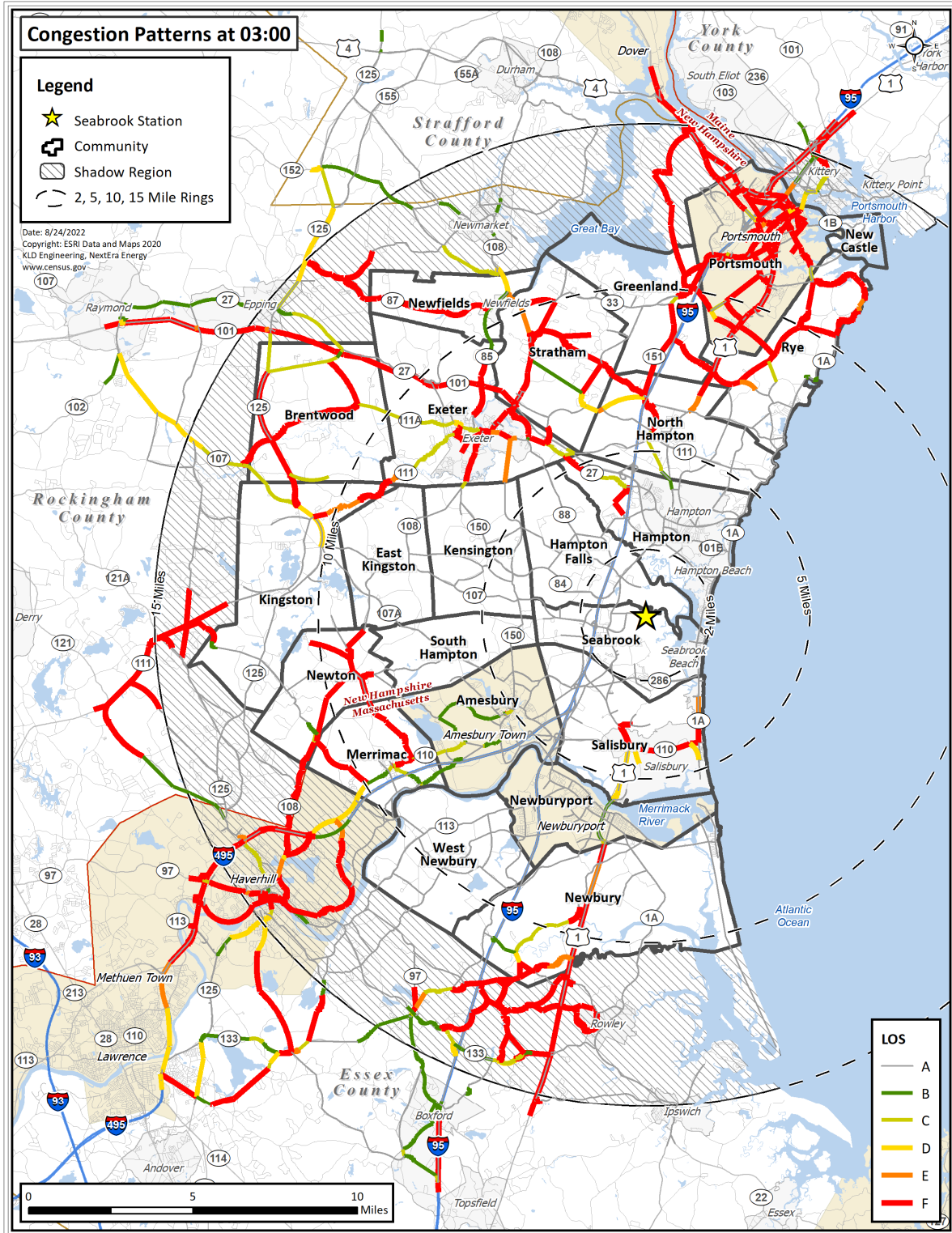


Figure 7-5. Congestion Patterns at 3 Hours after the Advisory to Evacuate

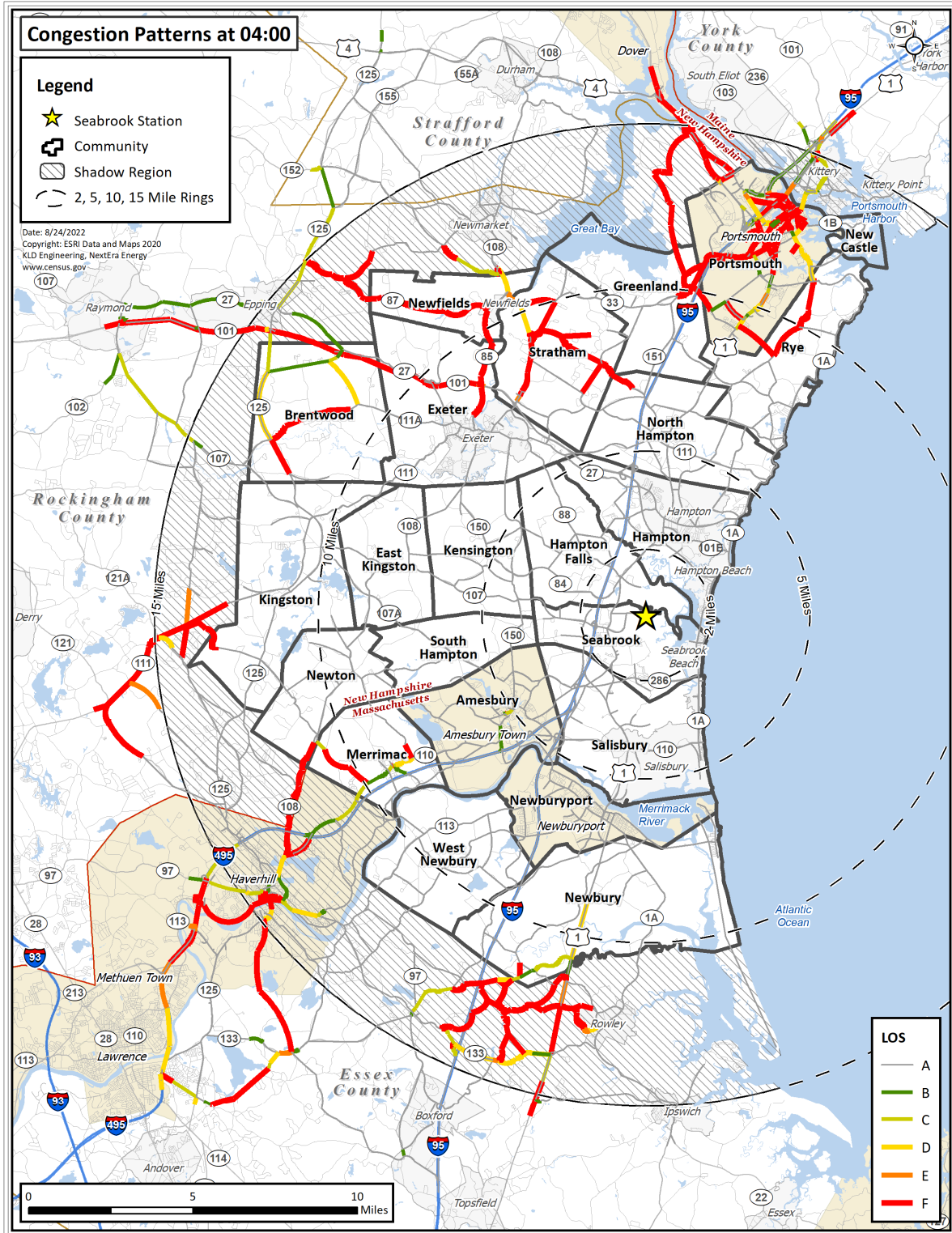


Figure 7-6. Congestion Patterns at 4 Hours after the Advisory to Evacuate

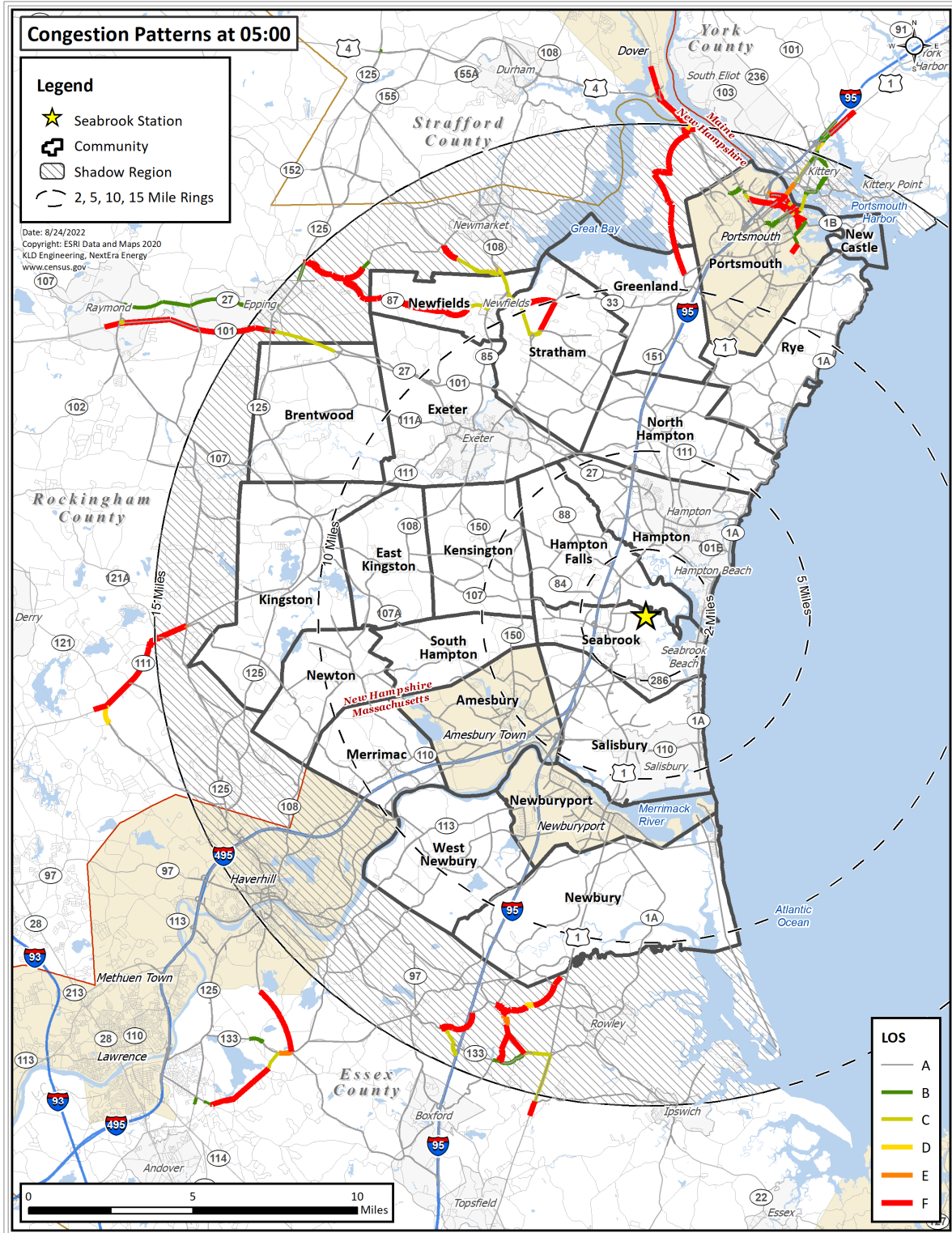


Figure 7-7. Congestion Patterns at 5 Hours after the Advisory to Evacuate

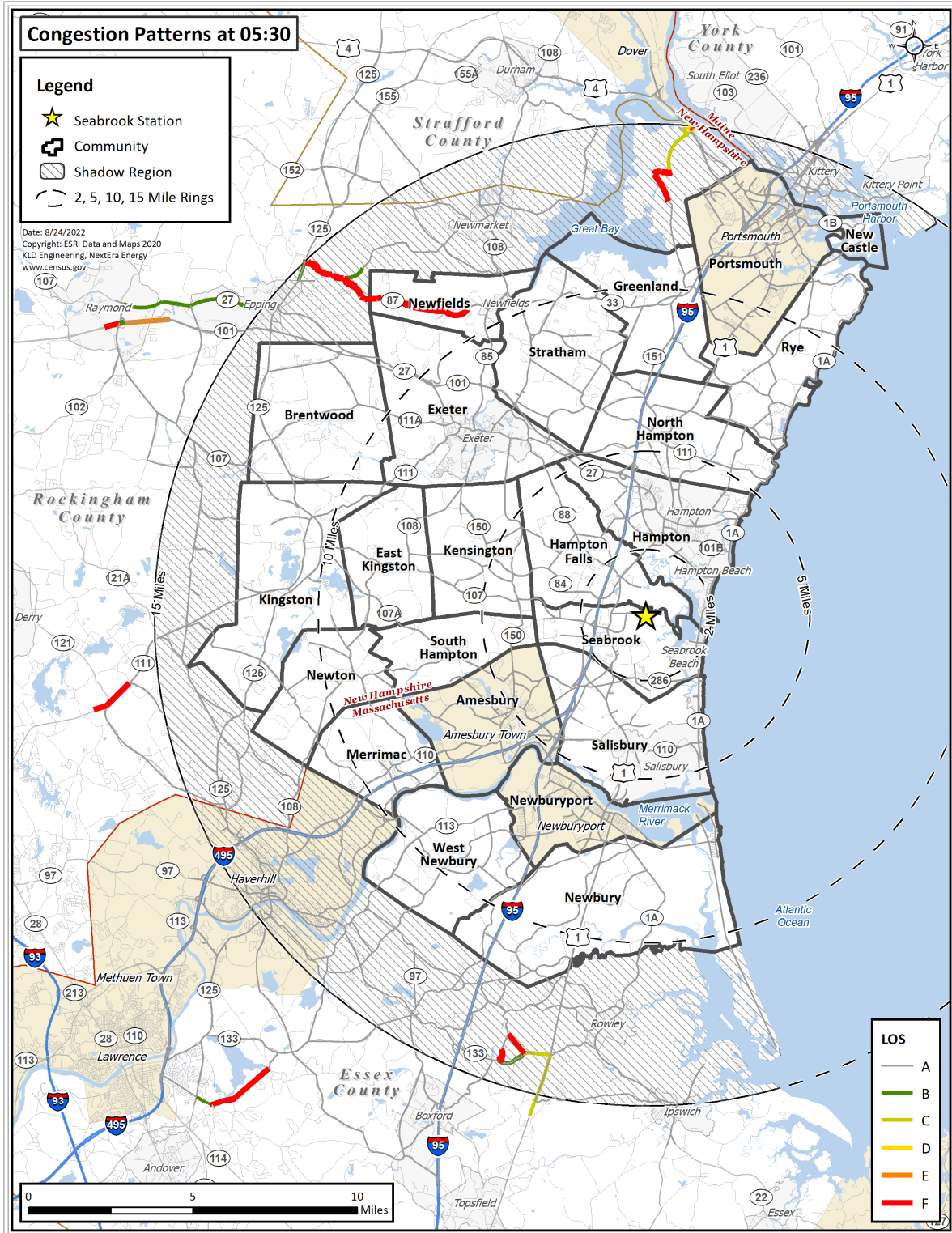


Figure 7-8. Congestion Patterns at 5 Hours and 30 minutes after the Advisory to Evacuate

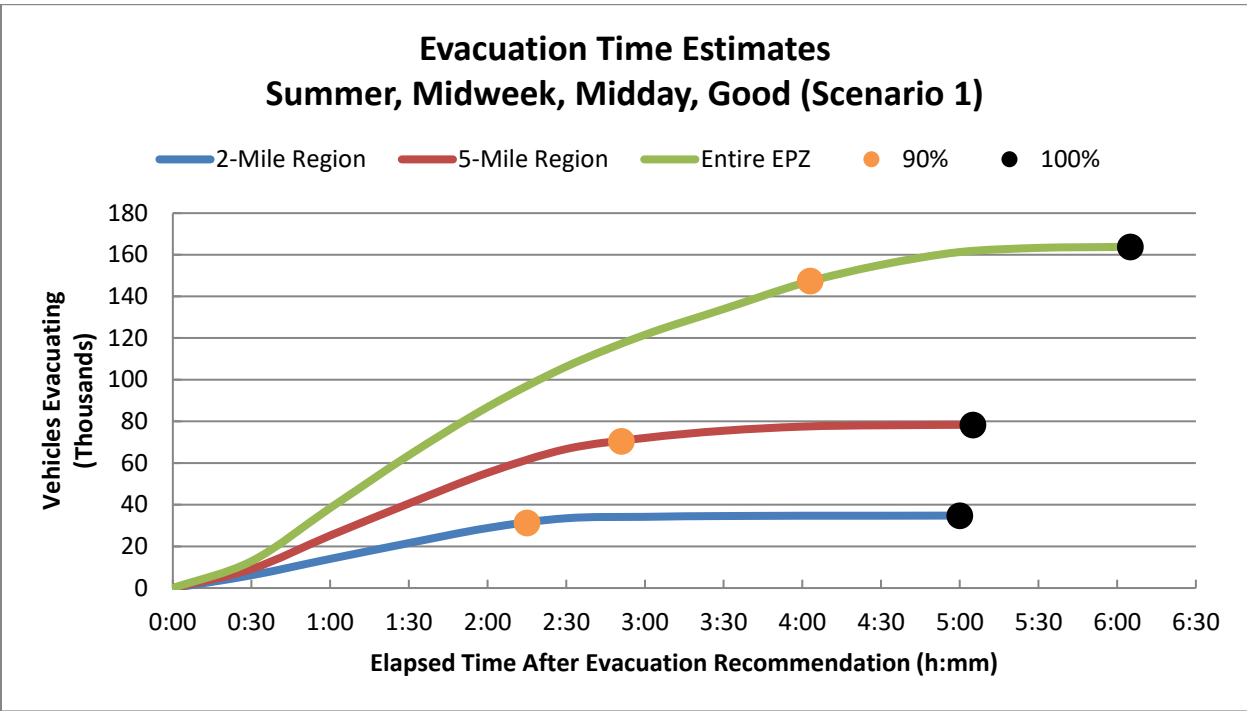


Figure 7-9. Evacuation Time Estimates - Scenario 1 for Region R03

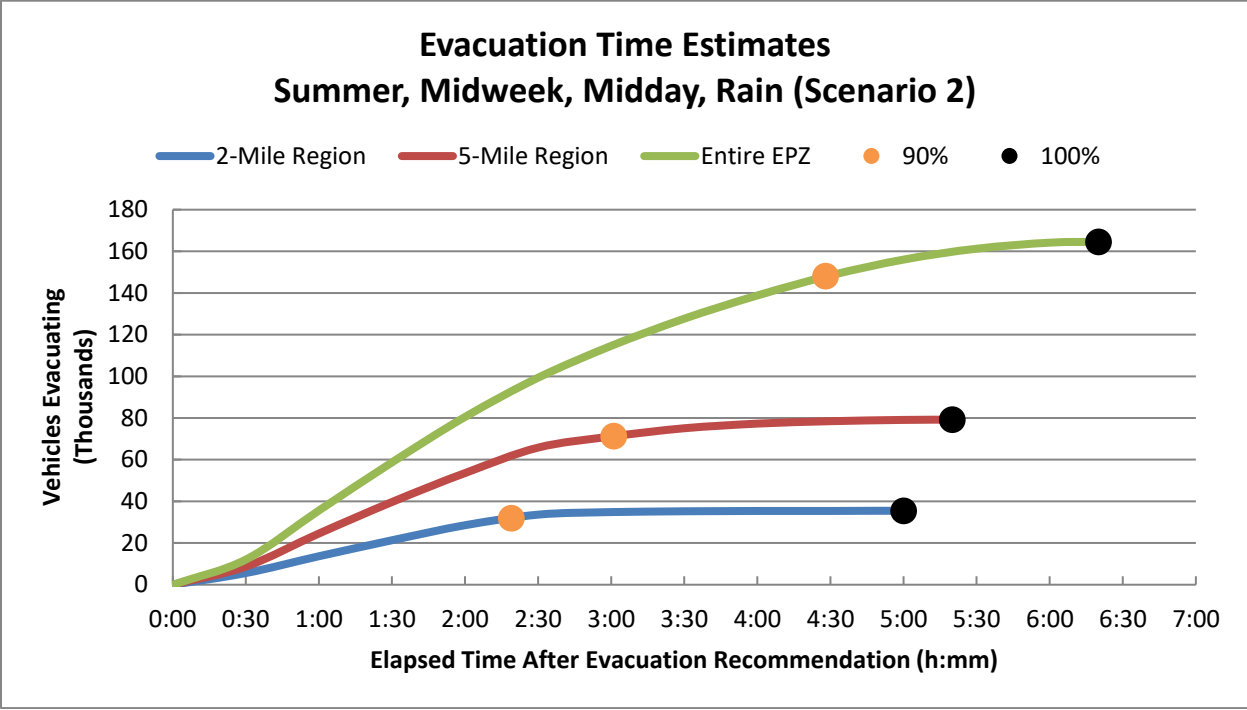


Figure 7-10. Evacuation Time Estimates - Scenario 2 for Region R03

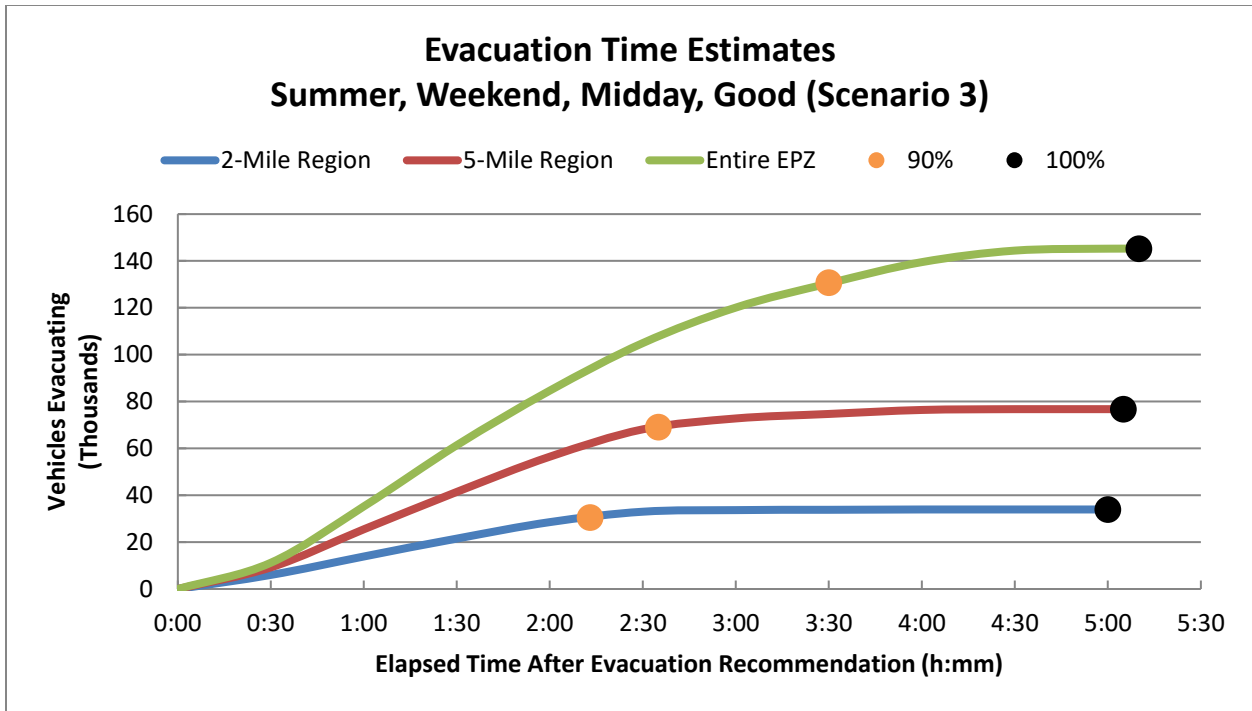


Figure 7-11. Evacuation Time Estimates - Scenario 3 for Region R03

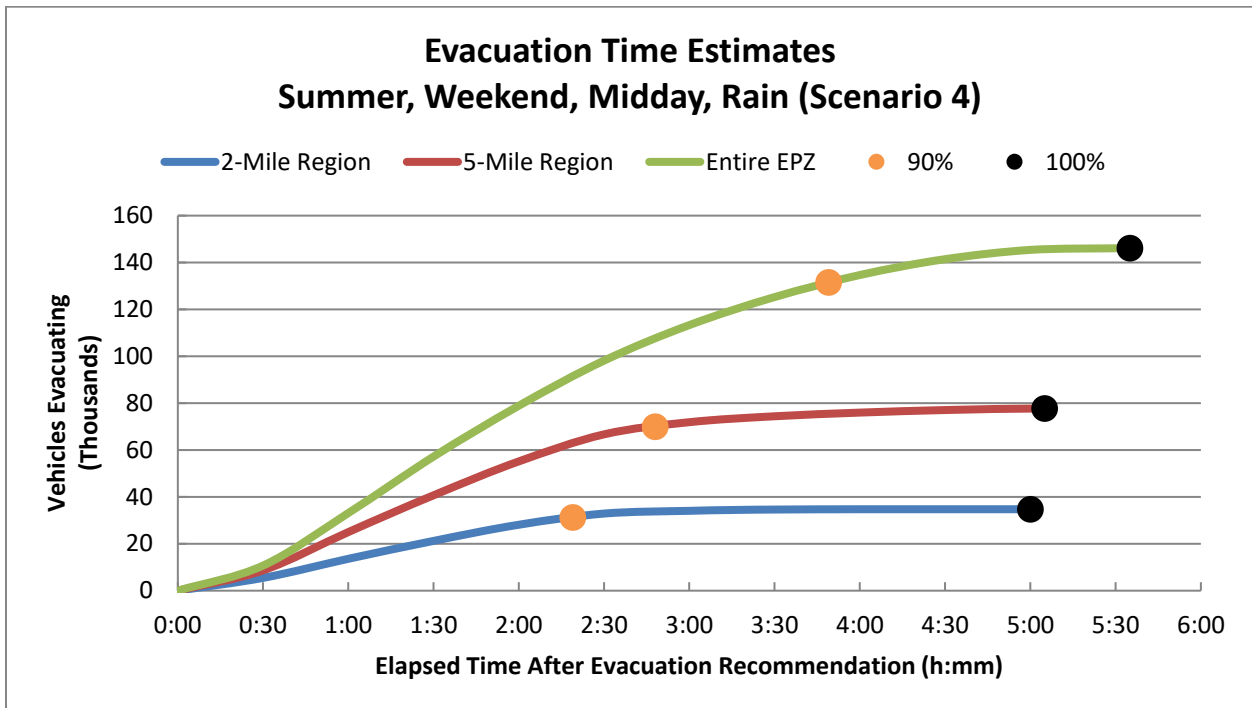


Figure 7-12. Evacuation Time Estimates - Scenario 4 for Region R03

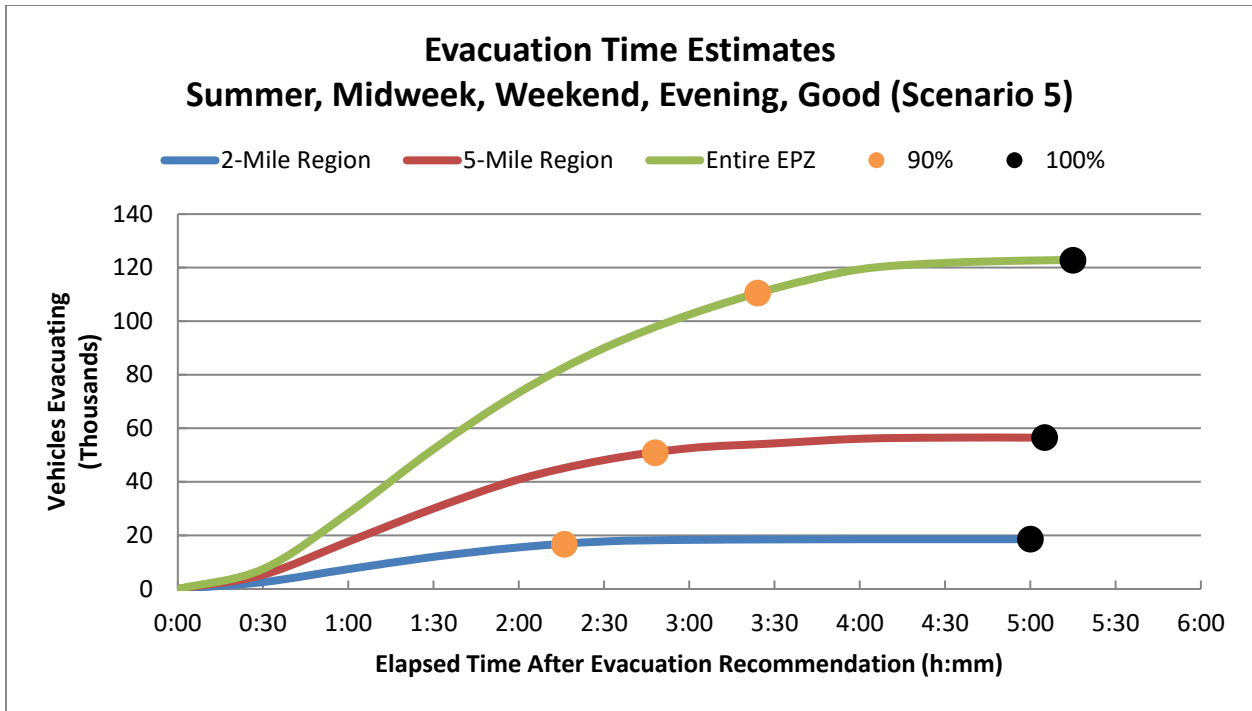


Figure 7-13. Evacuation Time Estimates - Scenario 5 for Region R03

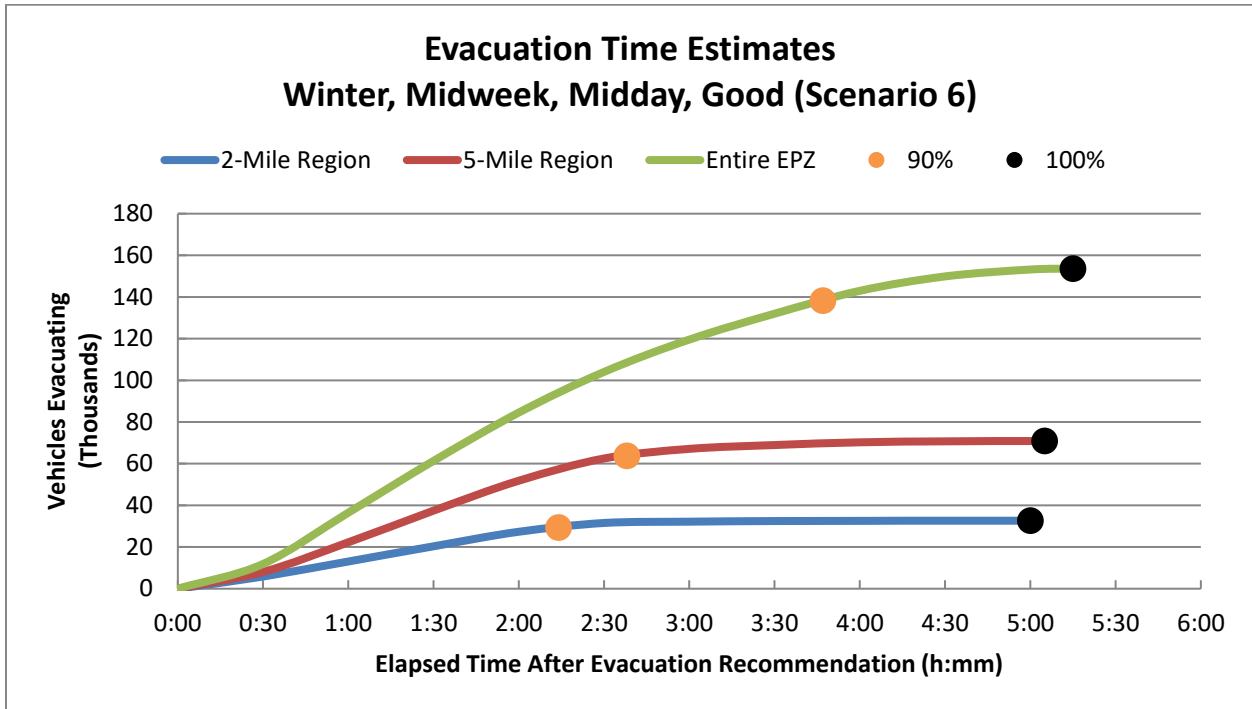


Figure 7-14. Evacuation Time Estimates - Scenario 6 for Region R03

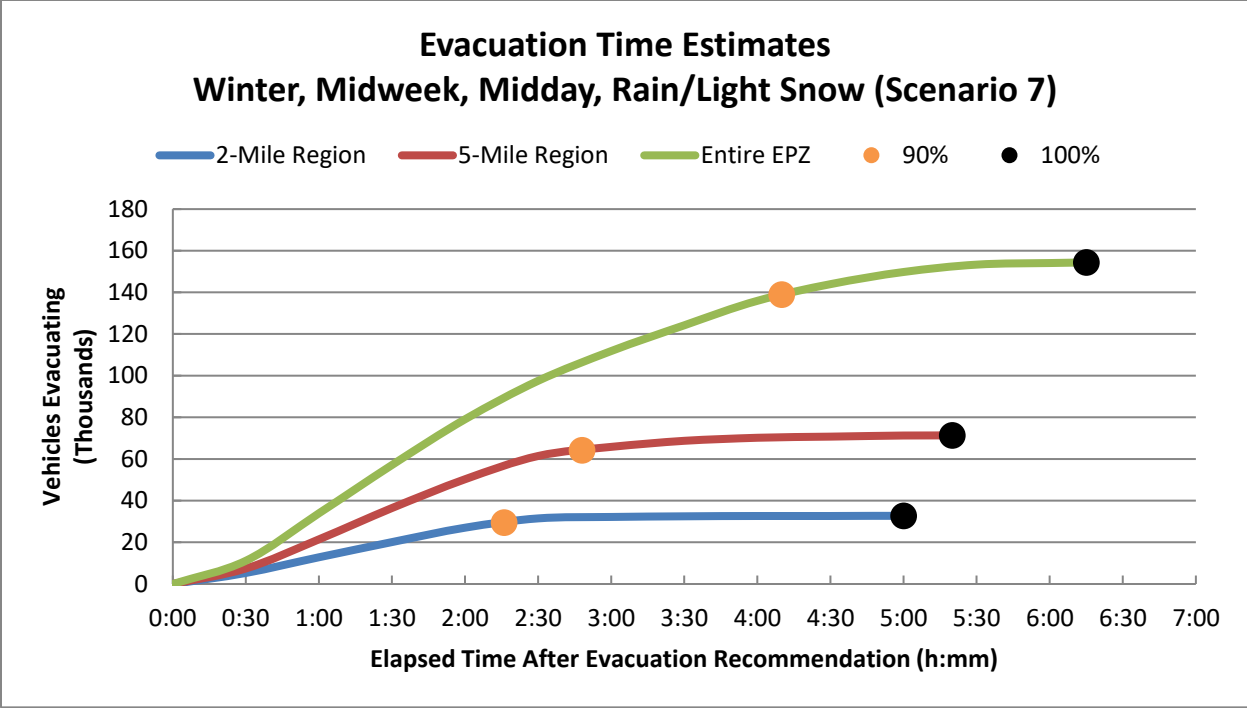


Figure 7-15. Evacuation Time Estimates - Scenario 7 for Region R03

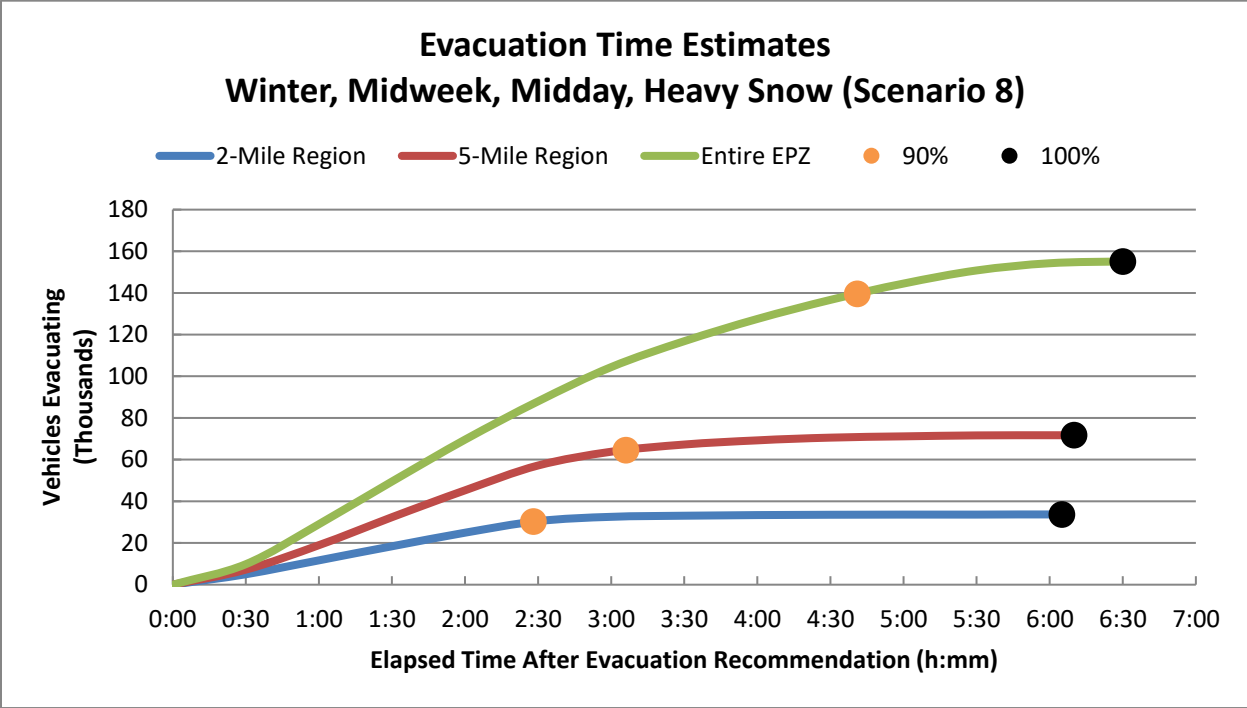


Figure 7-16. Evacuation Time Estimates - Scenario 8 for Region R03

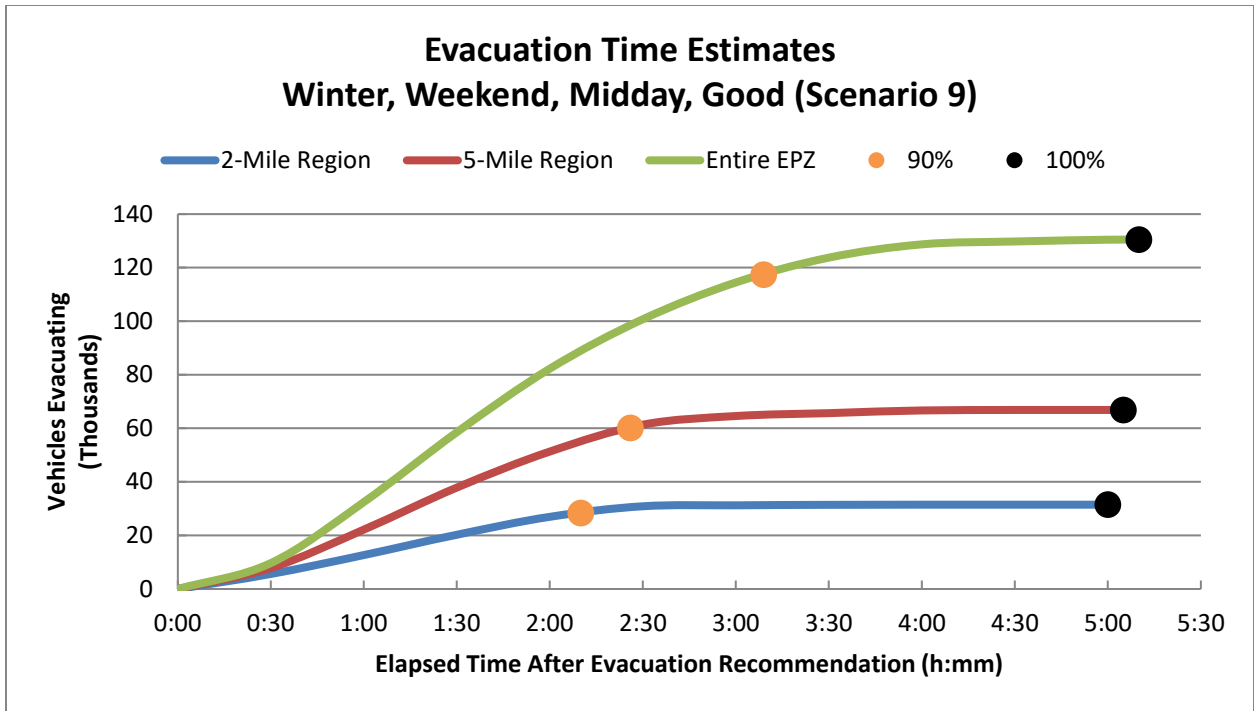


Figure 7-17. Evacuation Time Estimates - Scenario 9 for Region R03

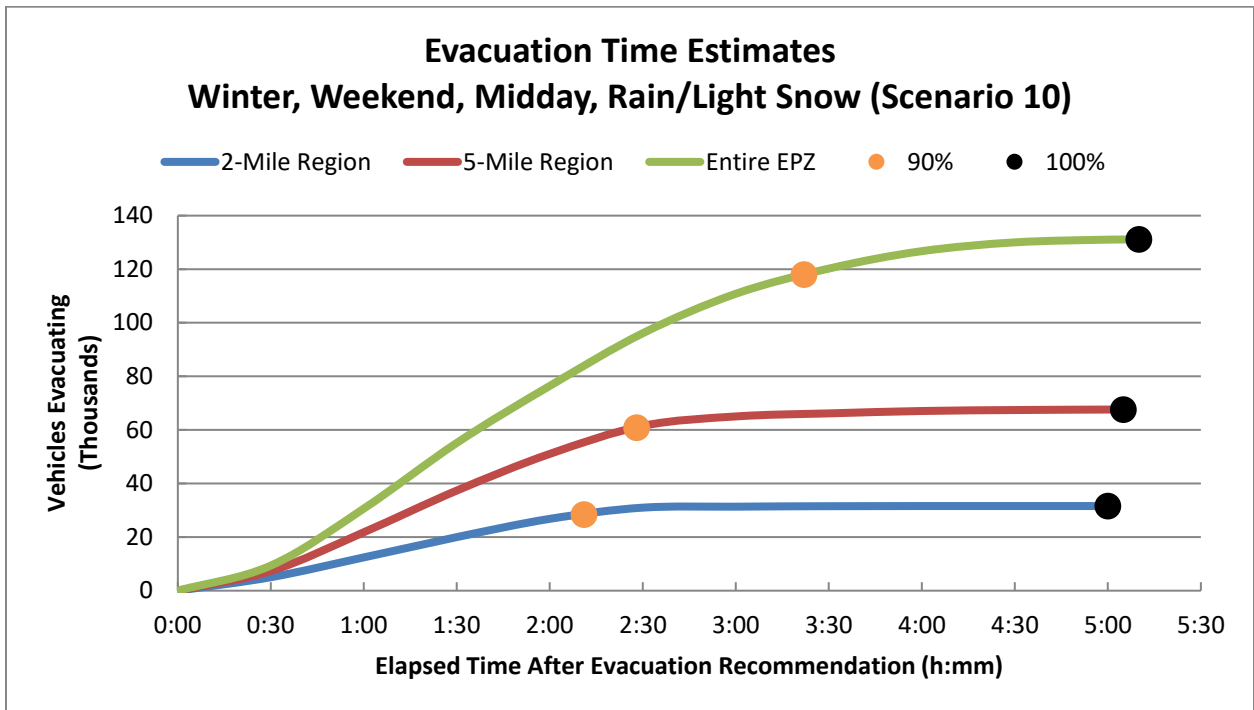


Figure 7-18. Evacuation Time Estimates - Scenario 10 for Region R03

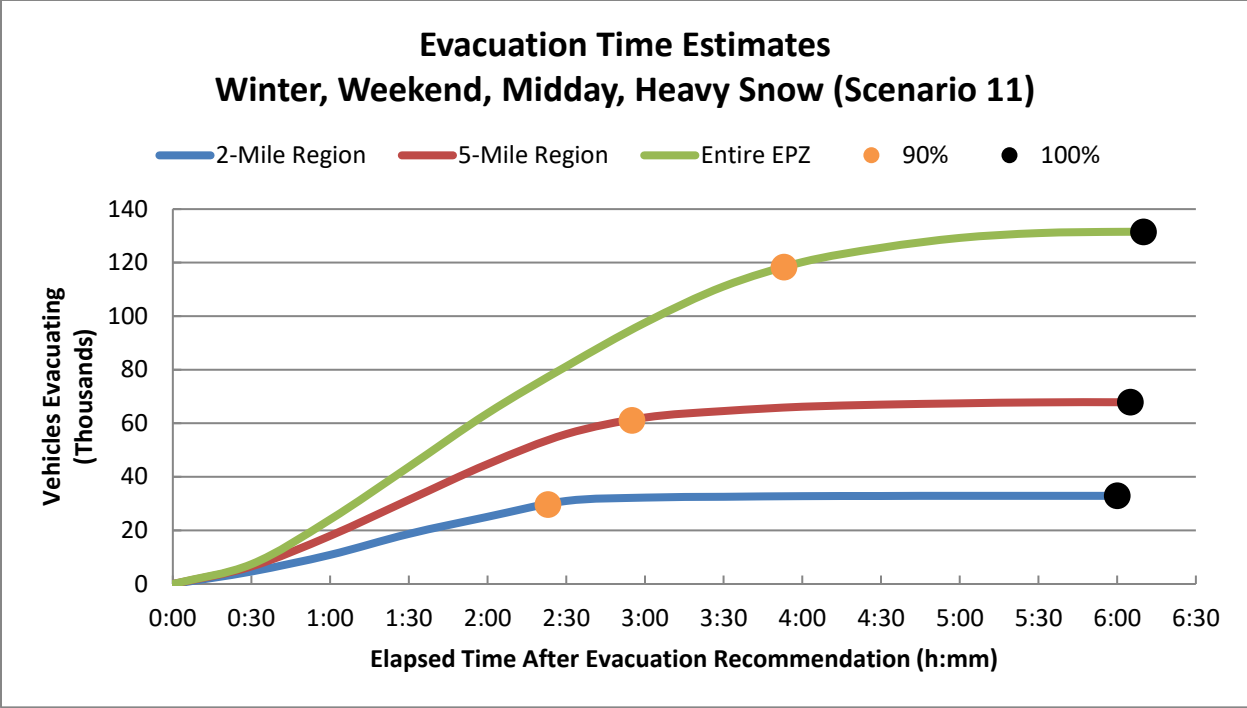


Figure 7-19. Evacuation Time Estimates - Scenario 11 for Region R03

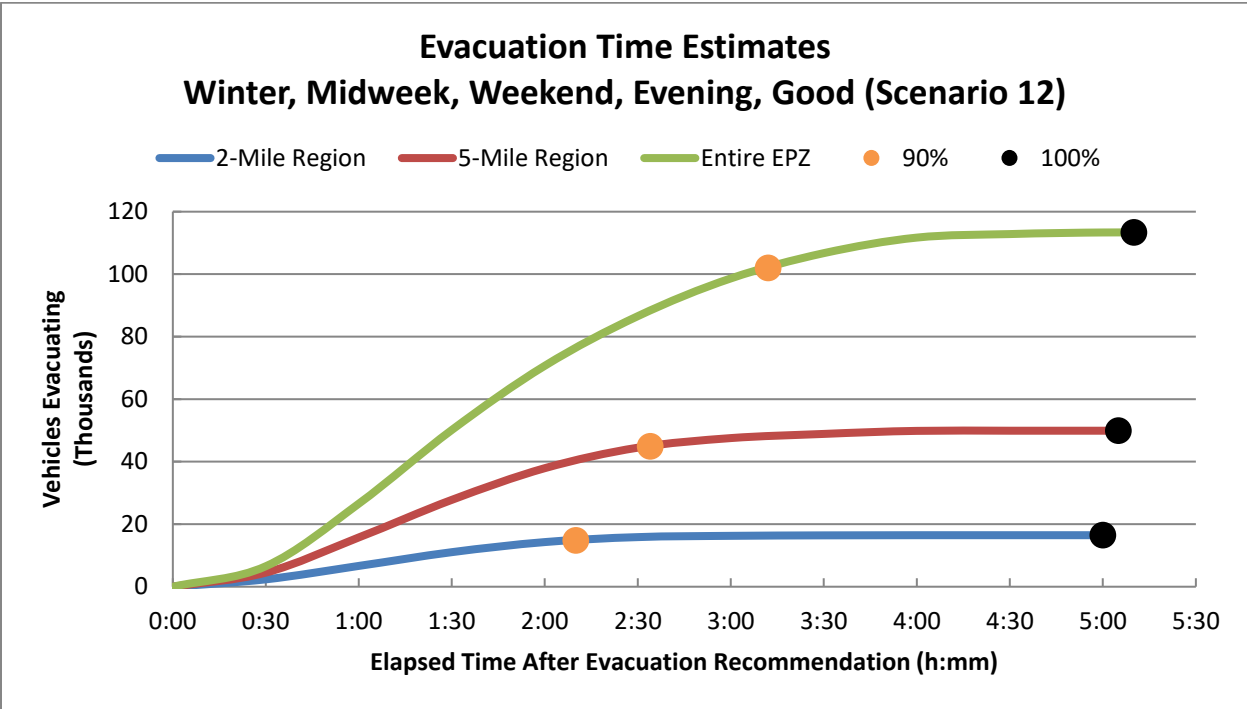


Figure 7-20. Evacuation Time Estimates - Scenario 12 for Region R03

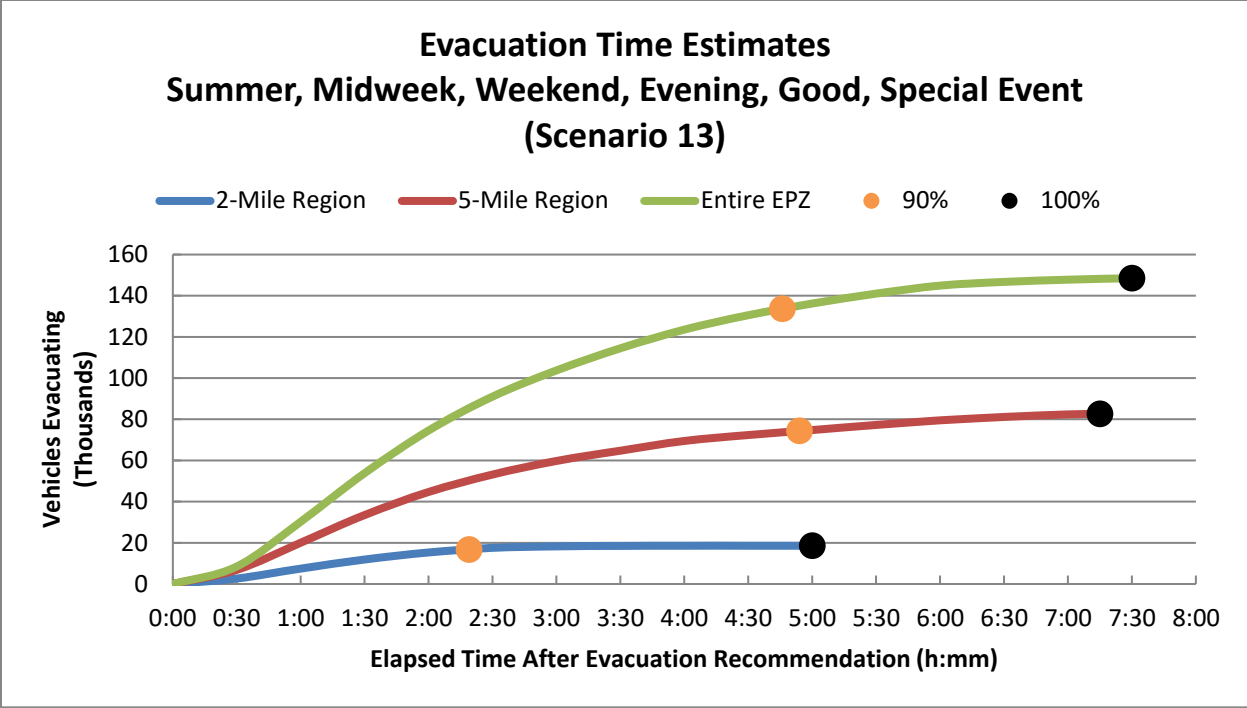


Figure 7-21. Evacuation Time Estimates - Scenario 13 for Region R03

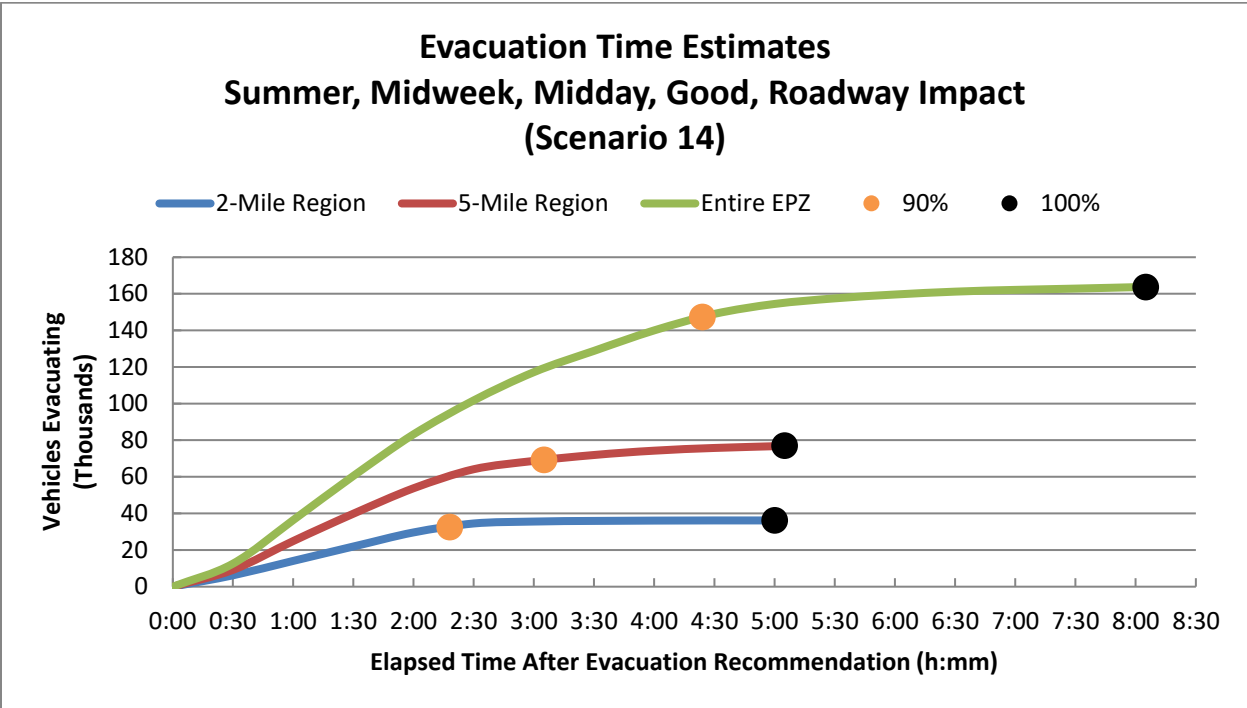


Figure 7-22. Evacuation Time Estimates - Scenario 14 for Region R03

8 TRANSIT-DEPENDENT AND SPECIAL FACILITY EVACUATION TIME ESTIMATES

This section details the analyses applied and the results obtained in the form of evacuation time estimates for transit vehicles (buses, half buses, vans, ambulances, and wheelchair transport vehicles). The demand for transit service reflects the needs of three population groups: (1) residents with no vehicles available; (2) residents of special facilities such as schools, preschools, childcare centers, day camps, and medical facilities; and (3) access and/or functional needs population.

These transit vehicles mix with the general evacuation traffic that is comprised mostly of “passenger cars” (pc’s). The presence of each transit vehicle in the evacuating traffic stream is represented within the modeling paradigm described in Appendix D as equivalent to two pc’s. This equivalence factor represents the larger size and more sluggish operating characteristics of a transit vehicle, relative to those of a pc.

Transit vehicles must be mobilized in preparation for their respective evacuation missions. Specifically:

- Bus drivers must be alerted
- They must travel to the bus depot
- They must be briefed there and assigned to a route or facility

These activities consume time. The location of bus depots impacts the time to travel from the bus depots to the facilities being evacuated. Locations of bus depots were not identified in this study. Rather, the offsite agencies were asked to factor the location of the depots and the distance to the EPZ into the estimate of mobilization time.

During this mobilization period, other mobilization activities are taking place. One of these is the action taken by parents, neighbors, relatives and friends to pick up children from school or childcare prior to the arrival of buses, so that they may join their families. Virtually all studies of evacuations have concluded that this “bonding” process of uniting families is universally prevalent during emergencies and should be anticipated in the planning process. The current public information disseminated to residents of the Seabrook EPZ indicates that schoolchildren will be evacuated to the reception centers/host schools where they can be picked up by their parents. As such, it is assumed no schoolchildren will be picked up by their parents prior to the arrival of the buses.

As discussed in Section 2, this study assumes a rapidly escalating event at the plant wherein evacuation is ordered promptly and no early protective actions have been implemented. Therefore, children are evacuated to reception centers/host schools. Picking up children at school could add to traffic congestion at the schools, delaying the departure of the buses evacuating schoolchildren, which may have to return in a subsequent “wave” to the EPZ to evacuate the transit-dependent population. This report provides estimates of buses under the assumption that no students will be picked up by their parents (in accordance with NUREG/CR-7002, Rev. 1), to present an upper bound estimate of buses required.

The procedure for computing transit-dependent ETE is to:

- Estimate demand for transit service (discussed in Section 3)
- Estimate time to perform all transit functions
- Estimate route travel times to the EPZ boundary and to the reception centers/host schools

8.1 ETEs for Schools, Transit Dependent People, and Medical Facilities¹

EPZ bus resources are assigned to evacuating schoolchildren (if school is in session at the time of the ATE) as the first priority in the event of an emergency. In the event that the allocation of buses dispatched from the depots to the various facilities and to the bus routes is somewhat inefficient, or if there is a shortfall of available drivers, then there may be a need for some buses to return to the EPZ from the reception centers after completing their first evacuation trip, to complete a “second wave” of providing transport service to evacuees. For this reason, the ETE for the transit-dependent population will be calculated for both a one wave transit evacuation and for two waves. Of course, if the impacted Evacuation Region is other than R03 (the entire EPZ), then there will likely be ample transit resources relative to demand in the impacted Region and this discussion of a second wave would likely not apply. A list of available transportation resources was provided by the states within the EPZ and is shown in Table 8-1. Also included in the table are the number of buses needed to evacuate schools, preschools, childcare centers, day camps, medical facilities, transit-dependent population and access and/or functional needs persons (discussed below in Section 8.2). These numbers indicate there are sufficient buses, half buses, and vans to evacuate everyone in a single wave. There is a shortfall of wheelchair-accessible vehicles and ambulances. As discussed in Section 2, it is assumed that there are enough drivers available to man all resources listed in Table 8-1.

ETE for transit trips were developed using both good weather and adverse weather conditions. Figure 8-1 presents the chronology of events relevant to transit operations. The elapsed time for each activity will now be discussed with reference to Figure 8-1.

School Evacuation

Activity: Mobilize Drivers (A→B→C)

Mobilization is the elapsed time from the ATE until the time the buses arrive at the school to be evacuated. It is assumed school bus drivers would require 90 minutes to be contacted, to travel to the depot, be briefed, and to travel to the schools for a rapidly escalating radiological emergency with no observable indication before the fact. Mobilization time is slightly longer in adverse weather – 100 minutes in rain/light snow, 110 minutes in heavy snow.

Activity: Board Passengers (C→D)

As discussed in Section 2.4 and shown in Table 2-3, a loading time of 15 minutes (20 minutes for rain/light snow and 25 minutes for heavy snow) for school buses is assumed.

¹ Correctional Facilities shelter in place, and ETE, therefore, is not computed for these facilities.

Activity: Travel to EPZ Boundary (D→E)

The buses servicing the schools are ready to begin their evacuation trips at 105 minutes after the advisory to evacuate – 90 minutes mobilization time plus 15 minutes loading time – in good weather. The UNITES software discussed in Section 1.3 was used to define bus routes along the most likely path from a school being evacuated to the EPZ boundary, traveling toward the appropriate reception centers/host schools. This is done in UNITES by interactively selecting the series of nodes from the school to the EPZ boundary. Each bus route is given an identification number and is written to the DYNEV II input stream. DYNEV computes the route length and outputs the average speed for each 5-minute interval, for each bus route. The specified bus routes are documented in Table 10-2 (refer to the maps of the link-node analysis network in Appendix K for node locations). Data provided by DYNEV during the appropriate timeframe depending on the mobilization and loading times (i.e., 100 to 105 minutes after the advisory to evacuate for good weather) were used to compute the average speed for each route, as follows:

$$\begin{aligned} & \text{Average Speed } \left(\frac{\text{mi.}}{\text{hr}} \right) \\ &= \left[\frac{\sum_{i=1}^n \text{length of link } i \text{ (mi.)}}{\sum_{i=1}^n \left\{ \text{Delay on link } i \text{ (min.)} + \frac{\text{length of link } i \text{ (mi.)}}{\text{current speed on link } i \left(\frac{\text{mi.}}{\text{hr.}} \right)} \times \frac{60 \text{ min.}}{1 \text{ hr.}} \right\}} \right] \times \frac{60 \text{ min.}}{1 \text{ hr.}} \end{aligned}$$

The average speed computed (using this methodology) for the buses servicing each of the schools in the EPZ is shown in Table 8-2 through Table 8-4 for good weather, rain/light snow and heavy snow, respectively. The travel time to the EPZ boundary was computed for each bus using the computed average speed and the distance to the EPZ boundary along the most likely route out of the EPZ. The travel time from the EPZ boundary to the reception centers/host schools was computed assuming an average speed of 45 mph for good weather, 41 mph for rain/light snow (10% decrease), and 38 mph for heavy snow (15% decrease). Speeds were reduced in Table 8-2 through Table 8-4 to 45 mph (41 mph for rain/light snow – 10% decrease, rounded – and 38 mph for heavy snow – 15% decrease, rounded) for those calculated bus speeds which exceeded 45 mph, which is based on state laws and the posted speed limits on the major roadways within the EPZ.

Table 8-2 (good weather), Table 8-3 (rain/light snow) and Table 8-4 (heavy snow) present the following ETE (rounded up to the nearest 5 minutes) for schools in the EPZ grouped by state: (1) The elapsed time from the ATE until the bus exits the EPZ; and (2) The elapsed time until the bus reaches the reception centers/host schools (RC/HS).

The evacuation time out of the EPZ can be computed as the sum of times associated with Activities A→B→C, C→D, and D→E (for example: 90 min. + 15 + 9 = 1:54, rounded up to 1:55 for Sparhawk School - Lower School in good weather). The average single wave ETE for schools,

preschools/childcare centers, and day camps in Massachusetts is 1 hour and 45 minutes less than the 90th percentile ETE for Region R03 for the general population during Scenario 6 conditions (3:45 – 2:00 = 1:45). The average single wave ETE for schools, preschools/childcare centers, and day camps in New Hampshire is 1 hour less than the 90th percentile ETE for Region R03 for the general population during Scenario 6 conditions (3:45 – 2:45 = 1:00). All school ETE are rounded up to the nearest 5 minutes.

The evacuation time to the reception centers/host schools is determined by adding the time associated with Activity E→F (discussed below), to this EPZ evacuation time.

Activity: Travel to Reception Centers/Host Schools (E→F)

The distances from the EPZ boundary to the reception centers/host schools are measured using GIS software along the most likely route from the EPZ exit point to the facility. The reception centers/host schools are mapped in Figure 10-7 For a one-wave evacuation, this travel time outside the EPZ does not contribute to the ETE. Assumed bus speeds of 45 mph, 41 mph, and 38 mph for good weather, rain/light snow, and heavy snow, respectively, will be applied for this activity for buses servicing the schools in the EPZ. Table 8-2 (good weather), Table 8-3 (rain/light snow) and Table 8-4 (heavy snow) present the elapsed time until the bus reaches the reception centers/host schools.

Activity: Passengers Leave Bus (F→G)

A bus can empty within 5 minutes. The driver takes a 10-minute break.

Activity: Bus Returns to Route for Second Wave Evacuation (G→C)

As shown in Table 8-1, there are a sufficient number of buses available for evacuation of schoolchildren in a single wave if the entire EPZ is evacuated at once (a highly unlikely event). However, if some drivers fail to report, a two-wave evacuation may be needed for some schools. A second wave ETE was not computed for each school. Rather, the following representative ETE is provided to estimate the additional time needed for a second wave evacuation of schools. The travel time from the reception centers/host schools back to the EPZ boundary and then back to the school was computed assuming an average speed of 45 mph (good weather), 41 mph (rain – 10% reduction) and 38 mph (snow – 15% reduction) as buses will be traveling counter to evacuating traffic. Times and distances are based on averages for all schools in the EPZ for good weather:

- For Massachusetts:
 - Buses arrive at the host schools at 2:30 (see average value in Table 8-2)
 - Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes
 - Bus returns to facility: 38 minutes (average distance to host schools (23.0 miles) + average distance to EPZ boundary (5.2 miles) at 45 mph)
 - Loading Time: 15 minutes
 - Bus completes second wave of service along route: 35 minutes (average distance to EPZ boundary (5.2 miles) at network wide average speed at 3:40 (8.92 mph))

- Bus exits EPZ at time $2:30 + 0:15 + 0:38 + 0:15 + 0:35 = 4:15$ (rounded up to nearest 5 minutes) after the ATE.
- For New Hampshire:
 - Buses arrive at the reception centers at 3:10 (see average value in Table 8-2)
 - Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes
 - Bus returns to facility: 36 minutes (average distance to reception centers (19.9 miles) + average distance to EPZ boundary (7.4 miles) at 45 mph)
 - Loading Time: 15 minutes
 - Bus completes second wave of service along route: 46 minutes (average distance to EPZ boundary (7.4 miles) at network wide average speed at 4:20 (9.64 mph))
 - Bus exits EPZ at time $3:10 + 0:15 + 0:36 + 0:15 + 0:46 = 5:10$ (rounded up to nearest 5 minutes) after the ATE.

Given the average single-wave ETE for schools is 2:00 and 2:45 (see Table 8-2) for Massachusetts and New Hampshire, respectively; a second wave evacuation would require an additional 2 hours and 20 minutes, on average. The average two-wave ETE of schools is 30 minutes longer and 1 hour and 25 minutes longer than the 90th percentile ETE (3:45) of the full EPZ during a winter, midweek, midday (Scenario 6) evacuation, for Massachusetts and New Hampshire, respectively, and could impact protective action decision making.

Evacuation of Transit-Dependent Population (Residents without access to a vehicle)

A detailed computation of transit-dependent population was done and is discussed in Section 3.6. The current public information disseminated to residents of the EPZ identifies 25 bus routes to pick up transit-dependent individuals. Most of the Communities require multiple waves of buses in order to pick up everyone who requires a ride. Therefore, the ETE was computed up to 3 waves of buses for the 25 bus routes needed to evacuate the transit-dependent population, specifically in the Communities of Amesbury, Exeter, Hampton, Newburyport, and Portsmouth due to their large population. The start of service on these waves of bus groupings is separated by 20-minute headways, as shown in Table 8-5 through Table 8-7. The use of bus headways ensures that those people who take longer to mobilize will be picked up.

The pre-defined bus routes (as discussed in Section 10) are shown graphically in Figures 10-2 through 10-6 and described in Table 10-1. Those buses servicing the transit-dependent evacuees will first travel along these routes, then proceed out of the EPZ.

Activity: Mobilize Drivers (A→B→C)

The buses dispatched from the depots to service the transit-dependent evacuees will be scheduled so that they arrive at their respective routes after their passengers have completed their mobilization. As shown in Figure 5-4 (Residents with no Commuters), approximately 90% of the evacuees will complete their mobilization at 135 minutes after the ATE. As such, mobilization time for the first buses to arrive at each route will be 135 minutes during good weather, 145 minutes in rain/light snow and 155 minutes in heavy snow, to account for slower travel speeds and reduced roadway capacity in adverse weather.

Activity: Board Passengers (C→D)

For multiple stops along a pick-up route (transit-dependent bus routes) estimation of travel time must allow for the delay associated with stopping and starting at each pick-up point. The time, t , required for a bus to decelerate at a rate, “ a ”, expressed in ft/sec/sec, from a speed, “ v ”, expressed in ft/sec, to a stop, is $t = v/a$. Assuming the same acceleration rate and final speed following the stop yields a total time, T , to service boarding passengers:

$$T = t + B + t = B + 2t = B + \frac{2v}{a},$$

Where B = Dwell time to service passengers. The total distance, “ s ” in feet, travelled during the deceleration and acceleration activities is: $s = v^2/a$. If the bus had not stopped to service passengers, but had continued to travel at speed, v , then its travel time over the distance, s , would be: $s/v = v/a$. Then the total delay (i.e., pickup time, P) to service passengers is:

$$P = T - \frac{v}{a} = B + \frac{v}{a}$$

Assigning reasonable estimates:

- $B = 50$ seconds: a generous value for a single passenger, carrying personal items, to board per stop
- $v = 25$ mph = 37 ft/sec
- $a = 4$ ft/sec/sec, a moderate average rate

Then, $P \approx 1$ minute per stop. Allowing 30 minutes pick-up time per bus run implies 30 stops per run, for good weather. It is assumed that bus acceleration and speed will be less in rain and snow; total loading time is 40 minutes per bus in rain/light snow, 50 minutes in heavy snow.

Activity: Travel to EPZ Boundary (D→E)

The travel distance along the respective pick-up routes within the EPZ is estimated using the UNITES software. Bus travel times within the EPZ are computed using average speeds computed by DYNEV, using the aforementioned methodology that was used for school evacuation.

Table 8-5 through Table 8-7 present the transit-dependent population evacuation time estimates for each bus route calculated using the above procedures for good weather, rain/light snow and heavy snow, respectively.

For example, the ETE for the first group of buses servicing Amesbury is computed as $135 + 50 + 30 = 3:35$ for good weather (rounded up to nearest 5 minutes). Here, 50 minutes is the time to travel 31.1 miles at 37.2 mph, the average speed output by the model for this route starting at 120 minutes.

The average single wave ETE for the transit dependent population is 35 minutes longer (4:20 minus 3:45) than the 90th percentile ETE for the general population for a winter, midweek, midday, good weather scenario (Scenario 6), and could impact protective action decision making.

The ETE for a second wave (discussed below) is presented in the event there is a shortfall of available buses or bus drivers.

Activity: Travel to Reception Centers (E→F)

The distances from the EPZ boundary to the reception centers are measured using GIS software along the most likely route from the EPZ exit point to the facility. The reception centers are mapped in Figure 10-7. For a one-wave evacuation, this travel time outside the EPZ does not contribute to the ETE. For a two-wave evacuation, the ETE for buses must be considered separately, since it could exceed the ETE for the general population. Similar to schools, assumed bus speeds of 45 mph, 41 mph, and 38 mph for good weather, rain/light snow, and heavy snow, respectively, will be applied for this activity for buses servicing the transit-dependent population.

Activity: Passengers Leave Bus (F→G)

A bus can empty within 5 minutes. The driver takes a 10-minute break.

Activity: Bus Returns to Route for Second Wave Evacuation (G→C)

The buses assigned to return to the EPZ to perform a “second wave” evacuation of transit-dependent evacuees will be those that have already evacuated transit-dependent people who mobilized more quickly. The first wave of transit-dependent people depart the bus, and the bus then returns to the EPZ, travels to its route and proceeds to pick up more transit-dependent evacuees along the route. Similar to schools, assumed speeds of 45 mph, 41 mph and 38 mph are used to estimate the travel time back to the EPZ in good weather, rain/light snow, and heavy snow, respectively, as buses are traveling counter to evacuating traffic.

The second-wave ETE for the first group of buses servicing Amesbury is computed as follows for good weather:

- Bus arrives at reception center at 3:47 in good weather (3:35 to exit EPZ + 12 minute travel time to reception center).
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Bus returns to EPZ, drives to the start of the route and completes second route: 12 minutes (8.9 miles back to the EPZ @ 45 mph) + 13 minutes (equal to travel time to start of route, i.e., 10 miles² @ 45 mph) + 47 minutes (equal to travel time for second route, i.e., 31.1 miles @ 39.7 mph – route specific speed at the time the bus begins the second route) = 72 minutes
- Bus completes pick-ups along route: 30 minutes.
- Bus exits EPZ at time 3:35 + 0:12 + 0:15 + 1:12 + 0:30 = 5:45 after the ATE.

The ETE for the completion of the second wave for all transit-dependent bus routes are provided in Table 8-5 through Table 8-7.

The average ETE for a two-wave evacuation of transit-dependent people exceeds the ETE for the general population at the 90th percentile (3:45) by 2 hours and 50 minutes and could impact protective action decision making.

² The routes are various distances from the EPZ boundary. An assumed average distance of 10 miles is used to represent the distance to the start of the route for all routes.

Evacuation of Medical Facilities

Activity: Mobilize Drivers (A→B→C)

As is done for the schools, it is estimated that mobilization time averages 90 minutes in good weather (100 minutes in rain/light snow, 110 in heavy snow). Specially trained medical support staff (working their regular shift) will be on site to assist in the evacuation of patients. Additional staff (if needed) could be mobilized over this same 90-minute timeframe.

Activity: Board Passengers (C→D)

Item 5 of Section 2.4 discusses transit vehicle loading times for medical facilities. Loading times are assumed to be 1 minute per ambulatory passenger in buses and vans, 5 minutes per wheelchair bound passenger in wheelchair vans, and 15 minutes per bedridden passenger in ambulances, respectively. No reduction was made to loading times for adverse weather as these loading times are already conservative. Item 3 of Section 2.4 discusses transit vehicle capacities to cap loading times per vehicle type.

Activity: Travel to EPZ Boundary (D→E)

The travel distance along the respective pick-up routes within the EPZ is estimated using the UNITES software. Transit vehicle travel times within the EPZ are computed using average speeds computed by DYNEV, using the aforementioned methodology that was used for school evacuation.

Table 8-8 through Table 8-10 summarize the ETE for medical facilities within the EPZ for good weather, rain/light snow, and heavy snow, respectively. The distances from the medical facilities to the EPZ boundary were estimated using GIS software. Average speeds output by the model for Scenario 6 (Scenario 7 for rain/light snow and Scenario 8 for heavy snow) Region 3, capped at 45 mph (41 mph for rain and 38 mph for snow), are used to compute travel time to the EPZ boundary. The travel time to the EPZ boundary is computed by dividing the distance to the EPZ boundary by the average travel speed. The ETE is the sum of the mobilization time, total passenger loading time, and travel time out of the EPZ. Concurrent loading on multiple buses, half buses, vans, wheelchair buses, wheelchair vans, and ambulances at capacity is assumed such that the maximum loading times for buses (maximum capacity of 36 times 1 minute per passenger), vans (maximum capacity of 15 times 1 minute per passenger), wheelchair vans for facilities in Massachusetts (maximum capacity of 4 passengers times 5 minutes per passenger), wheelchair vans for facilities in New Hampshire (maximum capacity of 2 passengers times 5 minutes per passenger) and ambulances (2 passenger times 15 minutes per passenger) are 36, 15, 20, 10, and 30 minutes, respectively. All ETE are rounded to the nearest 5 minutes.

For example, the calculation of ETE for Coastal Connections Inc. with 65 ambulatory residents during good weather is:

ETE: $90 + 36$ (max capacity per bus with concurrent loading on multiple buses) $\times 1 + 10 = 136$ minutes or 2:20, rounded up.

It is assumed that the medical facility population is directly evacuated to reception centers or appropriate host medical facilities that are at approximately the same distances to the EPZ boundary as the reception centers.

Average single wave ETE for medical facilities are 1 hour and 5 minutes less than the 90th percentile ETE (3:45) for the evacuation of the general population from Region R03 during Scenario 6 conditions and should not impact protective action decision making.

As shown in Table 8-1, there is a shortfall of wheelchair vans and ambulances in the EPZ. Two waves will be needed to evacuate the wheelchair bound population and bedridden population at medical facilities within the EPZ in the event of a full EPZ evacuation.

Activity: Travel to Reception Center (E→F), Passengers Leave Vehicle (F→G), Vehicle Returns to Route for Second Wave Evacuation (G→C)

A second wave ETE was not computed for each medical facility. Rather, the following representative ETE is provided to estimate the additional time needed for a second wave evacuation for all wheelchair bound and bedridden medical facility patients. Times and distances are based on facility-wide averages for wheelchair bound and bedridden patients. It is assumed that these people are taken to the hospital closest to the EPZ boundary for each state.

- Vehicles exit the EPZ at 2:40 on average
- Vehicles travel to reception center: 22 minutes (16.5 miles³ at 45mph)
- Bus discharges passengers: 23 minutes (average van/ambulance loading time from Table 8-8) and driver takes a 10-minute rest: 33 minutes.
- Bus returns to EPZ and completes second wave of service along the route: 22 minutes to travel back to the EPZ boundary + 9 minutes to travel back to the facility (average Dist. to EPZ Boundary in Table 8-8 – 7.1 miles @ 45 mph) and then back to the EPZ boundary (7.1 miles @ 9.56 mph = 45 minutes) = 76 minutes. The average distance to EPZ boundary is approximately 5.2 miles in Table 8-8. 9.56 mph is the network wide average speed at 4:10 for Scenario 6.
- Loading Time: 23 minutes (average van/ambulance loading time from Table 8-8)

Bus exits EPZ at time 2:40 + 0:22 + 0:33 + 1:16 + 0:23 = 5:15 (rounded up to nearest 5 minutes) after the ATE.

Thus, the second wave evacuation requires an additional 2 hours and 35 minutes (5:15 minus 2:40), on average. The average ETE for a two-wave evacuation of medical facilities exceeds the ETE for the general population at the 90th percentile (3:45) and could impact protective action decision making.

8.2 ETE for Access and/or Functional Needs Population

Section 3.9 and Table 3-11 summarize the access and/or functional needs population registered with the state emergency management agencies in the EPZ. Table 8-11 summarizes the ETE for

³ Assuming vehicles need to travel an average distance of 16.5 miles to the nearest hospital in MA and NH.

access and/or functional needs population. The table is categorized by type of vehicle required and then broken down by weather condition. The table takes into consideration the deployment of multiple vehicles (not filled to capacity) to reduce the number of stops per vehicle. Due to the potential mobility limitations for access and/or functional needs persons, it assumed they will be picked up from their homes. Furthermore, it is conservatively assumed that access and/or functional needs households are spaced 3 miles apart. Bus speeds approximate 20 mph between households in good weather (10% slower in rain/light snow, 15% slower in heavy snow). Mobilization times of 135 minutes were used (145 minutes for rain/light snow, and 155 minutes for heavy snow), similar to the transit dependent population as evacuees will need time to mobilize. Loading times of 1 minute per person are assumed for ambulatory people, 5 minutes for wheelchair bound people, and 15 minutes per person for bedridden people. The last household is assumed to be 5 miles from the EPZ boundary, and the network-wide average speed, capped at 45 mph (41 mph for rain/light snow and 38 mph for heavy snow), after the last pickup is used to compute travel time. ETE is computed by summing mobilization time, loading time at the first household, travel to subsequent households, loading time at subsequent households, and travel time to EPZ boundary. All ETE are rounded up to the nearest 5 minutes.

For example, assuming no more than one access and/or functional needs person per household implies that 1,902 ambulatory households need to be serviced. While only 53 buses are needed from a capacity perspective (36 persons per bus), if a combination of buses, half buses, and vans are deployed to service these households, then each vehicle would require less stops. The following outlines the ETE calculations:

1. Assume 75 buses (capacity of 36 persons per bus) are deployed, each with about 12 stops on average, to service a total of 895 households. 312 households will be serviced by 30 half buses with 11 stops per bus. The remaining 695 households will be serviced by 80 vans with 9 stops per van.
2. The ETE is calculated as follows for buses in good weather:
 - a. Buses arrive at the first pickup location: 135 minutes
 - b. Load household members at first pickup: 1 minute
 - c. Travel to subsequent pickup locations: 11 @ 9 minutes (3 miles @ 20 mph) = 99 minutes
 - d. Load household members at subsequent pickup locations: 11 @ 1 minute = 11 minutes
 - e. Travel to EPZ boundary: 30 minutes (5 miles @ 10 mph – network wide average speed at this time).

ETE: $135 + 1 + 99 + 11 + 30 = 4:40$ rounded up to the nearest 5 minutes.

The average ETE for a single wave evacuation of the access and/or functional needs population is 50 minutes longer than the general population ETE at the 90th percentile (3:45) for an evacuation of the entire EPZ (Region R03), during Scenario 6 conditions. Therefore, the evacuation of access and/or functional needs population could impact protective action decision making. Since vehicles are likely to be dispatched for the direct and exclusive evacuation of these people, a second wave ETE was not computed for the access and/or functional needs population.

Table 8-1. Summary of Transportation Resources

Transportation Resource	Buses	Half Buses	Vans	Wheelchair Buses	Wheelchair Vans	Ambulances
MA Resources Available						
Action Ambulance Service, Inc.	41	0	0	0	40	40
American Medical Response Northeast	0	2	0	0	54	125
Cataldo Ambulance Company	5	0	0	5	46	101
Fallon Ambulance Service, Inc.	1	0	0	1	23	50
Professional Ambulance Service	0	0	0	0	0	3
Worcester Regional Transit Authority	48	0	0	0	35	0
Lowell Regional Transit Authority	50	6	0	0	20	0
First Student Transportation Services (Marlborough)	149	2	1	0	1	0
Merrimack Valley Regional Transit Authority	49	0	0	1	19	0
Massachusetts Bay Transportation Authority (MBTA)	978	0	80	0	0	0
NRT North Reading Transit	87	0	0	5	0	0
NH Resources Available						
COAST (Dover)	23	4	2	0	4	0
Concord School Dist. (Concord)	26	10	4	0	0	0
Dail Transportation (Epsom)	75	4	0	0	4	0
Jalbert/CJ Trailways (Portsmouth)	19	0	1	0	0	0
Manchester Transit (Manchester)	98 buses with a capacity to hold up to 28 wheelchairs		1	98 buses with a capacity to hold up to 28 wheelchairs		0
Merrimack Valley School (Penacook)	20	3	7	0	5	0
Oyster River School Dist. (Durham)	23	4	6	0	2	0
Safeway Training and Transportation	0	0	0	0	7	0
Seacoast Learning Collaborative	0	5	17	0	13	0
Student Transportation of America	45	0	0	0	0	0
The Provider (Brentwood)	3	30	30	0	25	0
Wildcat Transit (Durham)	25	0	0	0	6	0
American Medical Response	0	0	4	0	4	16
Care Plus Ambulance Services	2	0	7	0	31	16
Golden Cross Ambulance Services	0	0	3	0	5	3
Rescue, Inc.	0	0	6	0	0	2
Trinity EMS	0	0	8	0	20	31
Upper Valley Ambulance	0	0	0	0	0	2
TOTAL:	1,767	70	177	12	364	389
Resources Needed						
Medical Facilities (Table 3-6):	81	0	32	0	288	280
Transit-Dependent Population (Section 3.6):	88	0	0	0	0	0
Schools (Table 3-8):	511	0	0	0	0	0
Preschools/Childcare Centers (Table 3-9):	121	0	0	0	0	0
Day Camps (Table 3-10):	70	0	0	0	0	0
Access and/or Functional Needs (Table 3-11):	75	30	80	12	221	123
Correctional Facilities (Section 3.5.2)	Shelter In Place					
TOTAL TRANSPORTATION NEEDS:	946	30	112	12	509	403

Table 8-2. School, Preschool, Childcare Center, and Day Camp Evacuation Time Estimates – Good Weather

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Massachusetts Schools									
Sparhawk School - Lower School	90	15	6.4	45.0	9	1:55	12.2	16	2:15
Amesbury Elementary School	90	15	6.5	42.4	9	1:55	12.2	16	2:15
Sparhawk School - Upper School	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Amesbury Innovation High School	90	15	5.5	45.0	7	1:55	12.2	16	2:15
Amesbury Middle School	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Amesbury High School	90	15	5.5	45.0	7	1:55	12.2	16	2:15
Cashman School	90	15	5.9	45.0	8	1:55	12.2	16	2:15
Dr. FN Sweetsir School	90	15	2.2	45.0	3	1:50	22.7	30	2:20
Helen R. Donaghue School	90	15	1.1	10.4	6	1:55	22.7	30	2:25
Newbury Elementary School	90	15	3.7	34.1	7	1:55	21.1	28	2:25
The Governor's Academy	90	15	0.6	45.0	1	1:50	24.4	33	2:25
Triton Regional Middle School and High School	90	15	2.6	29.0	5	1:50	21.0	28	2:20
Bresnahan Elementary School	90	15	6.4	30.0	13	2:00	34.1	45	2:45
Newburyport High School	90	15	7.2	30.4	14	2:00	34.1	45	2:45
Immaculate Conception School	90	15	8.2	34.0	14	2:00	34.1	45	2:45
E.G. Molin Upper Elementary School	90	15	6.0	37.1	10	1:55	34.1	45	2:40
Rupert A. Nock Middle School	90	15	6.0	37.1	10	1:55	34.1	45	2:40
River Valley Charter School	90	15	6.0	37.0	10	1:55	34.1	45	2:40
Salisbury Elementary School	90	15	9.9	34.4	17	2:05	15.1	20	2:25
Dr. John C. Page School	90	15	3.5	28.8	7	1:55	24.8	33	2:30
Pentucket Regional High School	90	15	0.1	9.2	1	1:50	24.8	33	2:25
Pentucket Regional Middle School	90	15	0.1	9.2	1	1:50	24.8	33	2:25
Massachusetts Preschools/Childcare Centers									
Amesbury Country Day School	90	15	6.8	41.5	10	1:55	12.2	16	2:15
Leaps & Bounds Preschool	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Little Hands Learning Center	90	15	5.7	45.0	8	1:55	12.2	16	2:15
James Place The Next Generation	90	15	5.6	45.0	7	1:55	12.2	16	2:15

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Windmill Country Day School	90	15	5.3	45.0	7	1:55	12.2	16	2:15
Little Sprouts Daycare	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Amesbury Montessori Preschool and Kindergarten	90	15	5.6	45.0	7	1:55	12.2	16	2:15
Leaps and Bounds Pre-School	90	15	5.4	45.0	7	1:55	12.2	16	2:15
Small Wonders Preschool Program	90	15	2.2	45.0	3	1:50	22.7	30	2:20
Our Secret Garden Nursery and Preschool	90	15	6.7	13.4	30	2:15	21.1	28	2:45
Harmony Natural Learning Center	90	15	6.7	13.4	30	2:15	21.1	28	2:45
Community Action, Inc. Newburyport Head Start	90	15	6.6	27.1	15	2:00	34.1	45	2:45
School's Out @ Bresnahan School	90	15	6.4	30.0	13	2:00	34.1	45	2:45
YWCA - School's Out Program	90	15	8.3	34.0	15	2:00	34.1	45	2:45
Newburyport Montessori School	90	15	8.3	34.0	15	2:00	34.1	45	2:45
Newburyport KinderCare	90	15	10.3	42.7	14	2:00	25.9	35	2:35
Bright Horizons at Newburyport	90	15	5.7	36.9	9	1:55	34.1	45	2:40
Mrs Murray's Nursery School	90	15	6.3	32.1	12	2:00	34.1	45	2:45
Kindercare Learning Center	90	15	6.6	3.6	110	3:35	34.1	45	4:20
Knoll Edge Preschool	90	15	5.7	39.0	9	1:55	34.1	45	2:40
Milestones Childcare and Preschool	90	15	7.4	45.0	10	1:55	12.2	16	2:15
Children's Castle	90	15	3.5	28.8	7	1:55	24.8	33	2:30
Learning Tree Preschool	90	15	2.5	26.1	6	1:55	24.8	33	2:30
Koinonia Preschool Day Care	90	15	1.5	21.9	4	1:50	24.8	33	2:25
Pathways For Learning	90	15	1.1	14.1	5	1:50	24.8	33	2:25
Massachusetts Day Camps									
US Sports Institute	90	15	6.4	45.0	9	1:55	12.2	16	2:15
James Place	90	15	5.6	45.0	7	1:55	12.2	16	2:15
Camp Bauercrest	90	15	3.5	45.0	5	1:50	25.9	35	2:25
Coastal Discoveries Marine	90	15	5.6	16.0	21	2:10	12.2	16	2:30
Governor's Academy	90	15	0.6	36.7	1	1:50	24.4	33	2:25
YWCA Greater Newburyport	90	15	8.3	34.0	15	2:00	34.1	45	2:45
Clipper Girls Basketball Camp	90	15	7.2	30.4	14	2:00	34.1	45	2:45
Mass Audubon Joppa Flats Education Center	90	15	7.5	16.8	27	2:15	34.1	45	3:00

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Metro Rock Climbing Camps	90	15	5.6	40.1	8	1:55	34.1	45	2:40
Koinonia Day Camp	90	15	1.5	14.8	6	1:55	24.8	33	2:30
MA Maximum: 3:35									
MA Average: 2:00									
New Hampshire Schools									
Swasey Central School	90	15	3.6	15.0	14	2:00	24.7	33	2:35
Brentwood Christian Academy	90	15	4.5	32.1	8	1:55	25.6	34	2:30
East Kingston Elementary School	90	15	6.9	34.7	12	2:00	25.6	34	2:35
Great Bay Charter School	90	15	6.3	7.2	52	2:40	24.7	33	3:15
Seacoast School of Technology	90	15	6.3	7.2	52	2:40	24.7	33	3:15
Phillips Exeter Academy	90	15	6.0	12.5	29	2:15	24.7	33	2:50
Main Street School	90	15	5.9	12.3	29	2:15	24.7	33	2:50
Lincoln Street Elementary School	90	15	5.9	7.9	45	2:30	24.7	33	3:05
Exeter High School	90	15	2.8	9.7	17	2:05	24.7	33	2:40
Greenland Central School	90	15	6.1	4.0	91	3:20	8.2	11	3:35
Winnacunnet Regional High School	90	15	13.5	17.1	47	2:35	8.2	11	2:50
Sacred Heart School	90	15	13.2	17.0	47	2:35	8.2	11	2:50
Hampton Academy	90	15	13.3	14.0	57	2:45	8.2	11	3:00
Marston School	90	15	13.3	16.9	47	2:35	8.2	11	2:50
Lincoln Akerman School	90	15	15.3	18.8	49	2:35	8.2	11	2:50
Heronfield Academy	90	15	14.0	6.3	134	4:00	8.2	11	4:15
Kensington Elementary School	90	15	10.3	9.5	65	2:50	24.7	33	3:25
Daniel J. Bakie Elementary School	90	15	3.0	32.7	6	1:55	25.6	34	2:30
Seacoast Charter School	90	15	3.0	32.7	6	1:55	25.6	34	2:30
Sanborn Regional High School	90	15	1.2	45.0	2	1:50	27.5	37	2:30
Maude H. Trefethen School	90	15	5.8	3.7	95	3:20	8.2	11	3:35
Newfields Elementary School	90	15	8.0	12.3	39	2:25	24.7	33	3:00
Memorial Elementary School	90	15	8.6	35.9	14	2:00	25.6	34	2:35
Seacoast Learning Collaborative	90	15	8.6	35.9	14	2:00	25.6	34	2:35
Squamscott River Academy	90	15	10.4	6.1	103	3:30	8.2	11	3:45

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
North Hampton Elementary School	90	15	10.4	6.1	103	3:30	8.2	11	3:45
Saint Patrick Academy	90	15	2.8	3.6	47	2:35	18.4	25	3:00
Dondero School	90	15	4.6	3.0	93	3:20	18.4	25	3:45
Robert J. Lister Academy	90	15	3.5	5.8	36	2:25	18.4	25	2:50
Portsmouth Career Technical Center	90	15	3.2	3.5	55	2:40	18.4	25	3:05
Portsmouth High School	90	15	3.2	3.5	55	2:40	18.4	25	3:05
Great Bay Community College	90	15	1.9	2.9	40	2:25	18.4	25	2:50
Little Harbour School	90	15	4.1	3.4	72	3:00	18.4	25	3:25
New Franklin School	90	15	2.3	6.0	23	2:10	18.4	25	2:35
Portsmouth Middle School	90	15	3.5	3.6	59	2:45	18.4	25	3:10
Learning Skills Academy	90	15	7.1	4.1	105	3:30	8.2	11	3:45
Rye Junior High School	90	15	6.9	4.3	96	3:25	8.2	11	3:40
Rye Elementary School	90	15	6.5	3.7	104	3:30	8.2	11	3:45
Seabrook Elementary School	90	15	18.6	14.7	76	3:05	24.7	33	3:40
Seabrook Middle School	90	15	18.6	14.7	76	3:05	24.7	33	3:40
Seventh Day Adventist School	90	15	9.5	38.4	15	2:00	25.6	34	2:35
Barnard School	90	15	9.5	38.4	15	2:00	25.6	34	2:35
Cooperative Middle School	90	15	8.5	6.9	74	3:00	24.7	33	3:35
The Cornerstone School	90	15	11.8	5.0	142	4:10	24.7	33	4:45
Cornerstone Christian Academy	90	15	9.3	8.1	69	2:55	24.7	33	3:30
Stratham Memorial School	90	15	11.9	7.0	103	3:30	24.7	33	4:05
New Hampshire Preschools/Childcare Centers									
Donna Clarke's Family Day Care	90	15	5.9	9.8	36	2:25	24.7	33	3:00
A Place To Grow	90	15	1.2	45.0	2	1:50	23.8	32	2:25
East Kingston Elementary School-Before & After School Program	90	15	6.9	34.7	12	2:00	25.6	34	2:35
KidLogic Early Learning Center	90	15	9.0	11.4	47	2:35	23.8	32	3:10
Appleseeds Day School	90	15	10.2	5.2	117	3:45	24.7	33	4:20
Exeter Day School	90	15	7.9	6.8	70	2:55	24.7	33	3:30
Little Munchkins Learning Center	90	15	7.1	5.9	72	3:00	24.7	33	3:35

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Swasey Central School Before & After School Program	90	15	3.6	15.0	14	2:00	24.7	33	2:35
Harris Family Children's Center	90	15	7.0	7.2	59	2:45	24.7	33	3:20
Great Bay Kids Company	90	15	6.1	12.3	30	2:15	24.7	33	2:50
Exeter Developmental Pre-School	90	15	5.9	7.9	45	2:30	24.7	33	3:05
Montessori School for the Arts & Sciences	90	15	6.2	31.1	12	2:00	24.7	33	2:35
Building Block Commons	90	15	5.9	8.2	43	2:30	24.7	33	3:05
De Colores Children's Center	90	15	5.0	12.3	24	2:10	24.7	33	2:45
Great Bay Kids' Company	90	15	5.0	12.3	24	2:10	24.7	33	2:45
Camp Gundalow	90	15	6.9	4.2	98	3:25	8.2	11	3:40
Greenland Peak Program	90	15	6.1	4.1	89	3:15	8.2	11	3:30
Fun After School & Summer Program	90	15	14.7	14.4	61	2:50	8.2	11	3:05
MPA at Hampton	90	15	14.7	14.4	61	2:50	8.2	11	3:05
Hampton Child & Family Program-DBA Village Preschool	90	15	14.7	14.4	61	2:50	8.2	11	3:05
Lincoln Akerman School After School Program	90	15	15.3	18.8	49	2:35	8.2	11	2:50
Robin's Childs Place	90	15	15.0	18.8	48	2:35	8.2	11	2:50
Seacoast Head Start	90	15	15.0	18.8	48	2:35	8.2	11	2:50
Kensington Elementary School After School Program	90	15	10.3	9.5	65	2:50	24.7	33	3:25
Daniel J. Bakie Elementary School Before & After Childcare Program	90	15	2.7	32.7	5	1:50	25.6	34	2:25
Kingston Children's Center	90	15	2.7	32.7	5	1:50	25.6	34	2:25
Nurture & Nature Children's Center	90	15	7.1	12.7	34	2:20	24.7	33	2:55
Newfields Action Club at Newfields Elementary School	90	15	8.0	12.3	39	2:25	24.7	33	3:00
Newton Learning Center	90	15	2.4	3.2	44	2:30	36.7	49	3:20
Memorial Elementary School - Before & After Program	90	15	8.6	35.9	14	2:00	25.6	34	2:35
North Hampton Elementary School Before and After School Program	90	15	10.4	6.1	103	3:30	8.2	11	3:45

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Imprint's Day School	90	15	7.8	4.6	101	3:30	8.2	11	3:45
Krempels Center-Brain Injury Program	90	15	4.9	3.1	96	3:25	18.4	25	3:50
Portsmouth Head Start	90	15	4.9	3.1	96	3:25	18.4	25	3:50
Seacoast Community School	90	15	4.9	3.1	96	3:25	18.4	25	3:50
Place for Friends and Fun	90	15	4.6	3.0	93	3:20	18.4	25	3:45
Dondero Peak Program	90	15	4.6	3.0	93	3:20	18.4	25	3:45
Kindercare Learning Center	90	15	3.7	2.9	77	3:05	18.4	25	3:30
Little Blessings Day Care	90	15	3.5	2.7	78	3:05	18.4	25	3:30
YMCA of the Seacoast	90	15	3.4	3.7	55	2:40	18.4	25	3:05
The Children's Garden	90	15	3.4	3.7	55	2:40	18.4	25	3:05
The Chase Home For Children	90	15	4.0	3.8	64	2:50	18.4	25	3:15
Edgewood Early Learning Center	90	15	3.5	3.5	59	2:45	18.4	25	3:10
Great Bay Kids-PEASE Center	90	15	1.6	2.9	34	2:20	18.4	25	2:45
Little Harbour Peak Program	90	15	4.1	3.4	72	3:00	18.4	25	3:25
Kathleen Tostenon	90	15	2.1	6.9	18	2:05	18.4	25	2:30
Discovery Child Enrichment Center	90	15	1.8	3.1	35	2:20	18.4	25	2:45
New Franklin School PEAK Program	90	15	2.3	6.0	23	2:10	18.4	25	2:35
Early Learning Center at Temple Israel Preschool	90	15	2.5	4.1	37	2:25	18.4	25	2:50
The Treehouse School of Portsmouth	90	15	2.5	4.1	37	2:25	18.4	25	2:50
Seacoast Community School at the Meadows	90	15	0.4	3.2	8	1:55	18.4	25	2:20
Rye Country Day School	90	15	7.1	4.1	105	3:30	8.2	11	3:45
Seabrook Elementary School After School Program	90	15	18.6	14.7	76	3:05	24.7	33	3:40
Seabrook Middle School Adventure Zone After School Program	90	15	18.6	14.7	76	3:05	24.7	33	3:40
Miss Beth's Family Day Care	90	15	18.1	14.4	75	3:00	24.7	33	3:35
Seabrook Head Start	90	15	16.5	13.7	73	3:00	24.7	33	3:35
Bright Horizons at Timberland	90	15	9.7	10.1	58	2:45	24.7	33	3:20
Little Sprouts Childcare & Preschool	90	15	7.1	7.8	55	2:40	24.7	33	3:15
Acorn School	90	15	11.0	4.6	143	4:10	24.7	33	4:45
Stratham Circle Learning Center	90	15	8.4	8.6	58	2:45	24.7	33	3:20

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)	
Stratham Memorial School Before & After School Program	90	15	11.9	7.0	103	3:30	24.7	33	4:05	
Richie McFarland Children's Center	90	15	10.9	6.3	104	3:30	24.7	33	4:05	
New Hampshire Day Camps										
Action Kids at Brentwood Commons	90	15	3.7	9.1	25	2:10	23.8	32	2:45	
YMCA Tricklin' Falls Day Camp	90	15	9.2	12.0	46	2:35	23.8	32	3:10	
Long Tree Scout Reservation	90	15	2.6	38.2	4	1:50	26.8	36	2:30	
YMCA Camp Lincoln Kingston	90	15	6.1	9.5	38	2:25	25.6	34	3:00	
Camp Tasker (Boys & Girls Club of Haverhill)	90	15	3.6	36.2	6	1:55	26.8	36	2:35	
Seawood Girl Scout Camp	90	15	4.3	4.9	52	2:40	18.4	25	3:05	
					NH Maximum:	4:10	NH Maximum:			4:45
					NH Average:	2:45	NH Average:			3:10

Table 8-3. School, Preschool, Childcare Center, and Day Camp Evacuation Time Estimates – Rain/Light Snow

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Massachusetts Schools									
Sparhawk School - Lower School	100	20	6.4	41.0	9	2:10	12.2	18	2:30
Amesbury Elementary School	100	20	6.5	41.0	10	2:10	12.2	18	2:30
Sparhawk School - Upper School	100	20	5.4	41.0	8	2:10	12.2	18	2:30
Amesbury Innovation High School	100	20	5.5	41.0	8	2:10	12.2	18	2:30
Amesbury Middle School	100	20	5.4	41.0	8	2:10	12.2	18	2:30
Amesbury High School	100	20	5.5	41.0	8	2:10	12.2	18	2:30
Cashman School	100	20	5.9	41.0	9	2:10	12.2	18	2:30
Dr. FN Sweetsir School	100	20	2.2	41.0	3	2:05	22.7	33	2:40
Helen R. Donaghue School	100	20	1.1	14.0	5	2:05	22.7	33	2:40
Newbury Elementary School	100	20	3.7	33.7	7	2:10	21.1	31	2:45
The Governor's Academy	100	20	0.6	38.0	1	2:05	24.4	36	2:45
Triton Regional Middle School and High School	100	20	2.6	41.0	4	2:05	21.0	31	2:40
Bresnahan Elementary School	100	20	6.4	41.0	9	2:10	34.1	50	3:00
Newburyport High School	100	20	7.2	41.0	11	2:15	34.1	50	3:05
Immaculate Conception School	100	20	8.2	41.0	12	2:15	34.1	50	3:05
E.G. Molin Upper Elementary School	100	20	6.0	41.0	9	2:10	34.1	50	3:00
Rupert A. Nock Middle School	100	20	6.0	41.0	9	2:10	34.1	50	3:00
River Valley Charter School	100	20	6.0	41.0	9	2:10	34.1	50	3:00
Salisbury Elementary School	100	20	9.9	38.3	16	2:20	15.1	22	2:45
Dr. John C. Page School	100	20	3.5	41.0	5	2:05	24.8	36	2:45
Pentucket Regional High School	100	20	0.1	19.2	0	2:00	24.8	36	2:40
Pentucket Regional Middle School	100	20	0.1	19.2	0	2:00	24.8	36	2:40
Massachusetts Preschools/Childcare Centers									
Amesbury Country Day School	100	20	6.8	41.0	10	2:10	12.2	18	2:30
Leaps & Bounds Preschool	100	20	5.4	41.0	8	2:10	12.2	18	2:30
Little Hands Learning Center	100	20	5.7	41.0	8	2:10	12.2	18	2:30
James Place The Next Generation	100	20	5.6	41.0	8	2:10	12.2	18	2:30

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Windmill Country Day School	100	20	5.3	41.0	8	2:10	12.2	18	2:30
Little Sprouts Daycare	100	20	5.4	41.0	8	2:10	12.2	18	2:30
Amesbury Montessori Preschool and Kindergarten	100	20	5.6	41.0	8	2:10	12.2	18	2:30
Leaps and Bounds Pre-School	100	20	5.4	41.0	8	2:10	12.2	18	2:30
Small Wonders Preschool Program	100	20	2.2	41.0	3	2:05	22.7	33	2:40
Our Secret Garden Nursery and Preschool	100	20	6.7	22.5	18	2:20	21.1	31	2:55
Harmony Natural Learning Center	100	20	6.7	22.5	18	2:20	21.1	31	2:55
Community Action, Inc. Newburyport Head Start	100	20	6.6	41.0	10	2:10	34.1	50	3:00
School's Out @ Bresnahan School	100	20	6.4	41.0	9	2:10	34.1	50	3:00
YWCA - School's Out Program	100	20	8.3	41.0	12	2:15	34.1	50	3:05
Newburyport Montessori School	100	20	8.3	41.0	12	2:15	34.1	50	3:05
Newburyport KinderCare	100	20	10.3	41.0	15	2:15	25.9	38	2:55
Bright Horizons at Newburyport	100	20	5.7	41.0	8	2:10	34.1	50	3:00
Mrs Murray's Nursery School	100	20	6.3	32.6	12	2:15	34.1	50	3:05
Kidercare Learning Center	100	20	6.6	4.1	97	3:40	34.1	50	4:30
Knoll Edge Preschool	100	20	5.7	41.0	8	2:10	34.1	50	3:00
Milestones Childcare and Preschool	100	20	7.4	41.0	11	2:15	12.2	18	2:35
Children's Castle	100	20	3.5	41.0	5	2:05	24.8	36	2:45
Learning Tree Preschool	100	20	2.5	40.4	4	2:05	24.8	36	2:45
Koinonia Preschool Day Care	100	20	1.5	40.8	2	2:05	24.8	36	2:45
Pathways For Learning	100	20	1.1	37.3	2	2:05	24.8	36	2:45
Massachusetts Day Camps									
US Sports Institute	100	20	6.4	41.0	9	2:10	12.2	18	2:30
James Place	100	20	5.6	41.0	8	2:10	12.2	18	2:30
Camp Bauercrest	100	20	3.5	41.0	5	2:05	25.9	38	2:45
Coastal Discoveries Marine	100	20	5.6	24.4	14	2:15	12.2	18	2:35
Governor's Academy	100	20	0.6	36.7	1	2:05	24.4	36	2:45
YWCA Greater Newburyport	100	20	8.3	41.0	12	2:15	34.1	50	3:05
Clipper Girls Basketball Camp	100	20	7.2	41.0	11	2:15	34.1	50	3:05
Mass Audubon Joppa Flats Education Center	100	20	7.5	26.0	17	2:20	34.1	50	3:10
Metro Rock Climbing Camps	100	20	5.6	41.0	8	2:10	34.1	50	3:00

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Koinonia Day Camp	100	20	1.5	26.2	3	2:05	24.8	36	2:45
New Hampshire Schools									
				MA Maximum:	MA Maximum:	3:40		MA Maximum:	4:30
				MA Average:	MA Average:	2:15		MA Average:	2:50
Swasey Central School	100	20	3.6	14.6	15	2:15	24.7	36	2:55
Brentwood Christian Academy	100	20	4.5	27.6	10	2:10	25.6	37	2:50
East Kingston Elementary School	100	20	6.9	34.6	12	2:15	25.6	37	2:55
Great Bay Charter School	100	20	6.3	6.5	58	3:00	24.7	36	3:40
Seacoast School of Technology	100	20	6.3	6.5	58	3:00	24.7	36	3:40
Phillips Exeter Academy	100	20	6.0	9.4	38	2:40	24.7	36	3:20
Main Street School	100	20	5.9	9.3	38	2:40	24.7	36	3:20
Lincoln Street Elementary School	100	20	5.9	6.5	54	2:55	24.7	36	3:35
Exeter High School	100	20	2.8	12.9	13	2:15	24.7	36	2:55
Greenland Central School	100	20	6.1	4.0	92	3:35	8.2	12	3:50
Winnacunnet Regional High School	100	20	13.5	16.5	49	2:50	8.2	12	3:05
Sacred Heart School	100	20	13.2	16.4	48	2:50	8.2	12	3:05
Hampton Academy	100	20	13.3	15.3	52	2:55	8.2	12	3:10
Marston School	100	20	13.3	16.4	49	2:50	8.2	12	3:05
Lincoln Akerman School	100	20	15.3	18.7	49	2:50	8.2	12	3:05
Heronfield Academy	100	20	14.0	6.8	124	4:05	8.2	12	4:20
Kensington Elementary School	100	20	10.3	9.7	64	3:05	24.7	36	3:45
Daniel J. Bakie Elementary School	100	20	3.0	39.1	5	2:05	25.6	37	2:45
Seacoast Charter School	100	20	3.0	39.1	5	2:05	25.6	37	2:45
Sanborn Regional High School	100	20	1.2	41.0	2	2:05	27.5	40	2:45
Maude H. Trefethen School	100	20	5.8	4.2	84	3:25	8.2	12	3:40
Newfields Elementary School	100	20	8.0	8.1	59	3:00	24.7	36	3:40
Memorial Elementary School	100	20	8.6	36.0	14	2:15	25.6	37	2:55
Seacoast Learning Collaborative	100	20	8.6	36.0	14	2:15	25.6	37	2:55
Squamscott River Academy	100	20	10.4	6.7	93	3:35	8.2	12	3:50
North Hampton Elementary School	100	20	10.4	6.7	93	3:35	8.2	12	3:50

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Saint Patrick Academy	100	20	2.8	4.0	42	2:45	18.4	27	3:15
Dondero School	100	20	4.6	3.2	87	3:30	18.4	27	4:00
Robert J. Lister Academy	100	20	3.5	5.6	38	2:40	18.4	27	3:10
Portsmouth Career Technical Center	100	20	3.2	3.4	57	3:00	18.4	27	3:30
Portsmouth High School	100	20	3.2	3.4	57	3:00	18.4	27	3:30
Great Bay Community College	100	20	1.9	2.7	43	2:45	18.4	27	3:15
Little Harbour School	100	20	4.1	3.3	74	3:15	18.4	27	3:45
New Franklin School	100	20	2.3	5.3	26	2:30	18.4	27	3:00
Portsmouth Middle School	100	20	3.5	3.6	59	3:00	18.4	27	3:30
Learning Skills Academy	100	20	7.1	4.8	88	3:30	8.2	12	3:45
Rye Junior High School	100	20	6.9	4.8	86	3:30	8.2	12	3:45
Rye Elementary School	100	20	6.5	3.9	100	3:40	8.2	12	3:55
Seabrook Elementary School	100	20	18.6	12.8	87	3:30	24.7	36	4:10
Seabrook Middle School	100	20	18.6	12.8	87	3:30	24.7	36	4:10
Seventh Day Adventist School	100	20	9.5	35.1	16	2:20	25.6	37	3:00
Barnard School	100	20	9.5	35.1	16	2:20	25.6	37	3:00
Cooperative Middle School	100	20	8.5	6.2	82	3:25	24.7	36	4:05
The Cornerstone School	100	20	11.8	5.3	134	4:15	24.7	36	4:55
Cornerstone Christian Academy	100	20	9.3	7.0	79	3:20	24.7	36	4:00
Stratham Memorial School	100	20	11.9	7.1	101	3:45	24.7	36	4:25
New Hampshire Preschools/Childcare Centers									
Donna Clarke's Family Day Care	100	20	5.9	8.9	40	2:40	24.7	36	3:20
A Place To Grow	100	20	1.2	41.0	2	2:05	23.8	35	2:40
East Kingston Elementary School-Before & After School Program	100	20	6.9	34.6	12	2:15	25.6	37	2:55
KidLogic Early Learning Center	100	20	9.0	11.8	46	2:50	23.8	35	3:25
Appleseeds Day School	100	20	10.2	5.5	111	3:55	24.7	36	4:35
Exeter Day School	100	20	7.9	6.8	70	3:10	24.7	36	3:50
Little Munchkins Learning Center	100	20	7.1	5.4	79	3:20	24.7	36	4:00

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	E TE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Swasey Central School Before & After School Program	100	20	3.6	14.6	15	2:15	24.7	36	2:55
Harris Family Children's Center	100	20	7.0	6.9	61	3:05	24.7	36	3:45
Great Bay Kids Company	100	20	6.1	9.3	40	2:40	24.7	36	3:20
Exeter Developmental Pre-School	100	20	5.9	6.5	54	2:55	24.7	36	3:35
Montessori School for the Arts & Sciences	100	20	6.2	27.7	13	2:15	24.7	36	2:55
Building Block Commons	100	20	5.9	6.5	54	2:55	24.7	36	3:35
De Colores Children's Center	100	20	5.0	9.0	33	2:35	24.7	36	3:15
Great Bay Kids' Company	100	20	5.0	9.0	33	2:35	24.7	36	3:15
Camp Gundalow	100	20	6.9	4.1	100	3:40	8.2	12	3:55
Greenland Peak Program	100	20	6.1	4.1	90	3:30	8.2	12	3:45
Fun After School & Summer Program	100	20	14.7	16.1	55	2:55	8.2	12	3:10
MPA at Hampton	100	20	14.7	16.1	55	2:55	8.2	12	3:10
Hampton Child & Family Program-DBA Village Preschool	100	20	14.7	16.1	55	2:55	8.2	12	3:10
Lincoln Akerman School After School Program	100	20	15.3	18.7	49	2:50	8.2	12	3:05
Robin's Childs Place	100	20	15.0	18.2	50	2:50	8.2	12	3:05
Seacoast Head Start	100	20	15.0	18.2	50	2:50	8.2	12	3:05
Kensington Elementary School After-School Program	100	20	10.3	9.7	64	3:05	24.7	36	3:45
Daniel J. Bakie Elementary School Before & After Childcare Program	100	20	2.7	39.1	4	2:05	25.6	37	2:45
Kingston Children's Center	100	20	2.7	39.1	4	2:05	25.6	37	2:45
Nurture & Nature Children's Center	100	20	7.1	8.2	52	2:55	24.7	36	3:35
Newfields Action Club at Newfields Elementary School	100	20	8.0	8.1	59	3:00	24.7	36	3:40
Newton Learning Center	100	20	2.4	3.3	44	2:45	36.7	54	3:40
Memorial Elementary School - Before & After Program	100	20	8.6	36.0	14	2:15	25.6	37	2:55
North Hampton Elementary School Before and After School Program	100	20	10.4	6.7	93	3:35	8.2	12	3:50

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Imprint's Day School	100	20	7.8	5.1	91	3:35	8.2	12	3:50
Krepels Center-Brain Injury Program	100	20	4.9	3.4	87	3:30	18.4	27	4:00
Portsmouth Head Start	100	20	4.9	3.4	87	3:30	18.4	27	4:00
Seacoast Community School	100	20	4.9	3.4	87	3:30	18.4	27	4:00
Place for Friends and Fun	100	20	4.6	3.2	87	3:30	18.4	27	4:00
Dondero Peak Program	100	20	4.6	3.2	87	3:30	18.4	27	4:00
Kindercare Learning Center	100	20	3.7	2.9	77	3:20	18.4	27	3:50
Little Blessings Day Care	100	20	3.5	2.7	78	3:20	18.4	27	3:50
YMCA of the Seacoast	100	20	3.4	3.8	53	2:55	18.4	27	3:25
The Children's Garden	100	20	3.4	3.8	53	2:55	18.4	27	3:25
The Chase Home For Children	100	20	4.0	3.7	65	3:05	18.4	27	3:35
Edgewood Early Learning Center	100	20	3.5	3.3	63	3:05	18.4	27	3:35
Great Bay Kids-PEASE Center	100	20	1.6	2.8	35	2:35	18.4	27	3:05
Little Harbour Peak Program	100	20	4.1	3.3	74	3:15	18.4	27	3:45
Kathleen Tostenson	100	20	2.1	5.2	24	2:25	18.4	27	2:55
Discovery Child Enrichment Center	100	20	1.8	3.2	33	2:35	18.4	27	3:05
New Franklin School PEAK Program	100	20	2.3	5.3	26	2:30	18.4	27	3:00
Early Learning Center at Temple Israel Preschool	100	20	2.5	3.8	40	2:40	18.4	27	3:10
The Treehouse School of Portsmouth	100	20	2.5	3.8	40	2:40	18.4	27	3:10
Seacoast Community School at the Meadows	100	20	0.4	3.9	6	2:10	18.4	27	2:40
Rye Country Day School	100	20	7.1	4.8	88	3:30	8.2	12	3:45
Seabrook Elementary School After School Program	100	20	18.6	12.8	87	3:30	24.7	36	4:10
Seabrook Middle School Adventure Zone After School Program	100	20	18.6	12.8	87	3:30	24.7	36	4:10
Miss Beth's Family Day Care	100	20	18.1	12.6	86	3:30	24.7	36	4:10
Seabrook Head Start	100	20	16.5	12.0	83	3:25	24.7	36	4:05
Bright Horizons at Timberland	100	20	9.7	8.1	72	3:15	24.7	36	3:55
Little Sprouts Childcare & Preschool	100	20	7.1	6.0	71	3:15	24.7	36	3:55
Acorn School	100	20	11.0	4.9	135	4:15	24.7	36	4:55
Stratham Circle Learning Center	100	20	8.4	7.0	72	3:15	24.7	36	3:55

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)	
Stratham Memorial School Before & After School Program	100	20	11.9	7.1	101	3:45	24.7	36	4:25	
Richie McFarland Children's Center	100	20	10.9	6.4	102	3:45	24.7	36	4:25	
New Hampshire Day Camps										
Action Kids at Brentwood Commons	100	20	3.7	8.5	26	2:30	23.8	35	3:05	
YMCA Tricklin' Falls Day Camp	100	20	9.2	12.3	45	2:45	23.8	35	3:20	
Long Tree Scout Reservation	100	20	2.6	38.8	4	2:05	26.8	39	2:45	
YMCA Camp Lincoln Kingston	100	20	6.1	9.9	37	2:40	25.6	37	3:20	
Camp Tasker (Boys & Girls Club of Haverhill)	100	20	3.6	35.8	6	2:10	26.8	39	2:50	
Seawood Girl Scout Camp	100	20	4.3	4.9	52	2:55	18.4	27	3:25	
					NH Maximum:	4:15			NH Maximum:	4:55
					NH Average:	3:00			NH Average:	3:30

Table 8-4. School, Preschool, Childcare Center, and Day Camp Evacuation Time Estimates – Heavy Snow

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Massachusetts Schools									
Sparhawk School - Lower School	110	25	6.4	38.0	10	2:25	12.2	19	2:45
Amesbury Elementary School	110	25	6.5	38.0	10	2:25	12.2	19	2:45
Sparhawk School - Upper School	110	25	5.4	38.0	9	2:25	12.2	19	2:45
Amesbury Innovation High School	110	25	5.5	38.0	9	2:25	12.2	19	2:45
Amesbury Middle School	110	25	5.4	38.0	9	2:25	12.2	19	2:45
Amesbury High School	110	25	5.5	38.0	9	2:25	12.2	19	2:45
Cashman School	110	25	5.9	38.0	9	2:25	12.2	19	2:45
Dr. FN Sweetsir School	110	25	2.2	38.0	3	2:20	22.7	36	3:00
Helen R. Donaghue School	110	25	1.1	38.0	2	2:20	22.7	36	3:00
Newbury Elementary School	110	25	3.7	15.8	14	2:30	21.1	33	3:05
The Governor's Academy	110	25	0.6	2.5	15	2:30	24.4	39	3:10
Triton Regional Middle School and High School	110	25	2.6	36.5	4	2:20	21.0	33	2:55
Bresnahan Elementary School	110	25	6.4	38.0	10	2:25	34.1	54	3:20
Newburyport High School	110	25	7.2	38.0	11	2:30	34.1	54	3:25
Immaculate Conception School	110	25	8.2	38.0	13	2:30	34.1	54	3:25
E.G. Molin Upper Elementary School	110	25	6.0	38.0	9	2:25	34.1	54	3:20
Rupert A. Nock Middle School	110	25	6.0	38.0	9	2:25	34.1	54	3:20
River Valley Charter School	110	25	6.0	38.0	9	2:25	34.1	54	3:20
Salisbury Elementary School	110	25	9.9	38.0	16	2:35	15.1	24	3:00
Dr. John C. Page School	110	25	3.5	38.0	6	2:25	24.8	39	3:05
Pentucket Regional High School	110	25	0.1	38.0	0	2:15	24.8	39	2:55
Pentucket Regional Middle School	110	25	0.1	38.0	0	2:15	24.8	39	2:55
Massachusetts Preschools/Childcare Centers									
Amesbury Country Day School	110	25	6.8	38.0	11	2:30	12.2	19	2:50
Leaps & Bounds Preschool	110	25	5.4	38.0	9	2:25	12.2	19	2:45
Little Hands Learning Center	110	25	5.7	38.0	9	2:25	12.2	19	2:45
James Place The Next Generation	110	25	5.6	38.0	9	2:25	12.2	19	2:45

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Windmill Country Day School	110	25	5.3	38.0	8	2:25	12.2	19	2:45
Little Sprouts Daycare	110	25	5.4	38.0	9	2:25	12.2	19	2:45
Amesbury Montessori Preschool and Kindergarten	110	25	5.6	38.0	9	2:25	12.2	19	2:45
Leaps and Bounds Pre-School	110	25	5.4	38.0	9	2:25	12.2	19	2:45
Small Wonders Preschool Program	110	25	2.2	38.0	3	2:20	22.7	36	3:00
Our Secret Garden Nursery and Preschool	110	25	6.7	37.5	11	2:30	21.1	33	3:05
Harmony Natural Learning Center	110	25	6.7	37.5	11	2:30	21.1	33	3:05
Community Action, Inc. Newburyport Head Start	110	25	6.6	38.0	10	2:25	34.1	54	3:20
School's Out @ Bresnahan School	110	25	6.4	38.0	10	2:25	34.1	54	3:20
YWCA - School's Out Program	110	25	8.3	38.0	13	2:30	34.1	54	3:25
Newburyport Montessori School	110	25	8.3	38.0	13	2:30	34.1	54	3:25
Newburyport KinderCare	110	25	10.3	38.0	16	2:35	25.9	41	3:20
Bright Horizons at Newburyport	110	25	5.7	38.0	9	2:25	34.1	54	3:20
Mrs Murray's Nursery School	110	25	6.3	37.8	10	2:25	34.1	54	3:20
Kindercare Learning Center	110	25	6.6	5.0	79	3:35	34.1	54	4:30
Knoll Edge Preschool	110	25	5.7	38.0	9	2:25	34.1	54	3:20
Milestones Childcare and Preschool	110	25	7.4	38.0	12	2:30	12.2	19	2:50
Children's Castle	110	25	3.5	38.0	6	2:25	24.8	39	3:05
Learning Tree Preschool	110	25	2.5	38.0	4	2:20	24.8	39	3:00
Koinonia Preschool Day Care	110	25	1.5	38.0	2	2:20	24.8	39	3:00
Pathways For Learning	110	25	1.1	38.0	2	2:20	24.8	39	3:00
Massachusetts Day Camps									
US Sports Institute	110	25	6.4	38.0	10	2:25	12.2	19	2:45
James Place	110	25	5.6	38.0	9	2:25	12.2	19	2:45
Camp Bauercrest	110	25	3.5	38.0	6	2:25	25.9	41	3:10
Coastal Discoveries Marine	110	25	5.6	37.2	9	2:25	12.2	19	2:45
Governor's Academy	110	25	0.6	36.7	1	2:20	24.4	39	3:00
YWCA Greater Newburyport	110	25	8.3	38.0	13	2:30	34.1	54	3:25
Clipper Girls Basketball Camp	110	25	7.2	38.0	11	2:30	34.1	54	3:25
Mass Audubon Joppa Flats Education Center	110	25	7.5	37.0	12	2:30	34.1	54	3:25

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Metro Rock Climbing Camps	110	25	5.6	38.0	9	2:25	34.1	54	3:20
Koinonia Day Camp	110	25	1.5	38.0	2	2:20	24.8	39	3:00
MA Maximum: 3:35									
MA Average: 2:30									
New Hampshire Schools									
Swasey Central School	110	25	3.6	16.1	13	2:30	24.7	39	3:10
Brentwood Christian Academy	110	25	4.5	27.9	10	2:25	25.6	40	3:05
East Kingston Elementary School	110	25	6.9	31.6	13	2:30	25.6	40	3:10
Great Bay Charter School	110	25	6.3	6.2	61	3:20	24.7	39	4:00
Seacoast School of Technology	110	25	6.3	6.2	61	3:20	24.7	39	4:00
Phillips Exeter Academy	110	25	6.0	8.5	42	3:00	24.7	39	3:40
Main Street School	110	25	5.9	8.4	42	3:00	24.7	39	3:40
Lincoln Street Elementary School	110	25	5.9	6.2	57	3:15	24.7	39	3:55
Exeter High School	110	25	2.8	9.7	17	2:35	24.7	39	3:15
Greenland Central School	110	25	6.1	4.2	87	3:45	8.2	13	4:00
Winnacunnet Regional High School	110	25	13.5	19.6	41	3:00	8.2	13	3:15
Sacred Heart School	110	25	13.2	19.5	41	3:00	8.2	13	3:15
Hampton Academy	110	25	13.3	18.2	44	3:00	8.2	13	3:15
Marston School	110	25	13.3	19.5	41	3:00	8.2	13	3:15
Lincoln Akerman School	110	25	15.3	21.5	43	3:00	8.2	13	3:15
Heronfield Academy	110	25	14.0	7.5	112	4:10	8.2	13	4:25
Kensington Elementary School	110	25	10.3	9.6	65	3:20	24.7	39	4:00
Daniel J. Bakie Elementary School	110	25	3.0	32.1	6	2:25	25.6	40	3:05
Seacoast Charter School	110	25	3.0	32.1	6	2:25	25.6	40	3:05
Sanborn Regional High School	110	25	1.2	38.0	2	2:20	27.5	43	3:05
Maude H. Trefethen School	110	25	5.8	4.9	72	3:30	8.2	13	3:45
Newfields Elementary School	110	25	8.0	6.6	72	3:30	24.7	39	4:10
Memorial Elementary School	110	25	8.6	9.7	53	3:10	25.6	40	3:50
Seacoast Learning Collaborative	110	25	8.6	9.7	53	3:10	25.6	40	3:50
Squamscott River Academy	110	25	10.4	7.9	79	3:35	8.2	13	3:50

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
North Hampton Elementary School	110	25	10.4	7.9	79	3:35	8.2	13	3:50
Saint Patrick Academy	110	25	2.8	3.9	43	3:00	18.4	29	3:30
Dondero School	110	25	4.6	3.5	78	3:35	18.4	29	4:05
Robert J. Lister Academy	110	25	3.5	6.8	31	2:50	18.4	29	3:20
Portsmouth Career Technical Center	110	25	3.2	3.4	56	3:15	18.4	29	3:45
Portsmouth High School	110	25	3.2	3.4	56	3:15	18.4	29	3:45
Great Bay Community College	110	25	1.9	2.6	43	3:00	18.4	29	3:30
Little Harbour School	110	25	4.1	3.9	63	3:20	18.4	29	3:50
New Franklin School	110	25	2.3	6.6	21	2:40	18.4	29	3:10
Portsmouth Middle School	110	25	3.5	3.9	54	3:10	18.4	29	3:40
Learning Skills Academy	110	25	7.1	5.1	83	3:40	8.2	13	3:55
Rye Junior High School	110	25	6.9	5.5	76	3:35	8.2	13	3:50
Rye Elementary School	110	25	6.5	4.7	83	3:40	8.2	13	3:55
Seabrook Elementary School	110	25	18.6	12.1	92	3:50	24.7	39	4:30
Seabrook Middle School	110	25	18.6	12.1	92	3:50	24.7	39	4:30
Seventh Day Adventist School	110	25	9.5	35.1	16	2:35	25.6	40	3:15
Barnard School	110	25	9.5	35.1	16	2:35	25.6	40	3:15
Cooperative Middle School	110	25	8.5	6.0	86	3:45	24.7	39	4:25
The Cornerstone School	110	25	11.8	6.0	119	4:15	24.7	39	4:55
Cornerstone Christian Academy	110	25	9.3	6.6	84	3:40	24.7	39	4:20
Stratham Memorial School	110	25	11.9	7.5	96	3:55	24.7	39	4:35
New Hampshire Preschools/Childcare Centers									
Donna Clarke's Family Day Care	110	25	5.9	8.8	40	2:55	24.7	39	3:35
A Place To Grow	110	25	1.2	38.0	2	2:20	23.8	38	3:00
East Kingston Elementary School-Before & After School Program	110	25	6.9	31.6	13	2:30	25.6	40	3:10
KidLogic Early Learning Center	110	25	9.0	12.6	43	3:00	23.8	38	3:40
Applesseeds Day School	110	25	10.2	5.9	105	4:00	24.7	39	4:40
Exeter Day School	110	25	7.9	6.5	73	3:30	24.7	39	4:10
Little Munchkins Learning Center	110	25	7.1	5.1	84	3:40	24.7	39	4:20

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Swasey Central School Before & After School Program	110	25	3.6	16.1	13	2:30	24.7	39	3:10
Harris Family Children's Center	110	25	7.0	6.5	64	3:20	24.7	39	4:00
Great Bay Kids Company	110	25	6.1	8.4	44	3:00	24.7	39	3:40
Exeter Developmental Pre-School	110	25	5.9	6.2	57	3:15	24.7	39	3:55
Montessori School for the Arts & Sciences	110	25	6.2	27.9	13	2:30	24.7	39	3:10
Building Block Commons	110	25	5.9	6.1	58	3:15	24.7	39	3:55
De Colores Children's Center	110	25	5.0	7.5	40	2:55	24.7	39	3:35
Great Bay Kids' Company	110	25	5.0	7.5	40	2:55	24.7	39	3:35
Camp Gundalow	110	25	6.9	4.6	91	3:50	8.2	13	4:05
Greenland Peak Program	110	25	6.1	4.3	84	3:40	8.2	13	3:55
Fun After School & Summer Program	110	25	14.7	20.2	44	3:00	8.2	13	3:15
MPA at Hampton	110	25	14.7	20.2	44	3:00	8.2	13	3:15
Hampton Child & Family Program-DBA Village Preschool	110	25	14.7	20.2	44	3:00	8.2	13	3:15
Lincoln Akerman School After School Program	110	25	15.3	21.5	43	3:00	8.2	13	3:15
Robin's Childs Place	110	25	15.0	21.5	42	3:00	8.2	13	3:15
Seacoast Head Start	110	25	15.0	21.5	42	3:00	8.2	13	3:15
Kensington Elementary School After School Program	110	25	10.3	9.6	65	3:20	24.7	39	4:00
Daniel J. Bakie Elementary School Before & After Childcare Program	110	25	2.7	32.1	5	2:20	25.6	40	3:00
Kingston Children's Center	110	25	2.7	32.1	5	2:20	25.6	40	3:00
Nurture & Nature Children's Center	110	25	7.1	6.8	63	3:20	24.7	39	4:00
Newfields Action Club at Newfields Elementary School	110	25	8.0	6.6	72	3:30	24.7	39	4:10
Newton Learning Center	110	25	2.4	4.3	34	2:50	36.7	58	3:50
Memorial Elementary School - Before & After Program	110	25	8.6	9.7	53	3:10	25.6	40	3:50
North Hampton Elementary School Before and After School Program	110	25	10.4	7.9	79	3:35	8.2	13	3:50

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)
Imprint's Day School	110	25	7.8	6.2	75	3:30	8.2	13	3:45
Krepfels Center-Brain Injury Program	110	25	4.9	3.9	76	3:35	18.4	29	4:05
Portsmouth Head Start	110	25	4.9	3.9	76	3:35	18.4	29	4:05
Seacoast Community School	110	25	4.9	3.9	76	3:35	18.4	29	4:05
Place for Friends and Fun	110	25	4.6	3.5	78	3:35	18.4	29	4:05
Dondero Peak Program	110	25	4.6	3.5	78	3:35	18.4	29	4:05
Kindercare Learning Center	110	25	3.7	3.2	69	3:25	18.4	29	3:55
Little Blessings Day Care	110	25	3.5	3.0	69	3:25	18.4	29	3:55
YMCA of the Seacoast	110	25	3.4	3.7	55	3:10	18.4	29	3:40
The Children's Garden	110	25	3.4	3.7	55	3:10	18.4	29	3:40
The Chase Home For Children	110	25	4.0	4.1	59	3:15	18.4	29	3:45
Edgewood Early Learning Center	110	25	3.5	3.5	61	3:20	18.4	29	3:50
Great Bay Kids-PEASE Center	110	25	1.6	2.7	35	2:50	18.4	29	3:20
Little Harbour Peak Program	110	25	4.1	3.9	63	3:20	18.4	29	3:50
Kathleen Tostenson	110	25	2.1	6.9	18	2:35	18.4	29	3:05
Discovery Child Enrichment Center	110	25	1.8	3.1	35	2:50	18.4	29	3:20
New Franklin School PEAK Program	110	25	2.3	6.6	21	2:40	18.4	29	3:10
Early Learning Center at Temple Israel Preschool	110	25	2.5	4.3	35	2:50	18.4	29	3:20
The Treehouse School of Portsmouth	110	25	2.5	4.3	35	2:50	18.4	29	3:20
Seacoast Community School at the Meadows	110	25	0.4	6.0	4	2:20	18.4	29	2:50
Rye Country Day School	110	25	7.1	5.1	83	3:40	8.2	13	3:55
Seabrook Elementary School After School Program	110	25	18.6	12.1	92	3:50	24.7	39	4:30
Seabrook Middle School Adventure Zone After School Program	110	25	18.6	12.1	92	3:50	24.7	39	4:30
Miss Beth's Family Day Care	110	25	18.1	11.8	92	3:50	24.7	39	4:30
Seabrook Head Start	110	25	16.5	11.2	89	3:45	24.7	39	4:25
Bright Horizons at Timberland	110	25	9.7	7.0	83	3:40	24.7	39	4:20
Little Sprouts Childcare & Preschool	110	25	7.1	5.3	80	3:35	24.7	39	4:15
Acorn School	110	25	11.0	5.3	124	4:20	24.7	39	5:00
Stratham Circle Learning Center	110	25	8.4	6.4	79	3:35	24.7	39	4:15

School	Driver Mobilization Time (min)	Loading Time (min)	Dist. To EPZ Bdry (mi)	Average Speed (mph)	Travel Time to EPZ Bdry (min)	ETE (hr:min)	Dist. EPZ Bdry to RC/HS (mi.)	Travel Time from EPZ Bdry to RC/HS (min)	ETA to RC/HS (hr:min)	
Stratham Memorial School Before & After School Program	110	25	11.9	7.5	96	3:55	24.7	39	4:35	
Richie McFarland Children's Center	110	25	10.9	6.7	97	3:55	24.7	39	4:35	
New Hampshire Day Camps										
Action Kids at Brentwood Commons	110	25	3.7	9.9	22	2:40	23.8	38	3:20	
YMCA Tricklin' Falls Day Camp	110	25	9.2	13.3	41	3:00	23.8	38	3:40	
Long Tree Scout Reservation	110	25	2.6	38.0	4	2:20	26.8	42	3:05	
YMCA Camp Lincoln Kingston	110	25	6.1	10.9	33	2:50	25.6	40	3:30	
Camp Tasker (Boys & Girls Club of Haverhill)	110	25	3.6	27.6	8	2:25	26.8	42	3:10	
Seawood Girl Scout Camp	110	25	4.3	4.7	55	3:10	18.4	29	3:40	
					NH Maximum:	4:20	NH Maximum:			5:00
					NH Average:	3:15	NH Average:			3:45

Table 8-5. Transit-Dependent Evacuation Time Estimates – Good Weather

Community Served	UNITES Route # ⁴	Bus Number	One-Wave						Two-Wave						
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R. C. (miles)	Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
Amesbury	17	1-3	135	31.1	37.2	50	30	3:35	8.9	12	5	10	72	30	5:45
		4-6	155	31.1	37.4	50	30	3:55	8.9	12	5	10	70	30	6:05
		7-8	175	31.1	37.4	50	30	4:15	8.9	12	5	10	70	30	6:25
Brentwood	155	1-2	135	35.4	15.9	133	30	5:00	23.7	32	5	10	93	30	7:50
East Kingston	156	1-2	135	4.9	30.1	10	30	2:55	25.6	34	5	10	54	30	5:10
Exeter	157	1-3	135	8.4	9.5	53	30	3:40	24.6	33	5	10	58	30	6:00
		4-7	155	8.4	9.9	51	30	4:00	24.6	33	5	10	58	30	6:20
Greenland	158	1-2	135	22.0	8.2	160	30	5:25	8.1	11	5	10	54	30	7:15
Hampton	159	1-3	135	41.0	17.9	137	30	5:05	8.1	11	5	10	79	30	7:20
		4-7	155	41.0	19.5	126	30	5:15	8.1	11	5	10	79	30	7:30
Hampton Beach	160	1-3	135	8.1	10.8	45	30	3:30	24.6	33	5	10	57	30	5:45
Hampton Falls	161	1	135	22.3	10.9	123	30	4:50	8.1	11	5	10	54	30	6:40
Kensington	162	1	135	25.8	12.1	128	30	4:55	24.6	33	5	10	81	30	7:35
Kingston	163	1-3	135	46.6	45.0	62	30	3:50	25.6	34	5	10	109	30	7:00
Merrimac	150	1-3	135	17.2	40.0	26	30	3:15	8.9	12	5	10	51	30	5:05
New Castle	164	1	135	2.6	3.3	48	30	3:35	8.1	11	5	10	37	30	5:10
Newbury	152	1-3	135	22.8	23.3	59	30	3:45	8.9	12	5	10	58	30	5:40
Newburyport	153	1-3	135	20.8	45.0	28	30	3:15	8.9	12	5	10	53	30	5:05
		4-6	155	20.8	45.0	28	30	3:35	8.9	12	5	10	53	30	5:25
		7-8	175	20.8	45.0	28	30	3:55	8.9	12	5	10	53	30	5:45
Newfields	165	1	135	10.9	3.9	167	30	5:35	28.1	37	5	10	65	30	8:05

⁴ See Table 10-2 and Appendix K.

Community Served	UNITES Route # ⁴	Bus Number	One-Wave					Two-Wave							
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R. C. (miles)	Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
Newton	166	1-3	135	25.0	13.2	114	30	4:40	25.6	34	5	10	81	30	7:20
North Hampton	167	1-2	135	31.3	14.4	130	30	4:55	8.1	11	5	10	66	30	7:00
		1-3	135	42.2	12.6	201	30	6:10	18.4	25	5	10	99	30	9:00
Portsmouth	168	4-7	155	42.2	13.7	184	30	6:10	18.4	25	5	10	99	30	9:00
		8-10	175	42.2	15.2	167	30	6:15	18.4	25	5	10	99	30	9:05
Rye	169	1-3	135	35.5	17.2	124	30	4:50	8.1	11	5	10	72	30	7:00
Salisbury	151	1-4	135	26.2	31.4	50	30	3:35	8.9	12	5	10	60	30	5:35
Seabrook	170	1-4	135	21.0	38.6	33	30	3:20	24.6	33	5	10	75	30	5:55
Seabrook Beach	171	1-3	135	1.5	15.5	6	30	2:55	34.6	46	5	10	61	30	5:30
South Hampton	172	1	135	15.4	37.4	25	30	3:10	25.6	34	5	10	68	30	5:40
Stratham	173	1-4	135	34.5	13.9	149	30	5:15	24.6	33	5	10	93	30	8:10
West Newbury	154	1-2	135	21.4	43.1	30	30	3:15	8.9	12	5	10	55	30	5:10
							Maximum ETE:	6:15						Maximum ETE:	9:05
							Average ETE:	4:20						Average ETE:	6:35

Table 8-6. Transit-Dependent Evacuation Time Estimates – Rain/Light Snow

Community Served	UNITES Route #	Bus Number	One-Wave					Two-Wave							
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R. C. (miles)	Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
Amesbury	17	1-3	145	31.1	37.3	50	30	3:45	8.9	13	5	10	73	30	6:00
		4-6	165	31.1	37.4	50	30	4:05	8.9	13	5	10	73	30	6:20
		7-8	185	31.1	37.3	50	30	4:25	8.9	13	5	10	73	30	6:40
Brentwood	155	1-2	145	35.4	17.2	123	30	5:00	23.7	35	5	10	101	30	8:05
East Kingston	156	1-2	145	4.9	36.1	8	30	3:05	25.6	37	5	10	59	30	5:30
Exeter	157	1-3	145	8.4	9.7	52	30	3:50	24.6	36	5	10	63	30	6:15
		4-7	165	8.4	10.4	48	30	4:05	24.6	36	5	10	63	30	6:30
Greenland	158	1-2	145	22.0	8.5	156	30	5:35	8.1	12	5	10	59	30	7:35
Hampton	159	1-3	145	41.0	18.6	132	30	5:10	8.1	12	5	10	87	30	7:35
		4-7	165	41.0	20.8	118	30	5:15	8.1	12	5	10	87	30	7:40
Hampton Beach	160	1-3	145	8.1	10.5	46	30	3:45	24.6	36	5	10	62	30	6:10
Hampton Falls	161	1	145	22.3	11.5	116	30	4:55	8.1	12	5	10	59	30	6:55
Kensington	162	1	145	25.8	13.2	117	30	4:55	24.6	36	5	10	88	30	7:45
Kingston	163	1-3	145	46.6	41.0	68	30	4:05	25.6	37	5	10	120	30	7:30
Merrimac	150	1-3	145	17.2	40.0	26	30	3:25	8.9	13	5	10	54	30	5:20
New Castle	164	1	145	2.6	3.5	44	30	3:40	8.1	12	5	10	37	30	5:15
Newbury	152	1-3	145	22.8	25.6	53	30	3:50	8.9	13	5	10	61	30	5:50
Newburyport	153	1-3	145	20.8	41.0	30	30	3:25	8.9	13	5	10	58	30	5:25
		4-6	165	20.8	41.0	30	30	3:45	8.9	13	5	10	58	30	5:45
		7-8	185	20.8	41.0	30	30	4:05	8.9	13	5	10	58	30	6:05
Newfields	165	1	145	10.9	4.0	162	30	5:40	28.1	41	5	10	72	30	8:20
Newton	166	1-3	145	25.0	13.9	108	30	4:45	25.6	37	5	10	88	30	7:35
North Hampton	167	1-2	145	31.3	15.9	118	30	4:55	8.1	12	5	10	72	30	7:05

Community Served	UNITES Route #	Bus Number	One-Wave					Two-Wave							
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R. C. (miles)	Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
Portsmouth	168	1-3	145	42.2	13.0	194	30	6:10	18.4	27	5	10	103	30	9:05
		4-7	165	42.2	14.3	177	30	6:15	18.4	27	5	10	103	30	9:10
		8-10	185	42.2	15.9	159	30	6:15	18.4	27	5	10	103	30	9:10
Rye	169	1-3	145	35.5	19.0	112	30	4:50	8.1	12	5	10	79	30	7:10
Salisbury	151	1-4	145	26.2	33.7	47	30	3:45	8.9	13	5	10	66	30	5:50
Seabrook	170	1-4	145	21.0	38.7	33	30	3:30	24.6	36	5	10	81	30	6:15
Seabrook Beach	171	1-3	145	1.5	17.7	5	30	3:00	34.6	51	5	10	68	30	5:45
South Hampton	172	1	145	15.4	39.6	23	30	3:20	25.6	37	5	10	74	30	6:00
Stratham	173	1-4	145	34.5	14.5	143	30	5:20	24.6	36	5	10	101	30	8:25
West Newbury	154	1-2	145	21.4	41.0	31	30	3:30	8.9	13	5	10	59	30	5:30
							Maximum ETE:	6:15						Maximum ETE:	9:10
							Average ETE:	4:25						Average ETE:	6:50

Table 8-7. Transit Dependent Evacuation Time Estimates – Heavy Snow

Community Served	UNITES Route #	Bus Number	One-Wave					Two-Wave							
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R. C. (miles)	Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
Amesbury	17	1-3	155	31.1	37.4	50	30	3:55	8.9	14	5	10	79	30	6:15
		4-6	175	31.1	37.4	50	30	4:15	8.9	14	5	10	79	30	6:35
		7-8	195	31.1	37.2	50	30	4:35	8.9	14	5	10	79	30	6:55
Brentwood	155	1-2	155	35.4	17.6	121	30	5:10	23.7	37	5	10	109	30	8:25
East Kingston	156	1-2	155	4.9	38.0	8	30	3:15	25.6	40	5	10	64	30	5:45
Exeter	157	1-3	155	8.4	9.9	51	30	4:00	24.6	39	5	10	68	30	6:35
		4-7	175	8.4	10.2	50	30	4:15	24.6	39	5	10	68	30	6:50
Greenland	158	1-2	155	22.0	9.5	138	30	5:25	8.1	13	5	10	64	30	7:30
Hampton	159	1-3	155	41.0	19.5	126	30	5:15	8.1	13	5	10	94	30	7:50
		4-7	175	41.0	22.1	111	30	5:20	8.1	13	5	10	94	30	7:55
Hampton Beach	160	1-3	155	8.1	10.3	47	30	3:55	24.6	39	5	10	68	30	6:30
Hampton Falls	161	1	155	22.3	12.6	107	30	4:55	8.1	13	5	10	64	30	7:00
Kensington	162	1	155	25.8	13.7	113	30	5:00	24.6	39	5	10	96	30	8:00
Kingston	163	1-3	155	46.6	38.0	74	30	4:20	25.6	40	5	10	129	30	7:55
Merrimac	150	1-3	155	17.2	38.0	27	30	3:35	8.9	14	5	10	57	30	5:35
New Castle	164	1	155	2.6	3.7	42	30	3:50	8.1	13	5	10	38	30	5:30
Newbury	152	1-3	155	22.8	28.2	48	30	3:55	8.9	14	5	10	66	30	6:00
		1-3	155	20.8	38.0	33	30	3:40	8.9	14	5	10	63	30	5:45
		4-6	175	20.8	38.0	33	30	4:00	8.9	14	5	10	63	30	6:05
Newburyport	153	7-8	195	20.8	38.0	33	30	4:20	8.9	14	5	10	63	30	6:25
		1	155	10.9	5.2	127	30	5:15	28.1	44	5	10	77	30	8:05
Newfields	165	1-3	155	25.0	15.7	95	30	4:40	25.6	40	5	10	95	30	7:40
North Hampton	167	1-2	155	31.3	16.3	116	30	5:05	8.1	13	5	10	78	30	7:25

Community Served	UNITES Route #	Bus Number	One-Wave					Two-Wave							
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R. C. (miles)	Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
Portsmouth	168	1-3	155	42.2	13.0	194	30	6:20	18.4	29	5	10	111	30	9:25
		4-7	175	42.2	15.0	168	30	6:15	18.4	29	5	10	111	30	9:20
		8-10	195	42.2	16.7	151	30	6:20	18.4	29	5	10	111	30	9:25
Rye	169	1-3	155	35.5	19.7	108	30	4:55	8.1	13	5	10	85	30	7:20
Salisbury	151	1-4	155	26.2	35.5	44	30	3:50	8.9	14	5	10	71	30	6:00
Seabrook	170	1-4	155	21.0	37.4	34	30	3:40	24.6	39	5	10	88	30	6:35
Seabrook Beach	171	1-3	155	1.5	19.9	5	30	3:10	34.6	55	5	10	73	30	6:05
South Hampton	172	1	155	15.4	37.8	24	30	3:30	25.6	40	5	10	80	30	6:15
Stratham	173	1-4	155	34.5	15.2	137	30	5:25	24.6	39	5	10	109	30	8:40
West Newbury	154	1-2	155	21.4	38.0	34	30	3:40	8.9	14	5	10	64	30	5:45
			Maximum ETE:					Maximum ETE:					9:25		
			Average ETE:					Average ETE:					7:05		

Table 8-8. Medical Facility Evacuation Time Estimates – Good Weather

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Massachusetts Medical Facilities								
Coastal Connections Inc	Ambulatory	90	1	65	36	7.6	10	2:20
	Wheelchair bound	90	5	17	75	7.6	10	2:55
	Bedridden	90	15	14	30	7.6	10	2:10
Amesbury Residence	Ambulatory	90	1	8	8	5.8	8	1:50
Maplewood Center	Ambulatory	90	1	57	36	5.3	7	2:15
	Wheelchair bound	90	5	48	20	5.3	7	2:00
	Bedridden	90	15	4	30	5.3	7	2:10
Lahey Health Primary Care, Amesbury	Ambulatory	90	1	6	6	5.3	7	1:45
Amesbury Village, LLC	Ambulatory	90	1	66	36	5.9	8	2:15
	Wheelchair bound	90	5	26	20	5.9	8	2:00
	Bedridden	90	15	10	30	5.9	8	2:10
Hillside Rest Home Inc	Ambulatory	90	1	28	28	5.0	7	2:05
	Ambulatory	90	1	10	10	6.0	8	1:50
Elizabeth Calsey House	Wheelchair bound	90	5	2	10	6.0	8	1:50
	Bedridden	90	15	2	30	6.0	8	2:10
	Ambulatory	90	1	17	15	6.0	8	1:55
Elizabeth Calsey House 2	Wheelchair bound	90	5	4	20	6.0	8	2:00
	Bedridden	90	15	4	30	6.0	8	2:10
Church Street House	Ambulatory	90	1	5	5	1.6	2	1:40
	Quaker Hill	90	1	24	15	1.5	4	1:50
Byfield Elderly Housing	Ambulatory	90	1	18	15	1.5	4	1:50
	Wheelchair bound	90	5	4	20	1.5	3	1:55
Home for Aged Men (Griffin House)	Ambulatory	90	1	9	9	9.9	13	1:55
Anna Jaques Hospital	Ambulatory	90	1	83	36	10.8	14	2:20
	Wheelchair bound	90	5	22	20	10.8	15	2:05
	Bedridden	90	15	18	30	10.8	14	2:15

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Newburyport Residence	Ambulatory	90	1	8	8	10.0	15	1:55
	Ambulatory	90	1	75	36	10.0	13	2:20
Constellation Health Services	Wheelchair bound	90	5	20	20	10.0	14	2:05
	Bedridden	90	15	16	30	10.0	13	2:15
Country Center for Health & Rehabilitation	Ambulatory	90	1	19	15	10.0	15	2:00
	Wheelchair bound	90	5	88	20	10.0	14	2:05
	Bedridden	90	15	4	30	10.0	13	2:15
James Steam Mill Elderly Housing	Ambulatory	90	1	79	36	10.9	21	2:30
	Wheelchair bound	90	5	42	20	10.9	28	2:20
	Bedridden	90	15	5	30	10.9	24	2:25
Harborside Adult Health at St. Paul's Church	Ambulatory	90	1	31	31	11.4	15	2:20
	Wheelchair bound	90	5	4	20	11.4	16	2:10
	Ambulatory	90	1	48	36	9.5	13	2:20
Avita of Newburyport	Wheelchair bound	90	5	12	20	9.5	13	2:05
	Bedridden	90	15	10	30	9.5	13	2:15
	Ambulatory	90	1	77	36	9.5	13	2:20
Atria Merrimack Place	Wheelchair bound	90	5	8	20	9.5	13	2:05
	Ambulatory	90	1	80	36	5.7	8	2:15
	Wheelchair bound	90	5	43	20	5.7	9	2:00
Heritage House	Bedridden	90	15	5	30	5.7	8	2:10
	Ambulatory	90	1	8	8	11.7	21	2:00
	Wheelchair bound	90	5	52	20	11.7	18	2:10
Brigham Health and Rehabilitation Center	Bedridden	90	15	4	30	11.7	16	2:20
	Ambulatory	90	1	51	36	6.0	8	2:15
	Ambulatory	90	1	83	36	6.4	10	2:20
Turning Point Inc.	Wheelchair bound	90	5	22	20	6.4	14	2:05
	Bedridden	90	15	18	30	6.4	12	2:15
	Ambulatory	90	1	88	36	5.5	7	2:15
Port Healthcare Center	Wheelchair bound	90	5	23	20	5.5	8	2:00
	Bedridden	90	15	19	30	5.5	7	2:10
	Ambulatory	90	1	19	15	10.0	15	2:00
Opportunity Works	Wheelchair bound	90	5	23	20	5.5	8	2:00
	Bedridden	90	15	19	30	5.5	7	2:10
	Ambulatory	90	1	19	15	10.0	15	2:00

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Assisted Living Center of Salisbury	Ambulatory	90	1	26	15	9.2	15	2:00
	Wheelchair bound	90	5	4	20	9.2	15	2:05
New Hampshire Medical Facilities								
Rockingham County Nursing Home	Ambulatory	90	1	136	36	2.1	11	2:20
	Wheelchair bound	90	5	36	10	2.1	18	2:00
	Bedridden	90	15	30	30	2.1	11	2:15
Langdon Place of Exeter	Ambulatory	90	1	77	36	10.2	105	3:55
	Wheelchair bound	90	5	20	10	10.2	120	3:40
	Bedridden	90	15	17	30	10.2	111	3:55
Exeter Rehab Center-Genesis HealthCare	Ambulatory	90	1	55	36	10.2	105	3:55
	Wheelchair bound	90	5	14	10	10.2	120	3:40
	Bedridden	90	15	12	30	10.2	111	3:55
Exeter Hospital	Ambulatory	90	1	64	36	7.6	53	3:00
	Bedridden	90	15	36	30	7.6	52	2:55
	Ambulatory	90	1	6	6	7.6	83	3:00
Exeter Healthcare	Wheelchair bound	90	5	12	10	7.6	83	3:05
	Bedridden	90	15	8	30	7.6	88	3:30
	Ambulatory	90	1	203	36	7.3	71	3:20
The Woods at Riverwoods	Wheelchair bound	90	5	53	10	7.3	58	2:40
	Bedridden	90	15	44	30	7.3	68	3:10
	Ambulatory	90	1	110	36	7.4	72	3:20
The Ridge at Riverwoods	Wheelchair bound	90	5	29	10	7.4	58	2:40
	Bedridden	90	15	24	30	7.4	68	3:10
	Ambulatory	90	1	118	36	7.4	72	3:20
The Boulders at Riverwoods	Wheelchair bound	90	5	31	10	7.4	58	2:40
	Bedridden	90	15	25	30	7.4	68	3:10
	Ambulatory	90	1	6	6	7.3	107	3:25
Fairweather Lodge Group Home	Wheelchair bound	90	5	1	5	7.3	106	3:25
	Bedridden	90	15	1	15	7.3	100	3:25
	Ambulatory	90	1	162	36	6.5	23	2:30

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Oceanside Skilled Nursing Home & Rehab - Genesis	Ambulatory	90	1	76	36	11.5	87	3:35
	Wheelchair bound	90	5	20	10	11.5	110	3:30
	Bedridden	90	15	16	30	11.5	100	3:40
Cornerstone at Hampton	Ambulatory	90	1	81	36	11.7	109	3:55
	Wheelchair bound	90	5	21	10	11.7	132	3:55
	Bedridden	90	15	18	30	11.7	118	4:00
Portsmouth Regional Hospital	Ambulatory	90	1	100	36	2.7	56	3:05
	Bedridden	90	15	100	30	2.7	57	3:00
	Ambulatory	90	1	69	36	3.5	63	3:10
Clipper Harbor of Portsmouth	Wheelchair bound	90	5	18	10	3.5	58	2:40
	Bedridden	90	15	15	30	3.5	63	3:05
	Ambulatory	90	1	8	8	3.5	58	2:40
The Inn at Edgewood	Wheelchair bound	90	5	2	10	3.5	58	2:40
	Bedridden	90	15	2	30	3.5	63	3:05
	Ambulatory	90	1	105	36	3.5	63	3:10
The Edgewood Centre	Wheelchair bound	90	5	28	10	3.5	58	2:40
	Bedridden	90	15	23	30	3.5	63	3:05
	Ambulatory	90	1	48	36	3.6	55	3:05
Wentworth Senior Living	Wheelchair bound	90	5	13	10	3.6	59	2:40
	Bedridden	90	15	10	30	3.6	60	3:00
	Ambulatory	90	1	22	15	1.5	24	2:10
Northeast Rehabilitation Hospital Network	Wheelchair bound	90	5	6	10	1.5	26	2:10
	Bedridden	90	15	5	30	1.5	22	2:25
	Ambulatory	90	1	44	36	7.6	81	3:30
Evolve at Rye	Wheelchair bound	90	5	11	10	7.6	98	3:20
	Bedridden	90	15	9	30	7.6	85	3:25
	Ambulatory	90	1	100	36	7.6	81	3:30
Webster at Rye	Wheelchair bound	90	5	26	10	7.6	98	3:20
	Bedridden	90	15	21	30	7.6	85	3:25
							Maximum ETE:	
						Average ETE:		2:40

Table 8-9. Medical Facility Evacuation Time Estimates – Rain/Light Snow

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Massachusetts Medical Facilities								
Coastal Connections Inc	Ambulatory	100	1	65	36	7.6	11	2:30
	Wheelchair bound	100	5	17	75	7.6	11	3:10
	Bedridden	100	15	14	30	7.6	11	2:25
Amesbury Residence	Ambulatory	100	1	8	8	5.8	8	2:00
	Ambulatory	100	1	57	36	5.3	8	2:25
Maplewood Center	Wheelchair bound	100	5	48	20	5.3	8	2:10
	Bedridden	100	15	4	30	5.3	8	2:20
Lahey Health Primary Care, Amesbury	Ambulatory	100	1	6	6	5.3	8	1:55
	Ambulatory	100	1	66	36	5.9	9	2:25
Amesbury Village, LLC	Wheelchair bound	100	5	26	20	5.9	9	2:10
	Bedridden	100	15	10	30	5.9	9	2:20
Hillside Rest Home Inc	Ambulatory	100	1	28	28	5.0	7	2:15
	Ambulatory	100	1	10	10	6.0	9	2:00
Elizabeth Calsey House	Wheelchair bound	100	5	2	10	6.0	9	2:00
	Bedridden	100	15	2	30	6.0	9	2:20
	Ambulatory	100	1	17	15	6.0	9	2:05
Elizabeth Calsey House 2	Wheelchair bound	100	5	4	20	6.0	9	2:10
	Bedridden	100	15	4	30	6.0	9	2:20
Church Street House	Ambulatory	100	1	5	5	1.6	2	1:50
	Ambulatory	100	1	24	15	1.5	4	2:00
Byfield Elderly Housing	Ambulatory	100	1	18	15	1.5	4	2:00
	Wheelchair bound	100	5	4	20	1.5	2	2:05
Home for Aged Men (Griffin House)	Ambulatory	100	1	9	9	9.9	14	2:05
	Ambulatory	100	1	83	36	10.8	16	2:35
Anna Jaques Hospital	Ambulatory	100	5	22	20	10.8	16	2:20
	Wheelchair bound	100	5	22	20	10.8	16	2:20

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Newburyport Residence	Bedridden	100	15	18	30	10.8	16	2:30
	Ambulatory	100	1	8	8	10.0	15	2:05
Constellation Health Services	Ambulatory	100	1	75	36	10.0	15	2:35
	Wheelchair bound	100	5	20	20	10.0	15	2:15
	Bedridden	100	15	16	30	10.0	15	2:25
Country Center for Health & Rehabilitation	Ambulatory	100	1	19	15	10.0	15	2:10
	Wheelchair bound	100	5	88	20	10.0	15	2:15
	Bedridden	100	15	4	30	10.0	15	2:25
James Steam Mill Elderly Housing	Ambulatory	100	1	79	36	10.9	18	2:35
	Wheelchair bound	100	5	42	20	10.9	24	2:25
	Bedridden	100	15	5	30	10.9	21	2:35
Harborside Adult Health at St. Paul's Church	Ambulatory	100	1	31	31	11.4	17	2:30
	Wheelchair bound	100	5	4	20	11.4	17	2:20
	Ambulatory	100	1	48	36	9.5	14	2:30
Avita of Newburyport	Wheelchair bound	100	5	12	20	9.5	14	2:15
	Bedridden	100	15	10	30	9.5	14	2:25
	Ambulatory	100	1	77	36	9.5	14	2:30
Atria Merrimack Place	Wheelchair bound	100	5	8	20	9.5	14	2:15
	Ambulatory	100	1	80	36	5.7	8	2:25
	Wheelchair bound	100	5	43	20	5.7	8	2:10
Heritage House	Bedridden	100	15	5	30	5.7	8	2:20
	Ambulatory	100	1	8	8	11.7	19	2:10
	Wheelchair bound	100	5	52	20	11.7	17	2:20
Turning Point Inc.	Bedridden	100	15	4	30	11.7	17	2:30
	Ambulatory	100	1	51	36	6.0	9	2:25
	Ambulatory	100	1	83	36	6.4	10	2:30
Port Healthcare Center	Wheelchair bound	100	5	22	20	6.4	12	2:15
	Bedridden	100	15	18	30	6.4	10	2:20
	Ambulatory	100	1	88	36	5.5	8	2:25
Opportunity Works	Wheelchair bound	100	5	23	20	5.5	8	2:10

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Assisted Living Center of Salisbury	Bedridden	100	15	19	30	5.5	8	2:20
	Ambulatory	100	1	26	15	9.2	15	2:10
	Wheelchair bound	100	5	4	20	9.2	14	2:15
New Hampshire Medical Facilities								
Rockingham County Nursing Home	Ambulatory	100	1	136	36	2.1	20	2:40
	Wheelchair bound	100	5	36	10	2.1	15	2:05
	Bedridden	100	15	30	30	2.1	11	2:25
Langdon Place of Exeter	Ambulatory	100	1	77	36	10.2	99	3:55
	Wheelchair bound	100	5	20	10	10.2	116	3:50
	Bedridden	100	15	17	30	10.2	105	3:55
Exeter Rehab Center-Genesis HealthCare	Ambulatory	100	1	55	36	10.2	99	3:55
	Wheelchair bound	100	5	14	10	10.2	116	3:50
	Bedridden	100	15	12	30	10.2	105	3:55
Exeter Hospital	Ambulatory	100	1	64	36	7.6	58	3:15
	Bedridden	100	15	36	30	7.6	53	3:05
	Ambulatory	100	1	6	6	7.6	87	3:15
Exeter Healthcare	Wheelchair bound	100	5	12	10	7.6	87	3:20
	Bedridden	100	15	8	30	7.6	88	3:40
	Ambulatory	100	1	203	36	7.3	73	3:30
The Woods at Riverwoods	Wheelchair bound	100	5	53	10	7.3	64	2:55
	Bedridden	100	15	44	30	7.3	71	3:25
	Ambulatory	100	1	110	36	7.4	74	3:30
The Ridge at Riverwoods	Wheelchair bound	100	5	29	10	7.4	65	2:55
	Bedridden	100	15	24	30	7.4	72	3:25
	Ambulatory	100	1	118	36	7.4	74	3:30
The Boulders at Riverwoods	Wheelchair bound	100	5	31	10	7.4	65	2:55
	Bedridden	100	15	25	30	7.4	72	3:25
	Ambulatory	100	1	6	6	7.3	102	3:30
Fairweather Lodge Group Home	Wheelchair bound	100	5	1	5	7.3	100	3:25
	Bedridden	100	15	1	15	7.3	92	3:30
	Ambulatory	100	1	162	36	6.5	22	2:40

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Oceanside Skilled Nursing Home & Rehab - Genesis	Ambulatory	100	1	76	36	11.5	83	3:40
	Wheelchair bound	100	5	20	10	11.5	102	3:35
	Bedridden	100	15	16	30	11.5	87	3:40
Cornerstone at Hampton	Ambulatory	100	1	81	36	11.7	98	3:55
	Wheelchair bound	100	5	21	10	11.7	122	3:55
	Bedridden	100	15	18	30	11.7	109	4:00
Portsmouth Regional Hospital	Ambulatory	100	1	100	36	2.7	53	3:10
	Bedridden	100	15	100	30	2.7	56	3:10
	Ambulatory	100	1	69	36	3.5	54	3:10
Clipper Harbor of Portsmouth	Wheelchair bound	100	5	18	10	3.5	62	2:55
	Bedridden	100	15	15	30	3.5	63	3:15
	Ambulatory	100	1	8	8	3.5	62	2:50
The Inn at Edgewood	Wheelchair bound	100	5	2	10	3.5	62	2:55
	Bedridden	100	15	2	30	3.5	63	3:15
	Ambulatory	100	1	105	36	3.5	54	3:10
The Edgewood Centre	Wheelchair bound	100	5	28	10	3.5	62	2:55
	Bedridden	100	15	23	30	3.5	63	3:15
	Ambulatory	100	1	48	36	3.6	54	3:10
Wentworth Senior Living	Wheelchair bound	100	5	13	10	3.6	59	2:50
	Bedridden	100	15	10	30	3.6	55	3:05
	Ambulatory	100	1	22	15	1.5	22	2:20
Northeast Rehabilitation Hospital Network	Wheelchair bound	100	5	6	10	1.5	24	2:15
	Bedridden	100	15	5	30	1.5	28	2:40
	Ambulatory	100	1	44	36	7.6	72	3:30
Evolve at Rye	Wheelchair bound	100	5	11	10	7.6	93	3:25
	Bedridden	100	15	9	30	7.6	81	3:35
	Ambulatory	100	1	100	36	7.6	72	3:30
Webster at Rye	Wheelchair bound	100	5	26	10	7.6	93	3:25
	Bedridden	100	15	21	30	7.6	81	3:35
	Maximum ETE:							81
Average ETE:							72	2:50

Table 8-10. Medical Facility Evacuation Time Estimates – Heavy Snow

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Massachusetts Medical Facilities								
Coastal Connections Inc	Ambulatory	110	1	65	36	7.6	12	2:40
	Wheelchair bound	110	5	17	75	7.6	12	3:20
Amesbury Residence	Bedridden	110	15	14	30	7.6	12	2:35
	Ambulatory	110	1	8	8	5.8	9	2:10
Maplewood Center	Ambulatory	110	1	57	36	5.3	8	2:35
	Wheelchair bound	110	5	48	20	5.3	8	2:20
	Bedridden	110	15	4	30	5.3	8	2:30
Lahey Health Primary Care, Amesbury	Ambulatory	110	1	6	6	5.3	8	2:05
	Ambulatory	110	1	66	36	5.9	9	2:35
Amesbury Village, LLC	Wheelchair bound	110	5	26	20	5.9	9	2:20
	Bedridden	110	15	10	30	5.9	9	2:30
Hillside Rest Home Inc	Ambulatory	110	1	28	28	5.0	8	2:30
	Ambulatory	110	1	10	10	6.0	9	2:10
Elizabeth Calsey House	Wheelchair bound	110	5	2	10	6.0	9	2:10
	Bedridden	110	15	2	30	6.0	9	2:30
	Ambulatory	110	1	17	15	6.0	9	2:15
Elizabeth Calsey House 2	Wheelchair bound	110	5	4	20	6.0	9	2:20
	Bedridden	110	15	4	30	6.0	9	2:30
Church Street House Quaker Hill	Ambulatory	110	1	5	5	1.6	3	2:00
	Ambulatory	110	1	24	15	1.5	2	2:10
Byfield Elderly Housing	Ambulatory	110	1	18	15	1.5	2	2:10
	Wheelchair bound	110	5	4	20	1.5	2	2:15
Home for Aged Men (Griffin House)	Ambulatory	110	1	9	9	9.9	16	2:15
	Ambulatory	110	1	83	36	10.8	17	2:45
Anna Jaques Hospital	Wheelchair bound	110	5	22	20	10.8	17	2:30

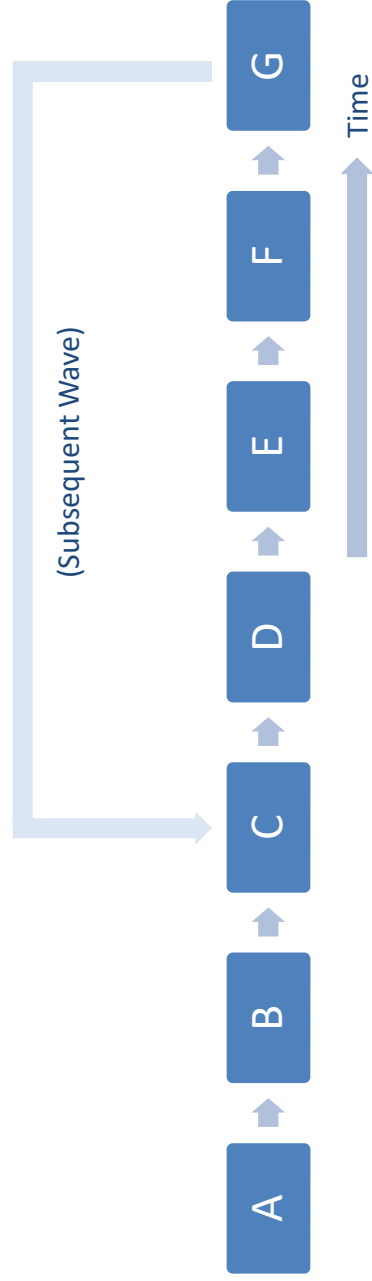
Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Newburyport Residence	Bedridden	110	15	18	30	10.8	17	2:40
	Ambulatory	110	1	8	8	10.0	16	2:15
Constellation Health Services	Ambulatory	110	1	75	36	10.0	16	2:45
	Wheelchair bound	110	5	20	20	10.0	16	2:30
	Bedridden	110	15	16	30	10.0	16	2:40
Country Center for Health & Rehabilitation	Ambulatory	110	1	19	15	10.0	16	2:25
	Wheelchair bound	110	5	88	20	10.0	16	2:30
	Bedridden	110	15	4	30	10.0	16	2:40
James Steam Mill Elderly Housing	Ambulatory	110	1	79	36	10.9	17	2:45
	Wheelchair bound	110	5	42	20	10.9	21	2:35
	Bedridden	110	15	5	30	10.9	19	2:40
Harborside Adult Health at St. Paul's Church	Ambulatory	110	1	31	31	11.4	18	2:40
	Wheelchair bound	110	5	4	20	11.4	18	2:30
	Ambulatory	110	1	48	36	9.5	15	2:45
Avita of Newburyport	Wheelchair bound	110	5	12	20	9.5	15	2:25
	Bedridden	110	15	10	30	9.5	15	2:35
	Ambulatory	110	1	77	36	9.5	15	2:45
Atria Merrimack Place	Wheelchair bound	110	5	8	20	9.5	15	2:25
	Ambulatory	110	1	80	36	5.7	9	2:35
	Wheelchair bound	110	5	43	20	5.7	9	2:20
Heritage House	Bedridden	110	15	5	30	5.7	9	2:30
	Ambulatory	110	1	8	8	11.7	18	2:20
	Wheelchair bound	110	5	52	20	11.7	18	2:30
Turning Point Inc.	Bedridden	110	15	4	30	11.7	18	2:40
	Ambulatory	110	1	51	36	6.0	9	2:35
	Ambulatory	110	1	83	36	6.4	10	2:40
Port Healthcare Center	Wheelchair bound	110	5	22	20	6.4	10	2:20
	Bedridden	110	15	18	30	6.4	10	2:30
	Ambulatory	110	1	88	36	5.5	9	2:35
Opportunity Works	Wheelchair bound	110	5	23	20	5.5	9	2:20

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Assisted Living Center of Salisbury	Bedridden	110	15	19	30	5.5	9	2:30
	Ambulatory	110	1	26	15	9.2	15	2:20
	Wheelchair bound	110	5	4	20	9.2	15	2:25
New Hampshire Medical Facilities								
Rockingham County Nursing Home	Ambulatory	110	1	136	36	2.1	17	2:45
	Wheelchair bound	110	5	36	10	2.1	11	2:15
	Bedridden	110	15	30	30	2.1	20	2:40
Langdon Place of Exeter	Ambulatory	110	1	77	36	10.2	89	3:55
	Wheelchair bound	110	5	20	10	10.2	111	3:55
	Bedridden	110	15	17	30	10.2	99	4:00
Exeter Rehab Center-Genesis HealthCare	Ambulatory	110	1	55	36	10.2	89	3:55
	Wheelchair bound	110	5	14	10	10.2	111	3:55
	Bedridden	110	15	12	30	10.2	99	4:00
Exeter Hospital	Ambulatory	110	1	64	36	7.6	62	3:30
	Bedridden	110	15	36	30	7.6	58	3:20
	Ambulatory	110	1	6	6	7.6	88	3:25
Exeter Healthcare	Wheelchair bound	110	5	12	10	7.6	88	3:30
	Bedridden	110	15	8	30	7.6	86	3:50
	Ambulatory	110	1	203	36	7.3	72	3:40
The Woods at Riverwoods	Wheelchair bound	110	5	53	10	7.3	68	3:10
	Bedridden	110	15	44	30	7.3	73	3:35
	Ambulatory	110	1	110	36	7.4	73	3:40
The Ridge at Riverwoods	Wheelchair bound	110	5	29	10	7.4	68	3:10
	Bedridden	110	15	24	30	7.4	74	3:35
	Ambulatory	110	1	118	36	7.4	73	3:40
The Boulders at Riverwoods	Wheelchair bound	110	5	31	10	7.4	68	3:10
	Bedridden	110	15	25	30	7.4	74	3:35
	Ambulatory	110	1	6	6	7.3	91	3:30
Fairweather Lodge Group Home	Wheelchair bound	110	5	1	5	7.3	92	3:30
	Bedridden	110	15	1	15	7.3	89	3:35
	Ambulatory	110	1	162	36	6.5	22	2:50

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Oceanside Skilled Nursing Home & Rehab - Genesis	Ambulatory	110	1	76	36	11.5	70	3:40
	Wheelchair bound	110	5	20	10	11.5	100	3:40
	Bedridden	110	15	16	30	11.5	83	3:45
Cornerstone at Hampton	Ambulatory	110	1	81	36	11.7	94	4:00
	Wheelchair bound	110	5	21	10	11.7	118	4:00
	Bedridden	110	15	18	30	11.7	98	4:00
Portsmouth Regional Hospital	Ambulatory	110	1	100	36	2.7	45	3:15
	Bedridden	110	15	100	30	2.7	53	3:15
	Ambulatory	110	1	69	36	3.5	53	3:20
Clipper Harbor of Portsmouth	Wheelchair bound	110	5	18	10	3.5	63	3:05
	Bedridden	110	15	15	30	3.5	54	3:15
	Ambulatory	110	1	8	8	3.5	63	3:05
The Inn at Edgewood	Wheelchair bound	110	5	2	10	3.5	63	3:05
	Bedridden	110	15	2	30	3.5	54	3:15
	Ambulatory	110	1	105	36	3.5	53	3:20
The Edgewood Centre	Wheelchair bound	110	5	28	10	3.5	63	3:05
	Bedridden	110	15	23	30	3.5	54	3:15
	Ambulatory	110	1	48	36	3.6	48	3:15
Wentworth Senior Living	Wheelchair bound	110	5	13	10	3.6	60	3:00
	Bedridden	110	15	10	30	3.6	54	3:15
	Ambulatory	110	1	22	15	1.5	25	2:30
Northeast Rehabilitation Hospital Network	Wheelchair bound	110	5	6	10	1.5	22	2:25
	Bedridden	110	15	5	30	1.5	26	2:50
	Ambulatory	110	1	44	36	7.6	63	3:30
Evolve at Rye	Wheelchair bound	110	5	11	10	7.6	85	3:25
	Bedridden	110	15	9	30	7.6	72	3:35
	Ambulatory	110	1	100	36	7.6	63	3:30
Webster at Rye	Wheelchair bound	110	5	26	10	7.6	85	3:25
	Bedridden	110	15	21	30	7.6	72	3:35
							Maximum ETE:	4:00
							Average ETE:	2:55

Table 8-11. Evacuation Time Estimates for Access and/or Functional Needs Population

Vehicle Type	People Requiring Vehicle	Vehicles deployed	Stops	Weather Conditions	Mobilization Time (min)	Loading Time at 1 st Stop (min)	Travel to Subsequent Stops (min)	Total Loading Time at Subsequent Stops (min)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Buses	895	75	12	Good	135	1	99	11	30	4:40
				Rain	145		110		35	5:05
				Snow	155		121		39	5:30
Half Buses	312	30	11	Good	135	1	90	10	31	4:30
				Rain	145		100		37	4:55
				Snow	155		110		39	5:15
Vans	695	80	9	Good	135	1	99	8	30	4:40
				Rain	145		110		36	5:05
				Snow	155		121		39	5:30
Wheelchair Vans	68	12	6	Good	135	5	45	25	34	4:05
				Rain	145		50		41	4:30
				Snow	155		55		45	4:45
Wheelchair Buses	884	221	4	Good	135	5	27	15	37	3:40
				Rain	145		30		42	4:00
				Snow	155		33		46	4:15
Ambulances	245	123	2	Good	135	15	10	15	38	3:35
				Rain	145		11		42	3:50
				Snow	155		12		47	4:05
									Maximum ETE:	5:30
									Average ETE:	4:35



Event

- A Advisory to Evacuate
- B Bus Dispatched from Depot
- C Bus Arrives at Facility/Pick-up Route
- D Bus Departs for Reception Centers/Host Schools
- E Bus Exits Region
- F Bus Arrives at Reception Centers/Host Schools
- G Bus Available for "Second Wave" Evacuation Service

Activity

- A→B Driver Mobilization
- B→C Travel to Facility or to Pick-up Route
- C→D Passengers Board the Bus
- D→E Bus Travels Towards Region Boundary
- E→F Bus Travels Towards Reception Centers/Host Schools Outside the EPZ
- F→G Passengers Leave Bus; Driver Takes a Break

Figure 8-1. Chronology of Transit Evacuation Operations

9 TRAFFIC MANAGEMENT STRATEGY

This section discusses the suggested traffic management strategy that is designed to expedite the movement of evacuating traffic. The resources required to implement this strategy include:

- Personnel with the capabilities of performing the planned control functions of traffic guides (preferably, not necessarily, law enforcement officers).
- The Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration (FHWA) of the U.S.D.O.T. provides guidance for Traffic Control Devices to assist these personnel in the performance of their tasks. All state and most county transportation agencies have access to the MUTCD, which is available on-line: <http://mutcd.fhwa.dot.gov> which provides access to the official PDF version.
- A plan that defines all locations, provides necessary details and is documented in a format that is readily understood by those assigned to perform traffic control.

The functions to be performed in the field are:

1. Facilitate evacuating traffic movements that safely expedite travel out of the EPZ.
2. Discourage traffic movements that move evacuating vehicles in a direction which takes them significantly closer to the power plant, or which interferes with the efficient flow of other evacuees.

We employ the terms "facilitate" and "discourage" rather than "enforce" and "prohibit" to indicate the need for flexibility in performing the traffic control function. There are always legitimate reasons for a driver to prefer a direction other than that indicated. For example:

- A driver may be traveling home from work or from another location to join other family members prior to evacuating.
- An evacuating driver may be travelling to pick up a relative or other evacuees.
- The driver may be an emergency worker en route to perform an important activity.

The implementation of a plan must also be flexible enough for the application of sound judgment by the traffic guide.

The traffic management plan is the outcome of the following process:

1. The detailed traffic control tactics discussed in the Massachusetts Emergency Management Agency Traffic Management Manual for Seabrook Station, dated July 2014, and the New Hampshire Homeland Security and Emergency Management Agency Traffic Management Manual for Seabrook Station, dated 2017, served as the basis of the traffic management plan, as per NUREG/CR-7002, Rev. 1. The ETE analysis treated all controlled intersections that are existing ACP or TCP locations in the state plan as being controlled by actuated signals. Appendix K identifies the number of intersections that were modeled as TCPs and ACPs.
2. Evacuation simulations were run using DYNEV II to predict traffic congestion during an evacuation (see Section 7.3 and Figures 7-3 through 7-8). These simulations help to identify the best routing and critical intersections that experience pronounced

congestion during evacuation. Any critical intersections that would benefit from traffic or access control which are not already identified in the existing county plans are examined. No additional TCPs or ACPs were identified as part of this study.

3. Prioritization of TCPs and ACPs. Application of traffic and access control at some TCPs and ACPs will have a more pronounced influence on expediting traffic movements than at other TCPs and ACPs. For example, TCPs controlling traffic originating from areas in close proximity to the power plant could have a more beneficial effect on minimizing potential exposure to radioactivity than those TCPs located far from the power plant. Key locations for manual traffic control (MTC) were analyzed and their impact to ETE was quantified, as per NUREG/CR-7002, Rev. 1. See Appendix G for more detail.

Appendix G documents the existing traffic management plan (TMP) and provides a list of potential priority TCPs and ACPs using the process enumerated above.

9.1 Assumptions

The ETE calculations documented in Sections 7 and 8 assume that the TMP is implemented during evacuation.

The ETE calculations reflect the assumption that all “external-external” trips are interdicted and diverted after 2 hours have elapsed from the ATE.

All transit vehicles and other responders entering the EPZ to support the evacuation are assumed to be unhindered by personnel manning TCPs and ACPs.

Section 2.5 discusses TCP and ACP operations.

9.2 Additional Considerations

The use of Intelligent Transportation Systems (ITS) technologies can reduce the manpower and equipment needs for MTC, while still facilitating the evacuation process. Dynamic Message Signs (DMS) can be placed within the EPZ to provide information to travelers regarding traffic conditions, route selection, and reception center information. DMS placed outside of the EPZ will warn motorists to avoid using routes that may conflict with the flow of evacuees away from the power plant. Highway Advisory Radio (HAR) can be used to broadcast information to evacuees during egress through their vehicle’s stereo systems. Automated Travel Information Systems (ATIS) can also be used to provide evacuees with information. Internet websites can provide traffic and evacuation route information before the evacuee begins their trip, while the on-board navigation systems (GPS units) and smartphones can be used to provide information during the evacuation trip.

These are only a few examples of how ITS technologies can benefit the evacuation process. Consideration should be given that ITS technologies be used to facilitate the evacuation process, and any additional signage placed should consider evacuation needs.

10 EVACUATION ROUTES AND RECEPTION CENTERS

10.1 Evacuation Routes

Evacuation routes are comprised of two distinct components:

- Routing from a Community being evacuated to the boundary of the Evacuation Region and thence out of the EPZ.
- Routing of transit-dependent evacuees from the EPZ boundary to reception centers.

Evacuees will select routes within the EPZ in such a way as to minimize their exposure to risk. This expectation is met by the DYNEV II model routing traffic away from the location of the plants to the extent practicable. The DTRAD model satisfies this behavior by routing traffic to balance traffic demand relative to the available highway capacity to the extent possible. See Appendices B through D for further discussion. The major evacuation routes for the EPZ are presented in Figure 10-1. These routes will be used by the general population evacuating in private vehicles, and by the transit-dependent population evacuating in buses, wheelchair transport vehicles, and ambulances. Transit-dependent evacuees will be routed to reception centers. The general population may evacuate to a reception center or some alternate destination (e.g., lodging facilities, relative's home, campgrounds) outside the EPZ.

The routing of transit-dependent evacuees from the EPZ boundary to the reception centers is designed to minimize the amount of travel outside the EPZ from the points where these routes cross the EPZ boundary. The 25 bus routes described in Table 10-1 and shown in Figure 10-2 through Figure 10-6 are based on the transit dependent bus routes detailed in the Public Information Brochures for both Massachusetts and New Hampshire. Transit dependent persons are instructed to walk to and congregate at one of the highlighted routes in Figure 10-2 through Figure 10-6 where a bus will pick them up and take them to the appropriate reception center for their Community. Seabrook Beach and Hampton Beach have pre-defined pick-up points. The routes shown for the Communities are designed to service those pick-up points. It is assumed that residents will arrive at these pre-designated pick-up locations, and that they can arrive at the stops within the 135-minute bus mobilization time (good weather) – see Section 8.

The specified bus routes for all the transit-dependent population are documented in Table 10-2 (refer to maps of the link-node analysis network in Appendix K for node locations). Representative routes were developed for all schools and medical facilities within each Community. This study does not consider the transport of evacuees from the reception center to congregate care centers if the counties make the decision to relocate evacuees.

10.2 Reception Centers and Host Schools

Figure 10-7 maps the general population reception centers and host schools for schools, preschools/childcare centers, and day camps relative to the EPZ. Table 10-3 lists the reception centers and host schools for each evacuating school, preschool/childcare center, and day camps in the EPZ. Children will be transported to these facilities where they will be subsequently retrieved by their respective families.

Table 10-1. Summary of Transit-Dependent Bus Routes

Route	UNITES Route #	No. of Buses	Length (mi.)
Amesbury	17	8	31.1
Brentwood	155	2	35.4
East Kingston	156	1	4.9
Exeter	157	7	8.4
Greenland	158	2	22.0
Hampton	159	7	41.0
Hampton Beach	160	5	8.1
Hampton Falls	161	1	22.3
Kensington	162	1	25.8
Kingston	163	3	46.6
Merrimac	150	3	17.2
New Castle	164	1	2.6
Newbury	152	3	22.8
Newburyport	153	8	20.8
Newfields	165	1	10.9
Newton	166	2	25.0
North Hampton	167	2	31.3
Portsmouth	168	10	42.2
Rye	169	3	35.5
Salisbury	151	4	26.2
Seabrook	170	4	21.0
Seabrook Beach	171	3	1.5
South Hampton	172	1	15.4
Stratham	173	4	34.5
West Newbury	154	2	21.4
Total:		88	

Table 10-2. Bus Route Descriptions

UNITES Bus Route #	Description	Nodes Traversed from Route Start to EPZ Boundary	
		<i>Transit Dependent Routes</i>	
152	Newbury TD Route	1269, 1301, 1302, 1303, 1304, 1305, 1306, 1307, 1308, 1309, 1310, 1261, 1364, 1365, 1366, 1367, 1368, 1369, 1370, 1371, 1372, 1373, 1374, 10, 9	
153	Newburyport TD Route	931, 927, 928, 930, 926, 922, 921, 924, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9	
154	West Newbury TD Route	1383, 1384, 1385, 1390, 1391, 1392, 1393, 1394, 1395, 1403, 1404, 1405, 1406, 1407	
155	Brentwood TD Route	785, 786, 787, 788, 789, 790, 791, 792, 793, 795, 1830, 830	
156	East Kingston TD Route	714, 748, 749, 750, 751, 752, 753, 754, 755, 765, 764, 827, 828, 829	
157	Exeter TD Route	604, 605, 609, 1610, 610, 611, 617, 636, 637, 638, 616, 618, 619, 621, 622, 627, 628, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64	
158	Greenland TD Route	454, 452, 427, 429, 379, 380, 428, 1822, 457, 458, 459, 477, 460, 1612, 484, 482, 485, 486	
159	Hampton TD Route 1st	858, 839, 838, 1658, 1659, 89, 840, 841, 842, 329, 330, 408, 414, 1607, 279, 602, 1819, 597, 596, 83, 82, 81, 80, 79, 78, 77, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64	
161	Hampton Falls TD Route	681, 687, 682, 654, 655, 653, 652, 651, 650, 649, 675, 648, 647, 646, 645, 644, 643, 642, 641, 640, 617, 611, 612, 613, 614, 473, 472, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64	
162	Kensington TD Route	701, 700, 699, 698, 697, 696, 721, 722, 723, 724, 720, 725, 726, 727, 620, 619, 621, 622, 623, 624, 625, 1603, 626, 494, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64	
163	Kingston TD Route	755, 754, 762, 763, 1029, 1030, 1031, 1032, 1033, 1034	
164	New Castle TD Route	242, 243, 244, 245, 240, 239, 238, 237, 236, 235, 234, 231, 230, 229, 228, 227, 214, 212, 222, 221, 137, 1563, 1560, 1764, 136, 133, 1567, 1575, 134, 135, 132, 289, 290, 291, 292	
165	Newfields TD Route	490, 512, 513, 514, 515, 516, 517, 518, 519	
166	Newton TD Route	1147, 1146, 1145, 1162, 1144, 1143, 1164, 1165, 1166, 1176, 1175	
167	North Hampton Td Route	407, 406, 409, 313, 274, 423, 421, 435, 436, 437, 454, 452, 427, 429, 379, 378, 377, 375, 1613, 287, 286, 288, 38, 130, 39, 127, 128, 60, 59, 1586, 58	
168	Portsmouth TD Route	377, 375, 1613, 287, 286, 1615, 285, 284, 283, 282, 254, 253, 250, 251, 252, 224, 223, 211, 218, 217, 201, 200, 202, 203, 135, 132, 289, 290, 291, 292	
169	Rye TD Route	315, 316, 317, 318, 319, 320, 321, 322, 323, 349, 350, 1621, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 327, 328, 388, 382, 383, 384, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58	

UNITES Bus Route #	Description	Nodes Traversed from Route Start to EPZ Boundary
170	Seabrook TD Route 1st	1650, 857, 856, 855, 851, 850, 1538, 847, 1715, 846, 845, 844, 843, 680, 1765, 702, 1767, 703, 704, 705, 1804, 706, 707, 701, 708, 709, 710, 711, 712, 713, 714, 748, 749, 750, 751, 752, 753, 754, 755, 765, 764, 827, 828, 829
171	Seabrook TD Route 2nd (Seabrook Beach)	839, 858, 1660, 1661, 857, 1650, 859, 861, 866, 867, 868, 870, 872, 873, 903, 1527, 1663, 904, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9
172	South Hampton TD Route	977, 1811, 1153, 1152, 1151, 1150, 1149, 1148, 761, 760, 759, 758, 753, 754, 755, 765, 764, 827, 828, 829
173	Stratham TD Route	614, 473, 472, 471, 443, 469, 1601, 470, 468, 467, 465, 463, 466, 482, 485, 486
151	Salisbury TD Route	857, 1650, 859, 861, 866, 867, 1782, 871, 1798, 854, 1797, 851, 853, 852, 1526, 25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9
160	Hampton TD Route 2nd (Hampton Beach)	858, 839, 838, 1658, 1659, 89, 88, 1604, 87, 86, 85, 84, 596, 83, 82, 81, 80, 79, 78, 77, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
17	Amesbury TD Route	956, 957, 1810, 958, 990, 959, 960, 961, 980, 981, 982, 983, 986, 987, 991, 992, 908, 1010, 1011, 1012, 1009, 1013, 1014, 1817, 1028, 1027, 1026, 1025, 1024, 1023, 1022, 102, 101, 100
150	Merrimac TD Route	1014, 1817, 1028, 1027, 1026, 1025, 1024, 1770, 1771, 1187, 1188, 1179, 1180
School, Preschool/Child Care Center, Day Camp, and Medical Facility Routes		
111	Leaps and Bounds Pre-School2, Sparhawk School	905, 906, 107, 106, 105, 104, 109, 103, 102, 101, 100
99	Amesbury Elementary School	958, 990, 959, 960, 961, 980, 981, 982, 983, 986, 987, 991, 992, 908, 909, 104, 109, 103, 102, 101, 100
105	Sparhawk High School, Amesbury Middle School	907, 908, 909, 104, 109, 103, 102, 101, 100
101	Amesbury Village LLC, Amesbury High School, Innovation High School	992, 908, 909, 104, 109, 103, 102, 101, 100
94	Helen R. Donaghue School	1188, 1179, 1180
139	Newbury Elementary School	1358, 1359, 1260, 1261, 1262, 1263
148	The Governor's Academy	1262, 1263, 1352
147	Triton Regional (both MS and HS)	1371, 1372, 1373, 1374, 10, 9
119	Bresnahan Elementary School	926, 922, 921, 924, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9
124	Newburyport High School, Clipper Girls Basketball Camp	931, 927, 928, 930, 926, 922, 921, 924, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9
134	Immaculate Conception	931, 927, 928, 930, 926, 922, 921, 924, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9

UNITES Bus Route #		Nodes Traversed from Route Start to EPZ Boundary	
UNITES Bus Route #	Description		
126	Rupert A. Nock Middle School, Molin Upper Elementary School	932, 950, 947, 948, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9	
127	Turning Point Inc, River Valley Charter	950, 947, 948, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9	
113	Salisbury Elementary School	871, 1782, 867, 868, 870, 872, 873, 903, 1527, 1663, 904, 905, 906, 107, 106, 105, 104, 109, 103, 102, 101, 100	
140	Children's Castle, Dr John C .Page School	1391, 1392, 1393, 1394, 1395, 1403, 1404, 1405, 1406, 1407	
144	Pentucket Regional (both High School and Middle School)	1406, 1407, 1408	
5	Swasey Elementary	792, 793, 795, 1830, 830	
19	Brentwood Christian Academy	793, 795, 1830, 830	
86	East Kingston Elementary School	714, 748, 749, 750, 751, 752, 753, 754, 755, 765, 764, 827, 828, 829	
13	Great Bay Charter School, Seacoast School of Technology	728, 729, 730, 731, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64	
16	Phillips Exeter Academy	622, 627, 628, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64	
15	Main Street School	627, 628, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64	
12	Lincoln Street Elementary School, Exeter Developmental Pre-School	728, 729, 730, 731, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64	
1	Exeter High School	499, 500, 501, 505, 65, 64	
41	Greenland Central School	429, 379, 378, 376, 374, 375, 1613, 287, 286, 288, 38, 130, 39, 127, 128, 60, 59, 1586, 58	
76	Winnacunnet High School	660, 280, 1547, 833, 279, 602, 1819, 597, 596, 83, 606, 590, 608, 593, 592, 591, 594, 35, 36, 1651, 37, 38, 130, 39, 127, 128, 60, 59, 1586, 58	
75	Sacred Heart School	280, 1547, 833, 279, 602, 1819, 597, 596, 83, 606, 590, 608, 593, 592, 591, 594, 35, 36, 1651, 37, 38, 130, 39, 127, 128, 60, 59, 1586, 58	
78	Hampton Academy	834, 833, 279, 602, 1819, 597, 596, 83, 606, 590, 608, 593, 592, 591, 594, 35, 36, 1651, 37, 38, 130, 39, 127, 128, 60, 59, 1586, 58	
79	Marston School	1607, 279, 602, 1819, 597, 596, 83, 606, 590, 608, 593, 592, 591, 594, 35, 36, 1651, 37, 38, 130, 39, 127, 128, 60, 59, 1586, 58	
82	Lincoln Akerman School	653, 654, 655, 657, 658, 662, 659, 663, 86, 85, 84, 596, 83, 606, 590, 608, 593, 592, 591, 594, 35, 36, 1651, 37, 38, 130, 39, 127, 128, 60, 59, 1586, 58	
28	Heronfield Academy	643, 642, 641, 640, 617, 611, 612, 613, 614, 473, 472, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64	

UNITES Bus Route #		Nodes Traversed from Route Start to EPZ Boundary	
UNITES Bus Route #	Description		
73	Kensington Elementary School		721, 722, 723, 724, 720, 725, 726, 727, 620, 619, 621, 622, 627, 628, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64
84	Seacoast Charter School, Daniel J. Bakie Elementary School		824, 825, 755, 765, 764, 827, 828, 829
91	Sanborn Regional High School		822, 814, 826
63	Maude H. Trefethen School, Little Harbour School		259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
30	Newfields Elementary School		490, 491, 492, 493, 494, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
2	Seacoast Learning, Memorial Elementary School		1140, 1032, 1131, 1132, 1133, 1134
45	North Hampton Elementary School, Squamscott River Academy		313, 274, 1688, 273, 272, 403, 271, 270, 1825, 269, 268, 267, 1689, 266, 265, 264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
66	Saint Patrick Academy		386, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
51	Place for Friends, Dondero School & Peak Program		264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
60	Robert J. Lister Academy		38, 130, 39, 127, 128, 60, 59, 1586, 58
59	Portsmouth High School & Tech Center, Edgewood Early Learning Center		259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
88	Great Bay Community College, Great Bay Kids PEASE Center		310, 306, 304, 303, 302, 1588, 58
68	New Franklin School & Peak Program, Kathleen Tostenon		205, 204, 1577, 118, 125, 119, 129, 60, 59, 1586, 58
65	Portsmouth Middle School		211, 218, 217, 201, 117, 118, 125, 119, 129, 60, 59, 1586, 58
47	Learning Skills Academy		270, 1825, 269, 268, 267, 1689, 266, 265, 264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
49	Rye Junior High School		321, 268, 267, 1689, 266, 265, 264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
54	Rye Elementary School		324, 325, 326, 327, 328, 388, 382, 383, 384, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
89	Seabrook Elementary School & Middle School		1772, 1541, 843, 680, 1765, 1766, 31, 32, 33, 34, 591, 592, 608, 590, 606, 82, 81, 80, 79, 78, 77, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64

UNITES Bus Route #		Nodes Traversed from Route Start to EPZ Boundary	
UNITES Bus Route #	Description		
87	Barnard School, Seventh Day Adventist School	1153, 1152, 1151, 1150, 1149, 1148, 761, 760, 759, 758, 753, 754, 755, 765, 764, 827, 828, 829	
26	Cooperative Middle School	444, 443, 471, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64	
38	The Cornerstone School	481, 456, 455, 451, 476, 478, 461, 462, 463, 483, 467, 468, 470, 1601, 469, 443, 471, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64	
33	Cornerstone Christian Academy	461, 462, 463, 483, 467, 468, 470, 1601, 469, 443, 471, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64	
37	Stratham Memorial School	457, 458, 459, 477, 460, 461, 462, 463, 483, 467, 468, 470, 1601, 469, 443, 471, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64	
98	Amesbury Country Day School	957, 1810, 958, 990, 959, 960, 961, 980, 981, 982, 983, 986, 987, 991, 992, 908, 909, 104, 109, 103, 102, 101, 100	
109	Leaps and Bounds Pre-School1	908, 909, 104, 109, 103, 102, 101, 100	
187	Little Hands Learning Center	906, 907, 908, 909, 104, 109, 103, 102, 101, 100	
104	James Place, Amesbury Residence	987, 991, 992, 908, 909, 104, 109, 103, 102, 101, 100	
106	Windmill Country Day School	907, 908, 909, 104, 109, 103, 102, 101, 100	
102	Little Sprouts Day Care	991, 992, 908, 909, 104, 109, 103, 102, 101, 100	
188	Amesbury Montessori	991, 992, 908, 909, 104, 109, 103, 102, 101, 100	
189	Small Wonders Preschool	1024, 1023, 1022, 102, 101, 100	
190	Our Secret Garden Nursery and Preschool, Harmony Natural Learning Center	941, 942, 943, 954, 946, 953, 948, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9	
115	Community Action Inc	923, 922, 921, 924, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9	
191	School's Out at Bresnahan	926, 922, 921, 924, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9	
133	YWCA Greater Newburyport, YWCA School's Out Program, Newburyport Montessori School	931, 927, 928, 930, 926, 922, 921, 924, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9	
122	Newburyport Kinder Care	925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9	
128	Bright Horizons at Newburyport, Heritage House	947, 948, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9	
125	Mrs. Murray Nursery, Port Healthcare Center	932, 933, 1232, 1233, 1234, 1235, 1236, 1237, 1238, 1239, 1240, 1241, 1242, 1243, 1244, 1245, 1246, 12, 11, 10, 9	
52	Kindericare Learning Center	1555, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58	

UNITES Bus Route #	Description	Nodes Traversed from Route Start to EPZ Boundary
131	Knoll Edge Preschool	946, 953, 948, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9
192	Milestones Childcare	873, 903, 1527, 1663, 904, 905, 906, 107, 106, 105, 104, 109, 103, 102, 101, 100
141	Learning Tree Preschool	1393, 1394, 1395, 1403, 1404, 1405, 1406, 1407
142	Koinonia Preschool	1403, 1404, 1405, 1406, 1407
143	Pathways for Learning	1404, 1405, 1406, 1407
90	Donna Clark's Family Day Care	794, 831, 505, 65, 64
4	A Place to Grow	795, 1830, 830, 544
97	KidLogic Early Learning Center	760, 759, 758, 753, 754, 755, 765, 796, 797, 793, 795, 1830
25	Appleseeds Day School	1610, 610, 611, 612, 613, 614, 473, 472, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
11	Exeter Day School	638, 616, 618, 619, 621, 622, 623, 624, 625, 1603, 626, 494, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
20	Little Munchkins Learning Center	639, 614, 473, 472, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
117	Harris Family Children's Center	621, 622, 623, 624, 625, 1603, 626, 494, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
14	Great Bay Kids Company	627, 628, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64
8	Building Block Commons	730, 731, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64
10	De Colores Children's Center, Great Bay Kids Company	632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64
137	Camp Gundalow	380, 378, 376, 374, 375, 1613, 287, 286, 288, 38, 130, 39, 127, 128, 60, 59, 1586, 58
40	Greenland Peak Program	427, 429, 379, 378, 376, 374, 375, 1613, 287, 286, 288, 38, 130, 39, 127, 128, 60, 59, 1586, 58
77	Fun After School & Summer Program, MPA at Hampton, Hampton Child & Family Program	834, 833, 279, 602, 1819, 597, 596, 83, 606, 590, 608, 593, 592, 591, 594, 35, 36, 1651, 37, 38, 130, 39, 127, 128, 60, 59, 1586, 58
80	Robin's Childs Place, Hampton Falls, Seacoast Head Start	655, 657, 658, 662, 659, 663, 86, 85, 84, 596, 83, 606, 590, 608, 593, 592, 591, 594, 35, 36, 1651, 37, 38, 130, 39, 127, 128, 60, 59, 1586, 58
29	Nurture & Nature Children Center	490, 491, 492, 493, 494, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
92	Newton Learning Center	1143, 1164, 1165, 1166, 1176, 1175
44	Imprint's Day School	271, 270, 1825, 269, 268, 267, 1689, 266, 265, 264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
50	Krempels Center, Portsmouth Head Start, Seacoast Community School	264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
53	Little Blessing Day Care	1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
57	Children's Garden, YMCA of the Seacoast	386, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58

UNITES Bus Route #	Description	Nodes Traversed from Route Start to EPZ Boundary
58	Chase Home for Children	386, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
70	Discovery Child Enrichment Center	310, 306, 304, 303, 302, 1588
22	Early Learning Center Temple Israel, Treehouse School of Portsmouth	212, 222, 221, 137, 1563, 1560, 1559, 117, 118, 125, 119, 129, 60, 59, 1586, 58
149	Seacoast Community School at Meadows	131, 59, 1586, 58
175	Rye County Day School	270, 1825, 269, 268, 267, 1689, 266, 265, 264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
184	Ms. Beth's Family Daycare	846, 845, 844, 843, 680, 1765, 1766, 31, 32, 33, 34, 591, 592, 608, 590, 606, 82, 81, 80, 79, 78, 77, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
185	Seabrook Head Start	681, 687, 682, 654, 655, 657, 658, 662, 659, 663, 86, 85, 84, 596, 83, 82, 81, 80, 79, 78, 77, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
23	Bright Horizons at Timberland	432, 80, 79, 78, 77, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
186	Little Sprouts Childcare & Preschool	473, 472, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
35	Acorn School	451, 476, 478, 461, 462, 463, 483, 467, 468, 470, 1601, 469, 443, 471, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
32	Stratham Circle Learning Center	467, 468, 470, 1601, 469, 443, 471, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
36	Richie McFarland Children's Center	459, 477, 460, 461, 462, 463, 483, 467, 468, 470, 1601, 469, 443, 471, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
202	US Sports Institute	993, 992, 908, 909, 104, 109, 103, 102, 101, 100
203	Camp Baurcrest	1014, 1817, 1028, 1027, 1026, 1025, 1024, 1023, 1022, 102, 101, 100
204	Coastal Discoveries Marine	881, 882, 883, 884, 885, 940, 941, 942, 943, 954, 946, 953, 948, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9
205	Governor's Academy	1262, 1517, 1518, 1513, 1515, 1516, 1484
193	Mass Audubon Joppa Flats Education Center	885, 940, 941, 942, 943, 954, 946, 953, 948, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9
194	Metro Rock Climbing Camps	953, 948, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9
195	Koinonia Day Camp	1404, 1405, 1406, 1407, 1408
196	Action Kids at Brentwood Commons	755, 765, 796, 797, 793, 795, 1830
197	YMCA Tricklin' Falls Day Camp	761, 760, 759, 758, 753, 754, 755, 765, 796, 797, 793, 795, 1830
198	Long Tree Scout Reservation	1031, 1032, 1131, 1132, 1133, 1134
199	YMCA Camp Lincoln Kingston	824, 825, 755, 765, 796, 797, 793, 795, 1830

UNITES Bus Route #	Description	Nodes Traversed from Route Start to EPZ Boundary
200	Camp Tasker	1140, 1032, 1131, 1132, 1133, 1134
201	Seawood Girl Scout Camp	389, 385, 386, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
110	Coastal Connections Inc	107, 106, 105, 104, 109, 103, 102, 101, 100
107	Maplewood Center, Lahey Health	907, 908, 909, 104, 109, 103, 102, 101, 100
108	Hillside Rest Home Inc	992, 908, 909, 104, 109, 103, 102, 101, 100
100	Cashman School, Elizabeth Calsey House 1&2	993, 992, 908, 909, 104, 109, 103, 102, 101, 100
95	Church Street House, Dr. FN Sweetsir School	1024, 1023, 1022, 102, 101, 100
145	Quaker Hill, Byfield Elderly Housing	1381, 1380, 1375, 1374, 10, 9
120	Home for Aged Men (Griffin House)	922, 921, 924, 925, 1528, 16, 17, 18, 19, 20, 21, 1664, 1663, 904, 905, 906, 107, 106, 105, 104, 109, 103, 102, 101, 100
123	Anna Jaques Hospital	927, 928, 930, 926, 922, 921, 924, 925, 1528, 16, 17, 18, 19, 20, 21, 1664, 1663, 904, 905, 906, 107, 106, 105, 104, 109, 103, 102, 101, 100
206	Newburyport Residents, Constellation Health Services, Country Center for Health & Rehabilitation	1789, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9
121	James Steam Mill Elderly Housing	889, 890, 891, 892, 878, 879, 880, 936, 946, 953, 948, 1249, 1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9
132	Harborside Adult Health at St. Paul's	931, 927, 928, 930, 926, 922, 921, 924, 925, 1528, 16, 17, 18, 19, 20, 21, 1664, 1663, 904, 905, 906, 107, 106, 105, 104, 109, 103, 102, 101, 100
207	Avita of Newburyport, Atria Merrimack Place	1789, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9
136	Brigham Health	931, 927, 928, 930, 926, 922, 921, 924, 925, 1528, 1529, 15, 14, 13, 12, 11, 10, 9
130	Opportunity Works	1250, 1251, 1252, 1253, 1254, 1255, 1256, 1257, 1248, 1246, 12, 11, 10, 9
114	Assisted Living Center of Salisbury	866, 867, 868, 870, 872, 873, 903, 1527, 1663, 904, 905, 906, 107, 106, 105, 104, 109, 103, 102, 101, 100
3	Rockingham County Nursing Home	794, 831, 505, 65, 64
24	Langdon Place of Exeter, Exeter Rehab Center-Genesis Health	1610, 610, 611, 612, 613, 614, 473, 472, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
18	Exeter Hospital	620, 619, 621, 622, 627, 628, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64
21	Exeter Healthcare	1599, 1598, 639, 614, 473, 472, 635, 1769, 76, 75, 74, 73, 72, 71, 70, 69, 68, 67, 66, 65, 64
9	The Woods at Riverwoods	730, 731, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64

UNITES Bus Route #	Description	Nodes Traversed from Route Start to EPZ Boundary
6	The Ridge at Riverwoods	730, 731, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64
7	The Boulders at Riverwoods	730, 731, 629, 630, 631, 632, 633, 634, 495, 70, 69, 68, 67, 66, 65, 64
208	Fairweather Lodge Group Home	270, 1825, 269, 268, 267, 1689, 266, 265, 264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
209	Partridge House	1549, 279, 602, 1819, 597, 596, 83, 606, 590, 608, 593, 592, 591, 594, 35, 36, 1651, 37, 38, 130, 39, 127, 128, 60, 59, 1586, 58
46	Oceanside Center	278, 277, 276, 275, 274, 1688, 273, 272, 403, 271, 270, 1825, 269, 268, 267, 1689, 266, 265, 264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
210	Cornerstone at Hampton	643, 642, 641, 640, 617, 611, 612, 613, 614, 473, 472, 471, 443, 469, 1601, 470, 468, 467, 465, 463, 466, 482, 485, 486
61	Portsmouth Regional Hospital	1579, 1580, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
62	Clipper Harbor of Portsmouth, The Inn Edgewood, Edgewood Center	259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58
64	Wentworth Senior Living	228, 227, 214, 212, 213, 211, 218, 217, 201, 117, 118, 125, 119, 129, 60, 59, 1586, 58
71	Northeast Rehabilitation Hospital	311, 306, 304, 303, 302, 1588
48	Webster at Rye, Evolve at Rye	319, 320, 321, 268, 267, 1689, 266, 265, 264, 1618, 263, 262, 1554, 261, 260, 259, 258, 257, 256, 121, 125, 119, 129, 60, 59, 1586, 58

Table 10-3. Host Schools/Reception Centers for Schools, Preschools/Childcare Centers, and Day Camps

Facility Name	Host School/Reception Center
Massachusetts	
Sparhawk School - Lower School	Mathuen High School
Amesbury Country Day School	
Leaps & Bounds Preschool	
Amesbury Elementary School	
Little Hands Learning Center	
Sparhawk School - Upper School	
James Place the Next Generation	
Amesbury Innovation High School	
Amesbury Middle School	
Windmill Country Day School	
Little Sprouts Daycare	
Amesbury Montessori Preschool and Kindergarten	
Amesbury High School	
Cashman School	
US Sports Institute	
Leaps and Bounds Pre-School	
James Place	
Camp Bauercrest	
Dr. FN Sweetsir School	John W. Wynn Middle School
Small Wonders Preschool Program	
Helen R. Donaghue School	
Our Secret Garden Nursery and Preschool	Wakefield High School
Coastal Discoveries Marine	
Newbury Elementary School	
Harmony Natural Learning Center	
The Governor's Academy	
Governor's Academy	
Triton Regional Middle School and High School	
Community Action, Inc. Newburyport Head Start	Minuteman High School
Bresnahan Elementary School	
School's Out @ Bresnahan School	
YWCA Greater Newburyport	
Clipper Girls Basketball Camp	
YWCA - School's Out Program	
Newburyport Montessori School	
Newburyport High School	
Immaculate Conception School	
Newburyport KinderCare	
E.G. Molin Upper Elementary School	
Rupert A. Nock Middle School	
Bright Horizons at Newburyport	
River Valley Charter School	
Mrs Murray's Nursery School	
Kindercare Learning Center	
Mass Audubon Joppa Flats Education Center	
Knoll Edge Preschool	
Metro Rock Climbing Camps	

Facility Name	Host School/Reception Center
Salisbury Elementary School	Marsh Grammar School
Milestones Childcare and Preschool	
Children's Castle	Tewksbury High School
Dr. John C. Page School	
Learning Tree Preschool	
Koinonia Day Camp	
Koinonia Preschool Day Care	
Pathways For Learning	
Pentucket Regional High School	
Pentucket Regional Middle School	
New Hampshire	
Camp Gundalow	Dover Middle School
Fun After School & Summer Program	
Greenland Central School	
Greenland Peak Program	
Hampton Academy	
Hampton Child & Family Program-DBA Village Preschool	
Heronfield Academy	
Imprint's Day School	
Learning Skills Academy	
Lincoln Akerman School	
Lincoln Akerman School After School Program	
Marston School	
Maude H. Trefethen School	
MPA at Hampton	
North Hampton Elementary School	
North Hampton Elementary School Before and After School Program	
Robin's Childs Place	
Rye Country Day School	
Rye Elementary School	
Rye Junior High School	
Sacred Heart School	
Seacoast Head Start	
Squamscott River Academy	
Winnacunnet Regional High School	

Facility Name	Host School/Reception Center
A Place to Grow	
Acorn School	
Action Kids at Brentwood Commons	
Appleseeds Day School	
Barnard School	
Brentwood Christian Academy	
Bright Horizons at Timberland	
Building Block Commons	
Camp Tasker (Boys & Girls Club of Haverhill)	
Cooperative Middle School	
Cornerstone Christian Academy	
Daniel J. Bakie Elementary School	
Daniel J. Bakie Elementary School Before & After Childcare Program	
De Colores Children's Center	
Donna Clarke's Family Day Care	
East Kingston Elementary School	
East Kingston Elementary School-Before & After School Program	
Exeter Day School	
Exeter Developmental Pre-School	
Exeter High School	
Great Bay Charter School	
Great Bay Kids Company	
Great Bay Kids' Company	
Harris Family Children's Center	
Kensington Elementary School	
Kensington Elementary School After School Program	Memorial High School
KidLogic Early Learning Center	
Kingston Children's Center	
Lincoln Street Elementary School	
Little Munchkins Learning Center	
Little Sprouts Childcare & Preschool	
Long Tree Scout Reservation	
Main Street School	
Memorial Elementary School	
Memorial Elementary School - Before & After Program	
Miss Beth's Family Day Care	
Montessori School for the Arts & Sciences	
Newfields Action Club at Newfields Elementary School	
Newfields Elementary School	
Newton Learning Center	
Nurture & Nature Children's Center	
Phillips Exeter Academy	
Richie McFarland Children's Center	
Sanborn Regional High School	
Seabrook Elementary School	
Seabrook Elementary School After School Program	
Seabrook Head Start	
Seabrook Middle School	
Seabrook Middle School Adventure Zone After School Program	

Facility Name	Host School/Reception Center	
Seacoast Charter School		
Seacoast Learning Collaborative		
Seacoast School of Technology		
Seventh Day Adventist School		
Stratham Circle Learning Center		
Stratham Memorial School		
Stratham Memorial School Before & After School Program		
Swasey Central School		
Swasey Central School Before & After School Program		
The Cornerstone School		
YMCA Camp Lincoln Kingston		
YMCA Tricklin' Falls Day Camp		
Discovery Child Enrichment Center		Rochester Middle School
Dondero Peak Program		
Dondero School		
Early Learning Center at Temple Israel Preschool		
Edgewood Early Learning Center		
Great Bay Community College		
Great Bay Kids-PEASE Center		
Kathleen Tostenson		
Kindercare Learning Center		
Krepfels Center-Brain Injury Program		
Little Blessings Day Care		
Little Harbour Peak Program		
Little Harbour School		
New Franklin School		
New Franklin School PEAK Program		
Place for Friends and Fun		
Portsmouth Career Technical Center		
Portsmouth Head Start		
Portsmouth High School		
Portsmouth Middle School		
Robert J. Lister Academy		
Saint Patrick Academy		
Seacoast Community School		
Seacoast Community School at the Meadows		
Seawood Girl Scout Camp		
The Chase Home for Children		
The Children's Garden		
The Treehouse School of Portsmouth		
YMCA of the Seacoast		

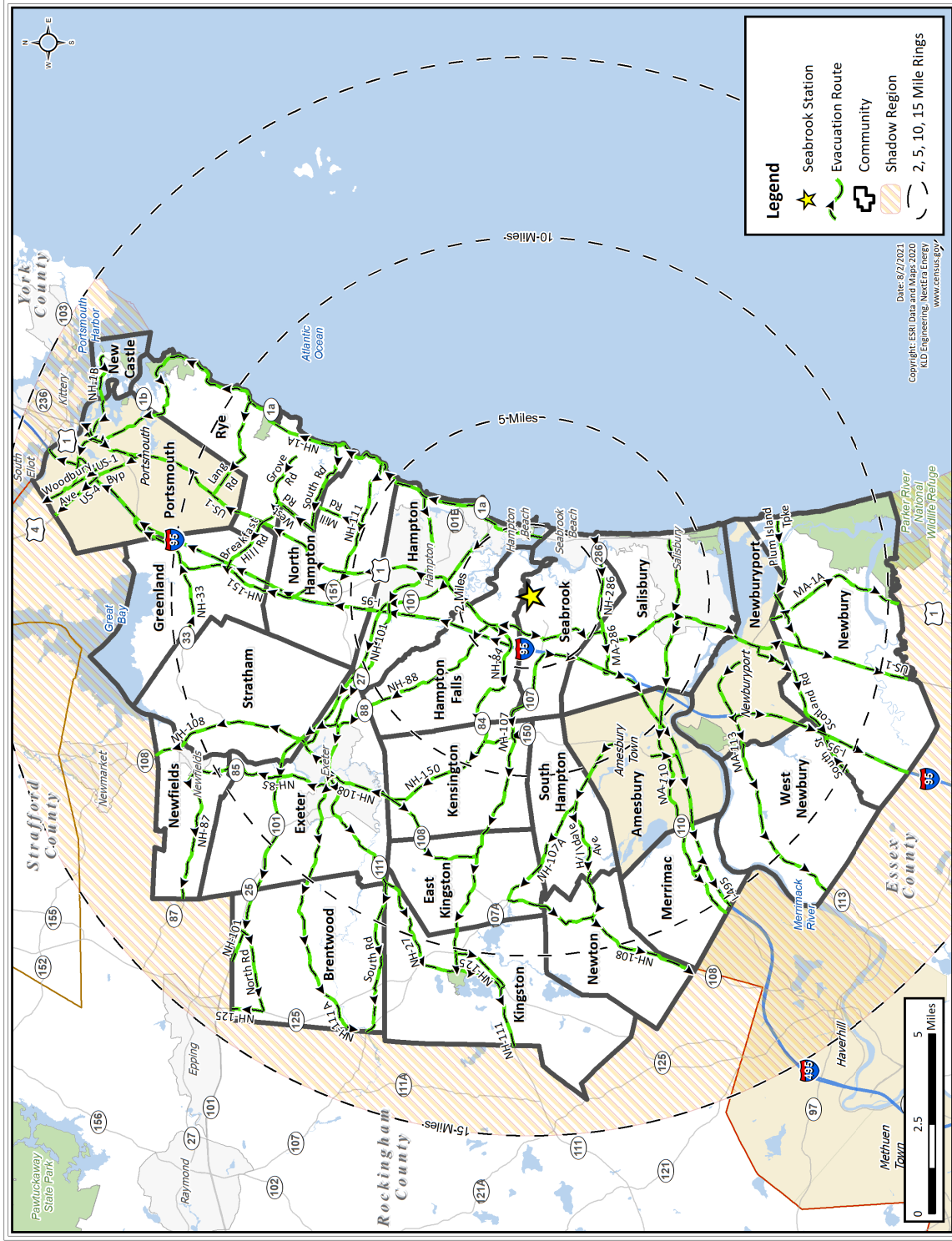


Figure 10-1. Evacuation Routes

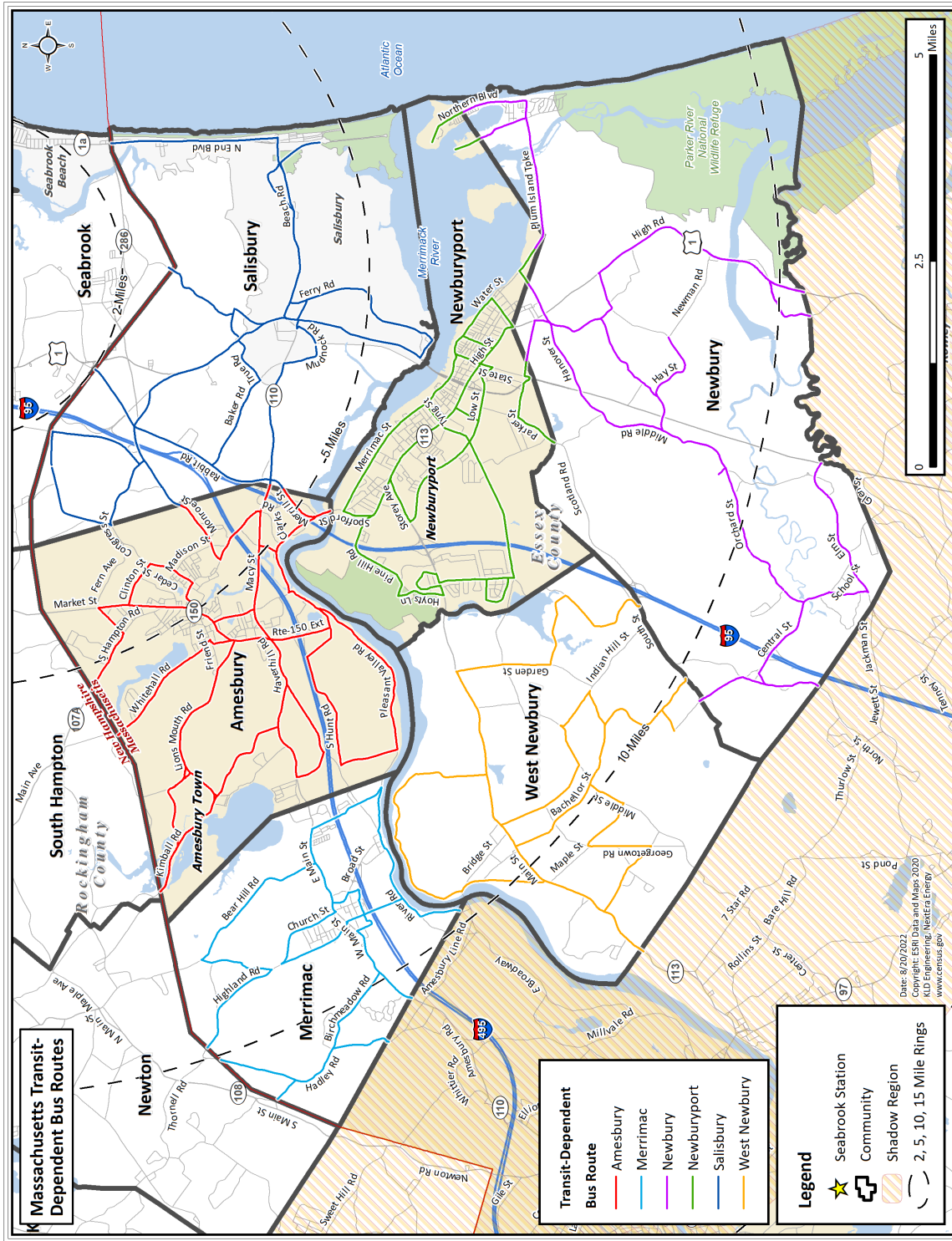


Figure 10-2. Massachusetts Transit-Dependent Bus Routes

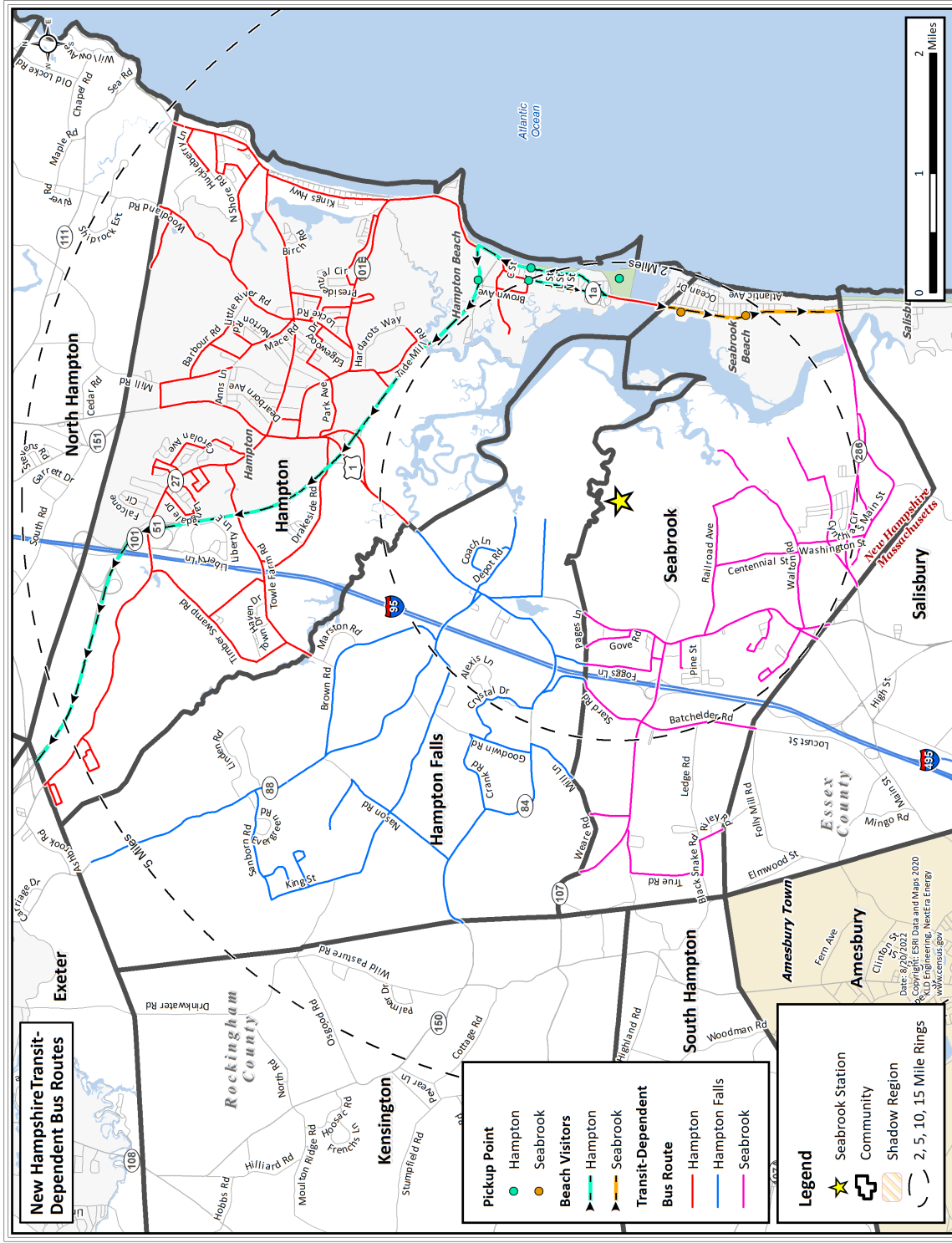


Figure 10-3. New Hampshire Transit-Dependent Bus Routes (Hampton, Hampton Falls, and Seabrook)

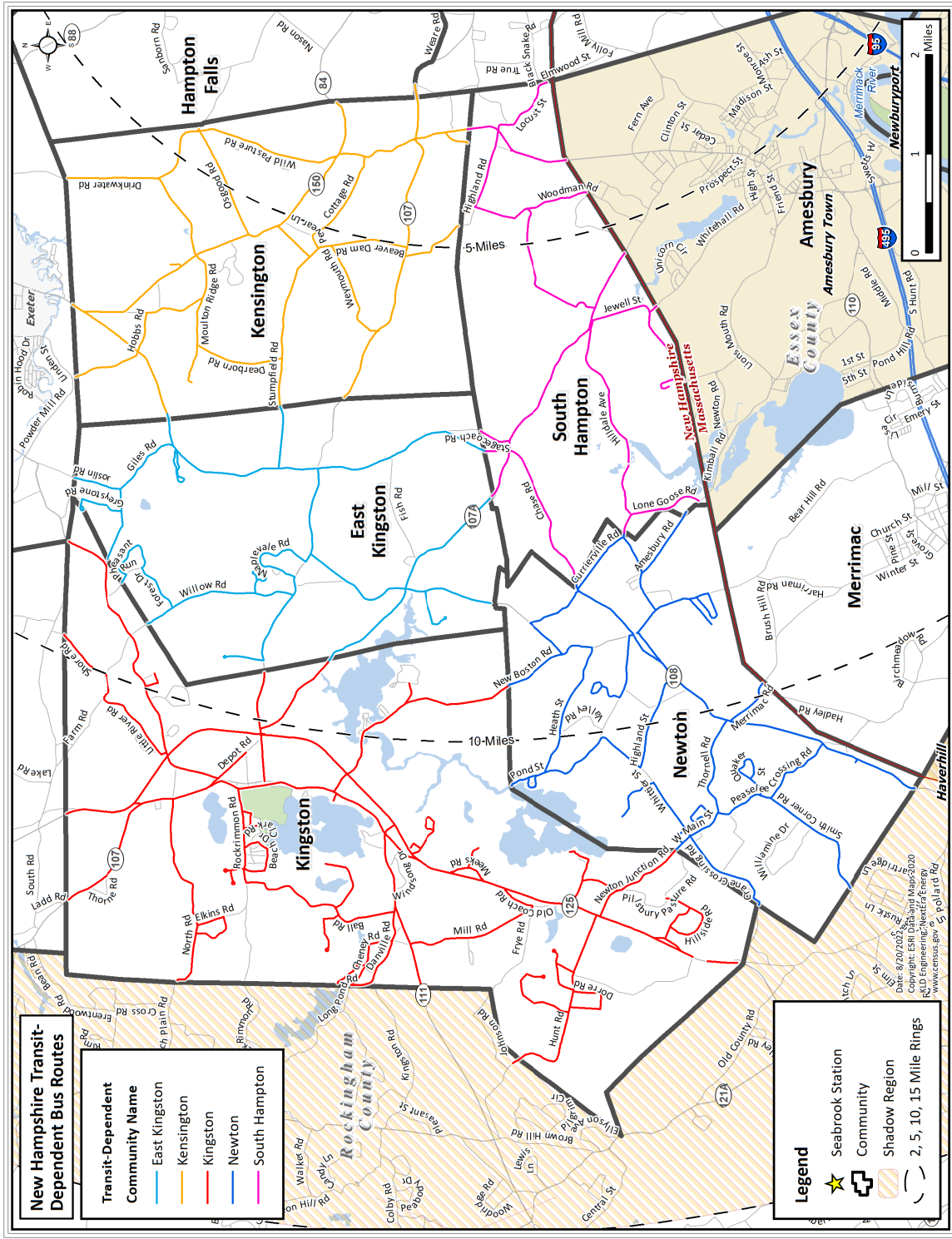


Figure 10-4. New Hampshire Transit-Dependent Bus Routes (East Kingston, Kensington, Newton, and South Hampton)

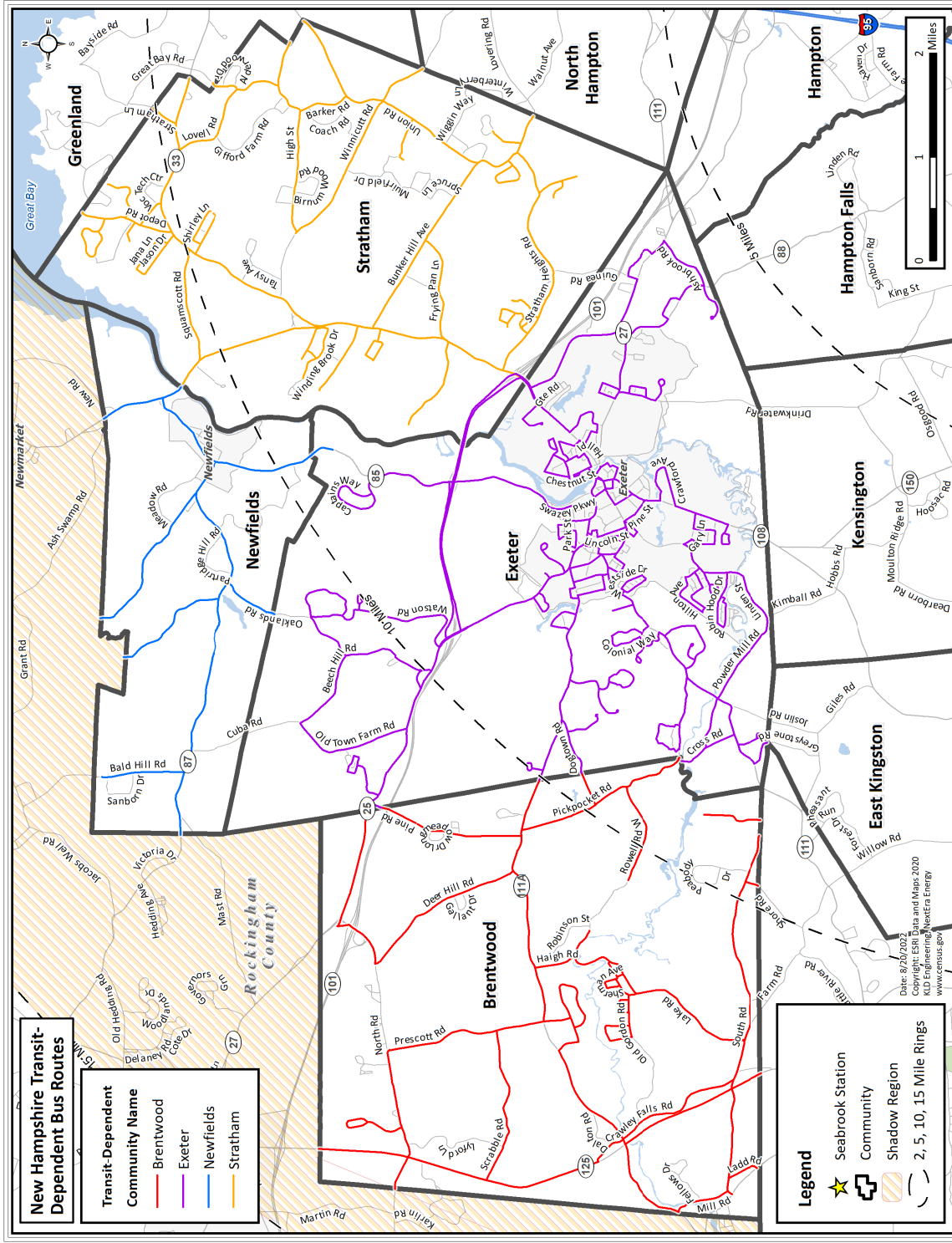


Figure 10-5. New Hampshire Transit-Dependent Bus Routes (Brentwood, Exeter, Newfields, and Stratham)

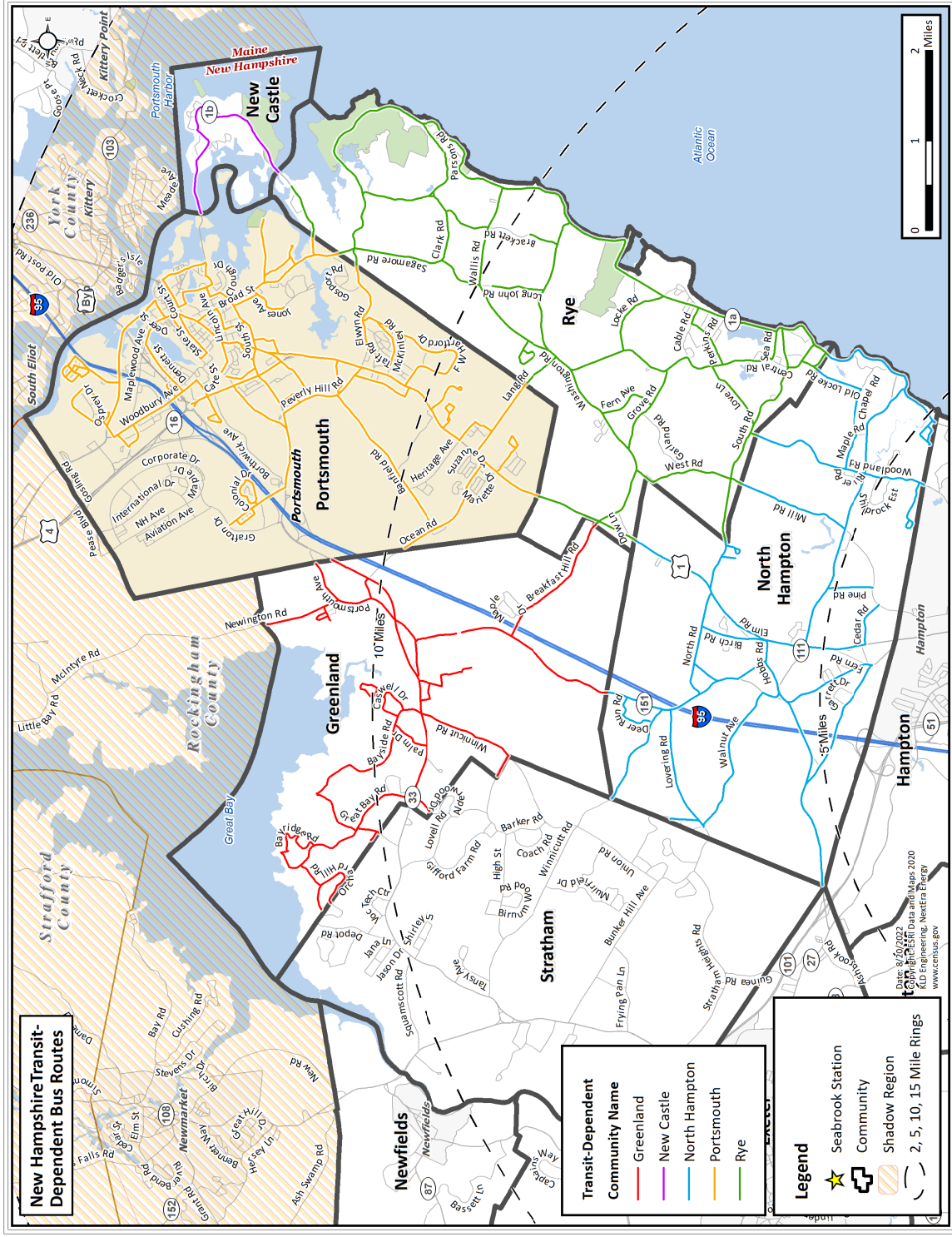


Figure 10-6. New Hampshire Transit-Dependent Bus Routes (Greenland, New Castle, North Hampton, Portsmouth, and Rye)

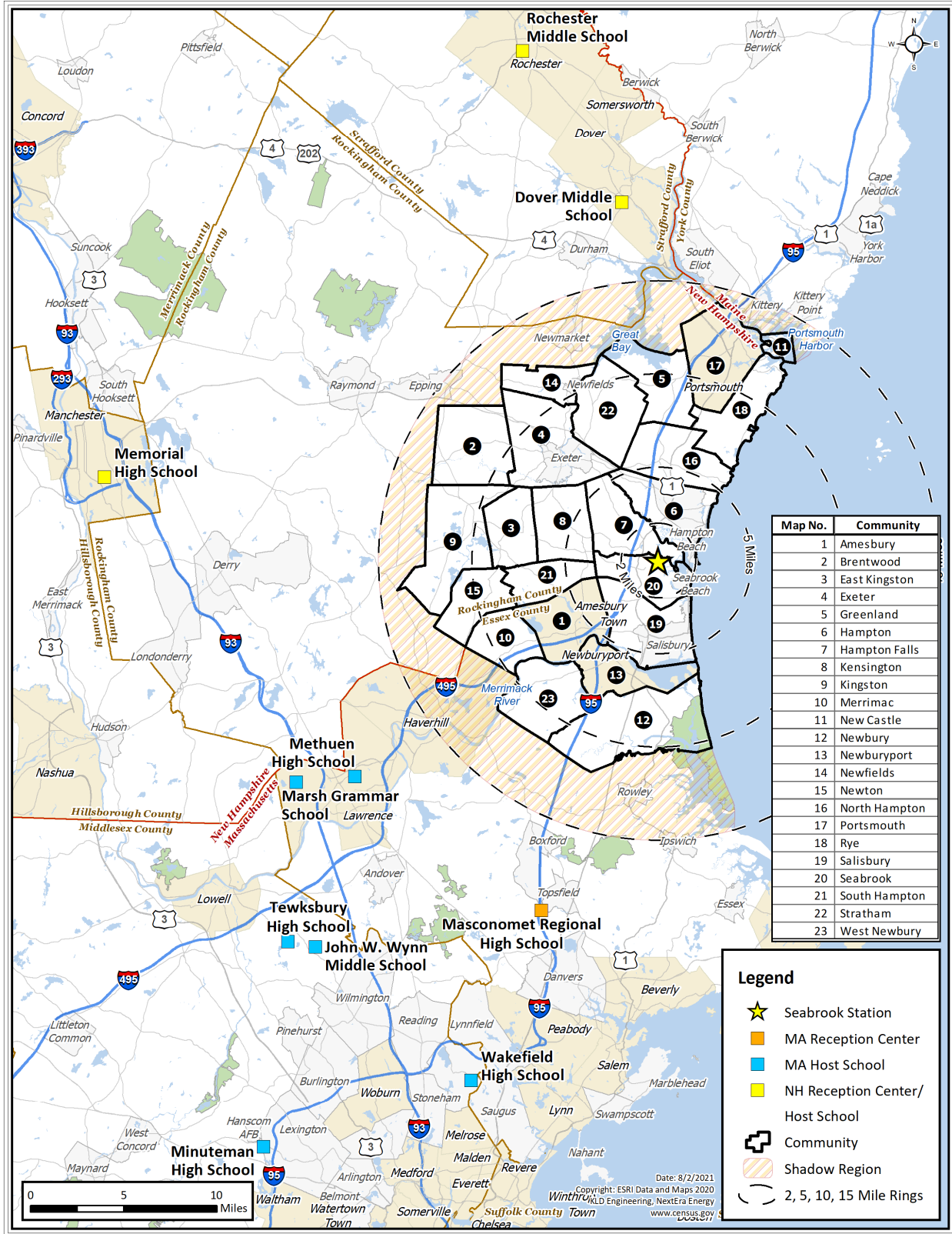


Figure 10-7. Reception Centers and Host Schools

APPENDIX A

Glossary of Traffic Engineering Terms

A. GLOSSARY OF TRAFFIC ENGINEERING TERMS

Table A-1. Glossary of Traffic Engineering Terms

Term	Definition
Analysis Network	A graphical representation of the geometric topology of a physical roadway system, which is comprised of directional links and nodes.
Link	A network link represents a specific, one-directional section of roadway. A link has both physical (length, number of lanes, topology, etc.) and operational (turn movement percentages, service rate, free-flow speed) characteristics.
Measures of Effectiveness	Statistics describing traffic operations on a roadway network.
Node	A network node generally represents an intersection of network links. A node has control characteristics, i.e., the allocation of service time to each approach link.
Origin	A location attached to a network link, within the EPZ or Shadow Region, where trips are generated at a specified rate in vehicles per hour (vph). These trips enter the roadway system to travel to their respective destinations.
Prevailing Roadway and Traffic Conditions	Relates to the physical features of the roadway, the nature (e.g., composition) of traffic on the roadway and the ambient conditions (weather, visibility, pavement conditions, etc.).
Service Rate	Maximum rate at which vehicles, executing a specific turn maneuver, can be discharged from a section of roadway at the prevailing conditions, expressed in vehicles per second (vps) or vph.
Service Volume	Maximum number of vehicles which can pass over a section of roadway in one direction during a specified time period with operating conditions at a specified Level of Service (The Service Volume at the upper bound of Level of Service, E, equals Capacity). Service Volume is usually expressed as vph.
Signal Cycle Length	The total elapsed time to display all signal indications, in sequence. The cycle length is expressed in seconds.
Signal Interval	A single combination of signal indications. The interval duration is expressed in seconds. A signal phase is comprised of a sequence of signal intervals, usually green, yellow, red.

Term	Definition
Signal Phase	A set of signal indications (and intervals) which services a particular combination of traffic movements on selected approaches to the intersection. The phase duration is expressed in seconds.
Traffic (Trip) Assignment	A process of assigning traffic to paths of travel in such a way as to satisfy all trip objectives (i.e., the desire of each vehicle to travel from a specified origin in the network to a specified destination) and to optimize some stated objective or combination of objectives. In general, the objective is stated in terms of minimizing a generalized "cost". For example, "cost" may be expressed in terms of travel time.
Traffic Density	The number of vehicles that occupy one lane of a roadway section of specified length at a point in time, expressed as vehicles per mile (vpm).
Traffic (Trip) Distribution	A process for determining the destinations of all traffic generated at the origins. The result often takes the form of a Trip Table, which is a matrix of origin-destination traffic volumes.
Traffic Simulation	A computer model designed to replicate the real-world operation of vehicles on a roadway network, so as to provide statistics describing traffic performance. These statistics are called Measures of Effectiveness (MOE).
Traffic Volume	The number of vehicles that pass over a section of roadway in one direction, expressed in vph. Where applicable, traffic volume may be stratified by turn movement.
Travel Mode	Distinguishes between private auto, bus, rail, pedestrian, and air travel modes.
Trip Table or Origin-Destination Matrix	A rectangular matrix or table, whose entries contain the number of trips generated at each specified origin, during a specified time period, that are attracted to (and travel toward) each of its specified destinations. These values are expressed in vph or in vehicles.
Turning Capacity	The capacity associated with that component of the traffic stream which executes a specified turn maneuver from an approach at an intersection.

APPENDIX B

DTRAD: Dynamic Traffic Assignment and Distribution Model

B. DYNAMIC TRAFFIC ASSIGNMENT AND DISTRIBUTION MODEL

This appendix describes the integrated dynamic trip assignment and distribution model named DTRAD (Dynamic Traffic Assignment and Distribution) that is expressly designed for use in analyzing evacuation scenarios. DTRAD employs logit-based path-choice principles and is one of the models of the DYNEV II System. The DTRAD module implements path-based *Dynamic Traffic Assignment* (DTA) so that time dependent Origin-Destination (O-D) trips are “assigned” to routes over the network based on prevailing traffic conditions.

To apply the DYNEV II System, the analyst must specify the highway network, link capacity information, the time-varying volume of traffic generated at all origin centroids and, optionally, a set of accessible candidate destination nodes on the periphery of the Emergency Planning Zone (EPZ) for selected origins. DTRAD calculates the optimal dynamic trip distribution (i.e., trip destinations) and the optimal dynamic trip assignment (i.e., trip routing) of the traffic generated at each origin node traveling to its set of candidate destination nodes, so as to minimize evacuee travel “cost.”

B.1 Overview of Integrated Distribution and Assignment Model

The underlying premise is that the selection of destinations and routes is intrinsically coupled in an evacuation scenario. That is, people in vehicles seek to travel out of an area of potential risk as rapidly as possible by selecting the “best” routes. The model is designed to identify these “best” routes in a manner that realistically distributes vehicles from origins to destinations and routes them over the highway network, in a consistent and optimal manner, reflecting evacuee behavior.

For each origin, a set of “candidate destination nodes” is selected by the software logic and by the analyst to reflect the desire by evacuees to travel away from the power plant and to access major highways. The specific destination nodes within this set that are selected by travelers and the selection of the connecting paths of travel, are both determined by DTRAD. This determination is made by a logit-based path choice model in DTRAD, so as to minimize the trip “cost”, as discussed later.

The traffic loading on the network and the consequent operational traffic environment of the network (density, speed, throughput on each link) vary over time as the evacuation takes place. The DTRAD model, which is interfaced with the DYNEV simulation model, executes a succession of “sessions” wherein it computes the optimal routing and selection of destination nodes for the conditions that exist at that time.

B.2 Interfacing the DYNEV Simulation Model with DTRAD

The DYNEV II system reflects NRC guidance that evacuees will seek to travel in a general direction away from the location of the hazardous event. An algorithm was developed to support the DTRAD model in dynamically varying the Trip Table (O-D matrix) over time from one DTRAD session to the next. Another algorithm executes a “mapping” from the specified “geometric” network (link-node analysis network) that represents the physical highway system, to a “path” network that represents the vehicle [turn] movements. DTRAD computations are performed on the “path” network: DYNEV simulation model, on the “geometric” network.

B.2.1 DTRAD Description

DTRAD is the DTA module for the DYNEV II System.

When the road network under study is large, multiple routing options are usually available between trip origins and destinations. The problem of loading traffic demands and propagating them over the network links is called Network Loading and is addressed by DYNEV II using macroscopic traffic simulation modeling. Traffic assignment deals with computing the distribution of the traffic over the road network for given O-D demands and is a model of the route choice of the drivers. Travel demand changes significantly over time, and the road network may have time dependent characteristics, e.g., time-varying signal timing or reduced road capacity because of lane closure, or traffic congestion. To consider these time dependencies, DTA procedures are required.

The DTRAD DTA module represents the dynamic route choice behavior of drivers, using the specification of dynamic origin-destination matrices as flow input. Drivers choose their routes through the network based on the travel cost they experience (as determined by the simulation model). This allows traffic to be distributed over the network according to the time-dependent conditions. The modeling principles of DTRAD include:

- It is assumed that drivers not only select the best route (i.e., lowest cost path) but some also select less attractive routes. The algorithm implemented by DTRAD archives several “efficient” routes for each O-D pair from which the drivers choose.
- The choice of one route out of a set of possible routes is an outcome of “discrete choice modeling”. Given a set of routes and their generalized costs, the percentages of drivers that choose each route is computed. The most prevalent model for discrete choice modeling is the logit model. DTRAD uses a variant of Path-Size-Logit model (PSL). PSL overcomes the drawback of the traditional multinomial logit model by incorporating an additional deterministic path size correction term to address path overlapping in the random utility expression.

- DTRAD executes the traffic assignment (TA) algorithm on an abstract network representation called "the path network" which is built from the actual physical link-node analysis network. This execution continues until a stable situation is reached: the volumes and travel times on the edges of the path network do not change significantly from one iteration to the next. The criteria for this convergence are defined by the user.
- Travel "cost" plays a crucial role in route choice. In DTRAD, path cost is a linear summation of the generalized cost of each link that comprises the path. The generalized cost for a link, a , is expressed as

$$c_a = \alpha t_a + \beta l_a + \gamma s_a,$$

where c_a is the generalized cost for link a and α , β , and γ are cost coefficients for link travel time, distance, and supplemental cost, respectively. Distance and supplemental costs are defined as invariant properties of the network model, while travel time is a dynamic property dictated by prevailing traffic conditions. The DYNEV simulation model computes travel times on all edges in the network and DTRAD uses that information to constantly update the costs of paths. The route choice decision model in the next simulation iteration uses these updated values to adjust the route choice behavior. This way, traffic demands are dynamically re-assigned based on time dependent conditions. The interaction between the DTRAD TA and DYNEV II simulation models is depicted in Figure B-1. Each round of interaction is called a Traffic Assignment Session (TA session). A TA session is composed of multiple iterations, marked as loop B in the figure.

- The supplemental cost is based on the "survival distribution" (a variation of the exponential distribution). The Inverse Survival Function is a "cost" term in DTRAD to represent the potential risk of travel toward the plant:

$$s_a = -\beta \ln(p), 0 \leq p \leq 1; \beta > 0$$

$$p = \frac{d_n}{d_0}$$

d_n = Distance of node, n , from the plant

d_0 = Distance from the plant where there is zero risk

β = Scaling factor

The value of $d_0 = 14$ miles, the outer distance of the EPZ. Note that the supplemental cost, s_a , of link, a , is (high, low), if its downstream node, n , is (near, far from) the power plant.

B.2.2 Network Equilibrium

In 1952, John Wardrop wrote:

Under equilibrium conditions traffic arranges itself in congested networks in such a way that no individual trip-maker can reduce his path costs by switching routes.

The above statement describes the “User Equilibrium” definition, also called the “Selfish Driver Equilibrium”. It is a hypothesis that represents a [hopeful] condition that evolves over time as drivers search out alternative routes to identify those routes that minimize their respective “costs”. It has been found that this “equilibrium” objective to minimize costs is largely realized by most drivers who routinely take the same trip over the same network at the same time (i.e., commuters). Effectively, such drivers “learn” which routes are best for them over time. Thus, the traffic environment “settles down” to a near-equilibrium state.

Clearly, since an emergency evacuation is a sudden, unique event, it does not constitute a long-term learning experience which can achieve an equilibrium state. Consequently, DTRAD was not designed as an equilibrium solution, but to represent drivers in a new and unfamiliar situation, who respond in a flexible manner to real-time information (either broadcast or observed) in such a way as to minimize their respective costs of travel.

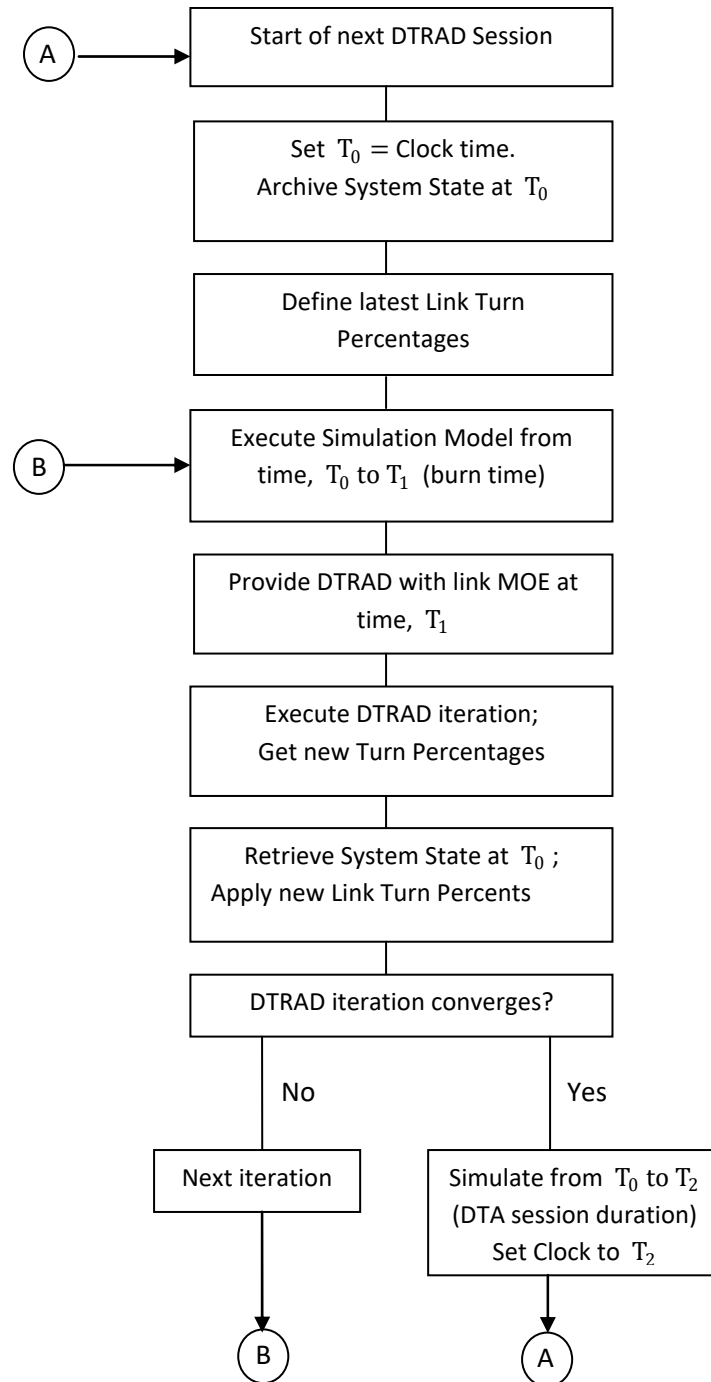


Figure B-1. Flow Diagram of Simulation-DTRAD Interface

APPENDIX C

DYNEV Traffic Simulation Model

C. DYNEV TRAFFIC SIMULATION MODEL

This appendix describes the DYNEV traffic simulation model. The DYNEV traffic simulation model is a *macroscopic* model that describes the operations of traffic flow in terms of aggregate variables: vehicles, flow rate, mean speed, volume, density, queue length, *on each link*, for each turn movement, during each Time Interval (simulation time step). The model generates trips from “sources” and from Entry Links and introduces them onto the analysis network at rates specified by the analyst based on the mobilization time distributions. The model simulates the movements of all vehicles on all network links over time until the network is empty. At intervals, the model outputs Measures of Effectiveness (MOE) such as those listed in Table C-1.

Model Features Include:

- Explicit consideration is taken of the variation in density over the time step; an iterative procedure is employed to calculate an average density over the simulation time step for the purpose of computing a mean speed for moving vehicles.
- Multiple turn movements can be serviced on one link; a separate algorithm is used to estimate the number of (fractional) lanes assigned to the vehicles performing each turn movement, based, in part, on the turn percentages provided by the Dynamic Traffic Assignment and Distribution (DTRAD) model.
- At any point in time, traffic flow on a link is subdivided into two classifications: queued and moving vehicles. The number of vehicles in each classification is computed. Vehicle spillback, stratified by turn movement for each network link, is explicitly considered and quantified. The propagation of stopping waves from link to link is computed within each time step of the simulation. There is no “vertical stacking” of queues on a link.
- Any link can accommodate “source flow” from zones via side streets and parking facilities that are not explicitly represented. This flow represents the evacuating trips that are generated at the source.
- The relation between the number of vehicles occupying the link and its storage capacity is monitored every time step for every link and for every turn movement. If the available storage capacity on a link is exceeded by the demand for service, then the simulator applies a “metering” rate to the entering traffic from both the upstream feeders and source node to ensure that the available storage capacity is not exceeded.
- A “path network” that represents the specified traffic movements from each network link is constructed by the model; this path network is utilized by the DTRAD model.
- A two-way interface with DTRAD: (1) provides link travel times; (2) receives data that translates into link turn percentages.
- Provides MOE to animation software, Evacuation Animator (EVAN)
- Calculates ETE statistics

All traffic simulation models are data-intensive. Table C-2 outlines the necessary input data elements.

To provide an efficient framework for defining these specifications, the physical highway environment is represented as a network. The unidirectional links of the network represent roadway sections: rural, multi-lane, urban streets or freeways. The nodes of the network generally represent intersections or points along a section where a geometric property changes (e.g., a lane drop, change in grade or free flow speed).

Figure C-1 is an example of a small network representation. The freeway is defined by the sequence of links, (20,21), (21,22), and (22,23). Links (8001, 19) and (3, 8011) are Entry and Exit links, respectively. An arterial extends from node 3 to node 19 and is partially subsumed within a grid network. Note that links (21,22) and (17,19) are grade-separated.

C.1 Methodology

C.1.1 The Fundamental Diagram

It is necessary to define the fundamental diagram describing flow-density and speed-density relationships. Rather than “settling for” a triangular representation, a more realistic representation that includes a “capacity drop”, $(I-R)Q_{\max}$, at the critical density when flow conditions enter the forced flow regime, is developed and calibrated for each link. This representation, shown in Figure C-2, asserts a constant free speed up to a density, k_f , and then a linear reduction in speed in the range, $k_f \leq k \leq k_c = 45$ vpm, the density at capacity. In the flow-density plane, a quadratic relationship is prescribed in the range, $k_c < k \leq k_s = 95$ vpm which roughly represents the “stop-and-go” condition of severe congestion. The value of flow rate, Q_s , corresponding to k_s , is approximated at $0.7 RQ_{\max}$. A linear relationship between k_s and k_j completes the diagram shown in Figure C-2. Table C-3 is a glossary of terms.

The fundamental diagram is applied to moving traffic on every link. The specified calibration values for each link are: (1) Free speed, v_f ; (2) Capacity, Q_{\max} ; (3) Critical density, $k_c = 45$ vpm; (4) Capacity Drop Factor, $R = 0.9$; (5) Jam density, k_j . Then, $v_c = \frac{Q_{\max}}{k_c}$, $k_f = k_c - \frac{(v_f - v_c) k_c^2}{Q_{\max}}$. Setting $\bar{k} = k - k_c$, then $Q = RQ_{\max} - \frac{RQ_{\max}}{8333} \bar{k}^2$ for $0 \leq \bar{k} \leq \bar{k}_s = 50$. It can be shown that $Q = (0.98 - 0.0056 \bar{k}) RQ_{\max}$ for $\bar{k}_s \leq \bar{k} \leq \bar{k}_j$, where $\bar{k}_s = 50$ and $\bar{k}_j = 175$.

C.1.2 The Simulation Model

The simulation model solves a sequence of “unit problems”. Each unit problem computes the movement of traffic on a link, for each specified turn movement, over a specified time interval (TI) which serves as the simulation time step for all links. Figure C-3 is a representation of the unit problem in the time-distance plane. Table C-3 is a glossary of terms that are referenced in the following description of the unit problem procedure.

The formulation and the associated logic presented below are designed to solve the unit problem for each sweep over the network (discussed below), for each turn movement serviced on each link that comprises the evacuation network, and for each TI over the duration of the evacuation.

Given = $Q_b, M_b, L, TI, E_0, LN, G/C, h, L_v, R_0, L_c, E, M$

Compute = O, Q_e, M_e

Define $O = O_Q + O_M + O_E$; $E = E_1 + E_2$

1. For the first sweep, $s = 1$, of this TI, get initial estimates of mean density, k_0 , the R – factor, R_0 and entering traffic, E_0 , using the values computed for the final sweep of the prior TI. For each subsequent sweep, $s > 1$, calculate $E = \sum_i P_i O_i + S$ where P_i, O_i are the relevant turn percentages from feeder link, i , and its total outflow (possibly metered) over this TI; S is the total source flow (possibly metered) during the current TI. Set iteration counter, $n = 0$, $k = k_0$, and $E = E_0$.

2. Calculate $v(k)$ such that $k \leq 130$ using the analytical representations of the fundamental diagram.

Calculate $Cap = \frac{Q_{max}(TI)}{3600} (G/C) LN$, in vehicles, this value may be reduced due to metering

Set $R = 1.0$ if $G/C < 1$ or if $k \leq k_c$; Set $R = 0.9$ only if $G/C = 1$ and $k > k_c$

Calculate queue length, $L_b = Q_b \frac{L_v}{LN}$

3. Calculate $t_1 = TI - \frac{L}{v}$. If $t_1 < 0$, set $t_1 = E_1 = O_E = 0$; Else, $E_1 = E \frac{t_1}{TI}$.

4. Then $E_2 = E - E_1$; $t_2 = TI - t_1$

5. If $Q_b \geq Cap$, then

$$O_Q = Cap, O_M = O_E = 0$$

If $t_1 > 0$, then

$$Q'_e = Q_b + M_b + E_1 - Cap$$

Else

$$Q'_e = Q_b - Cap$$

End if

Calculate Q_e and M_e using Algorithm A (below)

6. Else ($Q_b < Cap$)

$$O_Q = Q_b, RCap = Cap - O_Q$$

7. If $M_b \leq RCap$, then

8. If $t_1 > 0$, $O_M = M_b, O_E = \min\left(RCap - M_b, \frac{t_1 Cap}{TI}\right) \geq 0$

$$Q'_e = E_1 - O_E$$

If $Q'_e > 0$, then

- Calculate Q_e, M_e with Algorithm A
- Else
- $Q_e = 0, M_e = E_2$
- End if
- Else ($t_1 = 0$)
- $O_M = \left(\frac{v(TI) - L_b}{L - L_b} \right) M_b$ and $O_E = 0$
- $M_e = M_b - O_M + E; Q_e = 0$
- End if
9. Else ($M_b > RCap$)
- $O_E = 0$
- If $t_1 > 0$, then
- $O_M = RCap, Q'_e = M_b - O_M + E_1$
- Calculate Q_e and M_e using Algorithm A
10. Else ($t_1 = 0$)
- $M_d = \left[\left(\frac{v(TI) - L_b}{L - L_b} \right) M_b \right]$
- If $M_d > RCap$, then
- $O_M = RCap$
- $Q'_e = M_d - O_M$
- Apply Algorithm A to calculate Q_e and M_e
- Else
- $O_M = M_d$
- $M_e = M_b - O_M + E$ and $Q_e = 0$
- End if
- End if
- End if
- End if
11. Calculate a new estimate of average density, $\bar{k}_n = \frac{1}{4} [k_b + 2 k_m + k_e]$,
- where k_b = density at the beginning of the TI
- k_e = density at the end of the TI
- k_m = density at the mid-point of the TI
- All values of density apply only to the moving vehicles.
- If $|\bar{k}_n - \bar{k}_{n-1}| > \epsilon$ and $n < N$
- where N = max number of iterations, and ϵ is a convergence criterion, then
12. set $n = n + 1$, and return to step 2 to perform iteration, n , using $k = \bar{k}_n$.
- End if

Computation of unit problem is now complete. Check for excessive inflow causing spillback.

13. If $Q_e + M_e > \frac{(L-W) LN}{L_v}$, then

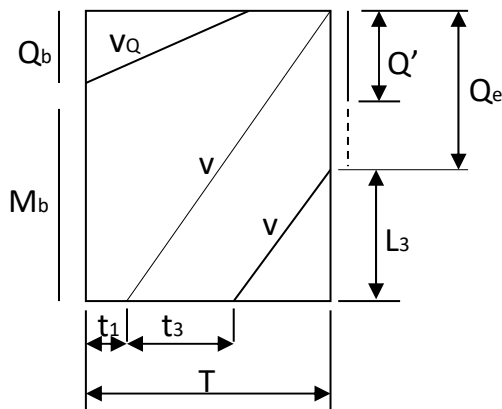
The number of excess vehicles that cause spillback is: $SB = Q_e + M_e - \frac{(L-W) \cdot LN}{L_v}$, where W is the width of the upstream intersection. To prevent spillback, meter the outflow from the feeder approaches and from the source flow, S , during this TI by the amount, SB . That is, set

$$M = 1 - \frac{SB}{(E + S)} \geq 0, \text{ where } M \text{ is the metering factor (over all movements).}$$

This metering factor is assigned appropriately to all feeder links and to the source flow, to be applied during the next network sweep, discussed later.

Algorithm A

This analysis addresses the flow environment over a TI during which moving vehicles can



join a standing or discharging queue. For the case shown, $Q_b \leq Cap$, with $t_1 > 0$ and a queue of length, Q'_e , formed by that portion of M_b and E that reaches the stop-bar within the TI, but could not discharge due to inadequate capacity. That is, $Q_b + M_b + E_1 > Cap$. This queue length, $Q'_e = Q_b + M_b + E_1 - Cap$ can be extended to Q_e by traffic entering the approach during the current TI, traveling at speed, v , and reaching the rear of the queue within the TI. A portion of the entering vehicles, $E_3 = E \frac{t_3}{TI}$, will likely join the queue. This analysis calculates

t_3 , Q_e and M_e for the input values of L , TI , v , E , t , L_v , LN , Q'_e .

When $t_1 > 0$ and $Q_b \leq Cap$:

Define: $L'_e = Q'_e \frac{L_v}{LN}$. From the sketch, $L_3 = v(TI - t_1 - t_3) = L - (Q'_e + E_3) \frac{L_v}{LN}$.

Substituting $E_3 = \frac{t_3}{TI} E$ yields: $-vt_3 + \frac{t_3}{TI} E \frac{L_v}{LN} = L - v(TI - t_1) - L'_e$. Recognizing that the first two terms on the right hand side cancel, solve for t_3 to obtain:

$$t_3 = \frac{L'_e}{\left[v - \frac{E}{TI} \frac{L_v}{LN} \right]} \quad \text{such that } 0 \leq t_3 \leq TI - t_1$$

If the denominator, $\left[v - \frac{E}{TI} \frac{L_v}{LN} \right] \leq 0$, set $t_3 = TI - t_1$.

$$\text{Then, } Q_e = Q'_e + E \frac{t_3}{\text{TI}} \quad , \quad M_e = E \left(1 - \frac{t_1 + t_3}{\text{TI}} \right)$$

The complete Algorithm A considers all flow scenarios; space limitation precludes its inclusion, here.

C.1.3 Lane Assignment

The “unit problem” is solved for each turn movement on each link. Therefore it is necessary to calculate a value, LN_x , of allocated lanes for each movement, x . If in fact all lanes are specified by, say, arrows painted on the pavement, either as full lanes or as lanes within a turn bay, then the problem is fully defined. If however there remain un-channelized lanes on a link, then an analysis is undertaken to subdivide the number of these physical lanes into turn movement specific virtual lanes, LN_x .

C.2 Implementation

C.2.1 Computational Procedure

The computational procedure for this model is shown in the form of a flow diagram as Figure C-4. As discussed earlier, the simulation model processes traffic flow for each link independently over TI that the analyst specifies; it is usually 60 seconds or longer. The first step is to execute an algorithm to define the sequence in which the network links are processed so that as many links as possible are processed after their feeder links are processed, within the same network sweep. Since a general network will have many closed loops, it is not possible to guarantee that every link processed will have all of its feeder links processed earlier.

The processing then continues as a succession of time steps of duration, TI , until the simulation is completed. Within each time step, the processing performs a series of “sweeps” over all network links; this is necessary to ensure that the traffic flow is synchronous over the entire network. Specifically, the sweep ensures continuity of flow among all the network links; in the context of this model, this means that the values of E , M , and S are all defined for each link such that they represent the synchronous movement of traffic from each link to all of its outbound links. These sweeps also serve to compute the metering rates that control spillback.

Within each sweep, processing solves the “unit problem” for each turn movement on each link. With the turn movement percentages for each link provided by the DTRAD model, an algorithm allocates the number of lanes to each movement serviced on each link. The timing at a signal, if any, applied at the downstream end of the link, is expressed as a G/C ratio, the signal timing needed to define this ratio is an input requirement for the model. The model also has the capability of representing, with macroscopic fidelity, the actions of actuated signals responding to the time-varying competing demands on the approaches to the intersection.

The solution of the unit problem yields the values of the number of vehicles, O , that discharge from the link over the time interval and the number of vehicles that remain on the link at the end of the time interval as stratified by queued and moving vehicles: Q_e and M_e . The

procedure considers each movement separately (multi-piping). After all network links are processed for a given network sweep, the updated consistent values of entering flows, E; metering rates, M; and source flows, S are defined so as to satisfy the “no spillback” condition. The procedure then performs the unit problem solutions for all network links during the following sweep.

Experience has shown that the system converges (i.e., the values of E, M and S “settle down” for all network links) in just two sweeps if the network is entirely under-saturated or in four sweeps in the presence of extensive congestion with link spillback. (The initial sweep over each link uses the final values of E and M, of the prior TI). At the completion of the final sweep for a TI, the procedure computes and stores all MOEs for each link and turn movement for output purposes. It then prepares for the following time interval by defining the values of Q_b and M_b for the start of the next TI as being those values of Q_e and M_e at the end of the prior TI. In this manner, the simulation model processes the traffic flow over time until the end of the run. Note that there is no space-discretization other than the specification of network links.

C.2.2 Interfacing with Dynamic Traffic Assignment (DTRAD)

The **DYNEV II** system reflects NRC guidance that evacuees will seek to travel in a general direction away from the location of the hazardous event. Thus, an algorithm was developed to identify an appropriate set of destination nodes for each origin based on its location and on the expected direction of travel. This algorithm also supports the DTRAD model in dynamically varying the Trip Table (O-D matrix) over time from one DTRAD session to the next.

Figure B-1 depicts the interaction of the simulation model with the DTRAD model in the **DYNEV II** system. As indicated, **DYNEV II** performs a succession of DTRAD “sessions”; each such session computes the turn link percentages for each link that remain constant for the session duration, $[T_0, T_2]$, specified by the analyst. The end product is the assignment of traffic volumes from each origin to paths connecting it with its destinations in such a way as to minimize the network-wide cost function. The output of the DTRAD model is a set of updated link turn percentages which represent this assignment of traffic.

As indicated in Figure B-1, the simulation model supports the DTRAD session by providing it with operational link MOE that are needed by the path choice model and included in the DTRAD cost function. These MOE represent the operational state of the network at a time, $T_1 \leq T_2$, which lies within the session duration, $[T_0, T_2]$. This “burn time”, $T_1 - T_0$, is selected by the analyst. For each DTRAD iteration, the simulation model computes the change in network operations over this burn time using the latest set of link turn percentages computed by the DTRAD model. Upon convergence of the DTRAD iterative procedure, the simulation model accepts the latest turn percentages provided by the Dynamic Traffic Assignment (DTA) model, returns to the origin time, T_0 , and executes until it arrives at the end of the DTRAD session duration at time, T_2 . At this time the next DTA session is launched and the whole process repeats until the end of the **DYNEV II** run.

Additional details are presented in Appendix B.

Table C-1. Selected Measures of Effectiveness Output by DYNEV II

Measure	Units	Applies To
Vehicles Discharged	Vehicles	Link, Network, Exit Link
Speed	Miles/Hours (mph)	Link, Network
Density	Vehicles/Mile/Lane	Link
Level of Service	LOS	Link
Content	Vehicles	Network
Travel Time	Vehicle-hours	Network
Evacuated Vehicles	Vehicles	Network, Exit Link
Trip Travel Time	Vehicle-minutes/trip	Network
Capacity Utilization	Percent	Exit Link
Attraction	Percent of total evacuating vehicles	Exit Link
Max Queue	Vehicles	Node, Approach
Time of Max Queue	Hours:minutes	Node, Approach
Route Statistics	Length (mi); Mean Speed (mph); Travel Time (min)	Route
Mean Travel Time	Minutes	Evacuation Trips; Network

Table C-2. Input Requirements for the DYNEV II Model

HIGHWAY NETWORK

- Links defined by upstream and downstream node numbers
- Link lengths
- Number of lanes (up to 9) and channelization
- Turn bays (1 to 3 lanes)
- Destination (exit) nodes
- Network topology defined in terms of downstream nodes for each receiving link
- Node Coordinates (X,Y)
- Nuclear Power Plant Coordinates (X,Y)

GENERATED TRAFFIC VOLUMES

- On all entry links and source nodes (origins), by Time Period

TRAFFIC CONTROL SPECIFICATIONS

- Traffic signals: link-specific, turn movement specific
- Signal control treated as fixed time or actuated
- Location of traffic control points (these are represented as actuated signals)
- Stop and Yield signs
- Right-turn-on-red (RTOR)
- Route diversion specifications
- Turn restrictions
- Lane control (e.g., lane closure, movement-specific)

DRIVER'S AND OPERATIONAL CHARACTERISTICS

- Driver's (vehicle-specific) response mechanisms: free-flow speed, discharge headway
- Bus route designation.

DYNAMIC TRAFFIC ASSIGNMENT

- Candidate destination nodes for each origin (optional)
- Duration of DTA sessions
- Duration of simulation "burn time"
- Desired number of destination nodes per origin

INCIDENTS

- Identify and Schedule of closed lanes
- Identify and Schedule of closed links

Table C-3. Glossary

Cap	The maximum number of vehicles, of a particular movement, that can discharge from a link within a time interval.
E	The number of vehicles, of a particular movement, that enter the link over the time interval. The portion, E_{TI} , can reach the stop-bar within the TI.
G/C	The green time: cycle time ratio that services the vehicles of a particular turn movement on a link.
h	The mean queue discharge headway, seconds.
k	Density in vehicles per lane per mile.
\bar{k}	The average density of <u>moving</u> vehicles of a particular movement over a TI, on a link.
L	The length of the link in feet.
L_b, L_e	The queue length in feet of a particular movement, at the [beginning, end] of a time interval.
LN	The number of lanes, expressed as a floating point number, allocated to service a particular movement on a link.
L_v	The mean effective length of a queued vehicle including the vehicle spacing, feet.
M	Metering factor (Multiplier): 1.
M_b, M_e	The number of moving vehicles on the link, of a particular movement, that are moving at the [beginning, end] of the time interval. These vehicles are assumed to be of equal spacing, over the length of link upstream of the queue.
O	The total number of vehicles of a particular movement that are discharged from a link over a time interval.
O_Q, O_M, O_E	The components of the vehicles of a particular movement that are discharged from a link within a time interval: vehicles that were Queued at the beginning of the TI; vehicles that were Moving within the link at the beginning of the TI; vehicles that Entered the link during the TI.
P_x	The percentage, expressed as a fraction, of the total flow on the link that executes a particular turn movement, x.

Q_b, Q_e	The number of queued vehicles on the link, of a particular turn movement, at the [beginning, end] of the time interval.
Q_{max}	The maximum flow rate that can be serviced by a link for a particular movement in the absence of a control device. It is specified by the analyst as an estimate of link capacity, based upon a field survey, with reference to the Highway Capacity Manual (HCM) 2016.
R	The factor that is applied to the capacity of a link to represent the “capacity drop” when the flow condition moves into the forced flow regime. The lower capacity at that point is equal to RQ_{max} .
RCap	The remaining capacity available to service vehicles of a particular movement after that queue has been completely serviced, within a time interval, expressed as vehicles.
S_x	Service rate for movement x, vehicles per hour (vph).
t_1	Vehicles of a particular turn movement that enter a link over the first t_1 seconds of a time interval, can reach the stop-bar (in the absence of a queue downstream) within the same time interval.
TI	The time interval, in seconds, which is used as the simulation time step.
v	The mean speed of travel, in feet per second (fps) or miles per hour (mph), of <u>moving</u> vehicles on the link.
v_Q	The mean speed of the last vehicle in a queue that discharges from the link within the TI. This speed differs from the mean speed of moving vehicles, v.
W	The width of the intersection in feet. This is the difference between the link length which extends from stop-bar to stop-bar and the block length.

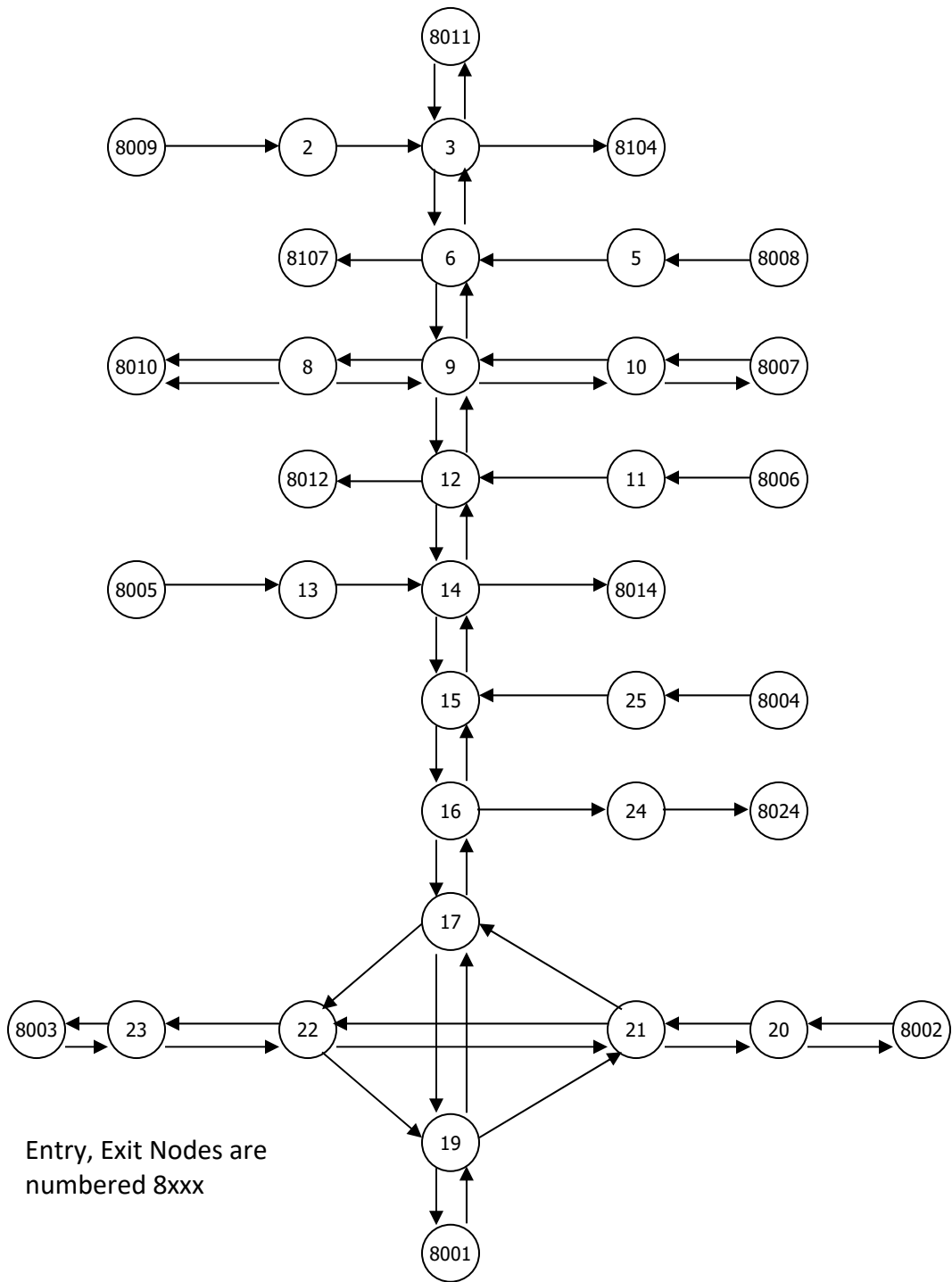


Figure C-1. Representative Analysis Network

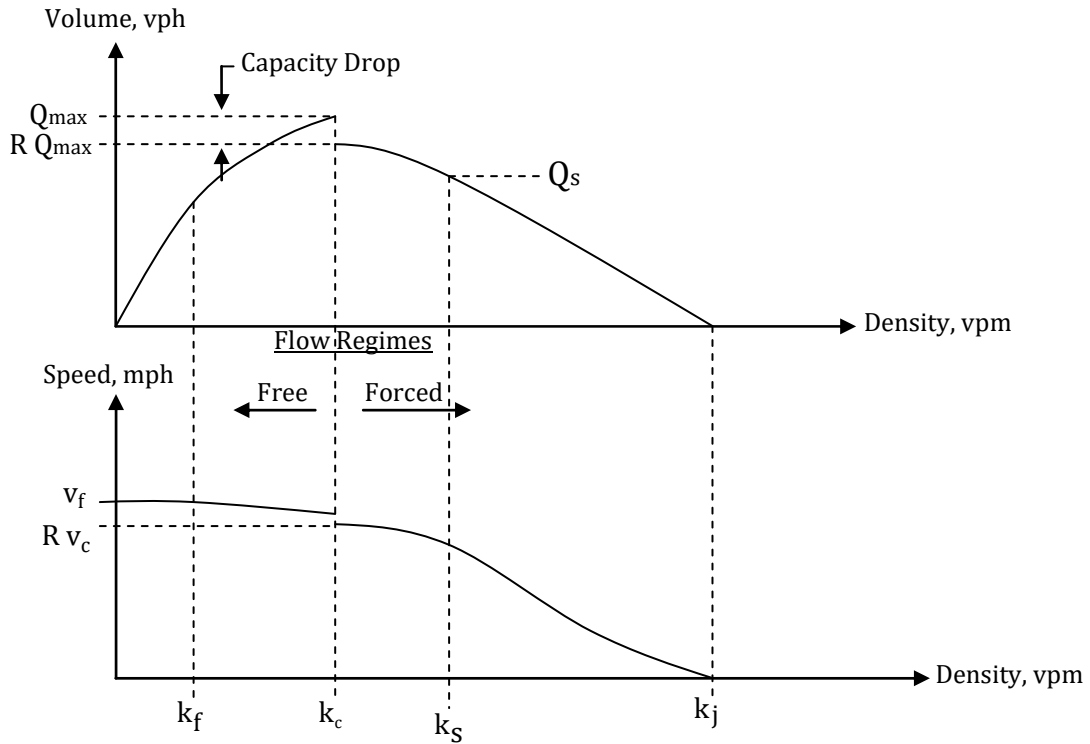


Figure C-2. Fundamental Diagrams

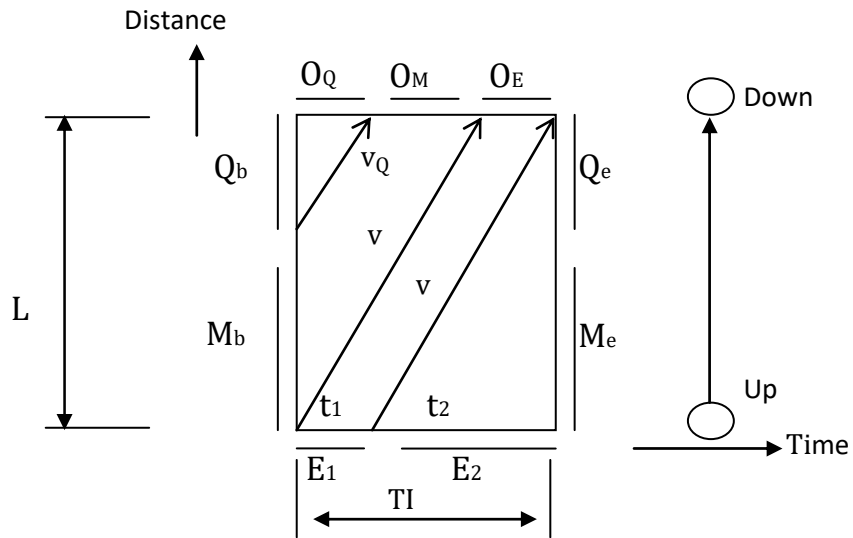


Figure C-3. A UNIT Problem Configuration with $t_1 > 0$

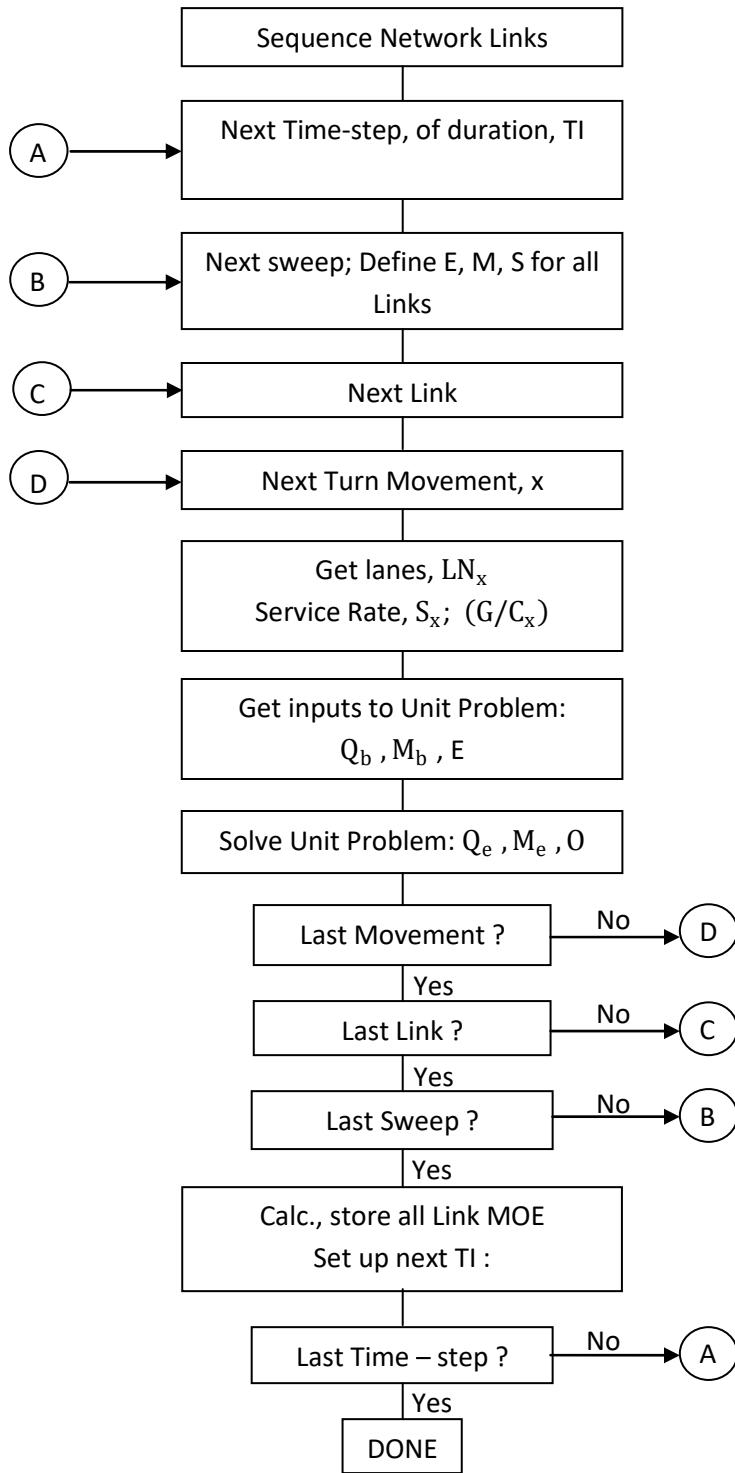


Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3)

APPENDIX D

Detailed Description of Study Procedure

D. DETAILED DESCRIPTION OF STUDY PROCEDURE

This appendix describes the activities that were performed to compute ETE. The individual steps of this effort are represented as a flow diagram in Figure D-1. Each numbered step in the description that follows corresponds to the numbered element in the flow diagram.

Step 1

The first activity was to obtain the EPZ boundary information and create a GIS base map. The base map extends beyond the Shadow Region which extends approximately 15 miles (radially) from the power plant location. The base map incorporates the local roadway topology, a suitable topographic background and the EPZ boundary.

Step 2

The 2020 Census block population information was obtained in GIS format. This information was used to estimate the permanent resident population within the EPZ and Shadow Region and to define the spatial distribution and demographic characteristics of the population within the study area. Employee data was provided by NextEra and was supplemented with estimations made using the US Census Longitudinal Employer-Household Dynamics from the OnTheMap Census analysis tool¹. Data for transients, schools, and other facilities were obtained from the state emergency management agencies, the National Center for Education Statistics website², data from the previous ETE study confirmed still accurate by the state agencies, phone calls to individual facilities, satellite imagery, and internet searches where data was not readily obtained. In addition, transportation resources available during an emergency were provided by the state agencies.

Step 3

A kickoff meeting was conducted with major stakeholders (state emergency officials and NextEra personnel). The purpose of the kickoff meeting was to present an overview of the work effort, identify key agency personnel, and indicate the data requirements for the study. Specific requests for information were presented to the state emergency officials and NextEra utility managers. Unique features of the study area were discussed to identify the local concerns that should be addressed by the ETE study.

Step 4

Next, a physical survey of the roadway system in the study area was conducted to determine the geometric properties of the highway sections, the channelization of lanes on each section of roadway, whether there are any turn restrictions or special treatment of traffic at intersections, the type and functioning of traffic control devices, gathering signal timings for pre-timed traffic signals (if any exist within the study area), and to make the necessary observations needed to estimate realistic values of roadway capacity. Roadway characteristics were also verified using aerial imagery.

¹ <https://onthemap.ces.census.gov/>

² <https://nces.ed.gov/ccd/schoolsearch/index.asp>

Step 5

An online demographic survey of the households within the EPZ was conducted to identify household dynamics, trip generation characteristics, and evacuation-related demographic information of the EPZ population for this study. The results of the 2012 telephone survey were used for the information on snow removal times. This information was used to determine important study factors including the average number of evacuating vehicles used by each household, and the time required to perform pre-evacuation mobilization activities.

Step 6

A computerized representation of the physical roadway system, called a link-node analysis network, was developed using the most recent UNITES software (see Section 1.3) developed by KLD. Once the geometry of the network was completed, the network was calibrated using the information gathered during the road survey (Step 4) and information obtained from aerial imagery. Estimates of highway capacity for each link and other link-specific characteristics were introduced to the network description. Traffic signal timings were input accordingly. The link-node analysis network was imported into a GIS map. The 2020 permanent resident population estimates (Step 2) were overlaid in the map, and origin centroids where trips would be generated during the evacuation process were assigned to appropriate links.

Step 7

The EPZ is subdivided into 23 Communities (then grouped into 7 ERPAs. Refer to Table 2-1. Based on wind direction and speed, Regions (groupings of ERPAs) that may be advised to evacuate, were developed.

The need for evacuation can occur over a range of time-of-day, day-of-week, seasonal and weather-related conditions. Scenarios were developed to capture the variation in evacuation demand, highway capacity and mobilization time, for different time of day, day of the week, time of year, and weather conditions.

Step 8

The input stream for the DYNEV II system, which integrates the dynamic traffic assignment and distribution model, DTRAD, with the evacuation simulation model, was created for a prototype evacuation case – the evacuation of the entire EPZ for a representative scenario.

Step 9

After creating this input stream, the DYNEV II System was executed on the prototype evacuation case to compute evacuating traffic routing patterns consistent with the appropriate NRC guidelines. DYNEV II contains an extensive suite of data diagnostics which check the completeness and consistency of the input data specified. The analyst reviews all warning and error messages produced by the model and then corrects the database to create an input stream that properly executes to completion.

The model assigns destinations to all origin centroids consistent with a (general) radial evacuation of the EPZ and Shadow Region. The analyst may optionally supplement and/or replace these model-assigned destinations, based on professional judgment, after studying the topology of the analysis highway network. The model produces link and network-wide measures of effectiveness as well as estimates of evacuation time.

Step 10

The results generated by the prototype evacuation case are critically examined. The examination includes observing the animated graphics (using the EVAN software – see Section 1.3) and reviewing the statistics output by the model. This is a labor-intensive activity, requiring the direct participation of skilled engineers who possess the necessary practical experience to interpret the results and to determine the causes of any problems reflected in the results.

Essentially, the approach is to identify those bottlenecks in the network that represent locations where congested conditions are pronounced and to identify the cause of this congestion. This cause can take many forms, either as excess demand due to high rates of trip generation, improper routing, a shortfall of capacity, or as a quantitative flaw in the way the physical system was represented in the input stream. This examination leads to one of two conclusions:

- The results are satisfactory; or
- The input stream must be modified accordingly.

This decision requires, of course, the application of the user's judgment and experience based upon the results obtained in previous applications of the model and a comparison of the results of the latest prototype evacuation case iteration with the previous ones. If the results are satisfactory in the opinion of the user, then the process continues with Step 13. Otherwise, proceed to Step 11.

Step 11

There are many "treatments" available to the user in resolving apparent problems. These treatments range from decisions to reroute the traffic by assigning additional evacuation destinations for one or more sources, imposing turn restrictions where they can produce significant improvements in capacity, changing the control treatment at critical intersections so as to provide improved service for one or more movements, adding minor routes (which are paved and traversable) that were not previously modelled but may assist in an evacuation and increase the available roadway network capacity, or in prescribing specific treatments for channelizing the flow so as to expedite the movement of traffic along major roadway systems. Such "treatments" take the form of modifications to the original prototype evacuation case input stream. All treatments are designed to improve the representation of evacuation behavior.

Step 12

As noted above, the changes to the input stream must be implemented to reflect the modifications undertaken in Step 11. At the completion of this activity, the process returns to Step 9 where the DYNEV II system is again executed.

Step 13

Evacuation of transit-dependent evacuees and special facilities are included in the evacuation analysis. Fixed routing for transit buses, school buses, ambulances, and other transit vehicles are introduced into the final prototype evacuation case data set. DYNEV II generates route-specific speeds over time for use in the estimation of evacuation times for the transit dependent and special facility population groups.

Step 14

The prototype evacuation case was used as the basis for generating all region and scenario-specific evacuation cases to be simulated. This process was automated through the UNITES user interface. For each specific case, the population to be evacuated, the trip generation distributions, the highway capacity and speeds, and other factors are adjusted to produce a customized case-specific data set.

Step 15

All evacuation cases were executed using the DYNEV II model to compute ETE. Once results were available, quality control procedures were used to assure the results were consistent, dynamic routing was reasonable, and traffic congestion/bottlenecks were addressed properly. Traffic management plans were analyzed, and traffic control points were prioritized, if applicable. Additional analysis is conducted to identify the sensitivity of the ETE to changes in some base evacuation conditions and model assumptions.

Step 16

Once vehicular evacuation results are accepted, average travel speeds for transit and special facility routes are used to compute ETE for transit-dependent permanent residents, schools, pre-schools/child care centers, day camps, medical facilities and other special facilities.

Step 17

The simulation results are analyzed, tabulated, and graphed. The results are then documented, as required by NUREG/CR-7002, Rev. 1.

Step 18

Following the completion of documentation activities, the ETE criteria checklist (see Appendix N) is completed. An appropriate report reference is provided for each criterion provided in the checklist.

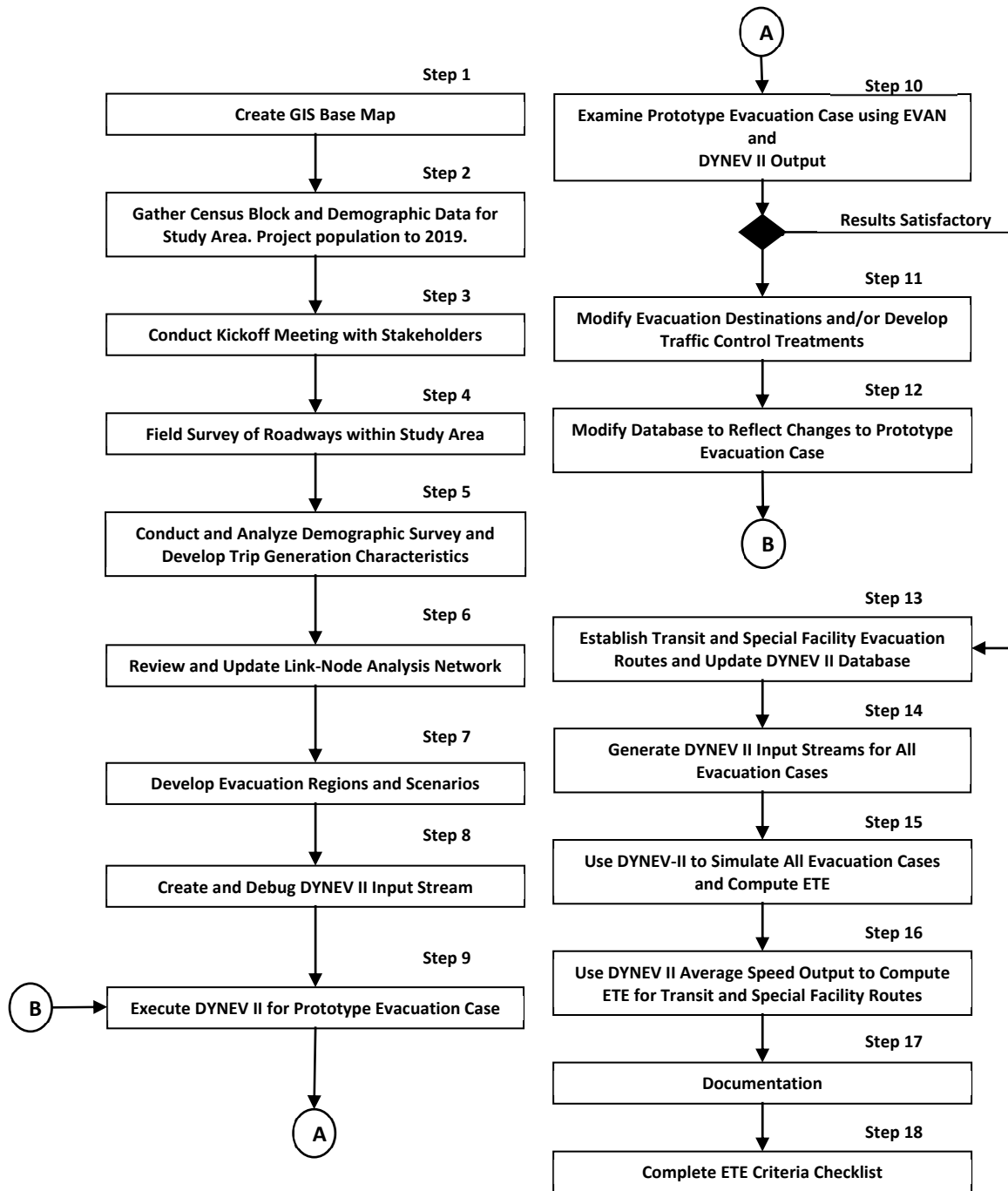


Figure D-1. Flow Diagram of Activities

APPENDIX E

Facility Data

E. FACILITY DATA

The following tables list population information, as of July 2022, for special facilities, transient attractions and major employers that are located within the Seabrook Station EPZ. Special facilities are defined as schools, preschools/child care centers, day camps, medical facilities, and correctional facilities. Transient population data is included in the tables for transient attractions (beaches, campgrounds, golf courses, historical sites, marinas, other recreational facilities) and lodging facilities. The employment data is included in the table for major employers. Each table is grouped by state. The location of the facility is defined by its straight-line distance (miles) and direction (magnetic bearing) from the center point of the plant. Maps of each school, preschool/child care center, day camp, medical facility, transient attraction (beach, campground, golf course, historical site, marina, other recreational facility), lodging facility, and correctional facility are also provided.

Table E-1. Schools within the EPZ

Community	Distance (miles)	Direction	School Name	Street Address	Municipality	Enrollment
MASSACHUSETTS						
Amesbury	4.5	SW	Sparhawk School - Lower School	259 Elm St	Amesbury	61
Amesbury	4.7	WSW	Amesbury Elementary School	20 S Hampton Rd	Amesbury	346
Amesbury	5.2	SW	Sparhawk School - Upper School	4 Noel St	Amesbury	89
Amesbury	5.3	SW	Amesbury Innovation High School	71 Friend St	Amesbury	50
Amesbury	5.4	SW	Amesbury Middle School	220 Main St	Amesbury	668
Amesbury	5.8	SW	Amesbury High School	5 Highland St	Amesbury	529
Amesbury	5.9	WSW	Cashman School	193 Lion's Mouth Rd	Amesbury	416
Merrimac	9.1	WSW	Dr. FN Sweetsir School	104 Church St	Merrimac	223
Merrimac	9.4	WSW	Helen R. Donaghue School	24 Union St	Merrimac	230
Newbury	7.6	S	Newbury Elementary School	63 Hanover St	Newbury	392
Newbury	10.5	SSW	The Governor's Academy	1 Elm St	Byfield	401
Newbury	11.2	SSW	Triton Regional Middle School and High School	112 Elm St	Byfield	1,030
Newburyport	6.0	SSW	Bresnahan Elementary School	333 High St	Newburyport	640
Newburyport	6.3	SSW	Newburyport High School	241 High St	Newburyport	816
Newburyport	6.3	S	Immaculate Conception School	1 Washington St	Newburyport	235
Newburyport	6.5	SSW	E.G. Molin Upper Elementary School	70 Low St	Newburyport	298
Newburyport	6.5	SSW	Rupert A. Nock Middle School	70 Low St	Newburyport	557
Newburyport	6.6	SSW	River Valley Charter School	2 Perry Way	Newburyport	288
Salisbury	3.2	SSW	Salisbury Elementary School	100 Lafayette Rd	Salisbury	519
West Newbury	8.5	SW	Dr. John C. Page School	694 Main St	West Newbury	329
West Newbury	11.5	SW	Pentucket Regional High School	24 Main St	West Newbury	749
West Newbury	11.7	SW	Pentucket Regional Middle School	22-24 Main St	West Newbury	393
<i>MA Subtotal:</i>						9,259
NEW HAMPSHIRE						
Brentwood	12.5	WNW	Swasey Central School	355 Middle Rd	Brentwood	305
Brentwood	13.3	WNW	Brentwood Christian Academy	263 NH-125	Brentwood	120
East Kingston	7.3	W	East Kingston Elementary School	5 Andrews Ln	East Kingston	130
Exeter	7.6	NW	Great Bay Charter School	30 Linden St	Exeter	155
Exeter	7.6	NW	Seacoast School of Technology	40 Linden St	Exeter	275
Exeter	7.7	NW	Phillips Exeter Academy	20 Main St	Exeter	1,060
Exeter	7.8	NW	Main Street School	40 Main St	Exeter	500

Community	Distance (miles)	Direction	School Name	Street Address	Municipality	Enrollment
Exeter	7.8	NW	Lincoln Street Elementary School	25 Lincoln St	Exeter	480
Exeter	11.2	NW	Exeter High School	1 Blue Hawk Dr	Exeter	1,600
Greenland	9.3	N	Greenland Central School	70 Post Rd	Greenland	410
Hampton	2.4	NNE	Winnacunnet Regional High School	1 Alumni Dr	Hampton	1,140
Hampton	2.6	NNE	Sacred Heart School	289 Lafayette Rd	Hampton	223
Hampton	2.8	NNE	Hampton Academy	29 Academy Ave	Hampton	365
Hampton	3.0	NNE	Marston School	4 Marston Way	Hampton	297
Hampton Falls	1.5	NW	Lincoln Akerman School	8 Exeter Rd	Hampton Falls	222
Hampton Falls	5.5	NW	Heronfield Academy	356 Exeter Rd	Hampton Falls	100
Kensington	5.2	WNW	Kensington Elementary School	122 Amesbury Rd	Kensington	140
Kingston	10.7	WNW	Daniel J. Bakie Elementary School	179 Main St	Kingston	388
Kingston	10.8	WNW	Seacoast Charter School	13 Church St	Kingston	170
Kingston	11.4	W	Sanborn Regional High School	17 Danville Rd	Kingston	646
New Castle	13.5	NNE	Maude H. Trefethen School	142 Cranfield St	New Castle	37
Newfields	10.6	NNW	Newfields Elementary School	9 Piscassic Rd	Newfields	113
Newton	11.2	WSW	Memorial Elementary School	31 W Main St	Newton	275
Newton	11.3	WSW	Seacoast Learning Collaborative	31A W Main St	Newton	70
North Hampton	4.4	N	Squamscott River Academy	14 Lafayette Rd, Unit 4	North Hampton	15
North Hampton	5.2	NNE	North Hampton Elementary School	201 Atlantic Ave	North Hampton	321
Portsmouth	10.4	NNE	Saint Patrick Academy	315 Banfield Rd	Portsmouth	220
Portsmouth	10.4	NNE	Dondero School	32 Van Buren Ave	Portsmouth	300
Portsmouth	11.3	NNE	Robert J. Lister Academy	35 Sherburne Rd	Portsmouth	20
Portsmouth	11.8	NNE	Portsmouth Career Technical Center ¹	50 Andrew Jarvis Dr	Portsmouth	Included below
Portsmouth	11.8	NNE	Portsmouth High School	50 Andrew Jarvis Dr	Portsmouth	1,079
Portsmouth	12.2	NNE	Great Bay Community College	320 Corporate Dr	Portsmouth	576
Portsmouth	12.6	NNE	Little Harbour School	50 Clough Dr	Portsmouth	411
Portsmouth	12.8	NNE	New Franklin School	1 Franklin Dr	Portsmouth	260
Portsmouth	12.9	NNE	Portsmouth Middle School	155 Parrott Ave	Portsmouth	545
Rye	7.7	NNE	Learning Skills Academy	1247 Washington Rd	Rye	60
Rye	8.9	NNE	Rye Junior High School	501 Washington Rd	Rye	170
Rye	10.1	NNE	Rye Elementary School	461 Sagamore Rd	Rye	196
Seabrook	1.2	S	Seabrook Elementary School	256 Walton Rd	Seabrook	400

¹ Portsmouth Career Technical Center shares the same address with Portsmouth High School. The students at the technical center are included in the high school student population.

Community	Distance (miles)	Direction	School Name	Street Address	Municipality	Enrollment
Seabrook	1.3	S	Seabrook Middle School	236 Walton Rd	Seabrook	315
South Hampton	5.6	WSW	Seventh Day Adventist School	285 Main Ave	South Hampton	15
South Hampton	6.0	WSW	Barnard School	219 Main Ave	South Hampton	84
Stratham	6.3	NNW	Cooperative Middle School	100 Academic Way	Stratham	1,218
Stratham	8.6	N	The Cornerstone School	146 High St	Stratham	170
Stratham	9.2	NNW	Cornerstone Christian Academy	8 Winnicutt Rd	Stratham	10
Stratham	9.3	N	Stratham Memorial School	39 Gifford Farm Rd	Stratham	563
<i>NH Subtotal:</i>						16,169
EPZ TOTAL:						25,428

Table E-2. Preschools/Child Care Centers within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Enrollment
MASSACHUSETTS						
Amesbury	4.5	WSW	Amesbury Country Day School	186 Market St	Amesbury	20
Amesbury	4.6	SW	Leaps & Bounds Preschool	239 Elm St	Amesbury	24
Amesbury	5.1	SW	Little Hands Learning Center	58 Macy St Unit 4	Amesbury	40
Amesbury	5.2	SW	James Place The Next Generation	67 Friend St	Amesbury	37
Amesbury	5.4	SW	Windmill Country Day School	4 Rosedale St	Amesbury	45
Amesbury	5.4	SW	Little Sprouts Daycare	36 Sparhawk St	Amesbury	60
Amesbury	5.5	SW	Amesbury Montessori Preschool and Kindergarten	120 Friend St	Amesbury	20
Amesbury	6.4	SW	Leaps and Bounds Pre-School	69 Haverhill Rd	Amesbury	24
Merrimac	9.2	WSW	Small Wonders Preschool Program	1 Hansom Dr	Merrimac	15
Newbury	6.9	S	Our Secret Garden Nursery and Preschool	20 High Rd	Newbury	29
Newbury	7.8	S	Harmony Natural Learning Center	67 Newburyport Tpke	Newbury	44
Newburyport	5.5	SSW	Community Action, Inc. Newburyport Head Start	447 Merrimac St	Newburyport	54
Newburyport	6.0	SSW	School's Out @ Bresnahan School	333 High St	Newburyport	120
Newburyport	6.2	SSW	YWCA - School's Out Program	13 Market St	Newburyport	65
Newburyport	6.2	S	Newburyport Montessori School	20 Pleasant St Rear	Newburyport	118
Newburyport	6.4	SSW	Newburyport KinderCare	151 Low St	Newburyport	71
Newburyport	6.6	SSW	Bright Horizons at Newburyport	2 Graf Rd	Newburyport	70
Newburyport	6.7	SSW	Mrs Murray's Nursery School	11 Hale St	Newburyport	33
Newburyport	6.8	SSW	Kindercare Learning Center	1 Daniel Lucy Way	Newburyport	80
Newburyport	6.9	SSW	Knoll Edge Preschool	188 Newburyport Tpke	Newburyport	20
Salisbury	4.4	SSW	Milestones Childcare and Preschool	167 Elm St Unit 10	Salisbury	26
West Newbury	8.5	SW	Children's Castle	694 Main St	West Newbury	110
West Newbury	9.3	SW	Learning Tree Preschool	491 Main St	West Newbury	15
West Newbury	10.2	SW	Koinonia Preschool Day Care	308 Main St	West Newbury	30
West Newbury	10.8	SW	Pathways For Learning	9 Pleasant St	West Newbury	20
MA Subtotal: 1,190						
NEW HAMPSHIRE						
Brentwood	12.4	NW	Donna Clarke's Family Day Care	17 Sanborn Way	Exeter	9
Brentwood	14.0	NW	A Place To Grow	436 NH-125	Brentwood	52
East Kingston	7.3	W	East Kingston Elementary School-Before & After School Program	5 Andrews Ln	East Kingston	45

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Enrollment
East Kingston	8.6	W	KidLogic Early Learning Center	14 Powwow River Rd	East Kingston	59
Exeter	6.2	NNW	Appleseeds Day School	15 Hampton Rd	Exeter	120
Exeter	7.3	NW	Exeter Day School	11 Marlboro St	Exeter	82
Exeter	7.6	NW	Little Munchkins Learning Center	134 Portsmouth Ave	Exeter	22
Exeter	7.6	NW	Swasey Central School Before & After School Program	56 Linden St	Exeter	50
Exeter	7.7	NW	Harris Family Children's Center	261 Water St	Exeter	68
Exeter	7.8	NW	Great Bay Kids Company	40 Main St	Exeter	65
Exeter	7.8	NW	Exeter Developmental Pre-School	13 School St	Exeter	0 ²
Exeter	8.1	NW	Montessori School for the Arts & Sciences	2 Newfields Rd	Exeter	80
Exeter	8.5	WNW	Building Block Commons	125 Kingston Rd	Exeter	56
Exeter	8.6	NW	De Colores Children's Center	87 Epping Rd	Exeter	13
Exeter	8.6	NW	Great Bay Kids' Company	64 Epping Rd	Exeter	143
Greenland	9.0	N	Camp Gundalow	176 Tuttle Ln	Greenland	200
Greenland	9.4	N	Greenland Peak Program	70 Post Rd	Greenland	29
Hampton	2.6	N	Fun After School & Summer Program	40 Stickney Ter	Hampton	99
Hampton	2.8	NNE	MPA at Hampton	30 Winnacunnet Rd	Hampton	22
Hampton	3.0	NNE	Hampton Child & Family Program-DBA Village Preschool	200 High St	Hampton	25
Hampton Falls	1.5	NW	Lincoln Akerman School After School Program	8 Exeter Rd	Hampton Falls	40
Hampton Falls	1.5	NNW	Robin's Childs Place	105 Lafayette Rd	Hampton Falls	166
Hampton Falls	1.5	NNW	Seacoast Head Start	137 Lafayette Rd	Hampton Falls	37
Kingston	5.2	WNW	Kingston Elementary School After School Program	122 Amesbury Rd	Kingston	25
Kingston	10.7	WNW	Daniel J. Bakie Elementary School Before & After Childcare Program	179 Main St	Kingston	30
Kingston	10.8	WNW	Kingston Children's Center	12 Church St	Kingston	68
Newfields	9.8	NNW	Nurture & Nature Children's Center	171 Exeter Rd	Newfields	52
Newfields	10.6	NNW	Newfields Action Club at Newfields Elementary School	9 Piscassic Rd	Newfields	25
Newton	9.9	WSW	Newton Learning Center	31 S Main St	Newton	80
Newton	11.2	WSW	Memorial Elementary School - Before & After Program	31 W Main St	Newton	21
North Hampton	5.2	NNE	North Hampton Elementary School Before and After School Program	201 Atlantic Ave	North Hampton	55
North Hampton	7.0	NNE	Imprint's Day School	2 Lafayette Rd	North Hampton	188

² Student enrollment for this facility is included in Main Street School

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Enrollment
Portsmouth	10.2	NNE	Krepels Center-Brain Injury Program	100 Campus Dr, Unit 24	Portsmouth	40
Portsmouth	10.2	NNE	Portsmouth Head Start	100 Campus Dr, Unit 22	Portsmouth	18
Portsmouth	10.2	NNE	Seacoast Community School	100 Campus Dr, Unit 20	Portsmouth	219
Portsmouth	10.3	NNE	Place for Friends and Fun	400 Coolidge Dr	Portsmouth	9
Portsmouth	10.4	NNE	Dondero Peak Program	32 Van Buren Ave	Portsmouth	45
Portsmouth	11.0	NNE	Kindercare Learning Center	72 Mirona Rd	Portsmouth	142
Portsmouth	11.0	NNE	Little Blessings Day Care	1035 Lafayette Rd	Portsmouth	71
Portsmouth	11.1	NNE	YMCA of the Seacoast	550 Peverly Hill Rd	Portsmouth	30
Portsmouth	11.3	NNE	The Children's Garden	290 Peverly Hill Rd	Portsmouth	30
Portsmouth	11.6	NNE	The Chase Home For Children	698 Middle Rd	Portsmouth	25
Portsmouth	12.3	NNE	Edgewood Early Learning Center	928 South St	Portsmouth	38
Portsmouth	12.3	N	Great Bay Kids-PEASE Center	81 New Hampshire Ave	Portsmouth	270
Portsmouth	12.6	NNE	Little Harbour Peak Program	50 Clough Dr	Portsmouth	45
Portsmouth	12.7	NNE	Kathleen Tostenson	306 Thornton St	Portsmouth	6
Portsmouth	12.8	N	Discovery Child Enrichment Center	30 Rye St	Portsmouth	143
Portsmouth	12.8	NNE	New Franklin School PEAK Program	1 Franklin Dr	Portsmouth	12
Portsmouth	13.1	NNE	Early Learning Center at Temple Israel Preschool	200 State St	Portsmouth	24
Portsmouth	13.2	NNE	The Treehouse School of Portsmouth	100 State St	Portsmouth	27
Portsmouth	13.6	N	Seacoast Community School at the Meadows	40 Wedgewood Rd	Portsmouth	22
Rye	7.7	NNE	Rye Country Day School	1245 Washington Rd	Rye	99
Seabrook	1.2	S	Seabrook Elementary School After School Program	256 Walton Rd	Seabrook	90
Seabrook	1.3	S	Seabrook Middle School Adventure Zone After School Program	236 Walton Rd	Seabrook	80
Seabrook	1.3	SSW	Miss Beth's Family Day Care	49 Belgian Dr	Seabrook	17
Seabrook	1.8	SW	Seabrook Head Start	146 Lafayette Rd	Seabrook	18
Stratham	5.8	NNW	Bright Horizons at Timberland	200 Domain Dr	Stratham	110
Stratham	7.6	NNW	Little Sprouts Childcare & Preschool	1 Portsmouth Ave, Unit 8	Stratham	98
Stratham	8.0	NNW	Acorn School	136 Winnicutt Rd	Stratham	54
Stratham	8.9	NNW	Stratham Circle Learning Center	6 Emery Ln	Stratham	66
Stratham	9.3	N	Stratham Memorial School Before & After School Program	39 Gifford Farm Rd	Stratham	90
Stratham	10.3	NNW	Richie McFarland Children's Center	11 Sandy Point Rd	Stratham	13
					<i>NH Subtotal:</i>	3,977
					EPZ TOTAL:	5,167

Table E-3. Day Camps within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Enrollment
MASSACHUSETTS						
Amesbury	6.1	WSW	US Sports Institute	222 Lion's Mouth Rd	Amesbury	196
Amesbury	6.7	WSW	James Place	8 W Whitehall Rd	Amesbury	46
Amesbury	7.6	WSW	Camp Bauercrest	17 Old County Rd	Amesbury	250
Newbury	7.3	SSE	Coastal Discoveries Marine	20 Columbia Way	Newburyport	24
Newbury	10.5	SSW	Governor's Academy	1 Elm St	Byfield	117
Newburyport	6.2	SSW	YWCA Greater Newburyport	13 Market St	Newburyport	65
Newburyport	6.2	SSW	Clipper Girls Basketball Camp	241 High St	Newburyport	196
Newburyport	6.9	S	Mass Audubon Joppa Flats Education Center	1 Plum Island Tpke	Newburyport	196
Newburyport	7.0	SSW	Metro Rock Climbing Camps	40 Parker St	Newburyport	196
West Newbury	10.2	SW	Koinonia Day Camp	308 Main St	West Newbury	196
MA Subtotal: 1,482						
NEW HAMPSHIRE						
Brentwood	12.3	WNW	Action Kids at Brentwood Commons	112 Crawley Falls Rd	Exeter	250
East Kingston	8.5	W	YMCA Tricklin' Falls Day Camp	140 Haverhill Rd	East Kingston	300
Kingston	11.5	W	Long Tree Scout Reservation	12 W Shore Park Rd	Kingston	100
Kingston	11.6	W	YMCA Camp Lincoln Kingston	67 Ball Rd	Kingston	600
Newton	11.1	W	Camp Tasker (Boys & Girls Club of Haverhill)	36 Country Pond Rd	Newton	140
Portsmouth	10.4	NNE	Seawood Girl Scout Camp	350 Banfield Rd	Portsmouth	150
NH Subtotal: 1,540						
EPZ TOTAL:						3,022

Table E-4. Medical Facilities within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Current Census	Ambulatory Patients	Wheel-chair Patients	Bed-ridden Patients
MASSACHUSETTS									
Amesbury	4.9	SW	Coastal Connections Inc	35 Water St	Amesbury	96	65	17	14
Amesbury	5.2	SW	Amesbury Residence	30 Field St	Amesbury	8	8	0	0
Amesbury	5.4	SW	Maplewood Center	6 Morrill Place	Amesbury	109	57	48	4
Amesbury	5.5	SW	Lahey Health Primary Care, Amesbury	24 Morrill Pl	Amesbury	6	6	0	0
Amesbury	5.6	WSW	Amesbury Village, LLC	22 Maple St	Amesbury	102	66	26	10
Amesbury	5.7	SW	Hillside Rest Home Inc	29 Hillside Ave	Amesbury	28	28	0	0
Amesbury	6.0	WSW	Elizabeth Calsey House	15 Elizabeth St	Amesbury	14	10	2	2
Amesbury	7.0	WSW	Elizabeth Calsey House 2	286 Lions Mouth Rd	Amesbury	25	17	4	4
Merrimac	9.0	WSW	Church Street House	40 Church St	Merrimac	5	5	0	0
Newbury	10.4	SSW	Quaker Hill	115 Main St	Newbury	24	24	0	0
Newbury	10.5	SSW	Byfield Elderly Housing	84 Main St	Byfield	22	18	4	0
Newburyport	5.8	SSW	Home for Aged Men (Griffin House)	361 High St	Newburyport	9	9	0	0
Newburyport	6.2	SSW	Anna Jaques Hospital	25 Highland Ave	Newburyport	123	83	22	18
Newburyport	6.2	SSW	Newburyport Residence	17 Simmons Dr	Newburyport	8	8	0	0
Newburyport	6.2	SSW	Constellation Health Services	180 Low St	Newburyport	111	75	20	16
Newburyport	6.2	SSW	Country Center for Health & Rehabilitation	180 Low St	Newburyport	111	19	88	4
Newburyport	6.3	S	James Steam Mill Elderly Housing	1 Charles St	Newburyport	126	79	42	5
Newburyport	6.3	SSW	Harborside Adult Health at St. Paul's Church	166 High St	Newburyport	35	31	4	0
Newburyport	6.4	SSW	Avita of Newburyport	4 Wallace Bashaw Junior Way	Newburyport	70	48	12	10
Newburyport	6.4	SSW	Atria Merrimack Place	85 Storey Ave	Newburyport	85	77	8	0
Newburyport	6.5	SSW	Heritage House	32 Low St	Newburyport	128	80	43	5
Newburyport	6.6	S	Brigham Health and Rehabilitation Center	77 High St	Newburyport	64	8	52	4
Newburyport	6.6	SSW	Turning Point Inc.	5 Perry Way	Newburyport	51	51	0	0
Newburyport	6.6	SSW	Port Healthcare Center	113 Low St	Newburyport	123	83	22	18
Newburyport	7.0	SSW	Opportunity Works	10 Opportunity Way	Newburyport	130	88	23	19
Salisbury	4.0	S	Assisted Living Center of Salisbury	19 Beach Rd	Salisbury	30	26	4	0
MA Subtotal:						1,643	1,069	441	133

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Current Census	Ambulatory Patients	Wheel-chair Patients	Bed-ridden Patients
NEW HAMPSHIRE									
Brentwood	12.9	NW	Rockingham County Nursing Home	117 North Rd	Brentwood	202	136	36	30
Exeter	6.2	NNW	Langdon Place of Exeter	17 Hampton Rd	Exeter	114	77	20	17
Exeter	6.2	NNW	Exeter Rehab Center-Genesis HealthCare	8 Hampton Rd	Exeter	81	55	14	12
Exeter	7.2	NW	Exeter Hospital	10 Buzell Ave	Exeter	100	64	0	36
Exeter	7.3	NW	Exeter Healthcare	4 Alumni Dr	Exeter	26	6	12	8
Exeter	8.1	WNW	The Woods at Riverwoods	7 Riverwoods Dr	Exeter	300	203	53	44
Exeter	8.5	NW	The Ridge at Riverwoods	10 White Oak Dr	Exeter	163	110	29	24
Exeter	8.8	NW	The Boulders at Riverwoods	5 Timer Ln	Exeter	174	118	31	25
Greenland	7.8	NNE	Fairweather Lodge Group Home	463 Breakfast Hill Rd	Greenland	8	6	1	1
Hampton	3.6	NNE	Partridge House	777 Lafayette Rd	Hampton	162	162	0	0
Hampton	3.6	NNE	Oceanside Skilled Nursing Home & Rehab - Genesis	22 Tuck Rd	Hampton	112	76	20	16
Hampton	3.8	N	Cornerstone at Hampton	298 Exeter Rd	Hampton	120	81	21	18
Portsmouth	11.8	NNE	Portsmouth Regional Hospital	333 Borthwick Ave	Portsmouth	200	100	0	100
Portsmouth	12.1	NNE	Clipper Harbor of Portsmouth	#200	Portsmouth	102	69	18	15
Portsmouth	12.2	NNE	The Inn at Edgewood	188 Jones Ave	Portsmouth	12	8	2	2
Portsmouth	12.3	NNE	The Edgewood Centre	936 South St	Portsmouth	156	105	28	23
Portsmouth	13.0	NNE	Wentworth Senior Living	928 South St	Portsmouth	71	48	13	10
Portsmouth	13.0	N	Northeast Rehabilitation Hospital Network	346 Pleasant St	Portsmouth	33	22	6	5
Rye	7.5	NNE	Evolve at Rye	105 Corporate Dr	Rye	64	44	11	9
Rye	8.1	NNE	Webster at Rye	295 Lafayette Rd Route 1	Rye	147	100	26	21
						NH Subtotal:	2,347	341	416
						EPZ TOTAL:	2,659	782	549

Table E-5. Major Employers³ within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Employees (Max Shift)	% Employees Commuting into the EPZ	Employees Commuting into the EPZ	Employee Vehicles Commuting into the EPZ
MASSACHUSETTS									
	Various locations throughout the EPZ					6,356	62.0%	3,939	3,822
					<i>MA Subtotal:</i>	<i>6,356</i>	-	<i>3,939</i>	<i>3,822</i>
NEW HAMPSHIRE									
	Various locations throughout the EPZ					34,238	62.0%	21,230	20,612
					<i>NH Subtotal⁴:</i>	<i>34,238</i>	-	<i>21,230</i>	<i>20,612</i>
					EPZ TOTAL:	40,594	-	25,169	24,434

³ The major employer locations identified by the Census Bureau are shown in Figure E-9. The locations are represented by circles which increase in size proportional to the number of employees commuting into the EPZ in each census block.

⁴ Based on the data provided by NextEra Energy, Seabrook Station has a maximum of 374 employees in a single shift, and 62.5% of the employees living outside of the EPZ. This employment data supplemented the census block data in the Seabrook community in the New Hampshire portion of the EPZ.

Table E-6. Beaches within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Transients	Vehicles
MASSACHUSETTS							
Newburyport	6.0	SSE	Plum Island	-	Newburyport	138	55
Salisbury	5.3	SSE	Salisbury State Beach	-	Salisbury	1,868	744
<i>MA Subtotal:</i>						2,006	799
NEW HAMPSHIRE							
Hampton	2.0	ENE	Hampton Beach	-	Hampton	2,692	1,073
Hampton	4.1	NE	North Beach	-	Hampton	538	215
Hampton	4.5	NE	Plaice Cove	-	Hampton	97	39
North Hampton	5.2	NE	North Hampton State Beach	-	North Hampton	146	58
North Hampton	5.6	NE	Little Boar's Head	-	North Hampton	35	14
Rye	6.5	NE	Bass Beach	-	Rye	55	22
Rye	7.0	NE	Sawyers Beach (Rye Beach)	-	Rye	141	56
Rye	7.4	NE	Jenness Beach	2280 Ocean Blvd	Rye	106	42
Rye	8.4	NE	Straws Point	-	Rye	235	94
Rye	10.8	NNE	Wallis Sands	Ocean Blvd	Rye	745	297
Seabrook	1.9	SE	Seabrook Beach	-	Seabrook	718	286
<i>NH Subtotal:</i>						5,508	2,196
EPZ TOTAL:						7,514	2,995

Table E-7. Campgrounds within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Transients	Vehicles
MASSACHUSETTS							
Salisbury	2.4	SW	Black Bear Campground	54 Main St	Salisbury	502	400
Salisbury	3.3	SSW	Rusnik Campground	115 Lafayette Rd	Salisbury	600	300
Salisbury	4.0	S	Beach Rose RV Park	147 Beach Rd	Salisbury	115	106
Salisbury	4.6	S	Pines Camping Area	28 Sand Hill Rd	Salisbury	800	800
Salisbury	5.4	SSE	Salisbury Beach State Reservation	1 Beach Rd	Salisbury	1,180	940
					<i>MA Subtotal:</i>	3,197	2,546
NEW HAMPSHIRE							
Exeter	6.8	NW	Exeter Elms Campground	190 Ct St	Exeter	1,020	408
Exeter	6.9	NW	The Green Gate Camping Area	185 Ct St	Exeter	274	218
Hampton	1.8	E	Hampton Beach State RV Park	NH-1A	Hampton	70	56
Hampton	2.1	N	Tidewater Campground	160 Lafayette Rd	Hampton	1,190	476
Hampton Falls	4.8	NW	Wakeda Campground	294 Exeter Rd	Hampton Falls	1,004	800
Kingston	11.2	W	Country Shore Camping Area	125 NH-125	Kingston	421	306
Kingston	11.5	W	Mill Brook RV Park	99 New Hampshire 125	Kingston	227	189
Newfields	11.1	NNW	Great Bay Camping	50-60 Route 108	Newfields	238	190
Newton	10.5	W	Whispering Pines Campground	8 Wenmarks Rd	Newton	165	120
North Hampton	5.8	N	Sea Coast Camping and RV Resort	115 Lafayette Rd	North Hampton	502	400
South Hampton	6.7	WSW	Tuxbury Pond Campground	88 Whitehall Rd	South Hampton	798	636
					<i>NH Subtotal:</i>	5,909	3,799
					EPZ TOTAL:	9,106	6,345

Table E-8. Golf Courses within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Transients	Vehicles
MASSACHUSETTS							
Amesbury	4.1	SW	Bass River Golf Course	2 Country Club Rd	Amesbury	77	29
Amesbury	4.3	SW	Amesbury Golf & Country Club	46 Monroe St	Amesbury	33	29
Newbury	10.3	SSW	Old Newbury Golf Club	319 Newburyport Tpke	Newbury	44	29
<i>MA Subtotal:</i>						154	87
NEW HAMPSHIRE							
East Kingston	6.9	W	Apple Hill Golf Club	69 East Rd	East Kingston	25	13
Exeter	7.9	NW	Exeter Country Club	58 Jady Hill Rd	Exeter	20	15
Greenland	7.4	N	Golf Club of New England	167 Winnicutt Rd	Stratham	57	29
Greenland	7.9	NNE	Breakfast Hill Golf Club	339 Breakfast Hill Rd	Greenland	99	45
Greenland	9.6	N	Golf & Ski Warehouse Inc	1680 Greenland Rd	Greenland	57	29
Greenland	10.3	N	Portsmouth Country Club	80 Country Club Ln	Greenland	57	29
Hampton	3.6	NNE	Captain's Cove Adventure Golf	814 Lafayette Rd	Hampton	57	28
Kingston	9.6	WNW	Kingston Fairways Golf Club	65 Depot Rd	Kingston	5	3
Kingston	12.4	WSW	Granite Fields Golf Club	7 New Hampshire 125	Kingston	10	8
North Hampton	6.3	NNE	Sagamore Golf Center	22 North Rd	North Hampton	57	29
North Hampton	6.5	N	Sagamore-Hampton Golf Club	101 North Rd	North Hampton	70	38
Portsmouth	11.2	N	Pease Golf Course	200 Grafton Rd	Portsmouth	225	113
Rye	12.2	NNE	Wentworth by the Sea Country Club	60 Wentworth Rd	Rye	418	152
<i>NH Subtotal:</i>						1,157	531
EPZ TOTAL:						1,311	618

Table E-9. Marinas within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Transients	Vehicles
MASSACHUSETTS							
Amesbury	5.6	SW	The Marina at Amesbury Point	2 Merrimac St	Amesbury	169	68
Newbury	9.5	S	Riverfront Marina	292 High Rd	Newbury	344	125
Newburyport	5.6	SSW	Freedom Boat Club	386 Merrimac St	Newburyport	113	45
Newburyport	5.6	SSW	Newburyport Boat Basin	346 Merrimac St	Newburyport	275	100
Newburyport	5.7	SSW	Newburyport Yacht Club	300R Merrimac St	Newburyport	528	192
Newburyport	5.7	SSW	North End Boat Club	282 Merrimac St	Newburyport	206	75
Newburyport	6.1	S	Newburyport Harbor Marina	51 Water St	Newburyport	179	65
Newburyport	6.2	S	American Yacht Club	115 Water St R	Newburyport	83	30
Salisbury	5.6	SSW	Cove Marina	8 Friedenfels St	Salisbury	96	35
Salisbury	5.8	S	Bridge Marina on the Merrimack River	179 Bridge Rd	Salisbury	138	50
Salisbury	5.8	S	Ring's Island Marina	16 1st St	Salisbury	193	70
Salisbury	5.8	S	Salisbury Town Wharf	1st St	Salisbury	44	16
<i>MA Subtotal:</i>						2,368	871
NEW HAMPSHIRE							
Hampton	1.6	E	Hampton River Marina	55 Harbor Rd	Hampton	208	83
New Castle	12.8	NNE	Wentworth By the Sea Marina	116 Morgans Way	New Castle	151	60
Portsmouth	11.9	NNE	Portsmouth Marina	185 Wentworth Rd	Portsmouth	83	30
<i>NH Subtotal:</i>						442	173
EPZ TOTAL:						2,810	1,044

Table E-10. Historical Sites and Other Recreational Facilities within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Facility Type	Transients	Vehicles
MASSACHUSETTS								
Amesbury	5.5	SW	Mary Baker Eddy Historical House	277 Main St	Amesbury	Historical Site	20	11
Amesbury	6.5	SW	Amesbury Sports Park	12 S Hunt Rd	Amesbury	Other, Not Listed	2,000	797
Newbury	7.3	S	Spencer-Peirce-Little Farm	5 Littles Ln	Newbury	Historical Site	20	11
<i>MA Subtotal:</i>							2,040	819
NEW HAMPSHIRE								
Exeter	7.6	NW	American Independence Museum	1 Governors Ln	Exeter	Historical Site	30	12
New Castle	13.8	NNE	Fort Constitution	-	New Castle	Historical Site	20	11
Portsmouth	10.0	NNE	Water Country	2300 Lafayette Rd	Portsmouth	Other, Not Listed	3,500	2,000
Portsmouth	12.6	NNE	Wentworth Coolidge Mansion	375 Little Harbor Rd	Portsmouth	Historical Site	9	4
Stratham	9.3	NNW	Stratham Historical Society	158 Portsmouth Ave	Stratham	Historical Site	20	11
<i>NH Subtotal:</i>							3,579	2,038
EPZ TOTAL:							5,619	2,857

Table E-11. Lodging Facilities within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Transients	Vehicles
MASSACHUSETTS							
Amesbury	4.6	SW	Hampton Inn Amesbury	284 Elm St	Amesbury	253	92
Amesbury	4.7	SW	Fairfield Inn by Marriott Amesbury	35 Clarks Rd	Amesbury	420	105
Newbury	7.6	SSE	Blue - Inn On The Beach	20 Fordham Way	Newbury	45	23
Newburyport	6.1	S	Compass Rose Inn	5 1/2 Center St	Newburyport	14	5
Newburyport	6.2	S	Essex Street Inn and Suites	7 Essex St	Newburyport	67	33
Newburyport	6.2	S	Garrison Inn Boutique Hotel	11 Brown Square	Newburyport	81	20
Newburyport	6.3	S	Clark Currier Inn	45 Green St	Newburyport	30	11
Salisbury	4.1	S	Knotty Pine Motel	79 Beach Rd	Salisbury	83	30
Salisbury	4.2	S	Beachway Motel	82 Beach Rd	Salisbury	83	30
Salisbury	5.7	S	The Inn at Ring's Island	175 Bridge Rd	Salisbury	50	18
<i>MA Subtotal:</i>						1,126	367
NEW HAMPSHIRE							
Exeter	7.2	NW	Around the Corner Bed & Breakfast	72 High St	Exeter	11	4
Exeter	7.4	NW	Hampton Inn and Suites Exeter	59 Portsmouth Ave	Exeter	281	94
Exeter	7.5	NW	Inn by the Bandstand	4 Front St	Exeter	10	5
Exeter	7.5	NW	Fairfield Inn & Suites Portsmouth Exeter	138 Portsmouth Ave	Exeter	180	60
Exeter	7.6	NW	The Exeter Inn	90 Front St	Exeter	116	39
Hampton	1.8	E	Hampton Harbor Motel	210 Ashworth Ave	Hampton	44	11
Hampton	1.9	ENE	Harris Sea Ranch Motel	75 Ocean Blvd	Hampton Beach	113	23
Hampton	2.0	ENE	Grayhurst Hotel	11 F St	Hampton	29	10
Hampton	2.1	ENE	Ships Inn Resort	15 A St	Hampton Beach	312	78
Hampton	2.2	ENE	Ashworth by the Sea Hotel	295 Ocean Blvd	Hampton	403	101
Hampton	2.3	ENE	Hampton House Hotel	333 Ocean Blvd	Hampton	26	13
Hampton	2.6	ENE	Jonathan's Hotel	415 Ocean Blvd	Hampton Beach	38	13
Hampton	2.6	ENE	Atlantic Breeze Suites	429 Ocean Blvd	Hampton Beach	45	15
Hampton	3.0	N	Lamie's Inn and The Old Salt Tavern	490 Lafayette Rd	Hampton	58	29
Hampton	3.3	NNE	Hampton Village Inn	660 Lafayette Rd	Hampton	128	96
Hampton	3.5	NE	The Victoria Inn Bed & Breakfast and Pavilion	430 High St	Hampton	12	6
Hampton	3.7	NNE	Best Western Plus the Inn at Hampton	815 Lafayette Rd	Hampton	202	67
Hampton	3.9	NNE	Magnuson Hotel Hampton NH	869 Lafayette Rd	Hampton	89	30
Hampton	4.0	N	SpringHill Suites by Marriott Hampton Portsmouth	299 Exeter Rd	Hampton	286	104

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Transients	Vehicles
New Castle	13.1	NNE	Wentworth by the Sea Marriott Hotel and Spa	588 Wentworth Rd	New Castle	644	322
Portsmouth	10.9	NNE	Quality Inn	1190 Lafayette Rd	Portsmouth	306	102
Portsmouth	12.3	NNE	Port Inn And Suites	505 US Hwy 1 Byp	Portsmouth	205	51
Portsmouth	12.5	NNE	Best Western Plus Portsmouth Hotel and Suites	580 US Hwy 1 Byp	Portsmouth	285	142
Portsmouth	12.6	NNE	Holiday Inn Portsmouth	300 Woodbury Ave	Portsmouth	221	111
Portsmouth	12.7	NNE	Howard Johnson by Wyndham Portsmouth	383 Woodbury Ave	Portsmouth	180	60
Portsmouth	12.9	NNE	The Hotel Portsmouth	40 Court St	Portsmouth	86	29
Portsmouth	13.1	NNE	Hampton Inn & Suites Portsmouth Downtown	23 Portwalk Pl	Portsmouth	330	120
Portsmouth	13.2	NNE	Residence Inn by Marriott Portsmouth Downtown/Waterfront	100 Deer St	Portsmouth	352	128
Portsmouth	13.2	NNE	Hilton Garden Inn Portsmouth Downtown	100 High St	Portsmouth	241	121
Portsmouth	13.2	NNE	AC Hotel by Marriott Portsmouth Downtown/Waterfront	299 Vaughan St	Portsmouth	429	156
Portsmouth	13.2	NNE	Sheraton Portsmouth Harborside Hotel	250 Market St	Portsmouth	360	180
Portsmouth	13.3	NNE	Courtyard by Marriott	1000 Market St	Portsmouth	266	133
Portsmouth	13.4	NNE	Hampton Inn Portsmouth Central	99 Durgin Ln	Portsmouth	475	119
Seabrook	1.0	W	Holiday Inn Express Hotel & Suites Seabrook	11 Rocks Rd	Seabrook	308	77
Seabrook	1.9	W	Seabrook Inn	9 Stard Rd	Seabrook	530	133
<i>NH Subtotal:</i>						7,601	2,782
EPZ TOTAL:						8,727	3,149

Table E-12. Correctional Facilities within the EPZ

Community	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Capacity	Current Census
NEW HAMPSHIRE							
Brentwood	12.9	NW	Rockingham County Jail	99 North Rd	Brentwood	386	210
<i>NH Subtotal:</i>						386	210
EPZ TOTAL:						386	210

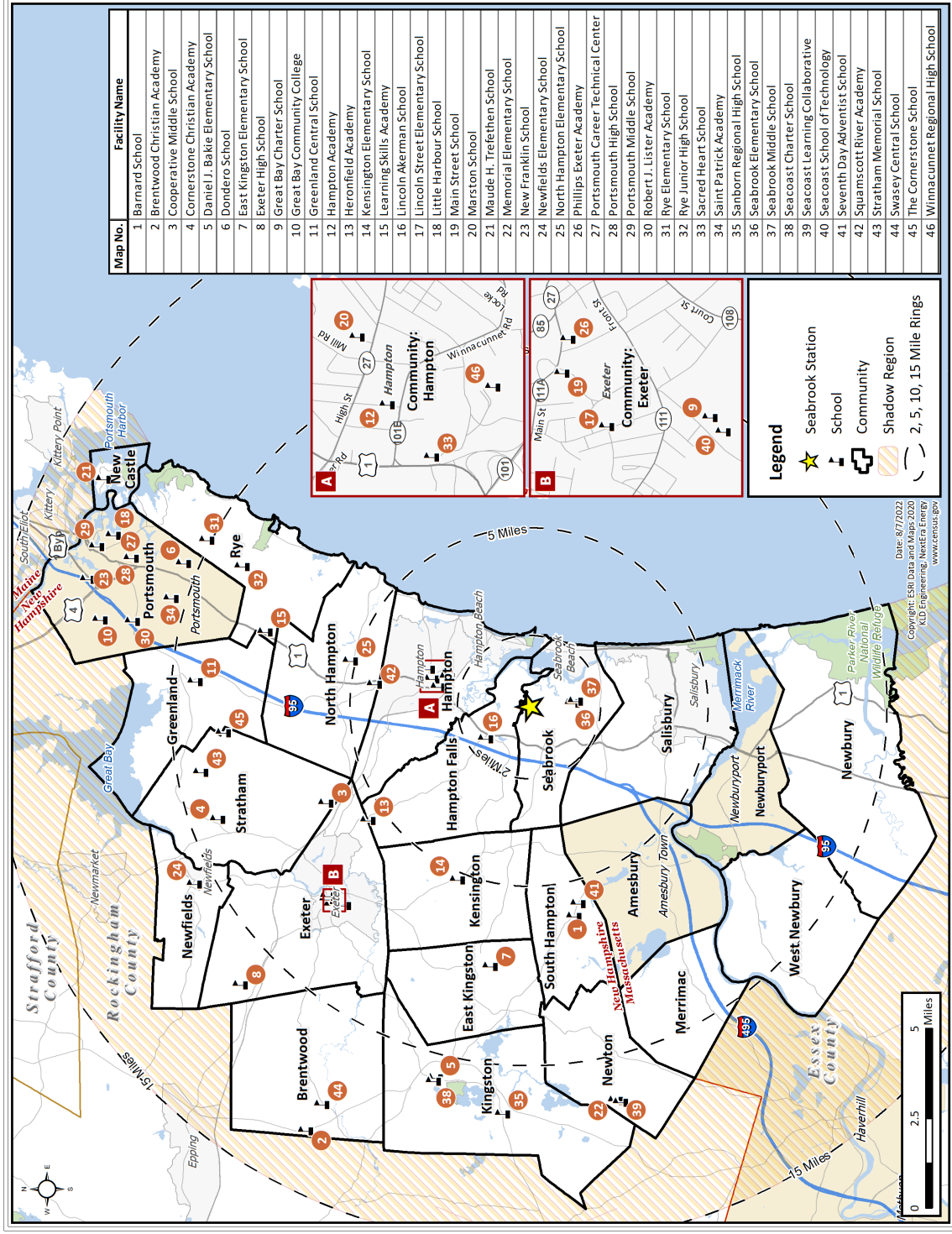


Figure E-1. Schools within the NH Portion of the EPZ

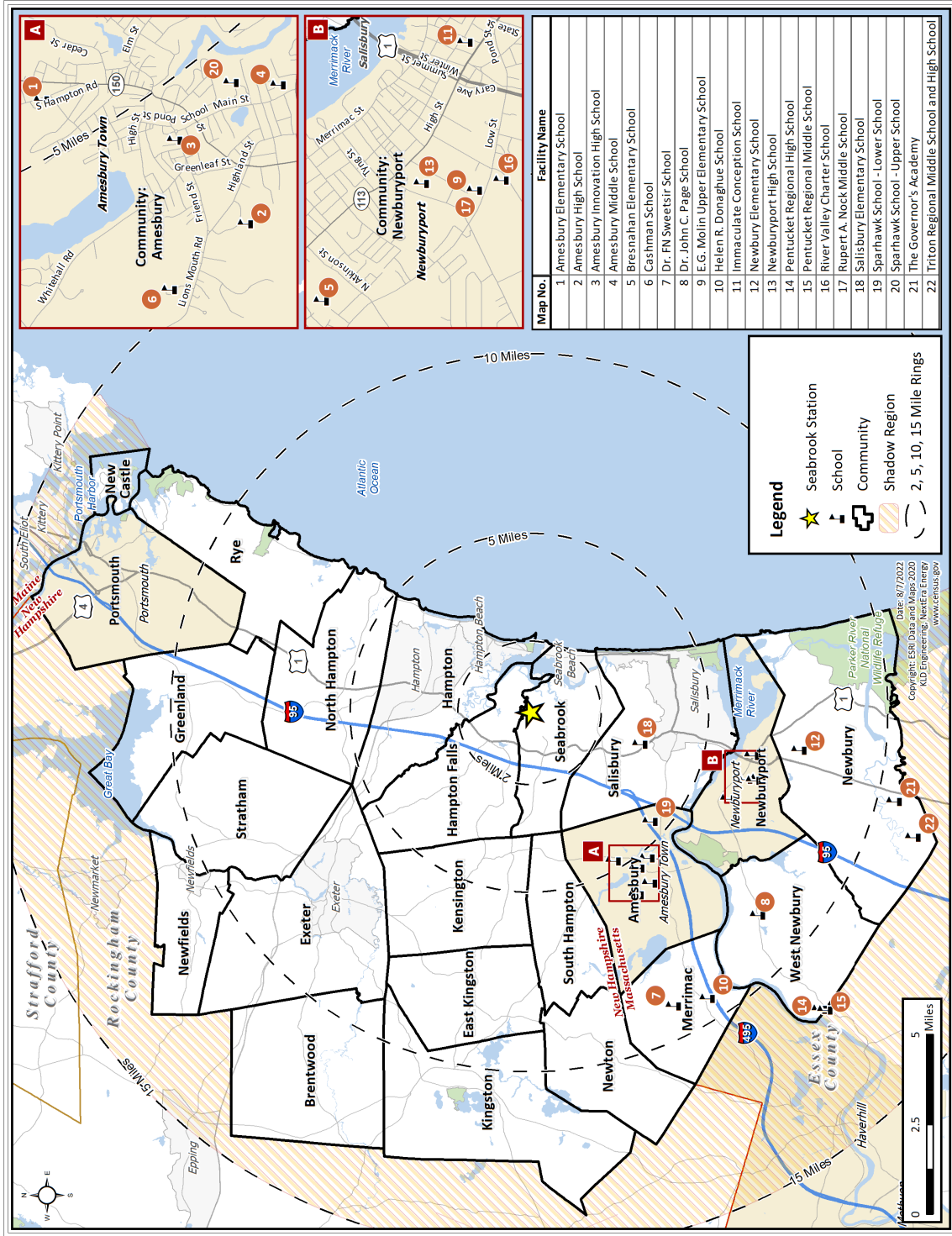


Figure E-2. Schools within the MA Portion of the EPZ

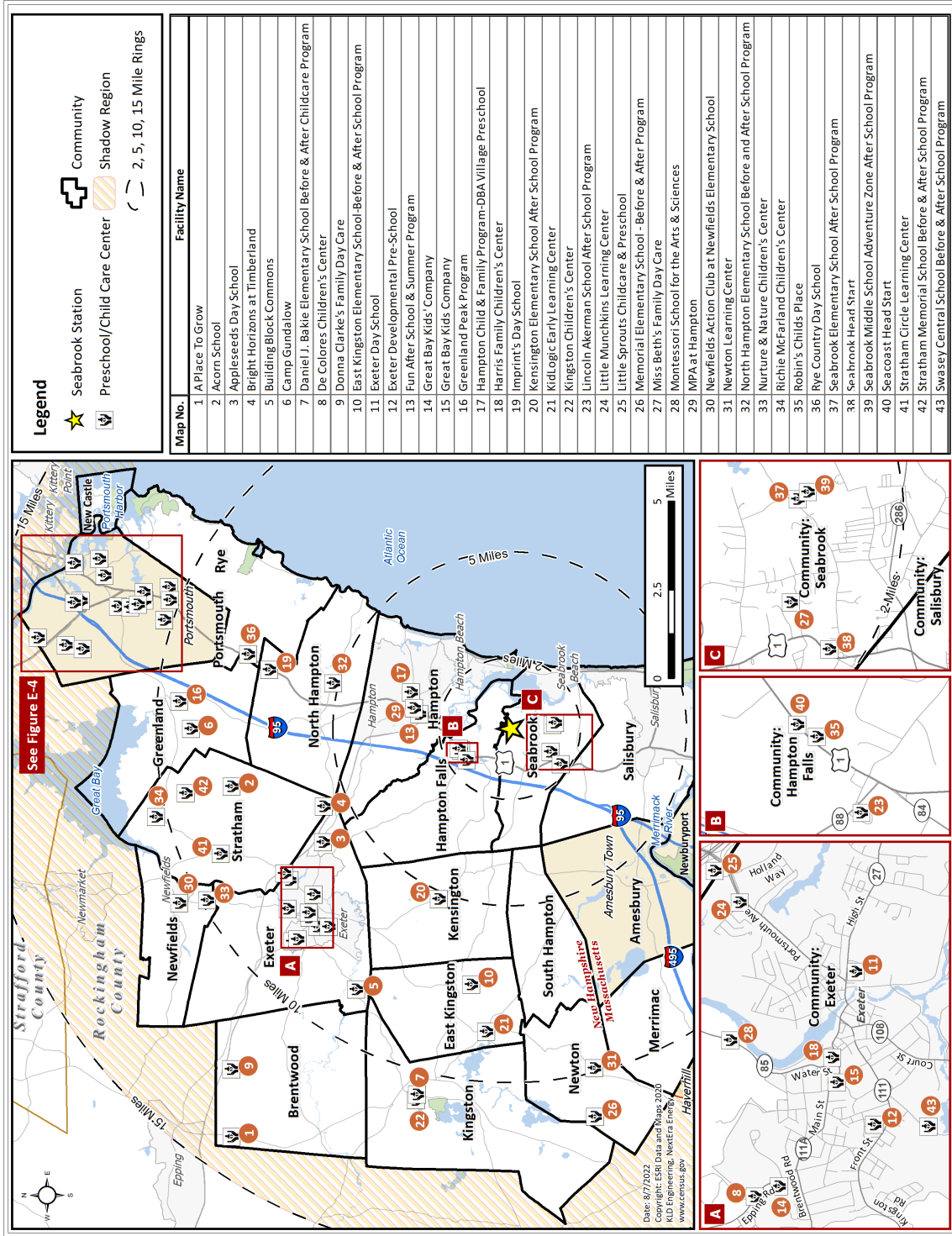


Figure E-3. Preschools/Child Care Centers within the NH Portion of the EPZ

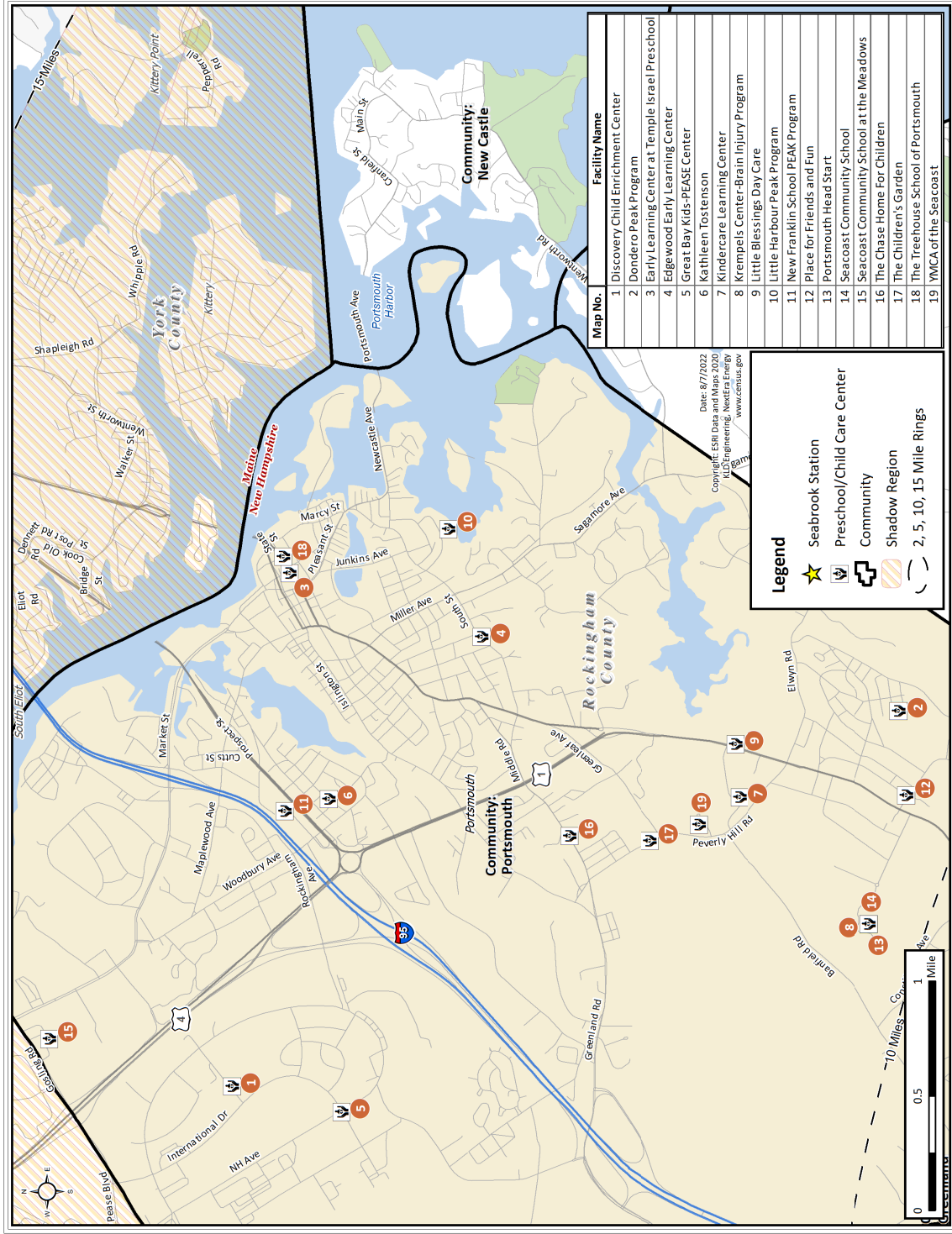


Figure E-4. Preschools/Child Care Centers within the NH Portion (Portsmouth) of the EPZ

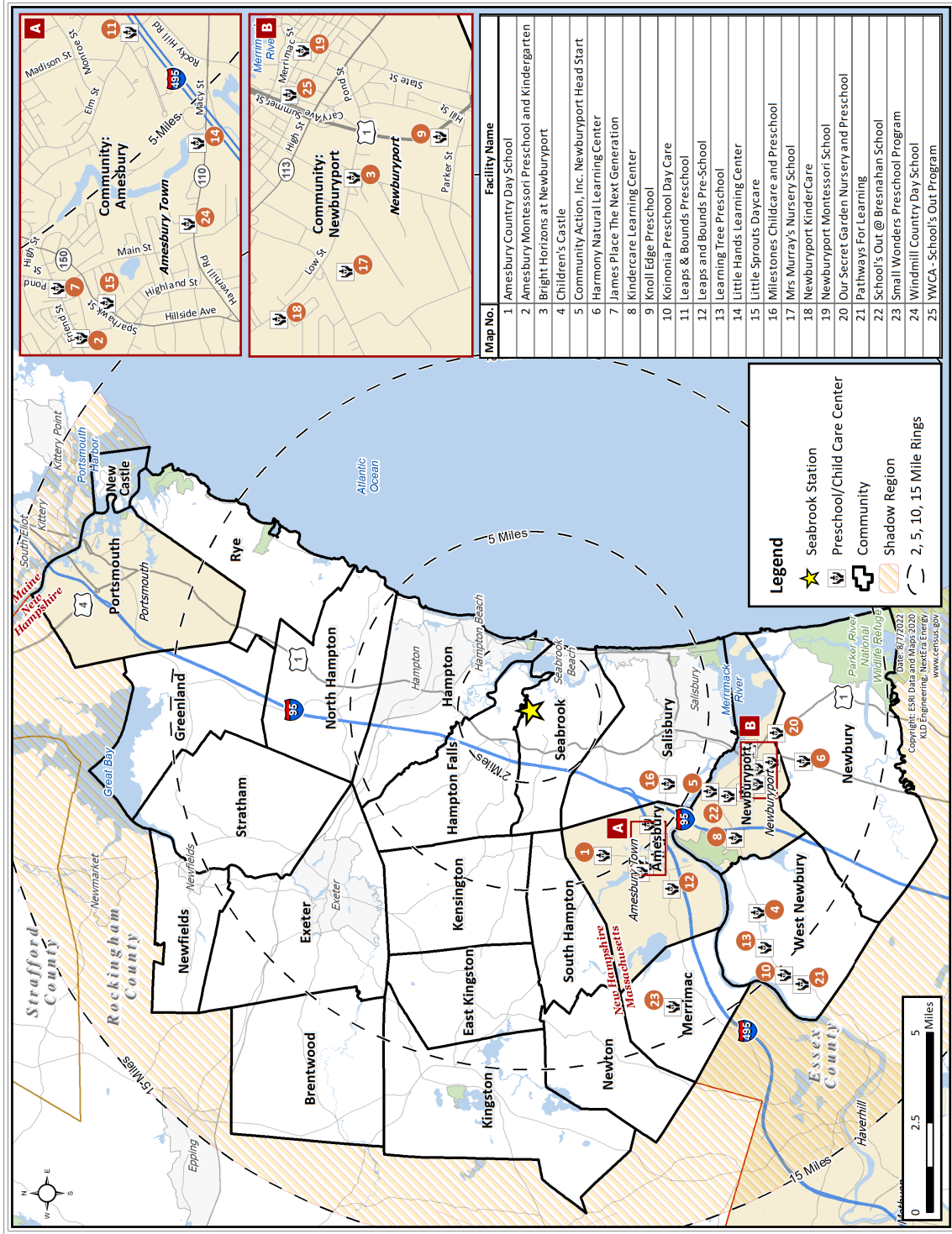


Figure E-5. Preschools/Child Care Centers within the MA Portion of the EPZ

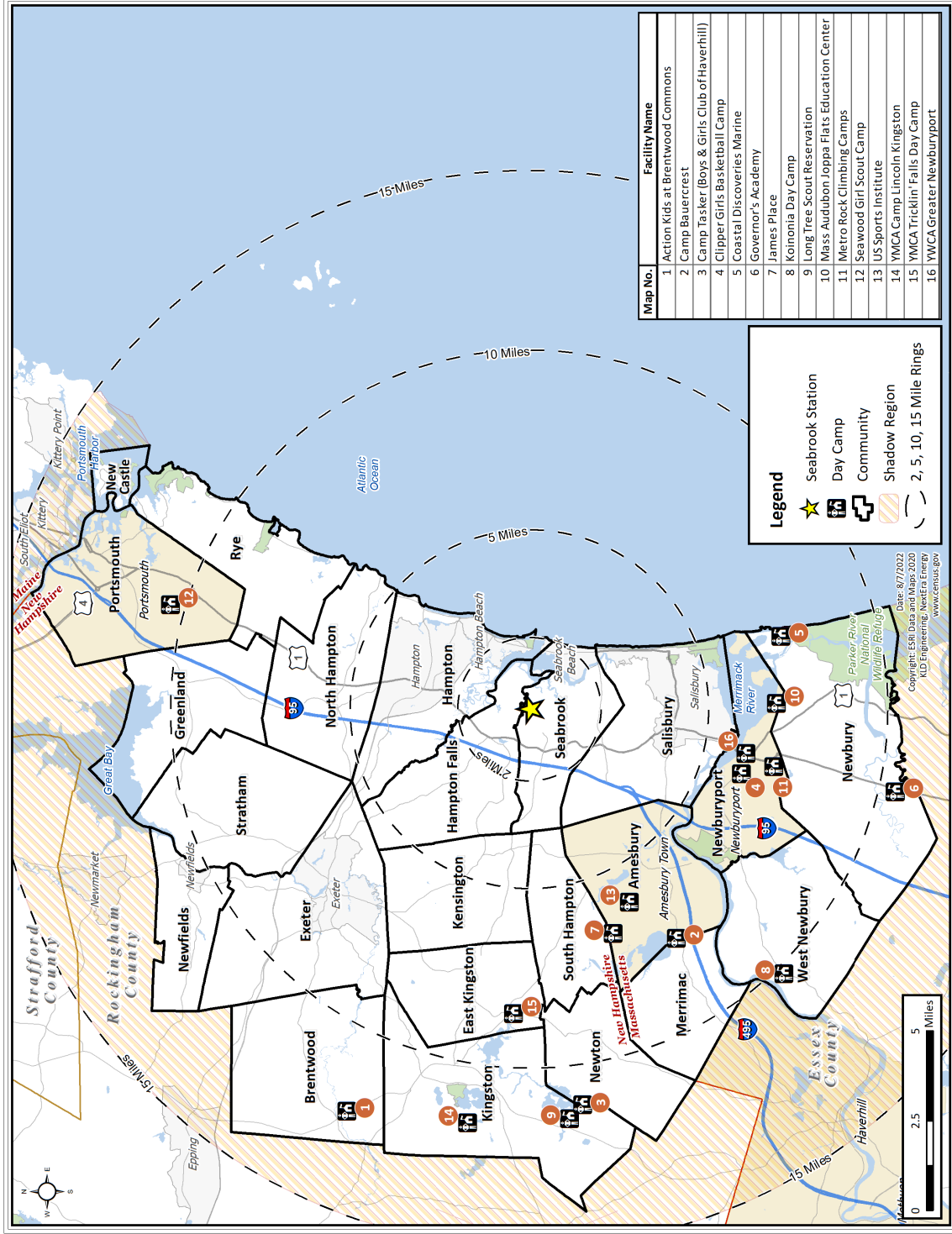


Figure E-6. Day Camps within the EPZ

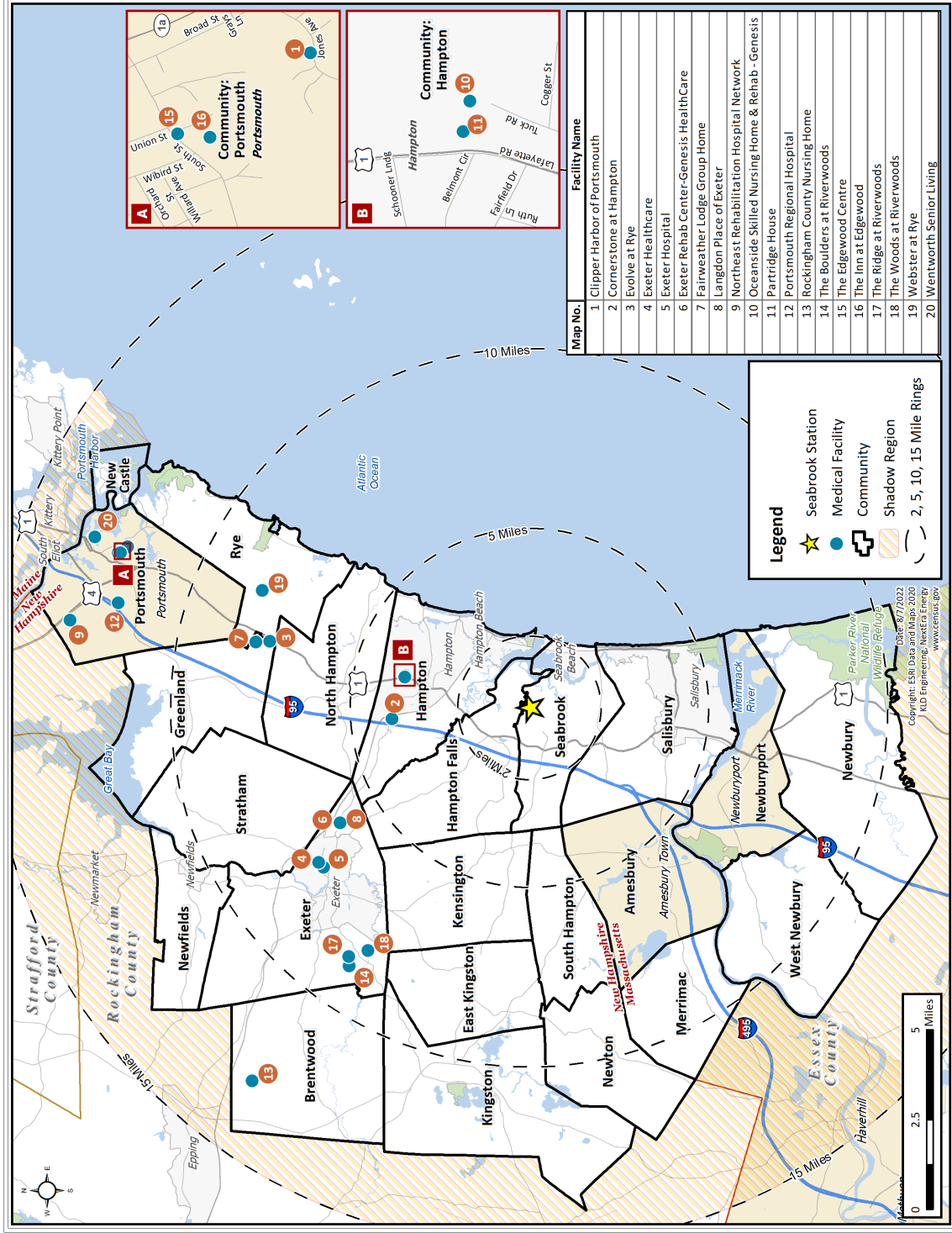


Figure E-7. Medical Facilities within the NH Portion of the EPZ

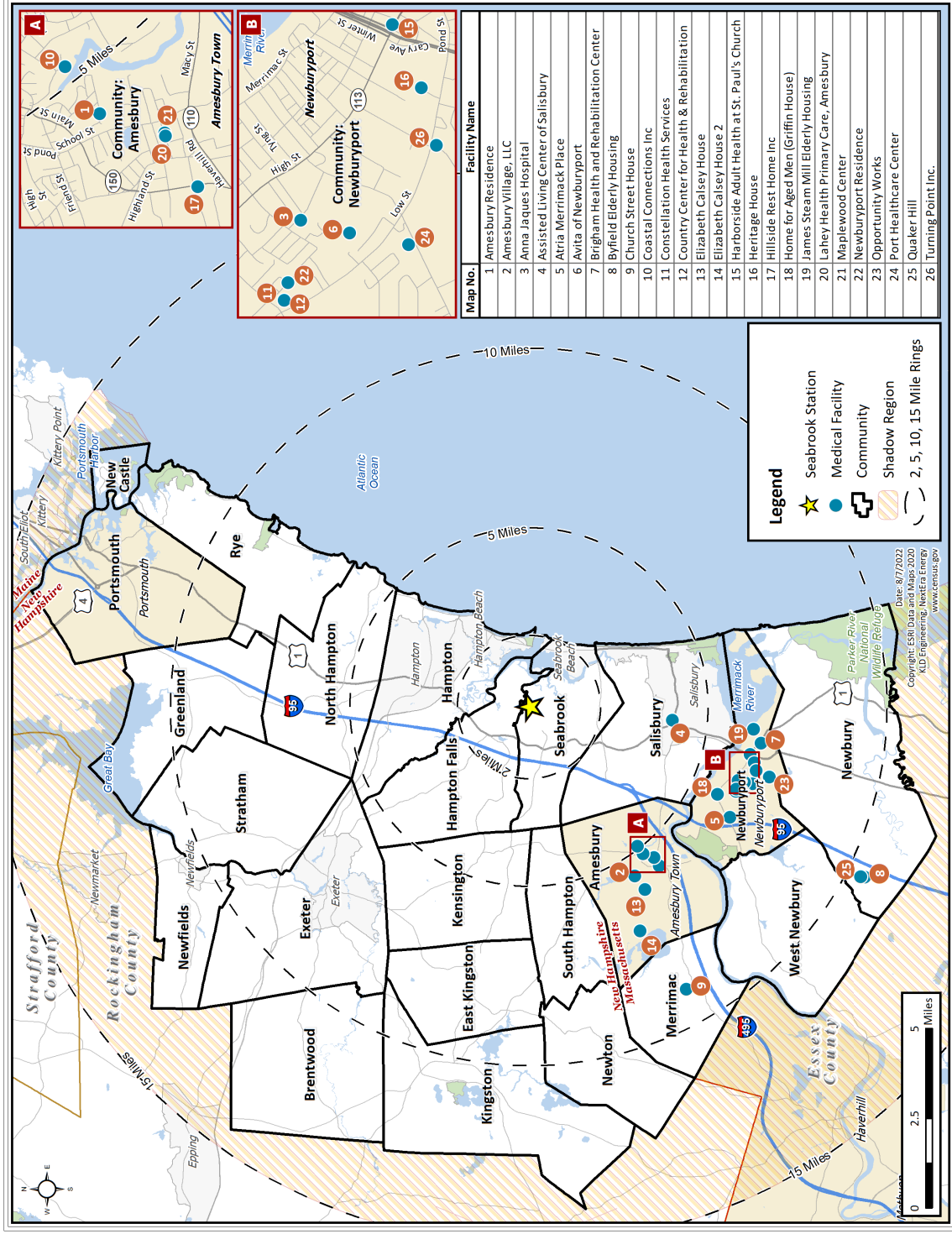


Figure E-8. Medical Facilities within the MA Portion of the EPZ

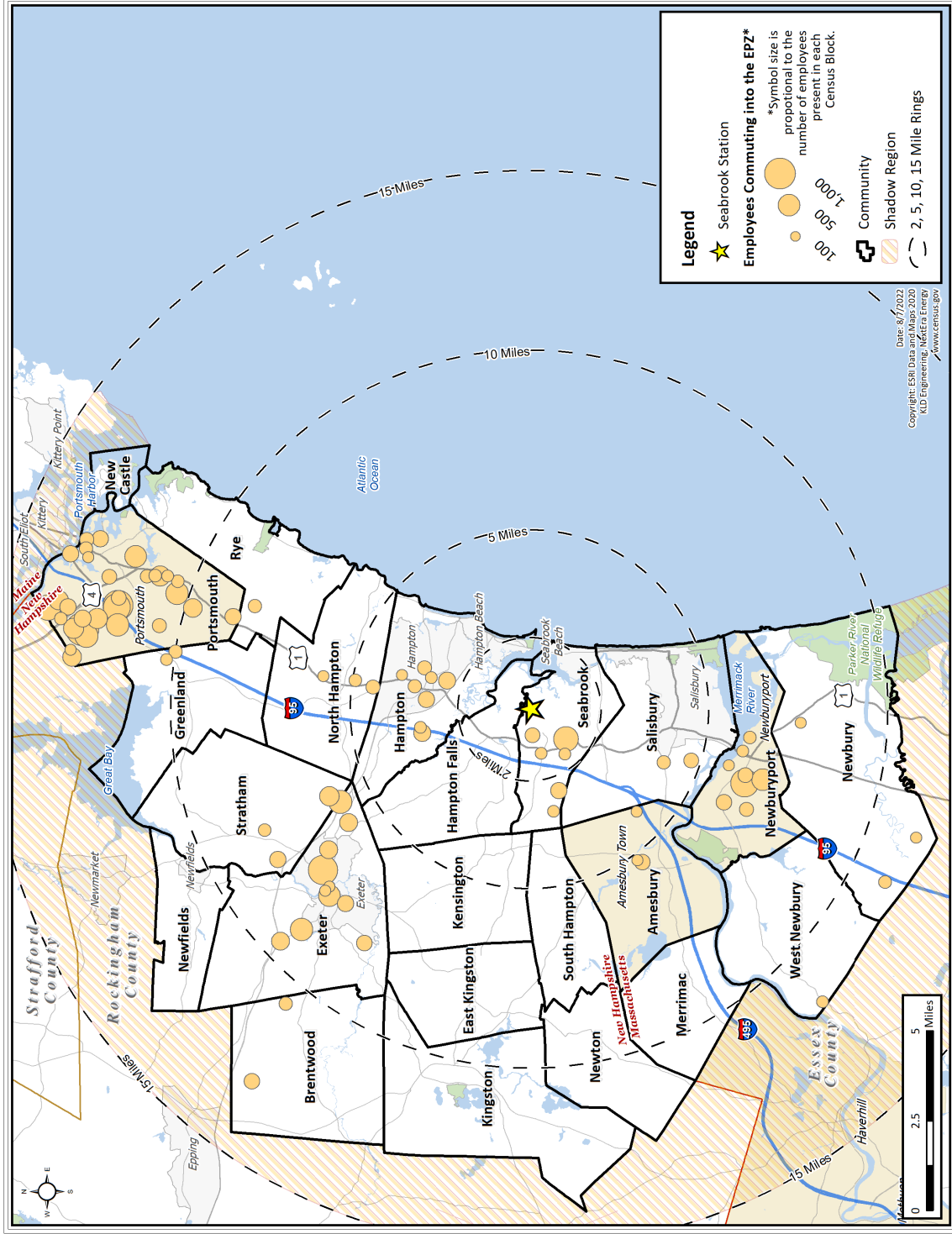


Figure E-9. Major Employers within the EPZ

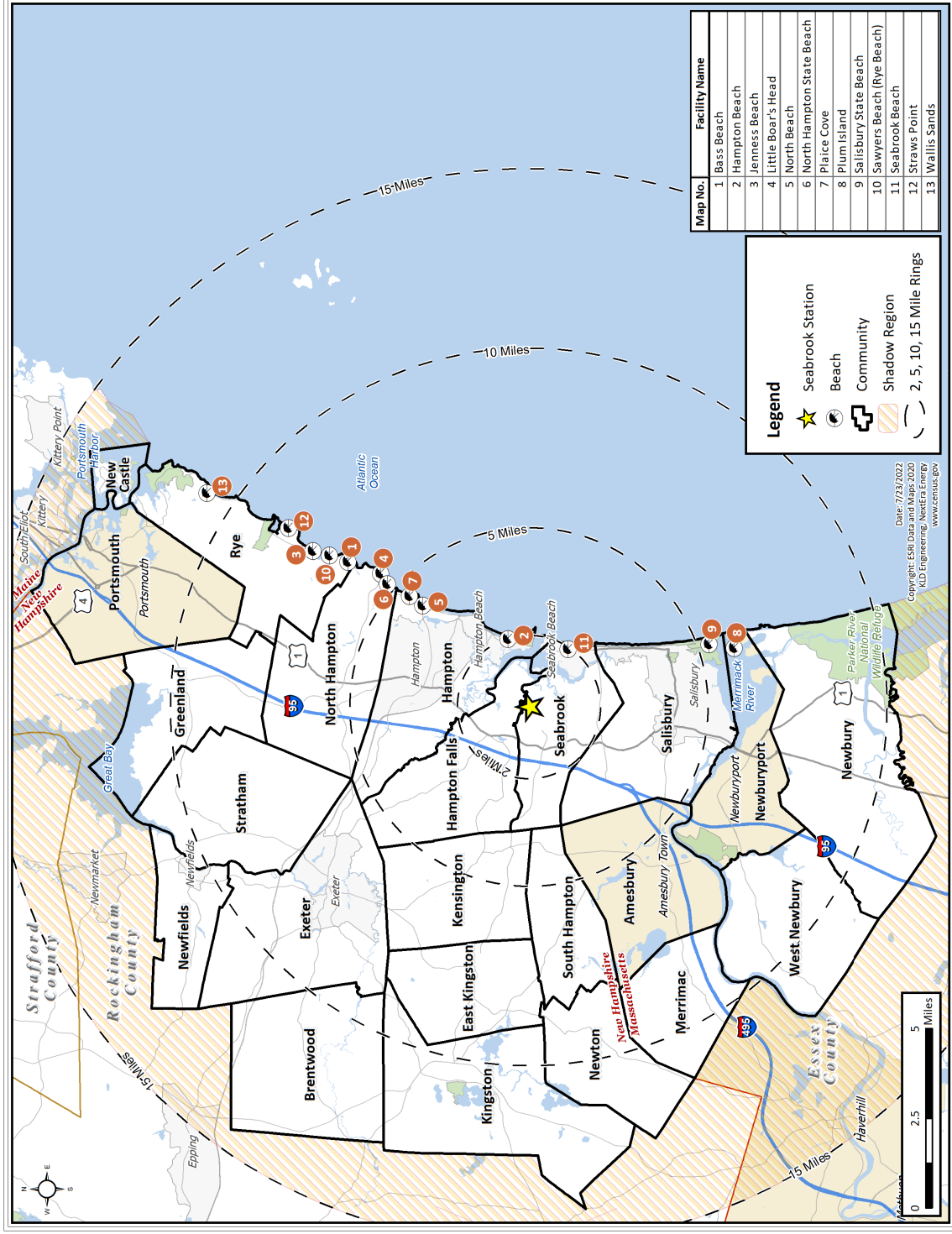


Figure E-10. Beaches within the EPZ

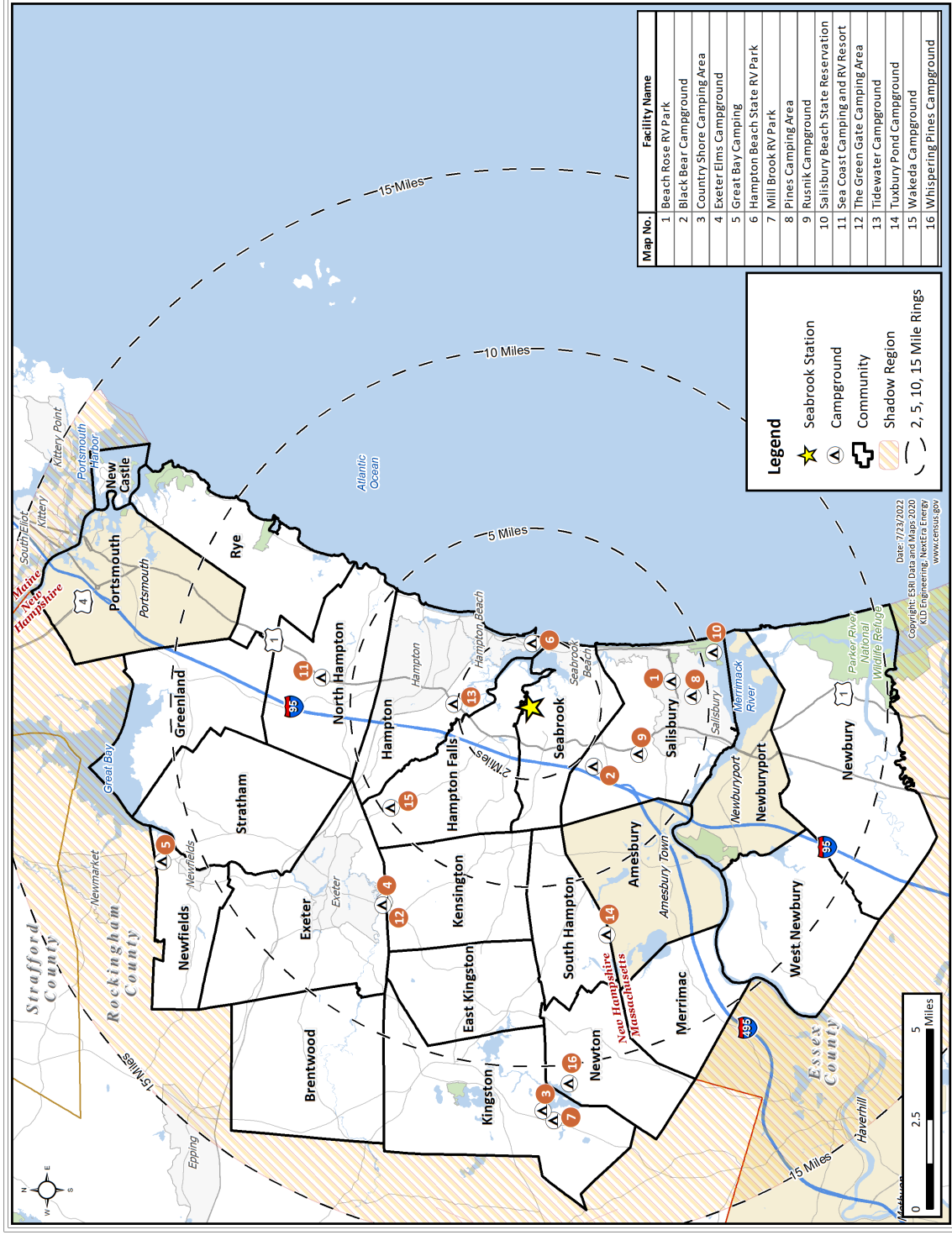


Figure E-11. Campgrounds within the EPZ

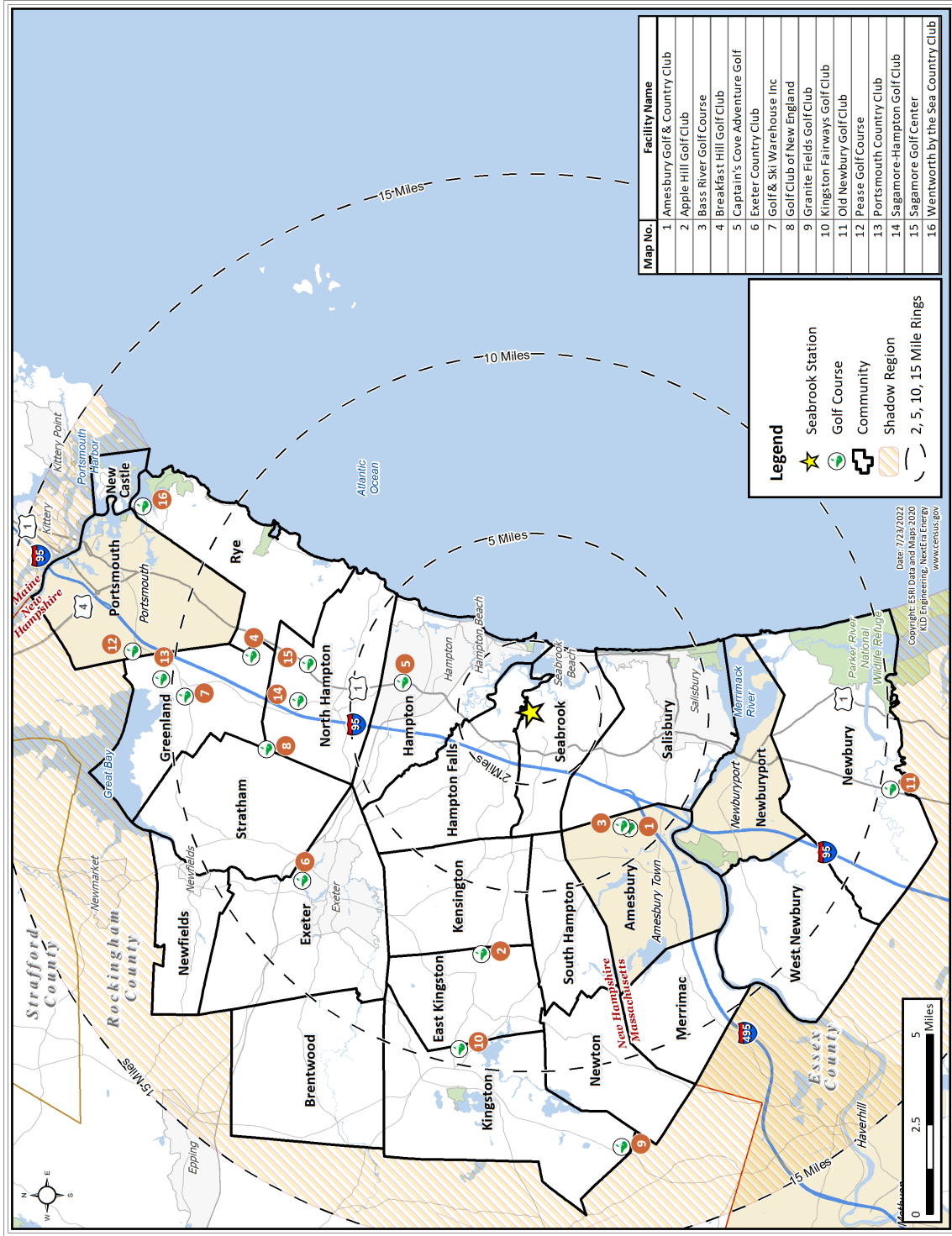


Figure E-12. Golf Courses within the EPZ

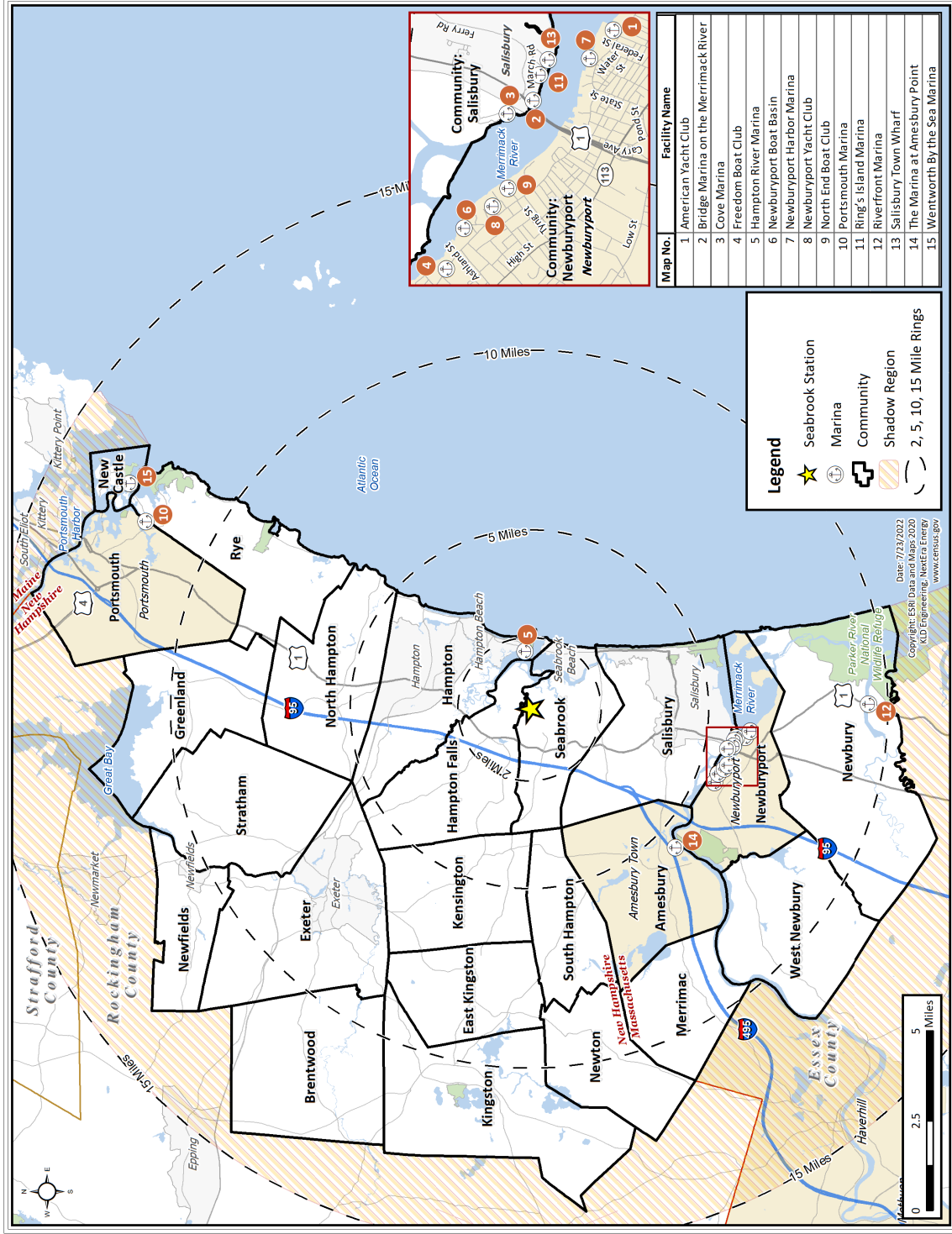


Figure E-13. Marinas within the EPZ

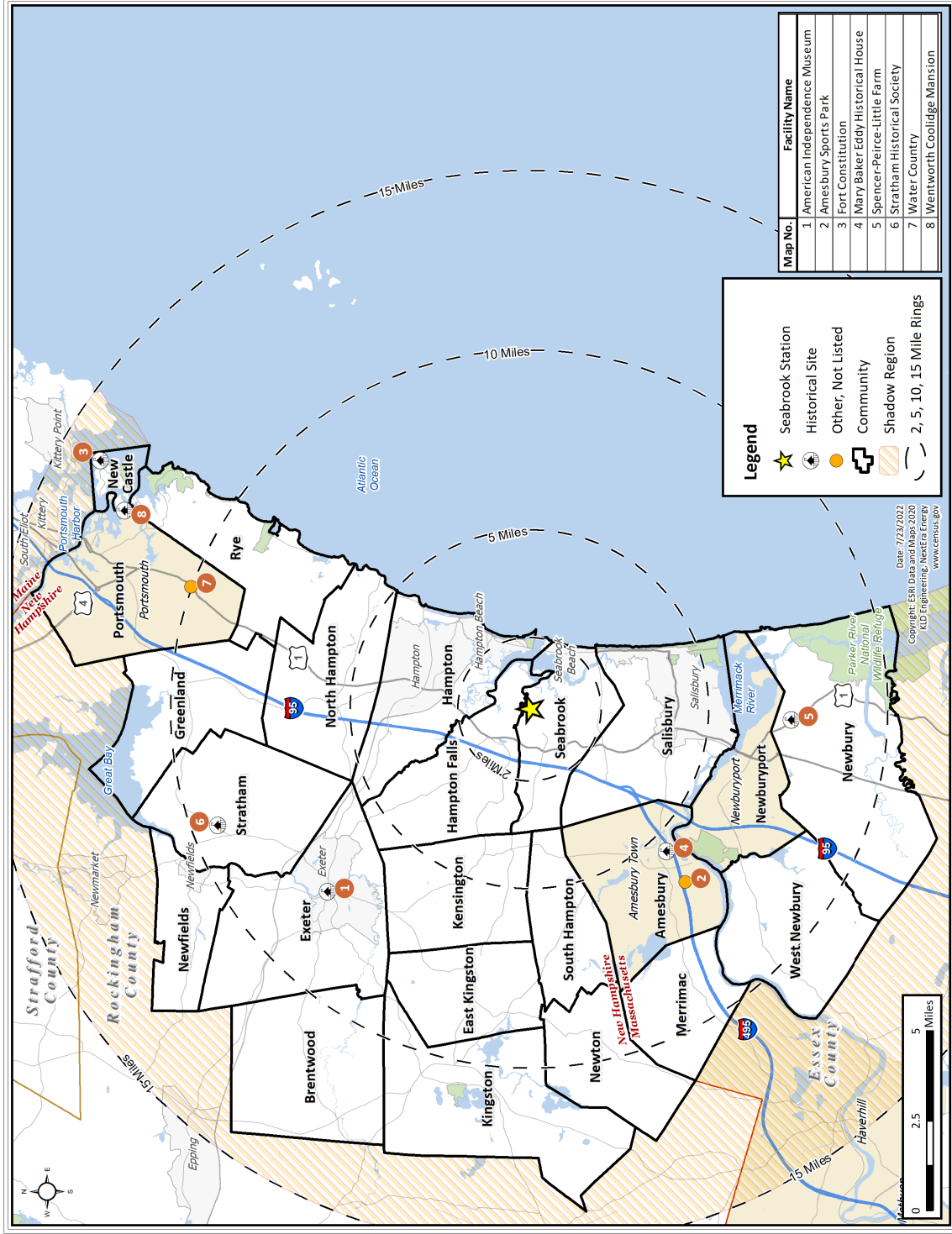


Figure E-14. Historical Sites and Other Recreational Facilities within the EPZ

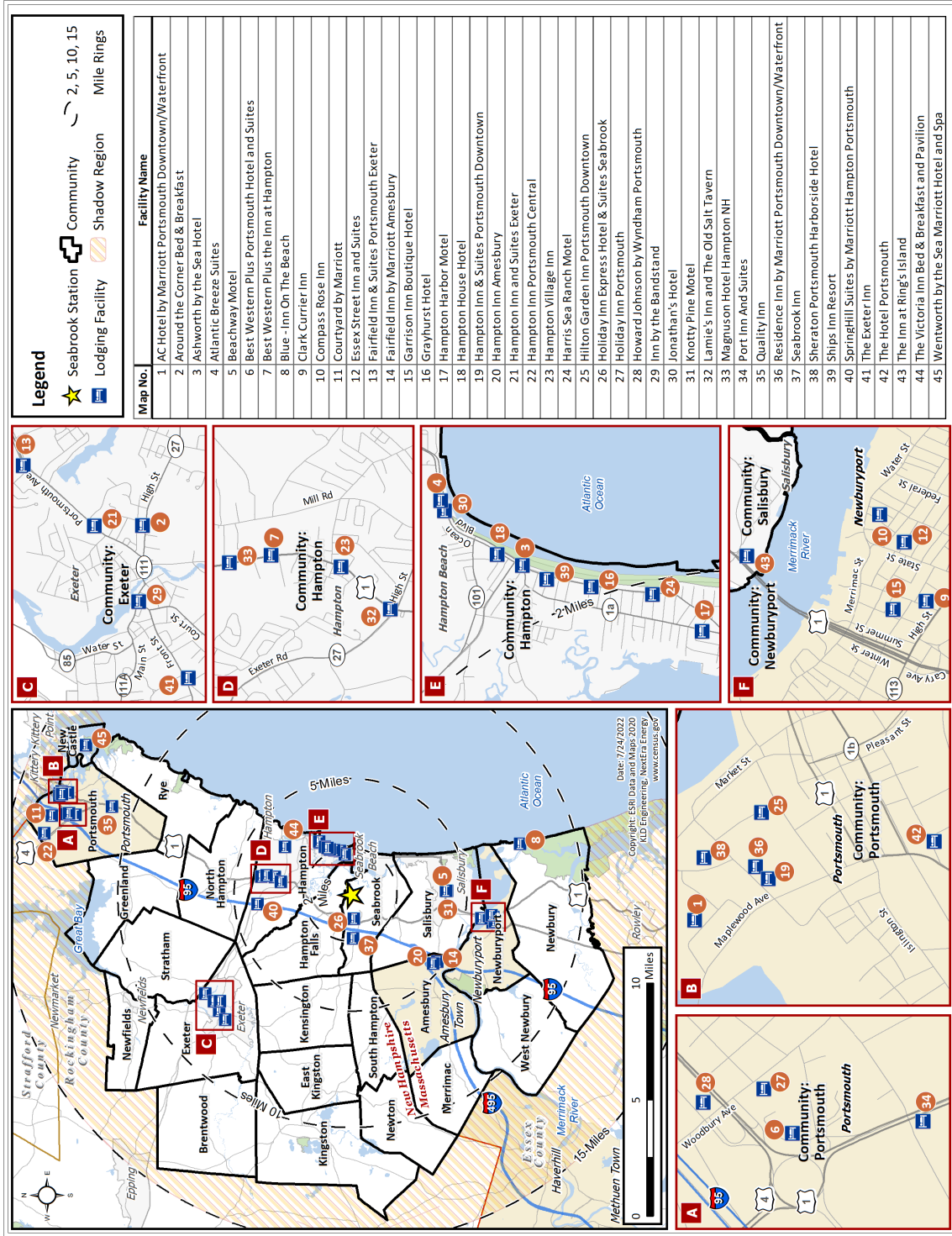


Figure E-15. Lodging Facilities within the EPZ

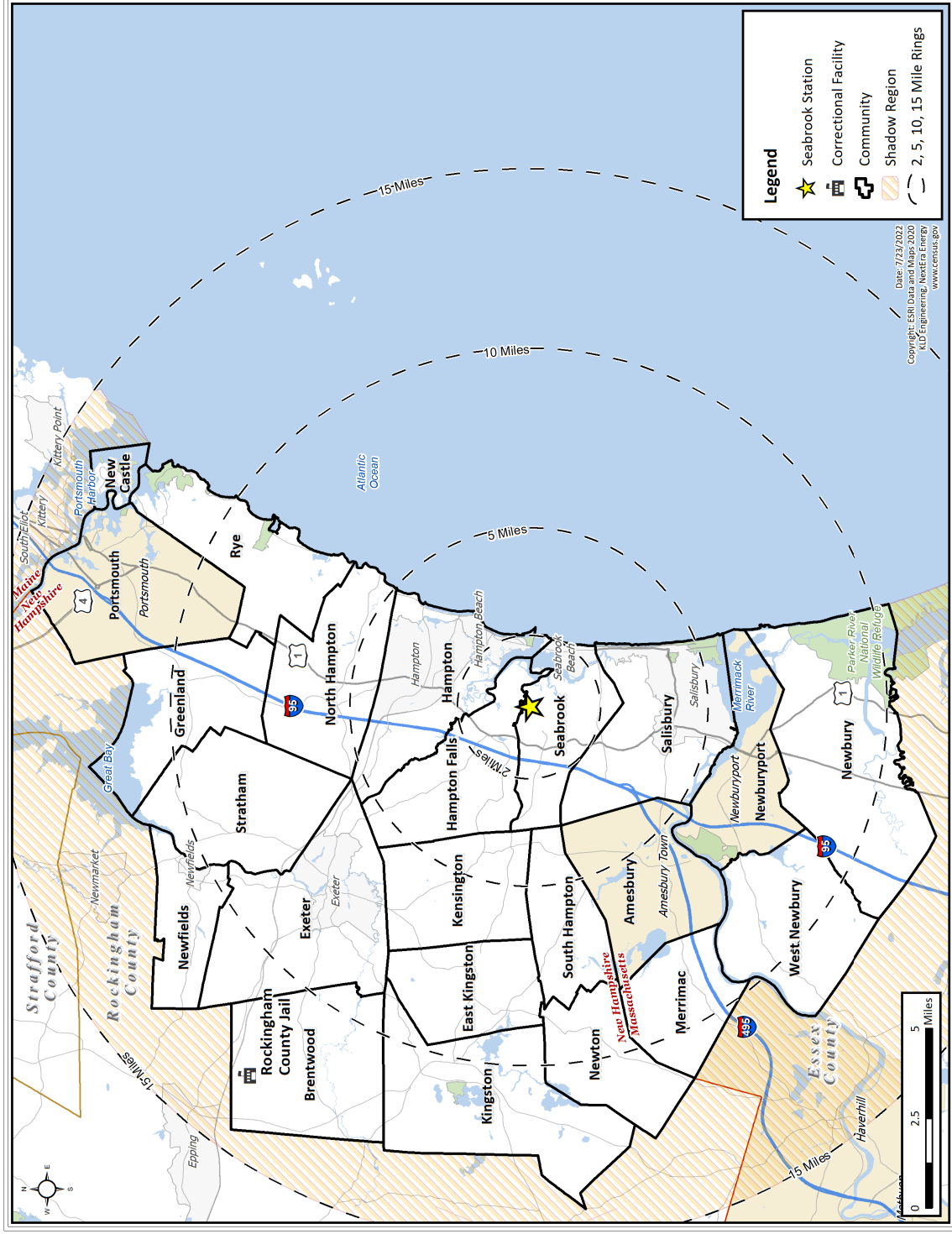


Figure E-16. Correctional Facilities within the EPZ

APPENDIX F

Demographic Survey

F. DEMOGRAPHIC SURVEY

F.1 Introduction

The development of evacuation time estimates for the Emergency Planning Zone (EPZ) of the Seabrook Station requires the identification of travel patterns, car ownership and household size of the population within the EPZ. Demographic information can be obtained from Census data. The use of this data has several limitations when applied to emergency planning. First, the Census data do not encompass the range of information needed to identify the time required for preliminary activities (mobilization) that must be undertaken prior to evacuating the area. Secondly, Census data do not contain attitudinal responses needed from the population of the EPZ and consequently may not accurately represent the anticipated behavioral characteristics of the evacuating populace.

These concerns are addressed by conducting a demographic survey of a representative sample of the EPZ population. The survey is designed to elicit information from the public concerning family demographics and estimates of response times to well defined events. The design of the survey includes a limited number of questions of the form “What would you do if ...?” and other questions regarding activities with which the respondent is familiar (“How long does it take you to ...?”).

F.2 Survey Instrument and Sampling Plan

Attachment A presents the final survey instrument used in this study for the demographic survey. A draft of the instrument was submitted to stakeholders for comment. Comments were received and the survey instrument was modified accordingly, prior to conducting the survey.

Following the completion of the instrument, a sampling plan was developed. Since the demographic survey discussed herein was performed prior to the release of the 2020 Census data, 2010 Census data was used to develop the sampling plan.

A sample size of 473 **completed** survey forms yield results with a sampling error of $\pm 4.5\%$ at the 95% confidence level. The sample must be drawn from the EPZ population. Consequently, a list of zip codes in the EPZ was developed using GIS software. This list is shown in Table F-1. Along with each zip code, an estimate of the population and number of households in each area was determined by overlaying 2010 Census data and the EPZ boundary, again using GIS software. The proportional number of desired completed survey interviews for each area was identified, as shown in Table F-1. Note that the average household size computed in Table F-1 was an estimate for sampling purposes and was not used in the ETE study.

A total of 349 completed household survey forms were obtained corresponding to a sampling error of $\pm 5.23\%$ at the 95% confidence level based on the 2010 Census data. The number of samples obtained within each zip code is also shown in Table F-1.

F.3 Survey Results

The results of the survey fall into two categories. First, the household demographics of the area can be identified. Demographic information includes such factors as household size, automobile ownership, and automobile availability. The distributions of the time to perform certain pre-evacuation activities are the second category of survey results. These data are processed to develop the trip generation distributions used in the evacuation modeling effort, as discussed in Section 5.

A review of the survey instrument reveals that several questions have a “I would rather not answer” or “Decline to State” entry for a response. It is accepted practice in conducting surveys of this type to accept the answers of a respondent who offers a “I would rather not answer” or who declines to answer a few questions. To address the issue of occasional Don’t know/declined responses from a large sample, the practice is to assume that the distribution of these responses is the same as the underlying distribution of the positive responses. In effect, the Don’t know/declined responses are ignored and the distributions are based upon the positive data that is acquired.

F.3.1 Household Demographic Results

Household Size

Figure F-1 presents the distribution of household size within the EPZ based on the responses to the demographic survey. The average household contains 2.75 people. The estimated household size from the 2020 Census data is 2.34 people. The difference between the Census data and survey data is 17.5%, which exceeds the sampling error of 5.23%. It was decided that the demographic survey value of 2.75 people per household should be used for this study. A sensitivity study was conducted to determine the impact of the average household size on ETE, see Appendix M.

Seasonal Residents

There are only 23 households with seasonal residents within the EPZ. Of the households that contain seasonal residents, 48% of the homes have one seasonal resident, 26% of the homes have two seasonal residents, and 26% of homes have three or more seasonal residents. Fifty (50%) of seasonal residents reside within the EPZ in the Fall, Winter, or Spring. The remaining 50% live in the EPZ in the Summer only.

Automobile Ownership

The average number of automobiles available per household in the EPZ is 2.11. All but one household in the study area have access to at least one vehicle. The distribution of automobile ownership is presented in Figure F-2. Figure F-3 and Figure F-4 present the automobile availability by household size.

Ridesharing

A majority (67.1%) of the households surveyed responded that they would share a ride with a neighbor, relative, or friend if a car was not available to them when advised to evacuate in the event of an emergency, as shown in Figure F-5.

Commuters

Figure F-6 presents the distribution of the number of commuters in each household. Commuters are defined as household members who travel to work or college on a daily basis. The data shows an average of 1.44 commuters in each household in the EPZ and 76% of households have at least one commuter.

Commuter Travel Modes

Figure F-7 presents the mode of travel that commuters use on a daily basis. The vast majority of commuters use their private automobiles to travel to work. The data shows an average of 1.03 employees per vehicle, assuming 2 people per vehicle – on average – for carpools.

Impact of COVID-19 on Commuters

Figure F-8 presents the distribution of the number of commuters in each household that were temporarily impacted by the COVID-19 pandemic. On average, 52% of households indicated someone in their household had a work and/or school commute that was temporarily impacted by the COVID-19 pandemic.

Functional or Transportation Needs

Figure F-9 presents the distribution of the number of individuals with functional or transportation need. The data shows that approximately 4.9% of households have an individual that requires functional or transportation needs. Of those with functional or transportation needs, 5 households (29%) require a bus, 1 household (6%) requires a medical bus/van, 8 households (47%) require a wheelchair accessible vehicle, 2 households (12%) require an ambulance, and 1 household (6%) indicated they would need some other form of transportation.

F.3.2 Evacuation Response

Several questions were asked to gauge the population's response to an emergency. These are now discussed:

“How many of the vehicles would your household use during an evacuation?” The response is shown in Figure F-10. On average, evacuating households would use 1.42 vehicles.

“Would your family await the return of other family members prior to evacuating the area?” Of the survey participants who responded, approximately 50% said they would await the return of other family members before evacuating and 50% indicated that they would not await the return of other family members before evacuating, as shown in Figure F-11.

“If you had a household pet, would you take your pet with you if you were asked to evacuate the area?” Based on responses from the survey, 62% of households have a family pet. Of the households with pets, about 12% indicated that they would take their pets with them to a shelter, about 85% indicated that they would take their pets somewhere else and about 3% would leave their pet at home, as shown in Figure F-12. Of the households that would evacuate with their pets, 98% indicated that they have sufficient room in their vehicle to evacuate with their pet(s)/animal(s).

“What type of pet(s) and/or animal(s) do you have?” Based on responses from the survey, 88% of households have a household pet (dog, cat, bird, reptile, or fish), 7% of households have farm animals (horse, chicken, goat, pig, etc.), and 5% have other small pets/animals.

“Emergency officials advise you to shelter-in-place in an emergency because you are not in the area of risk. Would you?” This question is designed to elicit information regarding compliance with instructions to shelter in place. As shown in Figure F-13, the results indicate that 84% of households who are advised to shelter in place would do so; the remaining 16% would choose to evacuate the area.

Note the baseline ETE study assumes 20% of households will not comply with the shelter advisory, as per Section 2.5.2 of NUREG/CR-7002, Rev. 1. Thus, the data obtained above is lower (4% less) than the federal guidance. A sensitivity study was conducted to estimate the impact of shadow evacuation non-compliance of shelter advisory on ETE – see Table M-2 in Appendix M.

“Emergency officials advise you to shelter-in-place now in an emergency and possibly evacuate later while people in other areas are advised to evacuate now. Would you?” This question is designed to elicit information specifically related to the possibility of a staged evacuation. That is, asking a population to shelter in place now and then to evacuate after a specified period of time. As shown in Figure F-14, 72% of households would follow instructions and delay the start of evacuation until so advised, while the other 28% would choose to begin evacuating immediately.

“Emergency officials advise you to evacuate due to an emergency. Where would you evacuate to?” This question is designed to elicit information regarding the destination of evacuees in case of an evacuation. Approximately 52% of households indicated that they would evacuate to a friend or relatives’ home, 2% to a reception center, 15% to a hotel, motel or campground, 11% to a second or seasonal home, and the remaining 20% answered other/don’t know or would not evacuate to this question, as shown in Figure F-15.

F.3.3 Time Distribution Results

The survey asked several questions about the amount of time it takes to perform certain pre-evacuation activities. These activities involve actions taken by residents during the course of their day-to-day lives. Thus, the answers fall within the realm of the responder’s experience.

The mobilization distributions provided below are the result of having applied the analysis described in Section 5.4.1 on the component activities of the mobilization.

As discussed in Section F.3.1 and shown in Figure F-8, the COVID-19 pandemic had a significant impact on the commuting patterns of those who live in the Seabrook Station EPZ. To minimize uncertainty in the survey data, data from the 2021 demographic survey was compared to the responses from the telephone survey responses conducted in 2012 for the distributions involving commuters (time to prepare to leave work/college and time to travel home from work/college). As shown in Figure F-16 and Figure F-17, the graphs for the 2021 demographic survey results and the 2012 telephone survey results have similar patterns and closely resemble one another. They also have the same endpoints. As such, the result from the 2021 demographic survey were deemed applicable for use in this study. Both the results of this survey and the results of the 2012 survey for these questions are discussed herein.

“How long does it take the commuter to complete preparation for leaving work?” Figure F-16 presents the cumulative distribution for the 2021 and 2012 survey responses. For both the 2021 survey and 2012 survey, in all cases, the activity is completed within 1 hour and 15 minutes. In both surveys, approximately 90% can leave within 30 minutes.

“How long would it take the commuter to travel home?” Figure F-17 presents the work to home travel time for the EPZ for the 2021 and 2012 survey responses. For both the 2021 survey and 2012 survey, in all cases, the activity is completed by 2 hours. In both surveys, approximately 85% can arrive home within 55 minutes.

“How long would it take the family to pack clothing, secure the house, and load the car?” Figure F-18 presents the time required to prepare for leaving on an evacuation trip. In many ways this activity mimics a family’s preparation for a short holiday or weekend away from home. Hence, the responses represent the experience of the responder in performing similar activities.

The distribution shown in has a long “tail.” Approximately, 85% of households can be ready to leave home within 90 minutes; the remaining households require up to an additional 2 hours.

Snow Removal

During adverse, snowy weather conditions, an additional activity must be performed before residents can depart on the evacuation trip. Although snow scenarios assume that the roads and highways have been plowed and are passable (albeit at lower speeds and capacities), it may be necessary to clear a private driveway prior to leaving the home so that the vehicle can access the street. Due to an oversight, the survey conducted in support of this study did not ask residents how long it would take to remove/shovel snow prior to evacuation if there were snow on the ground when an evacuation was ordered. The 2012 telephone survey conducted in support of the last ETE study did, however, include this question. As a result, the response to the snow removal question in the telephone survey conducted for the previous study is adapted for this study. It is assumed that the current snowfall and snow removal times are similar as the previous study.

“How long would it take you to clear 6 to 8 inches of snow from your driveway?” Figure F-19 presents the time distribution taken from the previous ETE study for removing 6 to 8 inches of snow from a driveway. The time distribution for clearing the driveway has a longtail; about 90%

of driveways are passable within 1 hour. The last driveway is clear 3 hours after the start of this activity.

Note that those respondents (47%) who answered that they would not take time to clear their driveway were assumed to be ready immediately at the start of this activity. Essentially, they would drive through the snow on the driveway to access the roadway and begin their evacuation trip.

F.3.4 Emergency Communications

“At your place of residence, how reliable is your cell phone signal?” This question is designed to elicit information regarding the ability to be notified in case of an evacuation. Approximately 81% of households indicated that they have very reliable signal to receive texts and phone calls, 5% indicated that their signal is reliable for text messages only, 11% indicated that they do not always receive cell communications at their residence, about 1% indicated that they do not have cell service at their residence, and the remaining 2% indicated they do not have a cellphone or use a landline telephone, as shown in Figure F-20.

“Emergency management officials in your state may send text messages, similar to AMBER Alerts, with emergency directions for the public during a radiological emergency at Seabrook Station. How likely would you be to take action on these directions, if you received the message?” This question is designed to elicit information regarding the likelihood of an individual to take action based on emergency management officials’ guidelines. 77% of households indicated that they are highly likely to take action on these directions, about 20% indicated likely, 2% indicated neither likely nor unlikely, 0.5% indicated unlikely, and 0.5% indicated they are highly unlikely to take action on emergency management officials’ directions. This data is shown in Figure F-21.

“Which of the following emergency communication methods do you think is most likely to alert you at your residence?” This question is designed to elicit information regarding the most efficient way to alert residents within the EPZ. There are 73.6% of households that indicated that a text message from emergency officials would be most likely to alert them at their residence, 18.8% indicated that a siren sounding near their home would be the most likely method, 2% indicated an alert broadcast on the TV. An alert broadcast on radio and a phone call/text message from a family member, friend or neighbor were each selected by approximately 1.5% of those who responded as the most likely to alert type. The remaining 4.1% indicated other forms of notification. This data is shown in Figure F-22.

Table F-1. Seabrook Station Demographic Survey Sampling Plan and Results

Zip Code	POP2010	HH 2010	Desired Samples	Responses
01860	6,361	2,427	15	25
01913	16,281	6,642	42	13
01922	3,110	1,077	7	3
01950	17,416	7,622	48	44
01951	3,556	1,518	10	5
01952	8,316	3,454	22	13
01985	4,235	1,508	10	164
03044	1	0	0	0
03801	20,770	10,623	67	6
03827	3,132	1,392	9	2
03833	20,942	8,655	55	18
03840	3,571	1,448	9	1
03842	15,338	9,798	62	12
03844	2,246	904	6	2
03848	6,111	2,517	16	1
03854	968	537	3	1
03856	1,681	592	4	3
03857	1	0	0	5
03858	4,591	1,743	11	6
03862	4,307	1,915	12	8
03870	5,156	2,785	18	2
03871	136	62	0	0
03874	8,723	4,639	29	9
03885	7,258	2,870	18	6
Total	164,207	74,728	473	349
Average HH Size:	2.20			

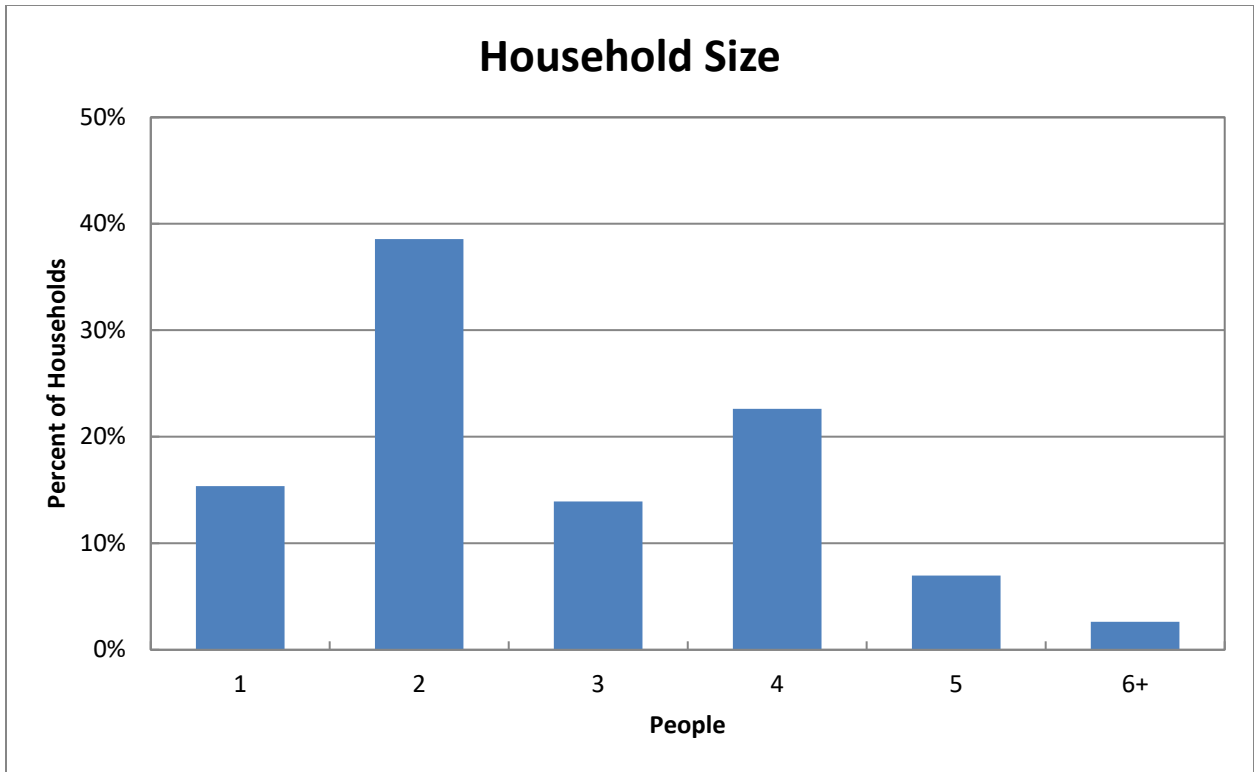


Figure F-1. Household Size in the EPZ

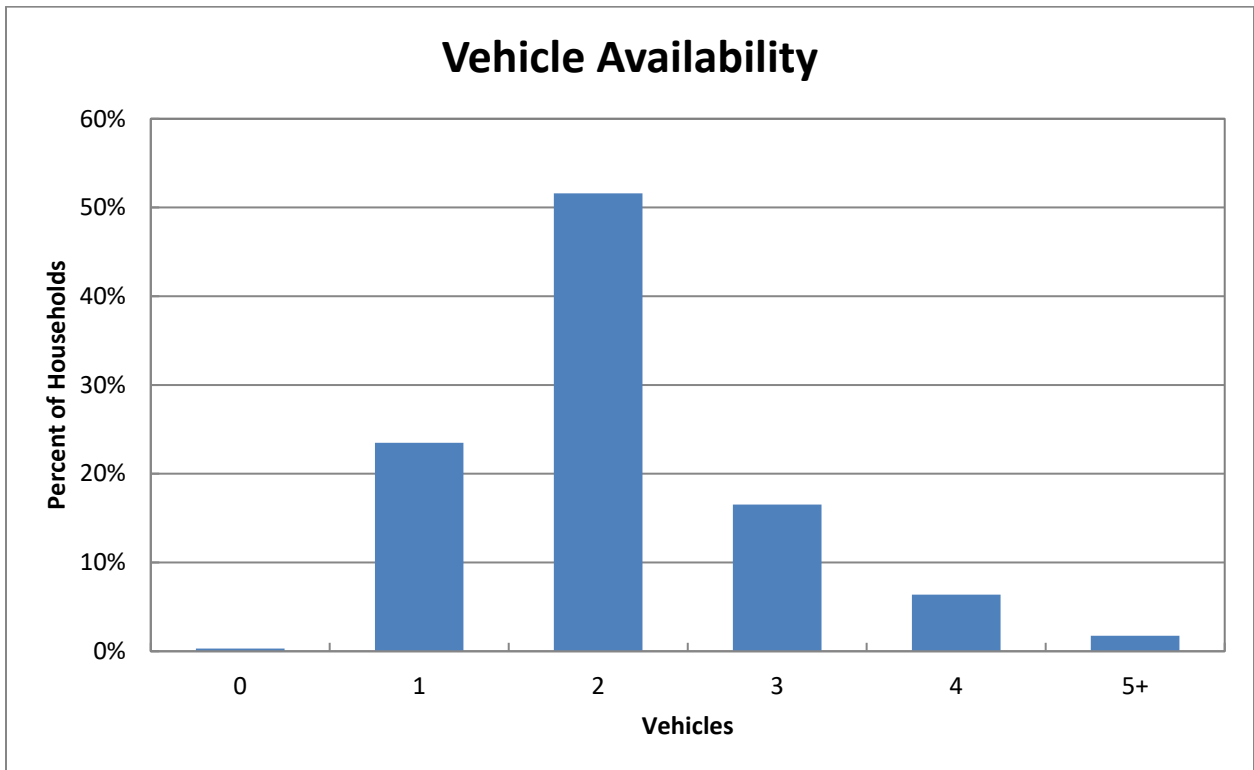


Figure F-2. Household Vehicle Availability

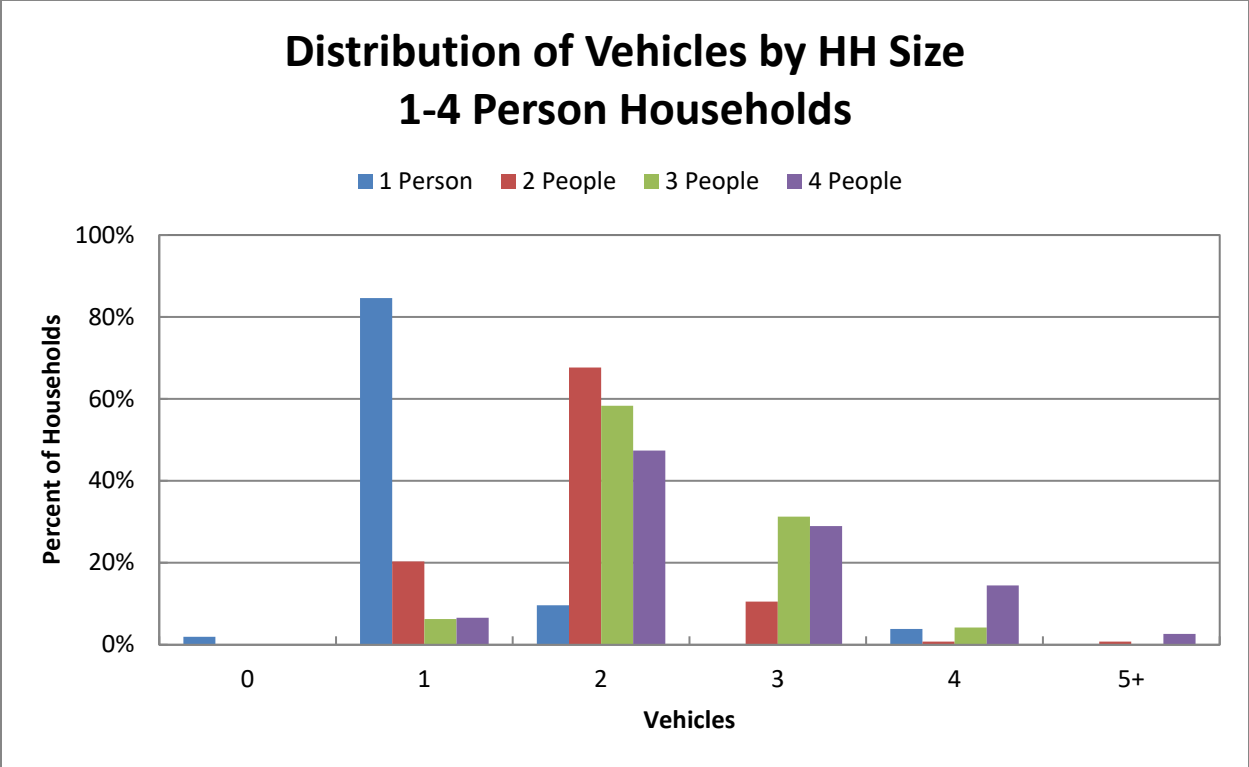


Figure F-3. Vehicle Availability - 1 to 4 Person Households

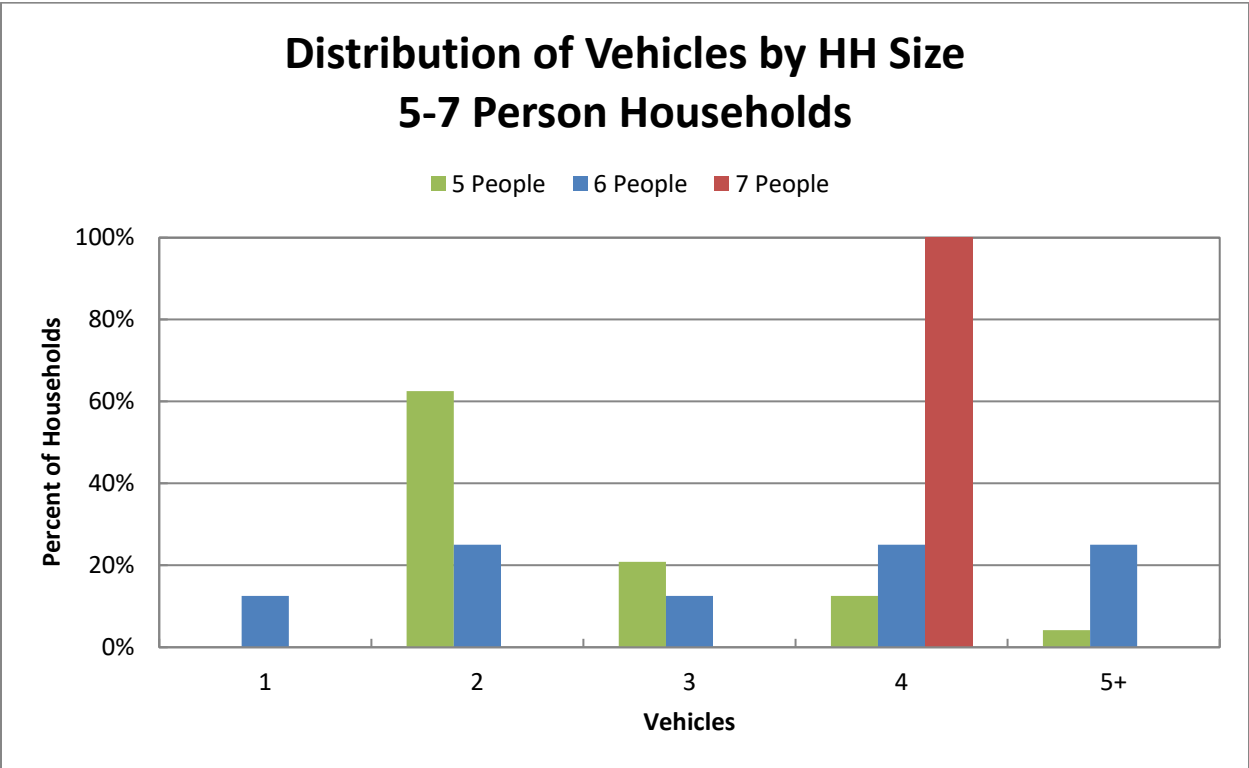


Figure F-4. Vehicle Availability - 5 to 7 Person Households

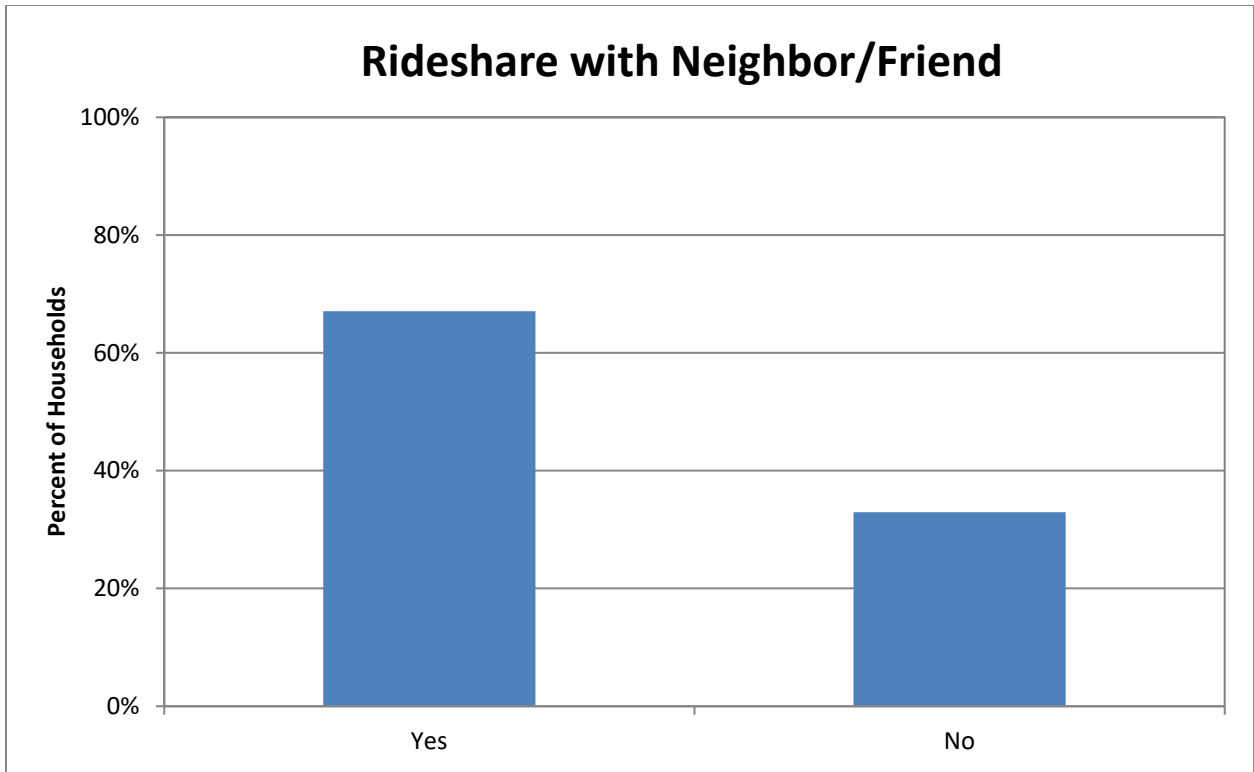


Figure F-5. Household Ridesharing Preference

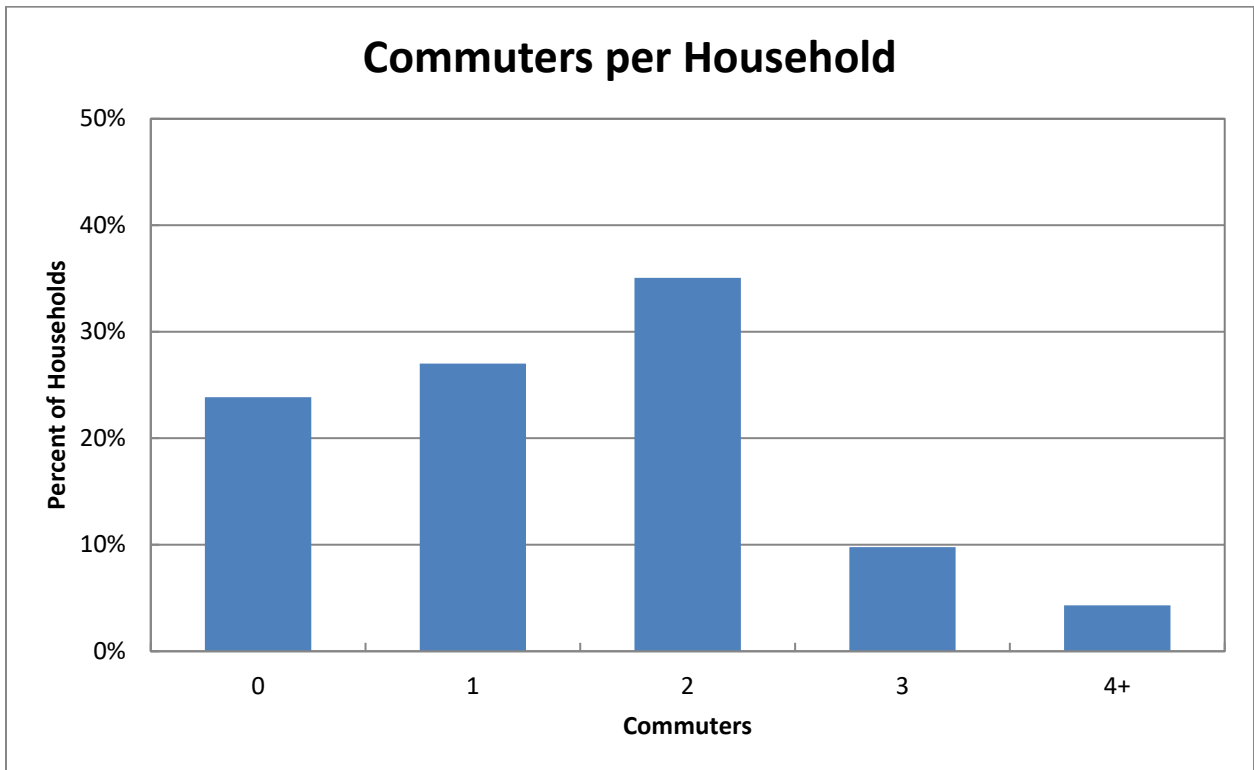


Figure F-6. Commuters per Households in the EPZ

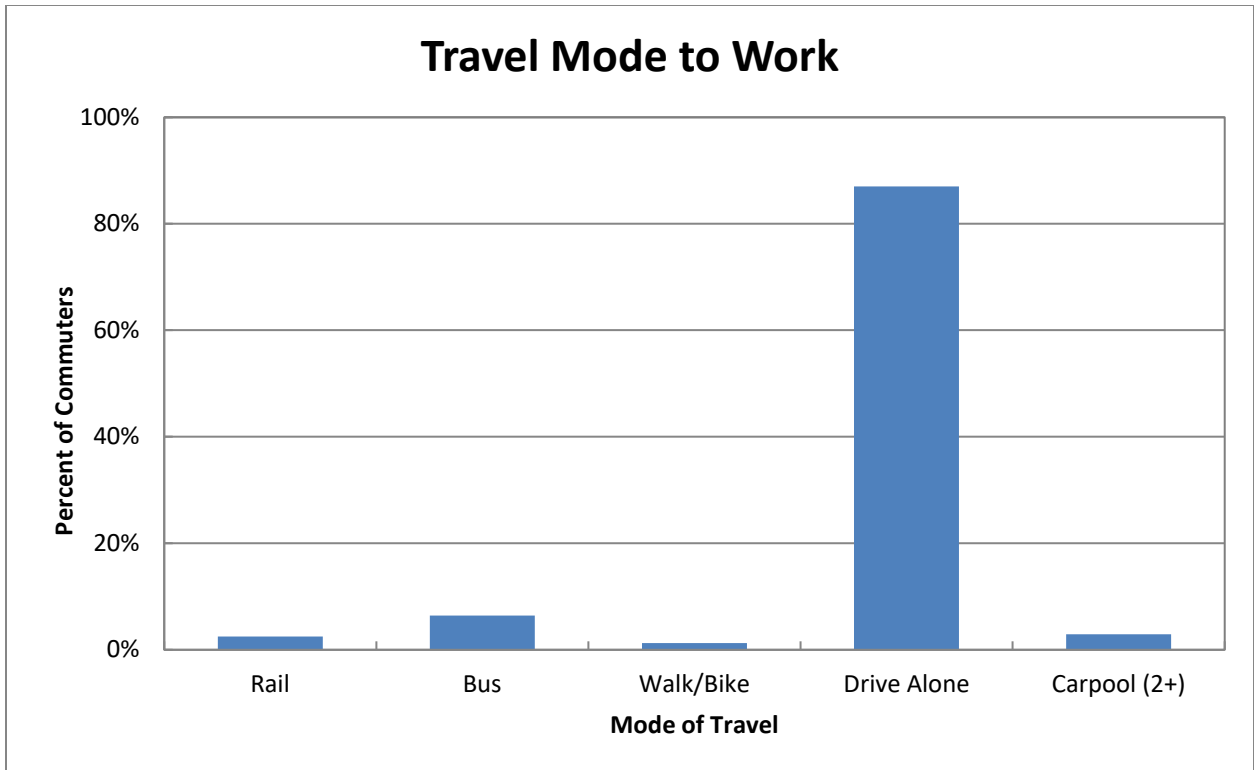


Figure F-7. Mode of Travel in the EPZ

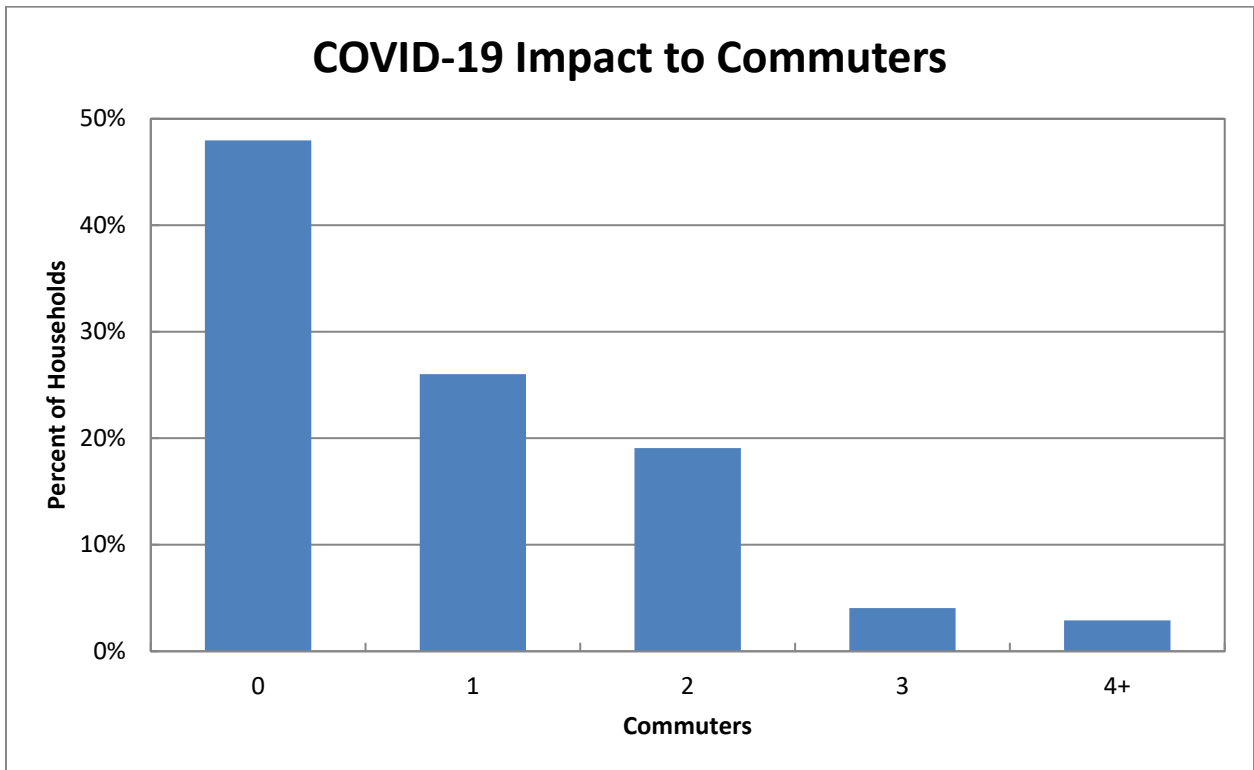


Figure F-8. Impact to Commuters due to the COVID-19 Pandemic

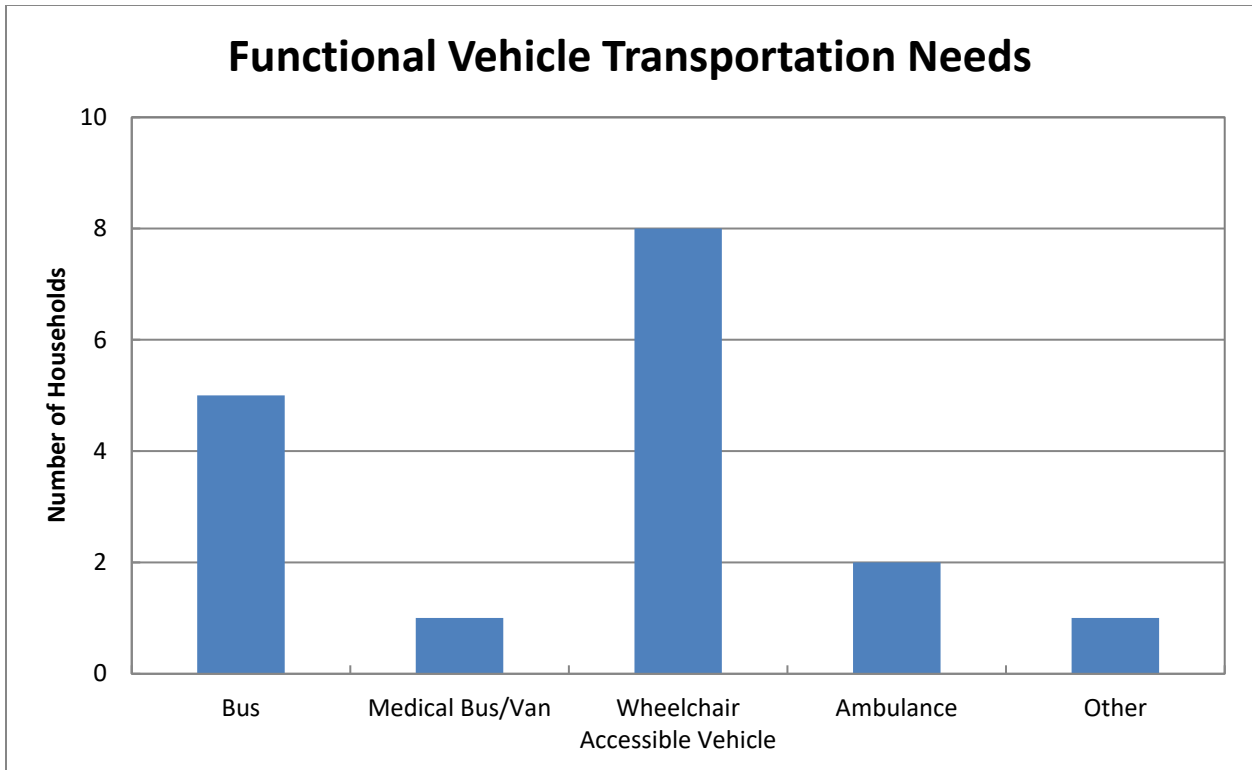


Figure F-9. Households with Functional or Transportation Needs

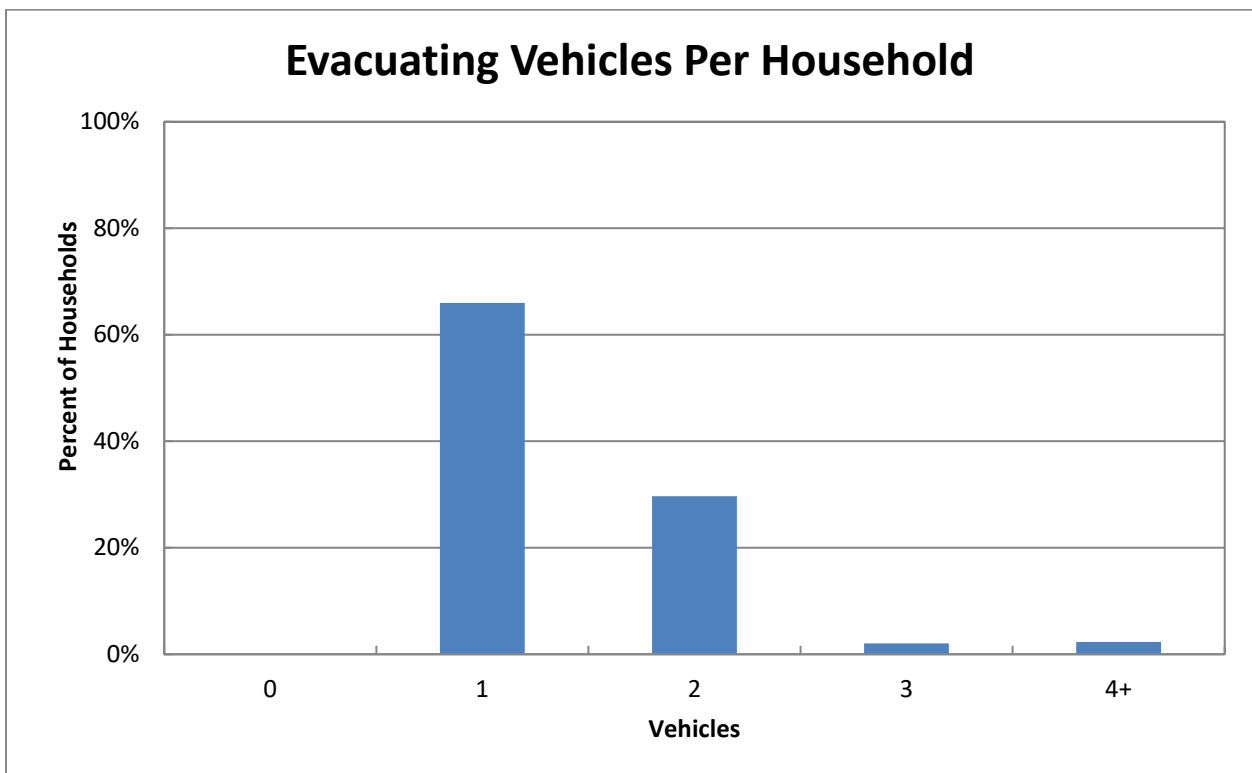


Figure F-10. Number of Vehicles Used for Evacuation

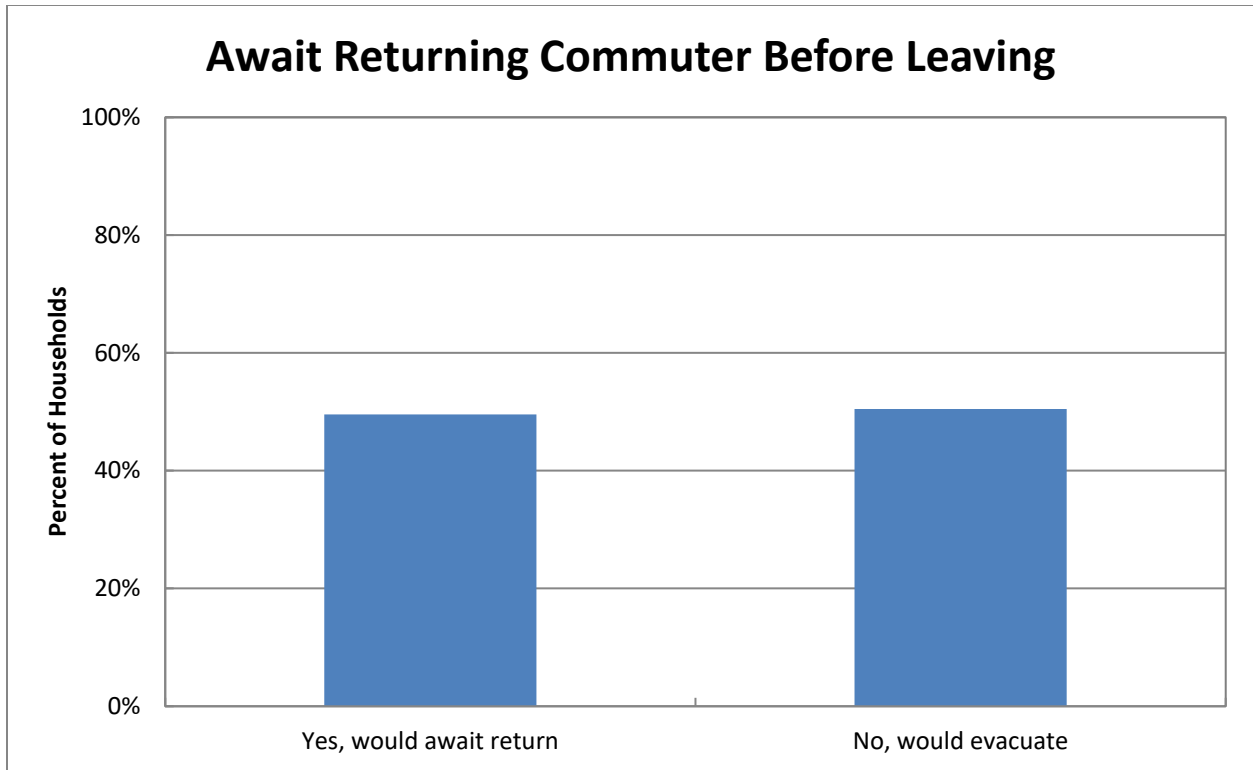


Figure F-11. Percent of Households that Await Returning Commuter Before Leaving

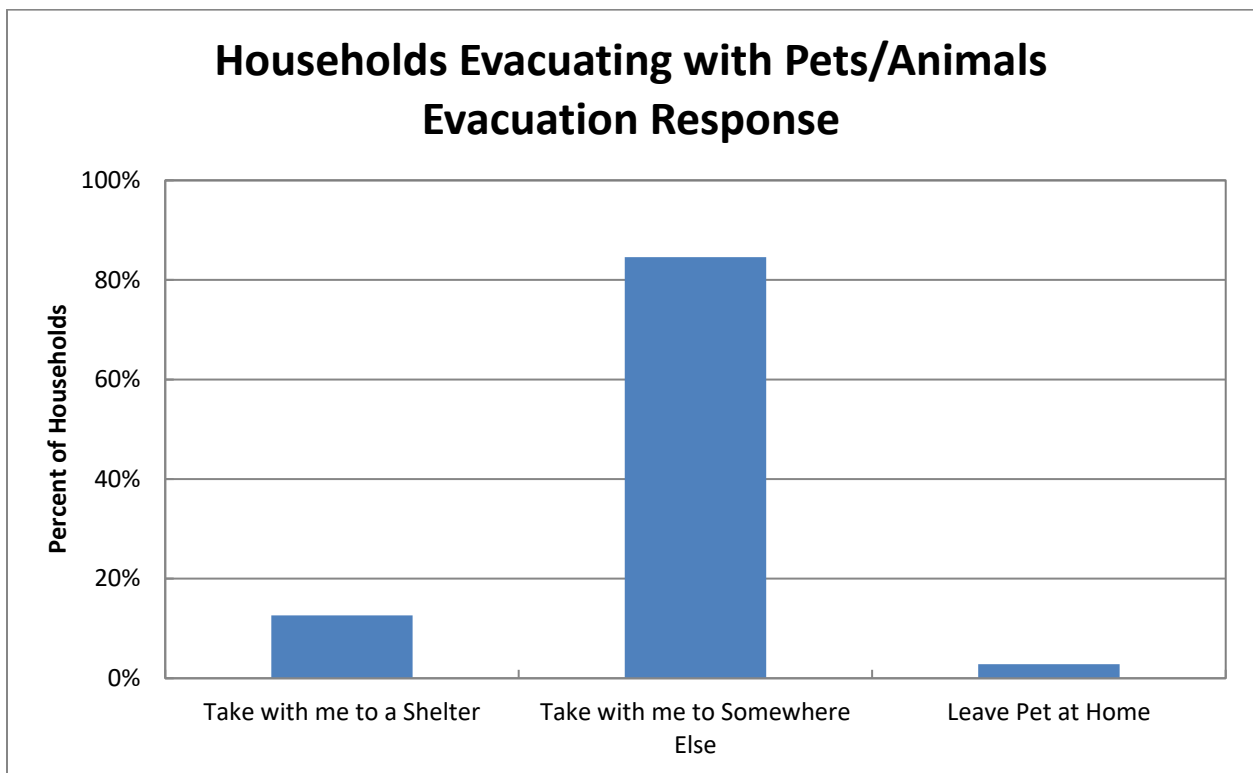


Figure F-12. Households Evacuating with Pets/Animals

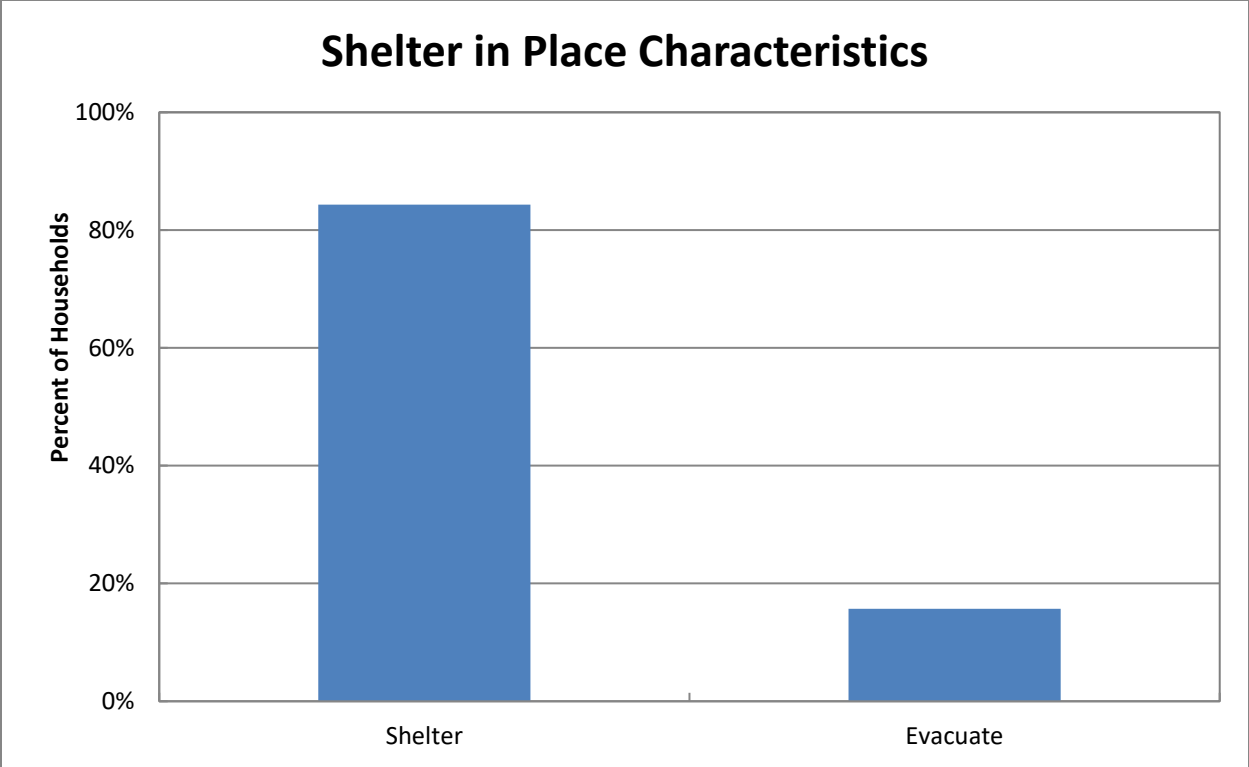


Figure F-13. Shelter in Place Characteristics

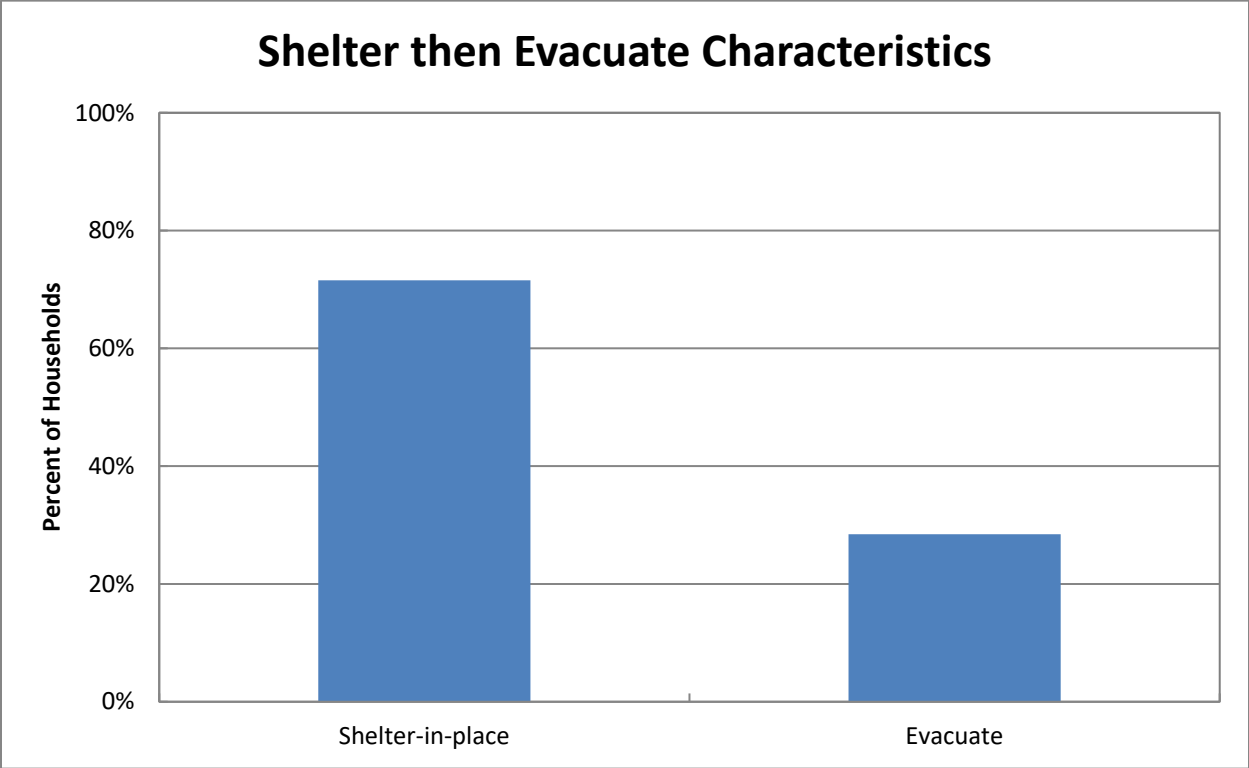


Figure F-14. Shelter Then Evacuate Characteristics

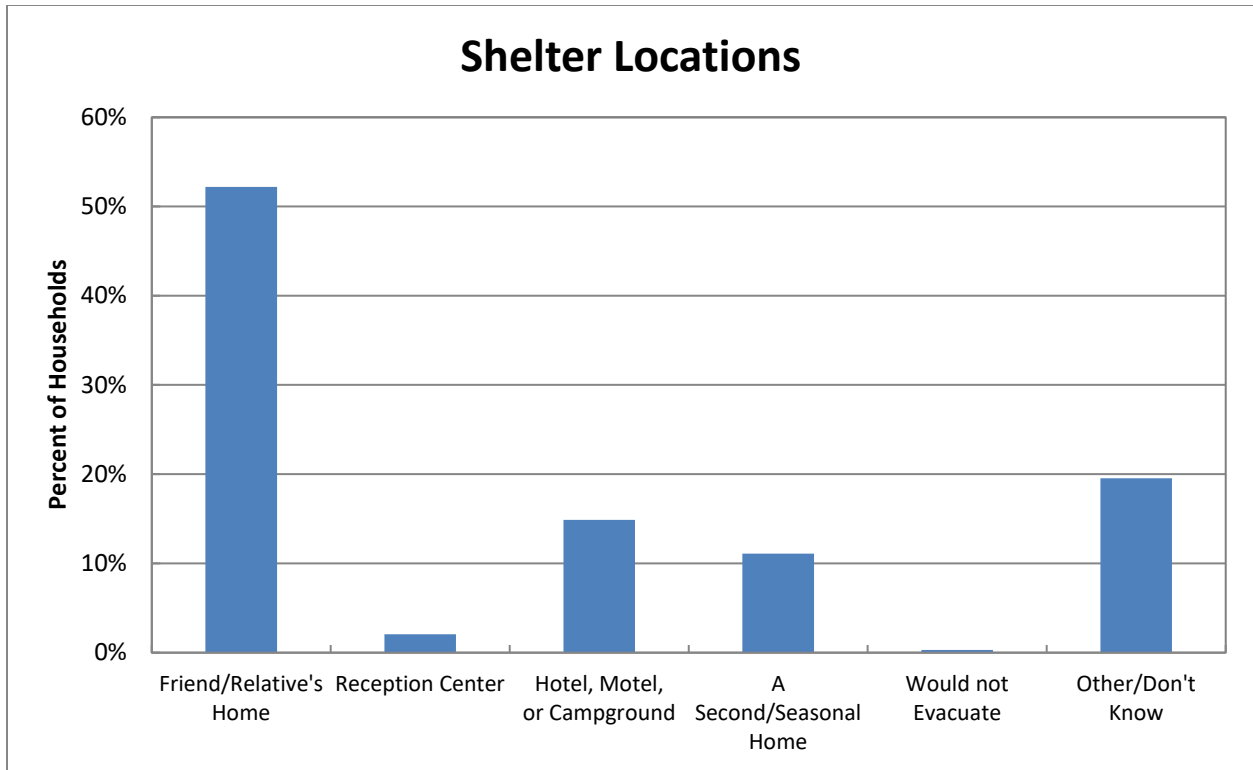


Figure F-15. Study Area Evacuation Destinations

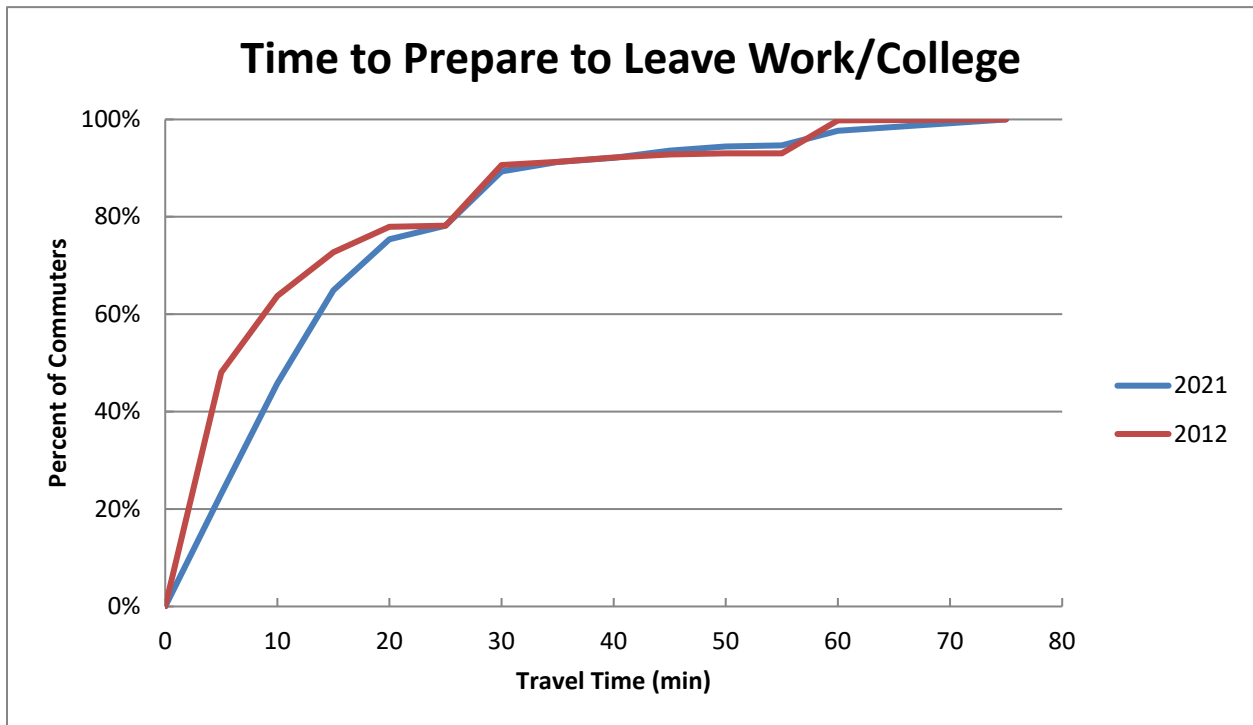


Figure F-16. Time Required to Prepare to Leave Work/College

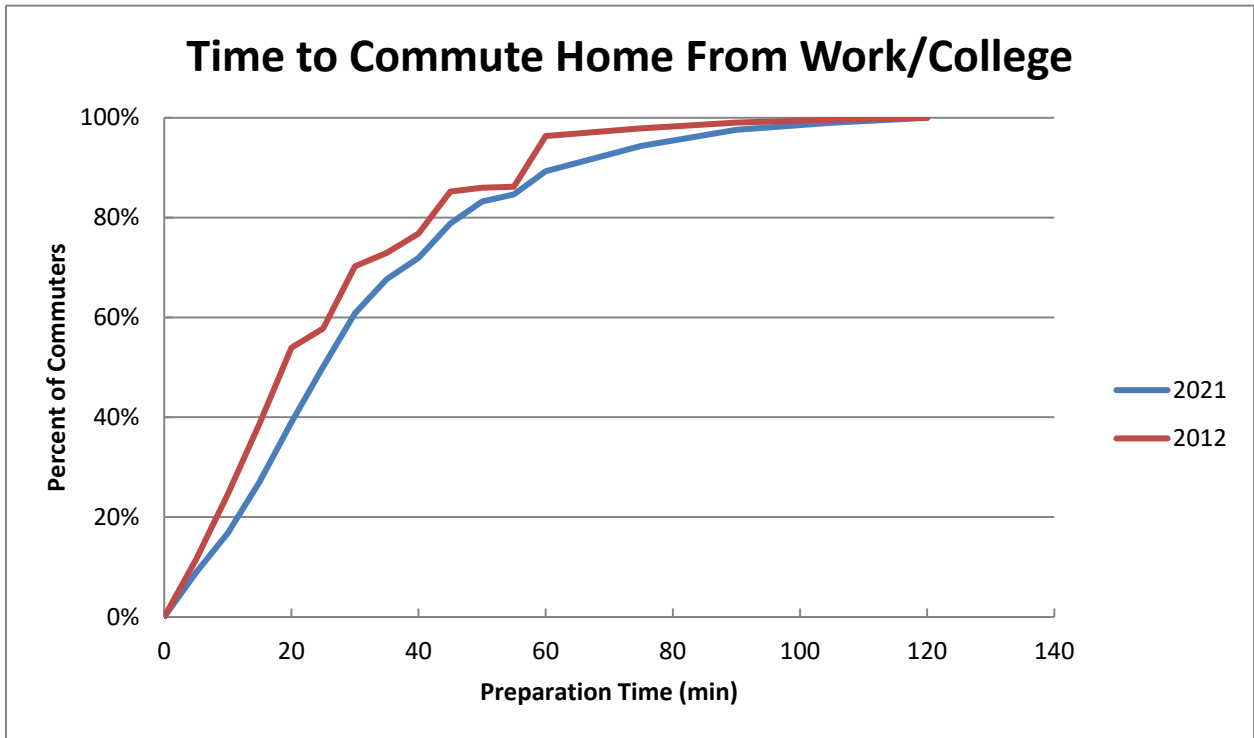


Figure F-17. Time to Commute Home from Work/College

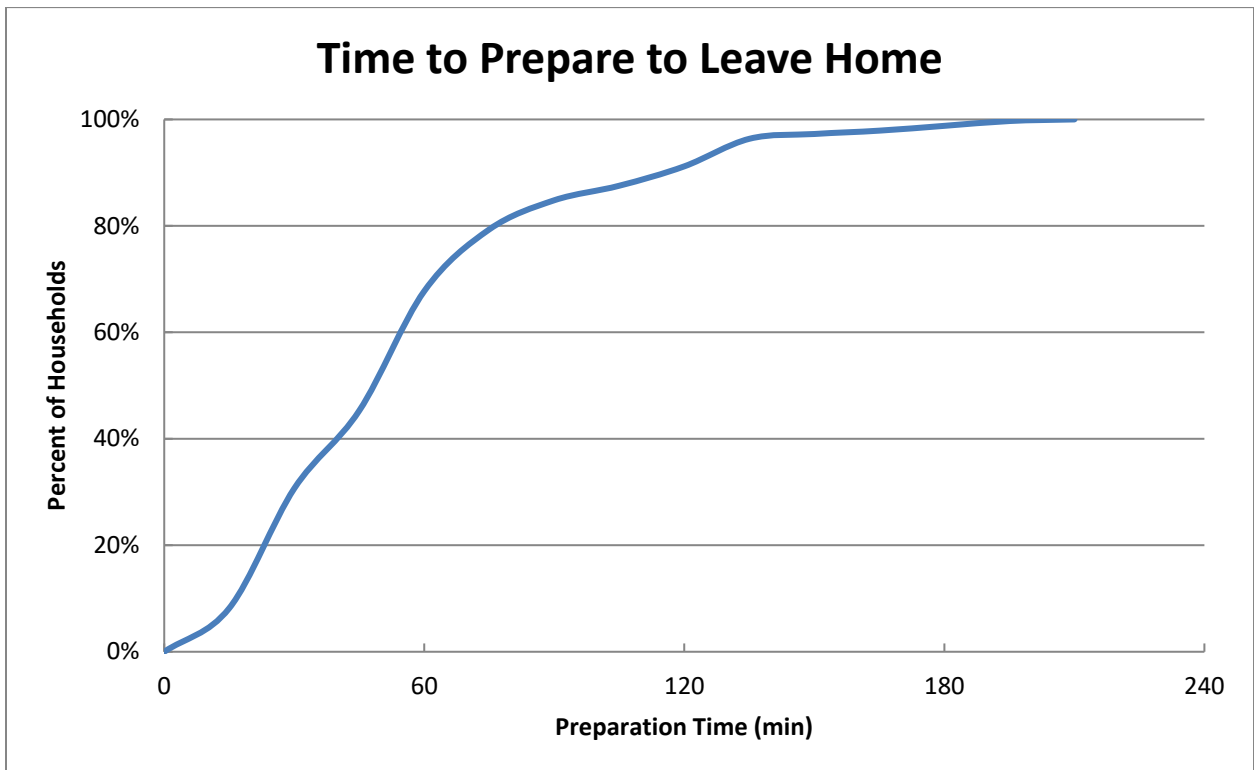


Figure F-18. Time to Prepare Home for Evacuation

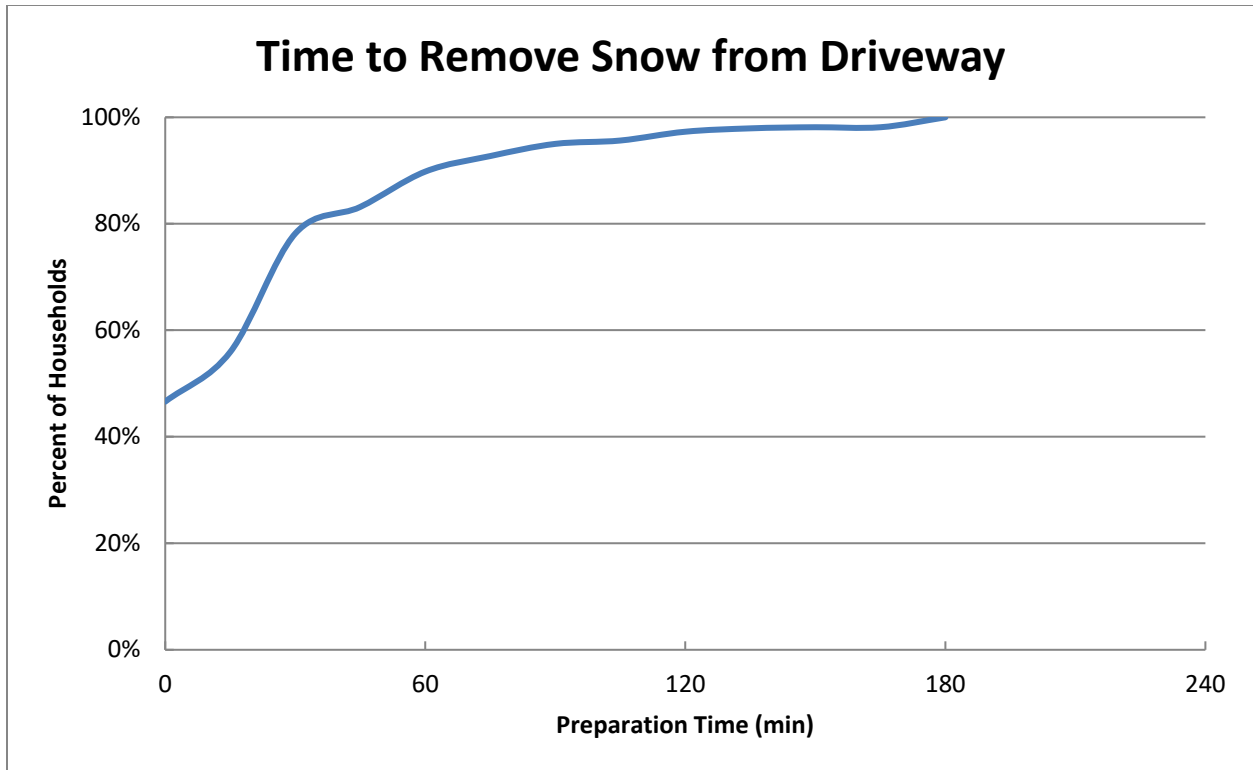


Figure F-19. Time to Remove 6-8" of Snow from Driveway (2012 Results)

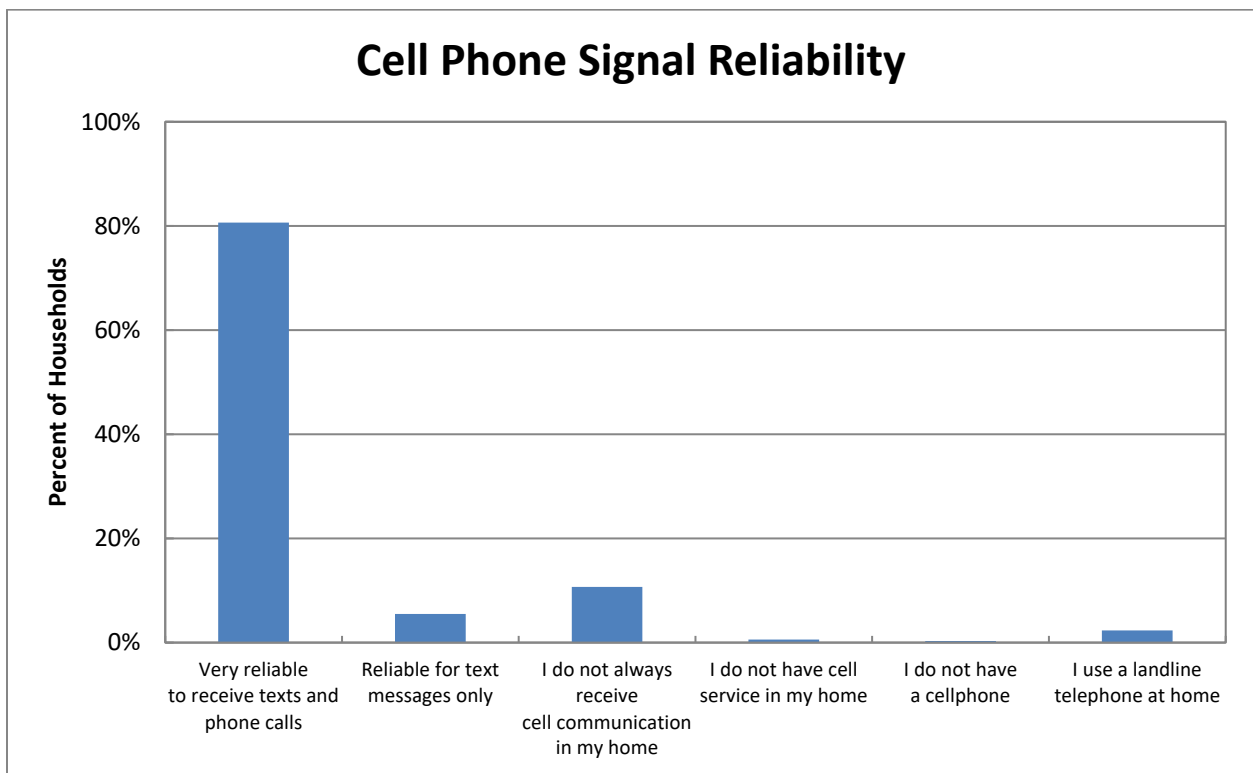


Figure F-20. Cell Phone Signal Reliability

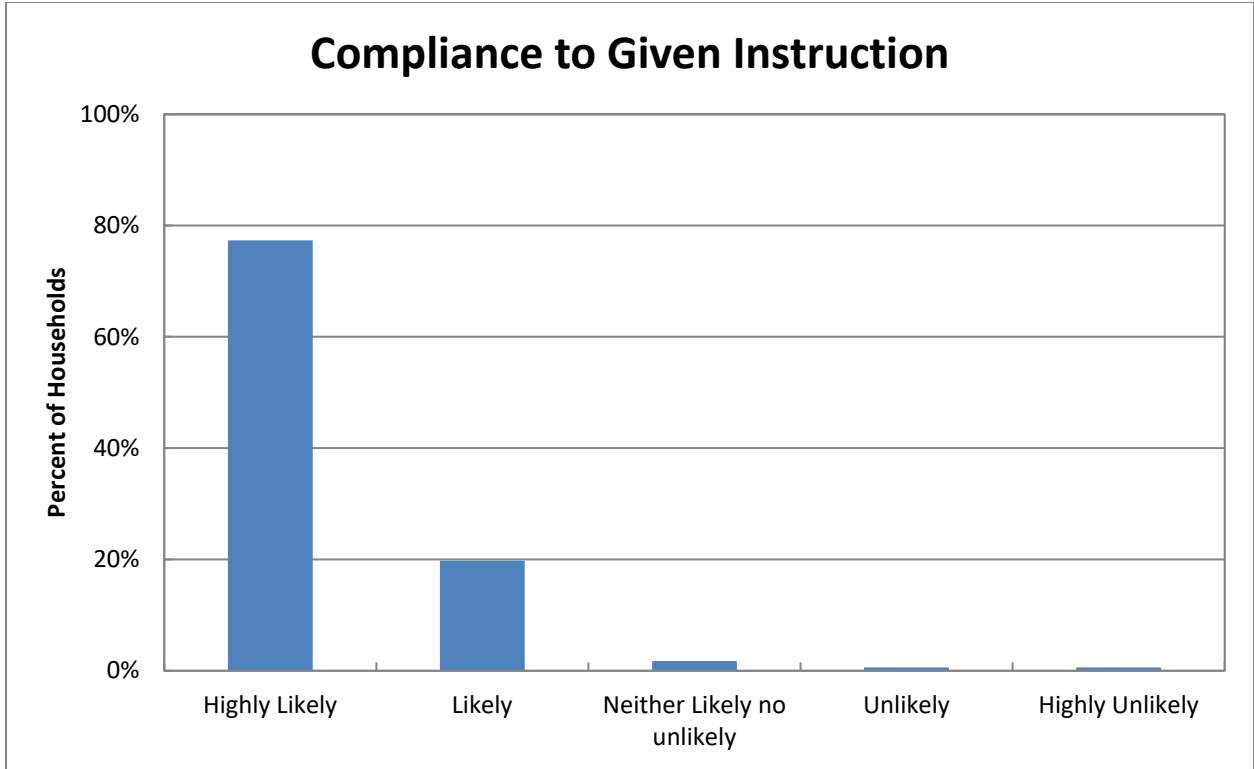


Figure F-21. Households Compliance to Given Instruction (by Emergency Management Officials)

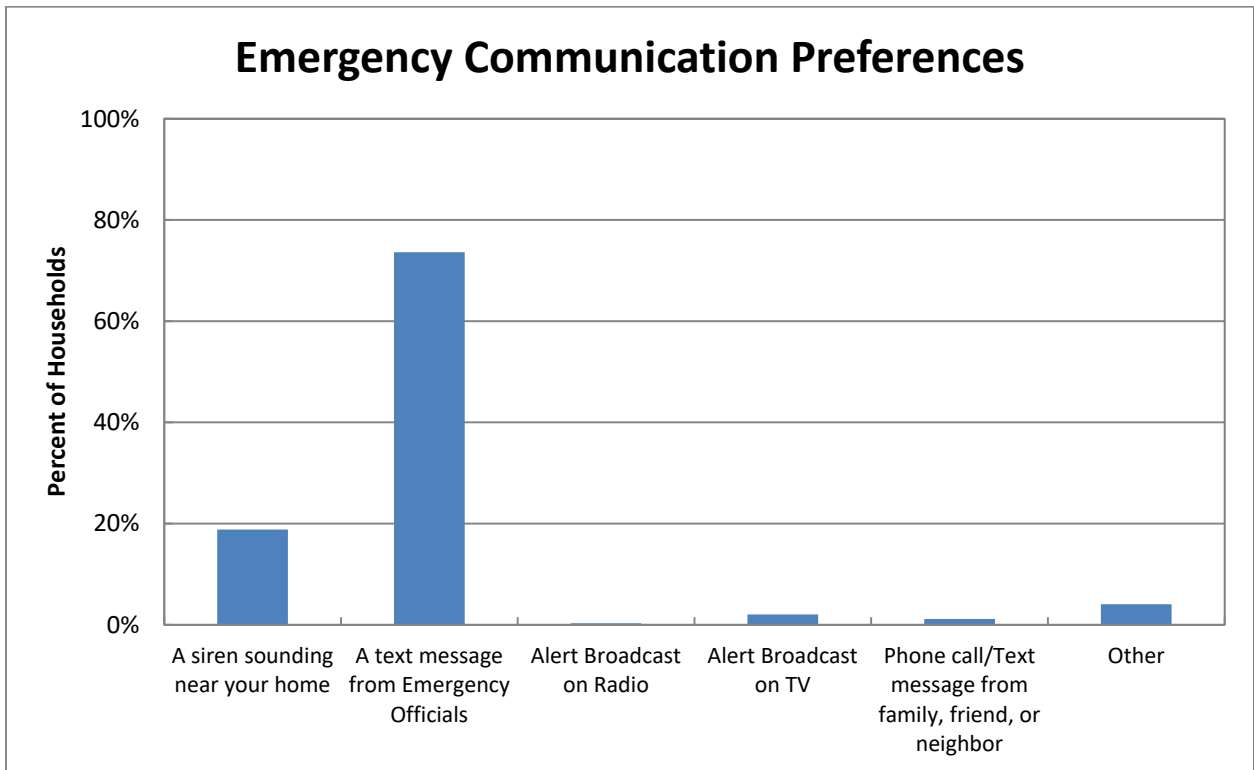


Figure F-22. Emergency Communication Alert

ATTACHMENT A
Demographic Survey Instrument

Emergency Response Survey

* Required

Purpose

The purpose of this survey is to identify local behavior during emergency situations with no prior warning, such as a wildfire, chemical spill or radiological event. The information gathered in this survey will be shared with state emergency planning personnel to enhance emergency response plans in your area. Your responses will greatly contribute to local emergency preparedness.

Please only complete one survey per household. Please have the head of the household (18 years or older) complete the survey. Do not provide your name or any personal information.

This survey will take less than five minutes to complete.

I. 1. What is your gender?

Mark only one oval.

Male

Female

I would rather not answer

Other: _____

2. 2. What is your home zip code? *

3. 3A. In total, how many vehicles are usually available to your household?

Mark only one oval.

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight
- Nine or more
- Zero (None)
- I would rather not answer

4. 3B. In an emergency, could you get a ride out of the area with a neighbor or friend?

Mark only one oval.

- Yes
- No
- I would rather not answer

5. 4. How many vehicles would your household use during an evacuation for an emergency with no prior warning?

Mark only one oval.

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight
- Nine or more
- Zero (None)
- I would evacuate by bicycle
- I would evacuate by bus
- I would rather not answer

6. 5A. How many people usually live in your household?

Mark only one oval.

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight
- Nine
- Ten
- Eleven
- Twelve
- Thirteen
- Fourteen
- Fifteen
- Sixteen
- Seventeen
- Eighteen
- Nineteen or more
- I would rather not answer

7. 5B. Of the people who live in your household, are any seasonal residents?

A seasonal resident is someone who does not reside in the household for most of the year.

Mark only one oval.

Yes

No *Skip to question 10*

I would rather not answer *Skip to question 10*

Skip to question 10

Seasonal Population

8. 5C. How many people only reside in your household for part of the year?

Mark only one oval.

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight
- Nine
- Ten
- Eleven
- Twelve
- Thirteen
- Fourteen
- Fifteen
- Sixteen
- Seventeen
- Eighteen
- Nineteen or more
- I would rather not answer

9. 5D. When do these residents live in your home? Choose all that apply.

Check all that apply.

- Summer
- Fall
- Winter
- Spring
- I would rather not answer

COVID-19

10. 6. How many adults in your household had to change their work or school commute due to the COVID-19 pandemic?

Mark only one oval.

- None
- One
- Two
- Three
- Four or more
- I would rather not answer

Commuters

11. 7. Before COVID-19, how many adults in your household would normally commute for work or school on a daily basis? *

Mark only one oval.

- Zero *Skip to question 56*
- One *Skip to question 12*
- Two *Skip to question 13*
- Three *Skip to question 14*
- Four or more *Skip to question 15*
- I would rather not answer *Skip to question 56*

Mode of Travel

12. 8. Thinking about each commuter, how does each person usually travel to work or school?

Mark only one oval per row.

	Rail	Bus	Walk/Bicycle	Drive Alone	Carpool-2 or more people	I would rather not answer
Commuter 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Skip to question 16

Mode of Travel

13. 8. Thinking about each commuter, how does each person usually travel to work or school?

Mark only one oval per row.

	Rail	Bus	Walk/Bicycle	Drive Alone	Carpool-2 or more people	I would rather not answer
Commuter 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commuter 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Skip to question 18

Mode of Travel

14. 8. Thinking about each commuter, how does each person usually travel to work or school?

Mark only one oval per row.

	Rail	Bus	Walk/Bicycle	Drive Alone	Carpool-2 or more people	I would rather not answer
Commuter 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commuter 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commuter 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Skip to question 22

Mode of Travel

15. 8. Thinking about each commuter, how does each person usually travel to work or school?

Mark only one oval per row.

	Rail	Bus	Walk/Bicycle	Drive Alone	Carpool-2 or more people	I would rather not answer
Commuter 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commuter 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commuter 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Commuter 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Skip to question 28

Preparation to leave Work/School

16. 9-1. During an emergency event with no prior warning, about how much time would it take Commuter #1 to stop working, grab essentials, and walk to their vehicle to start their trip home?

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

17. If over 2 hours for Question 9-1, specify time here
Leave blank if your answer for Question 9-1 is under 2 hours.

Skip to question 36

Preparation to leave Work/School

18. 9-1. During an emergency event with no prior warning, about how much time would it take Commuter #1 to stop working, grab essentials, and walk to their vehicle to start their trip home?

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

19. If over 2 hours for Question 9-1, specify time here
Leave blank if your answer for Question 9-1 is under 2 hours.

20. 9-2. During an emergency event with no prior warning, about how much time would it take Commuter #2 to stop working, grab essentials, and walk to their vehicle to start their trip home?

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

21. If over 2 hours for Question 9-2, specify time here
Leave blank if your answer for Question 9-2 is under 2 hours.

Skip to question 38

Preparation to leave Work/School

22. 9-1. During an emergency event with no prior warning, about how much time would it take Commuter #1 to stop working, grab essentials, and walk to their

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

23. If over 2 hours for Question 9-1, specify time here
Leave blank if your answer for Question 9-1 is under 2 hours.

24. 9-2. During an emergency event with no prior warning, about how much time would it take Commuter #2 to stop working, grab essentials, and walk to their

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

25. If over 2 hours for Question 9-2, specify time here
Leave blank if your answer for Question 9-2 is under 2 hours.

26. 9-3. During an emergency event with no prior warning, about how much time would it take Commuter #3 to stop working, grab essentials, and walk to their vehicle to start their trip home?

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 Hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

27. If over 2 hours for Question 9-3, specify time here
Leave blank if your answer for Question 9-3 is under 2 hours.

Skip to question 42

Preparation to leave Work/School

28. 9-1. During an emergency event with no prior warning, about how much time would it take Commuter #1 to stop working, grab essentials, and walk to their

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 Hours
- I would rather not answer

29. If over 2 hours for Question 9-1, specify time here
Leave blank if your answer for Question 9-1 is under 2 hours.

30. 9-2. During an emergency event with no prior warning, about how much time would it take Commuter #2 to stop working, grab essentials, and walk to their

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

31. If over 2 hours for Question 9-2, specify time here
Leave blank if your answer for Question 9-2 is under 2 hours.

32. 9-3. During an emergency event with no prior warning, about how much time would it take Commuter #3 to stop working, grab essentials, and walk to their

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

33. If over 2 hours for Question 9-3, specify time here
Leave blank if your answer for Question 9-3 is under 2 hours.

34. 9-4. During an emergency event with no prior warning, about how much time would it take Commuter #4 to stop working, grab essentials, and walk to their

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

35. If over 2 hours for Question 9-4, specify time here
Leave blank if your answer for Question 9-4 is under 2 hours.

Skip to question 48

Travel Home From Work/School

36. 10-1. On average, how much time would it take Commuter #1 to travel home from work or school?

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

37. If over 2 hours for Question 10-1, specify time here
Leave blank if your answer for Question 10-1 is under 2 hours.

Skip to question 56

Travel Home From Work/School

38. 10-1. On average, how much time would it take Commuter #1 to travel home from work or school?

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

39. If over 2 hours for Question 10-1, specify time here
Leave blank if your answer for Question 10-1 is under 2 hours.

40. 10-2. On average, how much time would it take Commuter #2 to travel home from work or school?

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

41. If over 2 hours for Question 10-2, specify time here
Leave blank if your answer for Question 10-2 is under 2 hours.

Skip to question 56

Travel Home From Work/School

42. 10-1. On average, how much time would it take Commuter #1 to travel home from

Mark only one oval.

- 5 minutes or Less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 Hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

43. If over 2 hours for Question 10-1 specify time here
Leave blank if your answer for Question 10-1 is under 2 hours.

44. 10-2. On average, how much time would it take Commuter #2 to travel home from

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

45. If over 2 hours for Question 10-2, specify time here
Leave blank if your answer for Question 10-2 is under 2 hours.

46. 10-3. On average, how much time would it take Commuter #3 to travel home from

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

47. If over 2 hours for Question 10-3, specify time here
Leave blank if your answer for Question 10-3 is under 2 hours.

Skip to question 56

Travel Home From Work/School

48. 10-1. On average, how much time would it take Commuter #1 to travel home from

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

49. If over 2 hours for Question 10-1, specify time here
Leave blank if your answer for Question 10-1 is under 2 hours.

50. 10-2. On average, how much time would it take Commuter #2 to travel home from

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 Hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 Hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

51. If over 2 hours for Question 10-2, specify time here
Leave blank if your answer for Question 10-2 is under 2 hours.

52. 10-3. On average, how much time would it take Commuter #3 to travel home from

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

53. If over 2 hours for Question 10-3, specify time here
Leave blank if your answer for Question 10-3 is under 2 hours.

54. 10-4. On average, how much time would it take Commuter #4 to travel home from

Mark only one oval.

- 5 minutes or less
- 6-10 minutes
- 11-15 minutes
- 16-20 minutes
- 21-25 minutes
- 26-30 minutes
- 31-35 minutes
- 36-40 minutes
- 41-45 minutes
- 46-50 minutes
- 51-55 minutes
- 56 minutes - 1 hour
- Over 1 hour, but less than 1 hour 15 minutes
- Between 1 hour 16 minutes and 1 hour 30 minutes
- Between 1 hour 31 minutes and 1 hour 45 minutes
- Between 1 hour 46 minutes and 2 hours
- Over 2 hours
- I would rather not answer

55. If over 2 hours for Question 10-4, specify time here
Leave blank if your answer for Question 10-4 is under 2 hours.

Skip to question 56

Additional Questions

56. 11. If you were advised by local authorities to evacuate, how much time would it take your household to pack essentials, secure your home, load the car and start evacuating the area?

Mark only one oval.

- Less than 15 minutes
- 15-30 minutes
- 31-45 minutes
- 46 minutes - 1 hour
- 1 hour to 1 hour 15 minutes
- 1 hour 16 minutes to 1 hour 30 minutes
- 1 hour 31 minutes to 1 hour 45 minutes
- 1 hour 46 minutes to 2 hours
- 2 hours to 2 hours 15 minutes
- 2 hours 16 minutes to 2 hours 30 minutes
- 2 hours 31 minutes to 2 hours 45 minutes
- 2 hours 46 minutes to 3 hours
- 3 hours to 3 hours 15 minutes
- 3 hours 16 minutes to 3 hours 30 minutes
- 3 hours 31 minutes to 3 hours 45 minutes
- 3 hours 46 minutes to 4 hours
- 4 hours to 4 hours 15 minutes
- 4 hours 16 minutes to 4 hours 30 minutes
- 4 hours 31 minutes to 4 hours 45 minutes
- 4 hours 46 minutes to 5 hours
- 5 hours to 5 hours 30 minutes
- 5 hours 31 minutes to 6 hours
- Over 6 hours
- Will not evacuate
- I would rather not answer

57. If over 6 hours for Question 11, specify time here

Leave blank if your answer for Question 11 is under 6 hours.

58. 12. How many people in your household would require any of the following functional or transportation assistance during an evacuation:

Mark only one oval per row.

	0	1	2	3	4	More than 4
Bus	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Medical Bus/Van	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wheelchair Accessible Vehicle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ambulance Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

59. Specify "Other" transportation need below

60. 13. If members of your household are in different locations when an evacuation is recommended, what would you do?

Mark only one oval.

- I would wait for all members of my household and evacuate together.
- I would evacuate independently and meet other members of my household later.
- I would rather not answer

61. 14A. If emergency officials advise you to shelter-in-place during an emergency because you are not in the affected area, would you:

Mark only one oval.

- Shelter-in-place
- Evacuate
- I would rather not answer

62. 14B. During an emergency, if emergency officials advise you to shelter-in-place while people in other areas are advised to evacuate, would you:

Mark only one oval.

- Shelter-in-place
- Evacuate
- I would rather not answer

63. 14C. During an emergency, if officials advise you to evacuate, where would you go?

Mark only one oval.

- A relative's or friend's home
- A reception center
- A hotel, motel or campground
- A second/seasonal home
- I would not evacuate
- I do not know
- I would rather not answer
- Other: _____

Pet Questions

64. 15A. Do you have any pets or animals?

Mark only one oval.

- Yes
- No *Skip to question 68*
- I would rather not answer *Skip to question 68*

Skip to question 68

Pet Questions

65. 15B. What type of pets or animals do you have? Check all that apply.

Check all that apply.

- Dog
- Cat
- Bird
- Reptile
- Horse
- Fish
- Chicken
- Goat
- Pig
- Other: _____

Pet Questions

66. 15C. What would you do with your pets or animals if you had to evacuate?

Mark only one oval.

- Take them with me to a shelter
- Take them with me to somewhere else
- Leave them at home *Skip to question 68*
- I would rather not answer *Skip to question 68*

Pet Questions

67. 15D. Do you have enough room in your vehicle(s) to evacuate with your pets or animals?

Mark only one oval.

- Yes
- No
- I would rather not answer
- Other: _____

Emergency Communications

68. 16A. In your home, how reliable is your cellphone signal?

Mark only one oval.

- Very reliable to receive texts and phone calls
- Reliable for text messages only
- I do not always receive cell communication in my home
- I do not have cell service in my home
- I would rather not answer

69. 16B. If you receive a text message similar to an AMBER Alert from emergency officials with directions for you to respond to an active radiological emergency at Seabrook Station Nuclear Power Plant, how likely is it you would follow these directions?

Mark only one oval.

- Highly likely
- Likely
- Nether likely or unlikely
- Unlikely
- Highly unlikely
- I would rather not answer

70. 16C. Which of the following is the best way to notify you of an emergency while you're home?

Mark only one oval.

- A siren sounding near your home
- A text message from emergency officials
- Alert broadcast on radio
- Alert broadcast on TV
- Information on twitter or Facebook
- Phone call/text message from family, friend or neighbor
- I would rather not answer
- Other: _____

This content is neither created nor endorsed by Google.

Google Forms

APPENDIX G

Traffic Management Plan

G. TRAFFIC MANAGEMENT PLAN

NUREG/CR-7002, Rev. 1 indicates that the existing Traffic Control Points (TCP) and Access Control Points (ACP) identified by the offsite agencies should be used in the evacuation simulation modeling. The traffic control plans for the Emergency Planning Zone (EPZ) were provided by the offsite response organizations (OROs) within the EPZ.

These plans were reviewed and the TCPs and ACPs were modeled accordingly. An analysis of the TCP and ACP locations was performed, and it was determined to model the ETE simulations with existing TCPs and ACPs that were provided in the approved state emergency plans, with no additional recommended TCPs and ACPs.

G.1 Manual Traffic Control

The TCPs and ACPs are forms of manual traffic control (MTC). MTC at intersections (which are controlled) are modeled as actuated signals. If an intersection has a pre-timed signal, stop, or yield control, and the intersection is identified as a TCP or ACP, the control type was changed to an actuated signal in the DYNEV II system, in accordance with Section 3.3 of NUREG/CR-7002, Rev. 1. MTCs at existing actuated traffic signalized intersections were essentially left alone.

Table K-1 provides the control type and number of nodes with each control type in the analysis network. If the existing control was changed due to the point being a TCP or ACP, the control type is indicated as "TCP/ACP" in Table K-1. The TCPs and ACPs, as shown in the state emergency plans, are mapped as blue dots and red squares in Figure G-1, respectively. No additional locations for MTC are suggested as part of this study.

It is assumed that the ACPs will be established within 120 minutes of the advisory to evacuate (ATE) to discourage through travelers from using major through routes which traverse the EPZ. As discussed in Section 3.10, external traffic was considered on Interstate 95 (I-95), US-4, I-495, and New Hampshire State Highway 101 (SH-101) in this analysis.

G.2 Analysis of Key TCP/ACP Locations

As discussed in Section 5.2 of NUREG/CR-7002, Rev. 1, MTC at intersections could benefit from the ETE analysis. The MTC locations contained within the traffic management plans (TMPs) were analyzed to determine key locations where MTC would be most useful and can be readily implemented. As previously mentioned, signalized intersections that were actuated based on field data collection were essentially left as actuated traffic signals in the model, with modifications to green time allocation as needed. Other controlled intersections (pre-timed signals, stop signs and yield signs) were changed to actuated traffic signals to represent the MTC that would be implemented according to the TMPs.

Table G-1 shows a list of the controlled intersections that were identified as MTC points in the TMPs that were not previously actuated signals, including the type of control that currently exists at each location. To determine the impact of MTC at these locations, a summer, midweek, midday, with good weather scenario (Scenario 1) evacuation of the 2-Mile Radius, 5-Mile Radius

and the entire EPZ (Region R01, R02, R03) were simulated wherein these intersections were left as is (without MTC). The results were compared to the results presented in Section 7. Although localized congestion worsened, the 90th percentile ETE was minimally affected (by at most 5 minutes). When MTC was removed, the 100th percentile ETE for the 2-Mile Region (Region R01) and for the 5-Mile Region (Region R02) were minimally impacted (both by 5 minutes), while the ETE for an evacuation of the Full EPZ (Region R03) actually improved by 25 minutes. The remaining TCPs and ACPs at controlled intersections were left as actuated signals in the model and, therefore, had no material impact to ETE. External traffic along I-95, US-4, I-495, and SH-101 was assumed to be stopped at 2 hours after the ATE similar to the base case.

The decrease in the 100th percentile ETE is a result of the dynamic traffic and routing assignment feature of the model. As shown in Figure 7-3 through Figure 7-8, the last roadway to clear is SR-87 leaving Newfields. The ACP at the intersection of SR-87 and Jacobs Well Rd (EP-03) is established to stop the flow of traffic into the EPZ and expedite the flow of traffic out of the EPZ. When a traffic control guide is placed at this intersection, it flows better than when it is a stop-controlled intersection, specifically for vehicles utilizing Jacob Well Rd. As a result, the paths utilizing SR-87 and Jacob Well Rd become more desirable in the model. Once vehicles pass this intersection, however, traffic along SR-87 westbound meets with SR-125 at a stop sign. Stop signs can process very little vehicles per hour in comparison to signals and TCPs resulting in congestion and queuing along SR-87. When the TCP at SR-87 and Jacob Well Rd is not implemented, the paths that utilize this intersection become less desirable resulting in less vehicles utilizing these roadways. As a result, the congestion and queuing are less at the intersection of SR-87 and SR-125 in the 'No MTC' case resulting in a reduction in ETE for this case.

Although there is no significant reduction in ETE when MTC is implemented, access control can be beneficial in the reduction of localized congestion and driver confusion and can be extremely helpful for fixed point surveillance, amongst other things. Should there be a shortfall of personnel to staff the TCPs and ACPs, the list of locations provided in Table G-1 could be considered as priority locations when implementing the TMP.

Table G-1. List of Key Manual Traffic Control Locations

TCP/ACP Number	Intersection	Node Number	Previous Control (Prior to being an TCP/ACP)
F-BR-02	SR-125 & South St	797	Stop Control
F-BR-04	North Rd & SR-27/SR-101	505, 501	Stop Control
DU-01	US-4 & SR-108	1734, 1737	Stop Control
F-EK-03	SR-108 & SR-107A	761	Stop Control
EK-05	SR-108 & Stumpfield Rd	715	Stop Control
EP-02	North Rd & SR-27/SR-101	505, 501	Stop Control
EP-03	SR-87 & Jacobs Well Rd	510	Stop Control
F-EX-01	SR-111/SR-111A & SR-108	619, 616	Stop Control
F-EX-02	SR-101 & SH-27	634, 495	Stop Control
F-EX-03	SR-101 & SR-85	626, 494	Stop Control
F-EX-06	SR-27 & SR-88	617, 611	Stop Control
G-GR-01	SR-151 & Breakfast Hill Rd	427	Stop Control
D-HA-06	US-1 & SR-151	276	Stop Control
C-KE-01	SR-108 & SR-150	720	Stop Control
C-KE-02	SR-150 & SR-84	696	Stop Control
C-KE-03	SR-150 & SR-107	701	Stop Control
F-KI-02	SR-125 & SR-107/SR-107A	754, 753	Stop Control
F-KI-04	SR-111 & SR-125/Main St	822, 763	Stop Control
F-KI-05	SR-107 & SR-125	764, 765	Stop Control
F-NT-01	SR-108 & Peaselee Crossing Rd	1165	Stop Control
F-NT-02	SR-108 & Bear Hill Rd	1144	Stop Control
D-NH-01	SR-151 & North Rd	436	Stop Control
D-NH-02	SR-111 & SR-151	420, 421	Stop Control
D-NH-05	Lovering Rd & Walnut Ave	440	Stop Control
PL-1	SR-108 & Sweet Hill Rd	1120	Stop Control
G-PO-01	I-95 & US-1	123, 122, 120, 121, 125, 119	Traffic Circle
G-PO-13	SR-1A & SR-1B	247	Stop Control
G-RY-02	SR-1A & Elwin Rd/Sagamore Rd	328, 388, 326, 327	Traffic Circle
G-RY-06	South Rd & Woodland Rd	412	Stop Control
G-RY-07	West Rd/Mills Rd & North Rd/South Rd	316	Stop Control
A-SE-01	US-1 & Main St	1537, 1538, 847	Stop Control
G-ST-01	SR-108 & SR-33	467, 463	Yield Control
G-ST-05	Winnicut Rd & Union Rd	451	Stop Control
B-AM-01	SR-150 & Elm St	959, 960, 961, 962	Traffic Circle
B-AM-06	I-95 & SR-110	905, 904, 1663, 1527	Yield Control
B-AM-10	Whitehall Rd & Friend St	994	Stop Control
E-NB-01	Sunset Dr & Plum Island Tpke	882	Stop Control

TCP/ACP Number	Intersection	Node Number	Previous Control (Prior to being an TCP/ACP)
E-NP-01	US-1 & Parker St	942, 943, 944, 945, 954, 1258	Stop Control
E-NP-03	SR-113 & Ferry Rd/High St	921	Stop Control
E-NP-04	High St & Broad St/Toppans Ln	927, 931	Stop Control
E-NP-07	Water St & Rolfes Ln	885	Stop Control
B-SA-04	SR-1A & Cable Ave	859	Stop Control
B-SA-05	SR-1A & State Beach Rd	861	Stop Control
E-WN-04	SR-113 & Bridge St	1395	Stop Control
GT-3	North St & Thurlow St	1444	Stop Control
GR-2	Middle St & Byfield Rd	1419	Stop Control
GR-3	SR-113 & Broad St	1411	Stop Control
HA-1	Merimac Rd & Old Amesbury Rd	1219	Stop Control
HA-2	SH-110 & Old Amesbury Rd	1180	Stop Control
HA-5	SH-110 & SH-108	1115	Stop Control
HA-6	Bridge St & River Rd	1398	Stop Control
RO-2	US-1 & Central St/Glen St	1263	Stop Control
NP-09	Water St & Spofford St	919, 1707, 1708, 1709	Traffic Circle

Table G-2. ETE with No MTC

Region	Scenario 1					
	90 th Percentile ETE			100 th Percentile ETE		
	Base	No MTC	Difference	Base	No MTC	Difference
R01 (2-Mile)	2:10	2:10	0:00	5:00	5:05	0:05
R02 (5-Mile)	2:45	2:50	0:05	5:05	5:10	0:05
R03 (Full EPZ)	4:05	4:10	0:05	6:05	5:40	-0:25

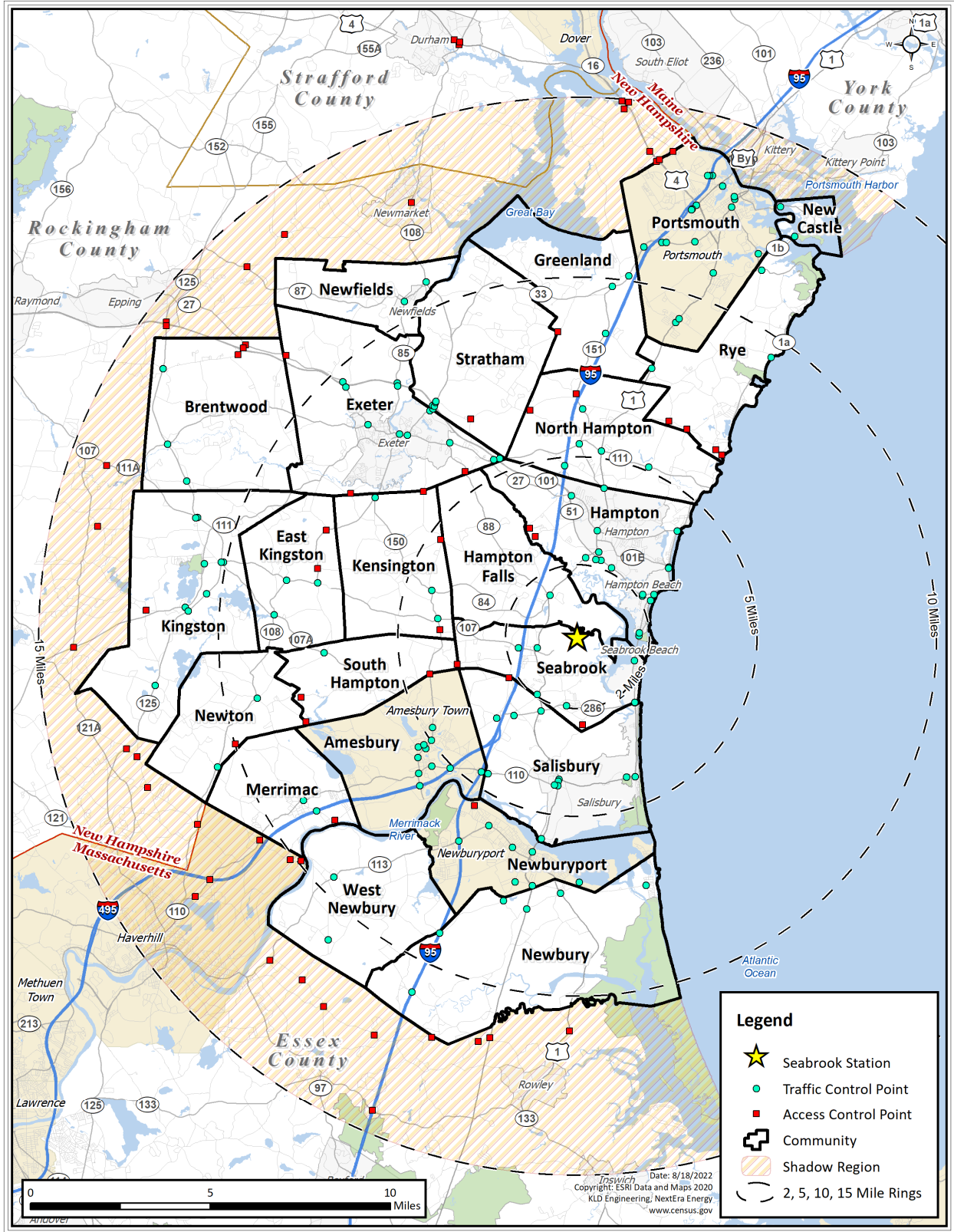


Figure G-1. Traffic and Access Control Points for the Seabrook Station EPZ

APPENDIX H
Evacuation Regions

H. EVACUATION REGIONS

This appendix presents the evacuation percentages for each Evacuation Region and maps of all Evacuation Regions (Figure H-1 through Figure H-19). Communities are grouped into ERPA. Table H-1 presents the Communities that comprise each ERPA. ERPA are then grouped into Evacuation Regions (Table H-2). Table H-2 also presents the evacuation percentages for each ERPA. The percentages presented in Table H-2 are based on the methodology discussed in assumption 10 of Section 2.2 and shown in Figure 2-1.

Note the baseline ETE study assumes 20% of households will not comply with the shelter advisory, as per Section 2.5.2 of NUREG/CR-7002, Rev. 1.

Table H-1. ERPA Designations by Community

Community	ERPA
NEW HAMPSHIRE	
Seabrook	A
Hampton Falls	
Kensington	C
South Hampton	
Hampton	D
North Hampton	
Brentwood	F
East Kingston	
Exeter	
Newfields	
Newton	
Kingston	G
Greenland	
Stratham	
Rye	
New Castle	
Portsmouth	
MASSACHUSETTS	
Amesbury	B
Salisbury	
Merrimac	E
Newburyport	
Newbury	
West Newbury	

Table H-2. Percent of ERPA Population Evacuating for Each Region

Radial Regions								
Region ¹	Description	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R01	2-Mile Region	100%	20%	20%	20%	20%	20%	20%
R02	5-Mile Region	100%	100%	100%	20%	20%	100%	20%
R03	Full EPZ	100%	100%	100%	100%	100%	100%	100%
Evacuate 2-Mile Region and Downwind to 5 Miles								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R04	NW, NNW, N, NNE	100%	20%	20%	20%	20%	100%	20%
R05	NE, ENE, E	100%	100%	20%	20%	20%	100%	20%
R06	ESE	100%	100%	20%	20%	20%	20%	20%
R07	SE, SSE	100%	100%	100%	20%	20%	20%	20%
R08	S, SSW, SW, WSW, W	100%	20%	100%	20%	20%	20%	20%
N/A	WNW	Refer to Region R01						
Evacuate 5-Mile Region and Downwind to the EPZ Boundary								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R09	NW, NNW, N, NNE	100%	100%	100%	20%	20%	100%	100%
R10	NE, ENE, E	100%	100%	100%	100%	20%	100%	100%
R11	ESE	100%	100%	100%	100%	20%	100%	20%
R12	SE, SSE, S	100%	100%	100%	100%	100%	100%	20%
R13	SSW, SW, WSW	100%	100%	100%	20%	100%	100%	20%
N/A	W, WNW	Refer to Region R02						
Staged Evacuation - 2-Mile Region Evacuates, then Evacuate Downwind to 5 Miles								
Region	Wind Direction From	ERPA						
		NH					MA	
		A	C	D	F	G	B	E
R14	N/A	100%	100%	100%	20%	20%	100%	20%
R15	NW, NNW, N, NNE	100%	20%	20%	20%	20%	100%	20%
R16	NE, ENE, E	100%	100%	20%	20%	20%	100%	20%
R17	ESE	100%	100%	20%	20%	20%	20%	20%
R18	SE, SSE	100%	100%	100%	20%	20%	20%	20%
R19	S, SSW, SW, WSW, W	100%	20%	100%	20%	20%	20%	20%
N/A	WNW	Refer to Region R01						
ERPA(s) Evacuate		ERPAs) Shelter-in-Place			ERPA(s) Shelter-in-Place until 90% ETE for R01, then Evacuate			

¹ New Hampshire beaches will be evacuated, and Massachusetts beaches will be closed for all wind directions as per the Seabrook Station PAR procedure.

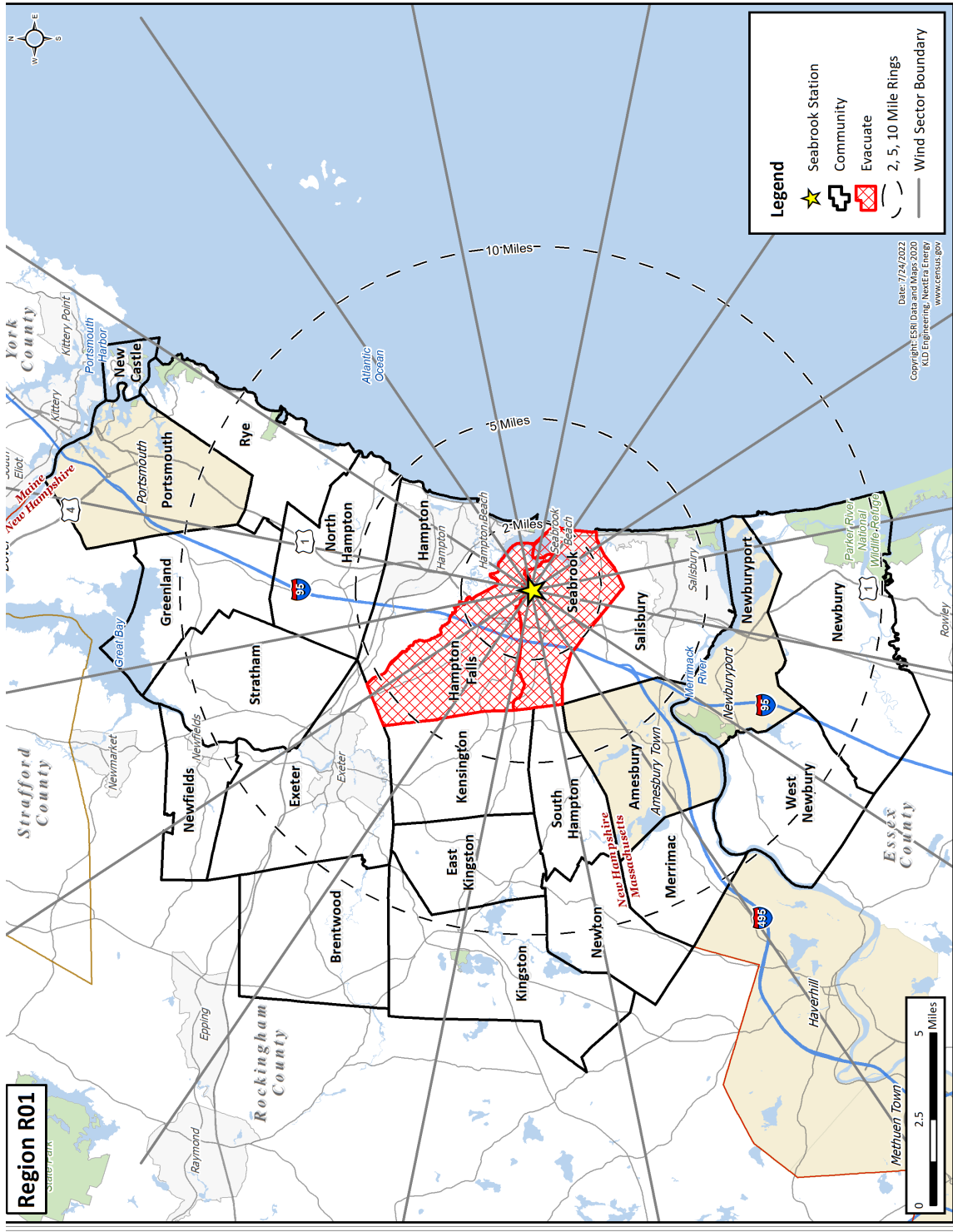


Figure H-1. Region R01

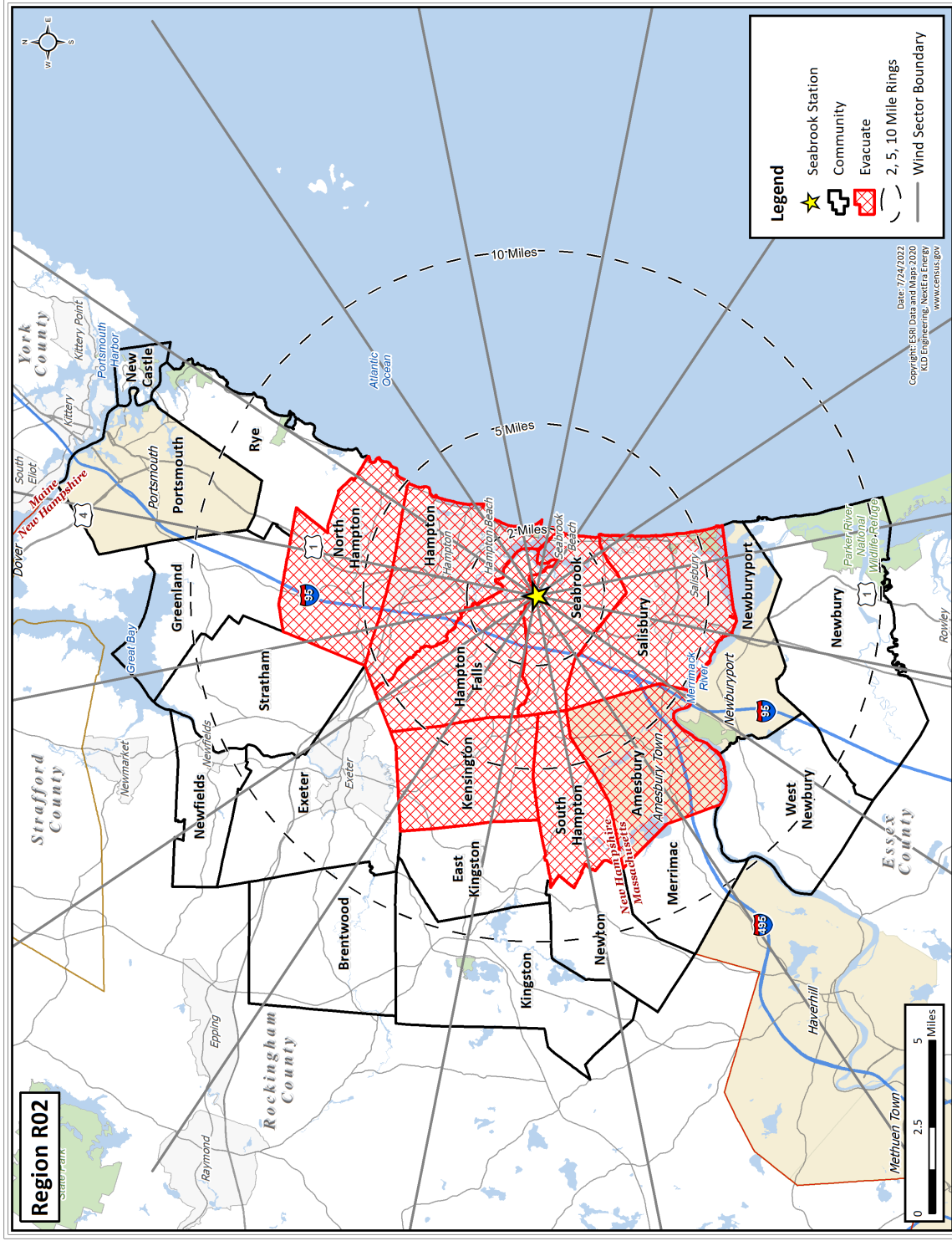


Figure H-2. Region R02

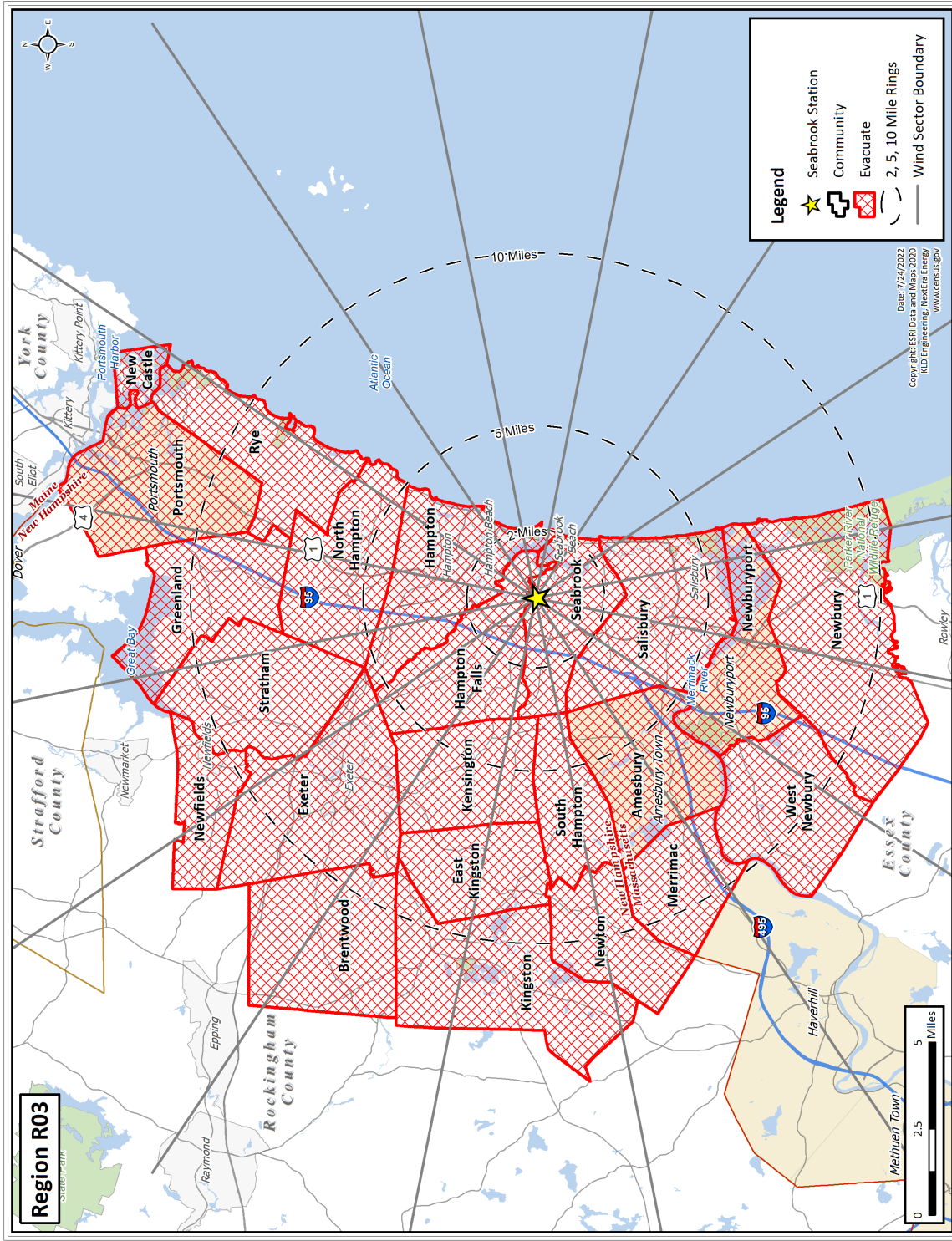


Figure H-3. Region R03

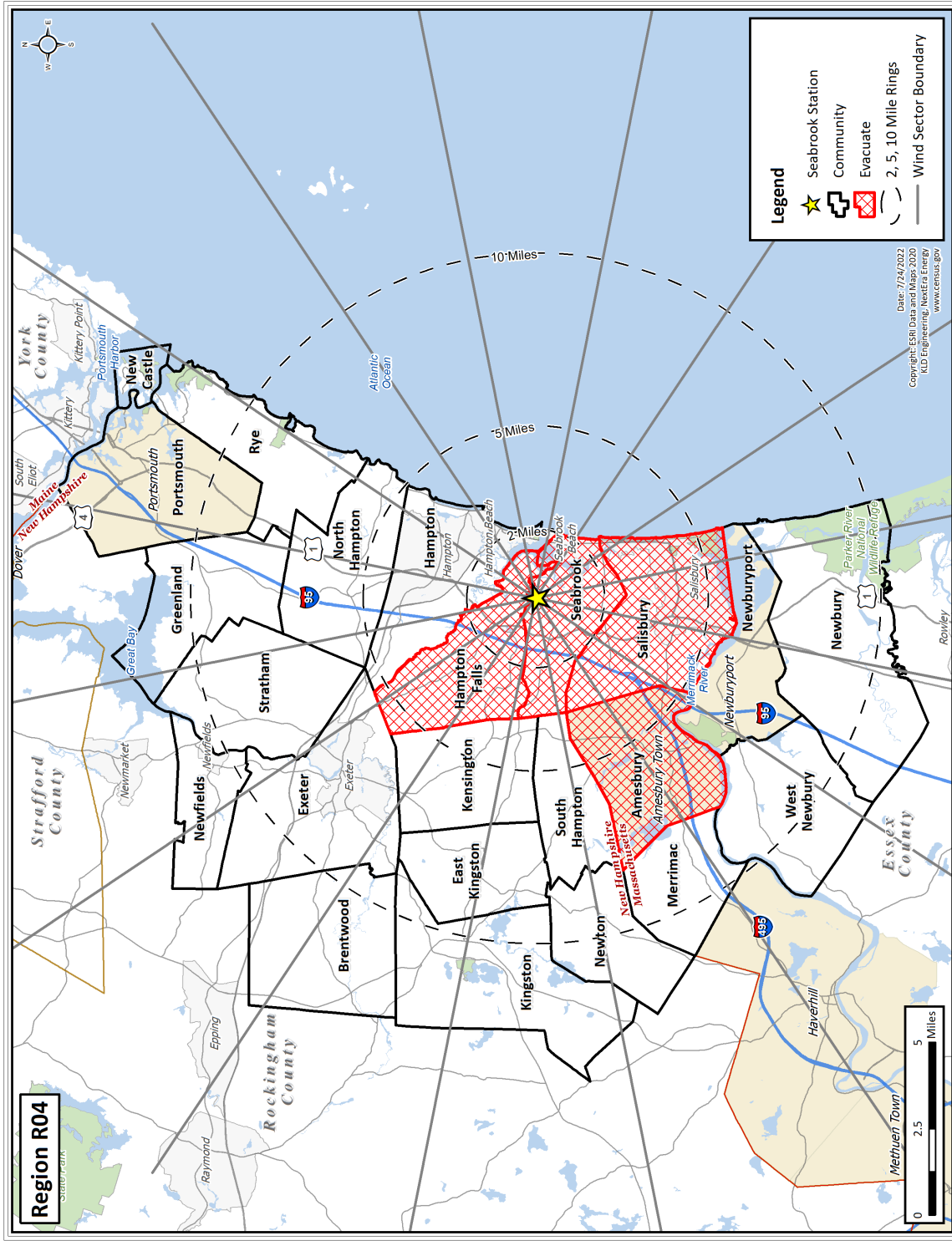


Figure H-4. Region R04

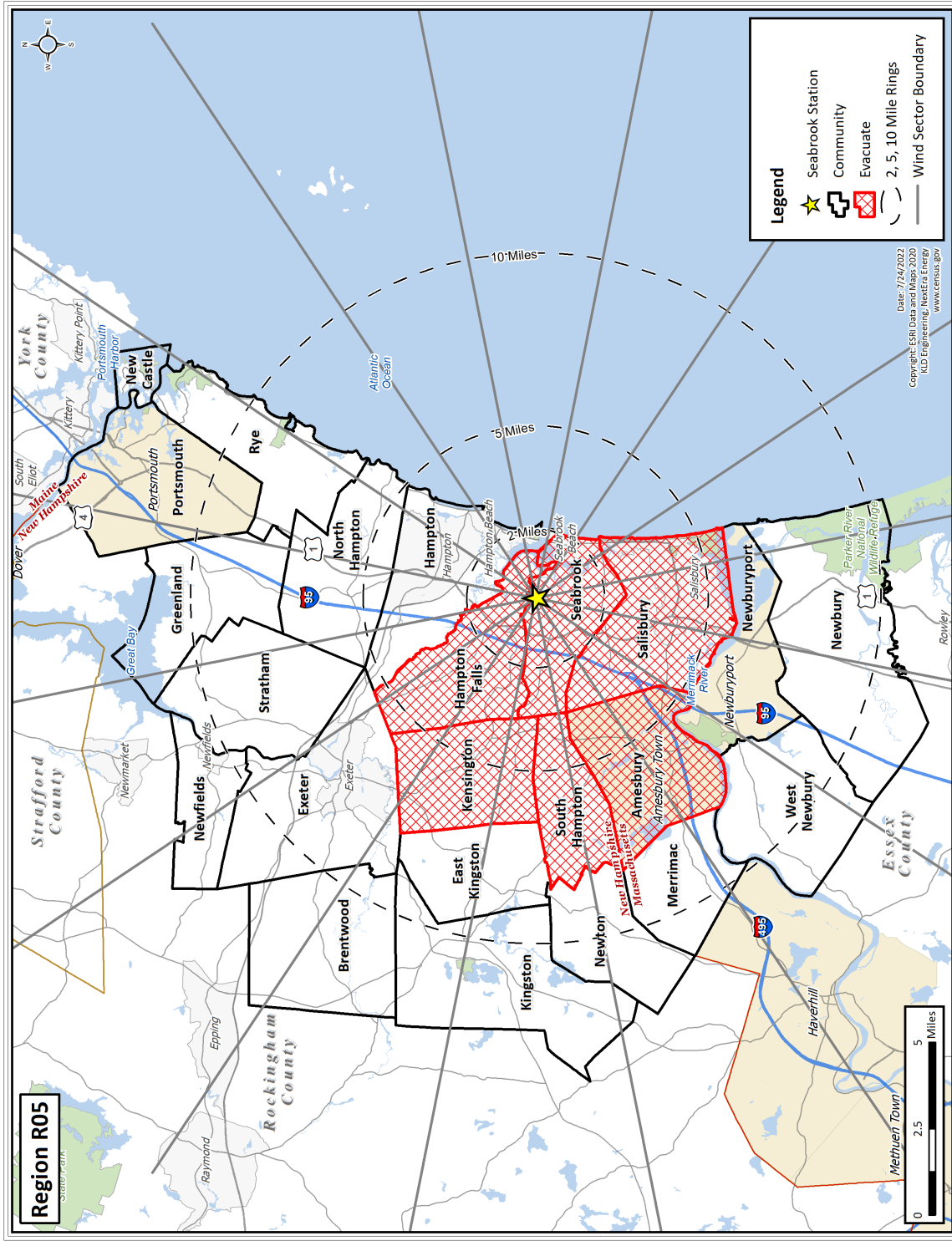


Figure H-5. Region R05

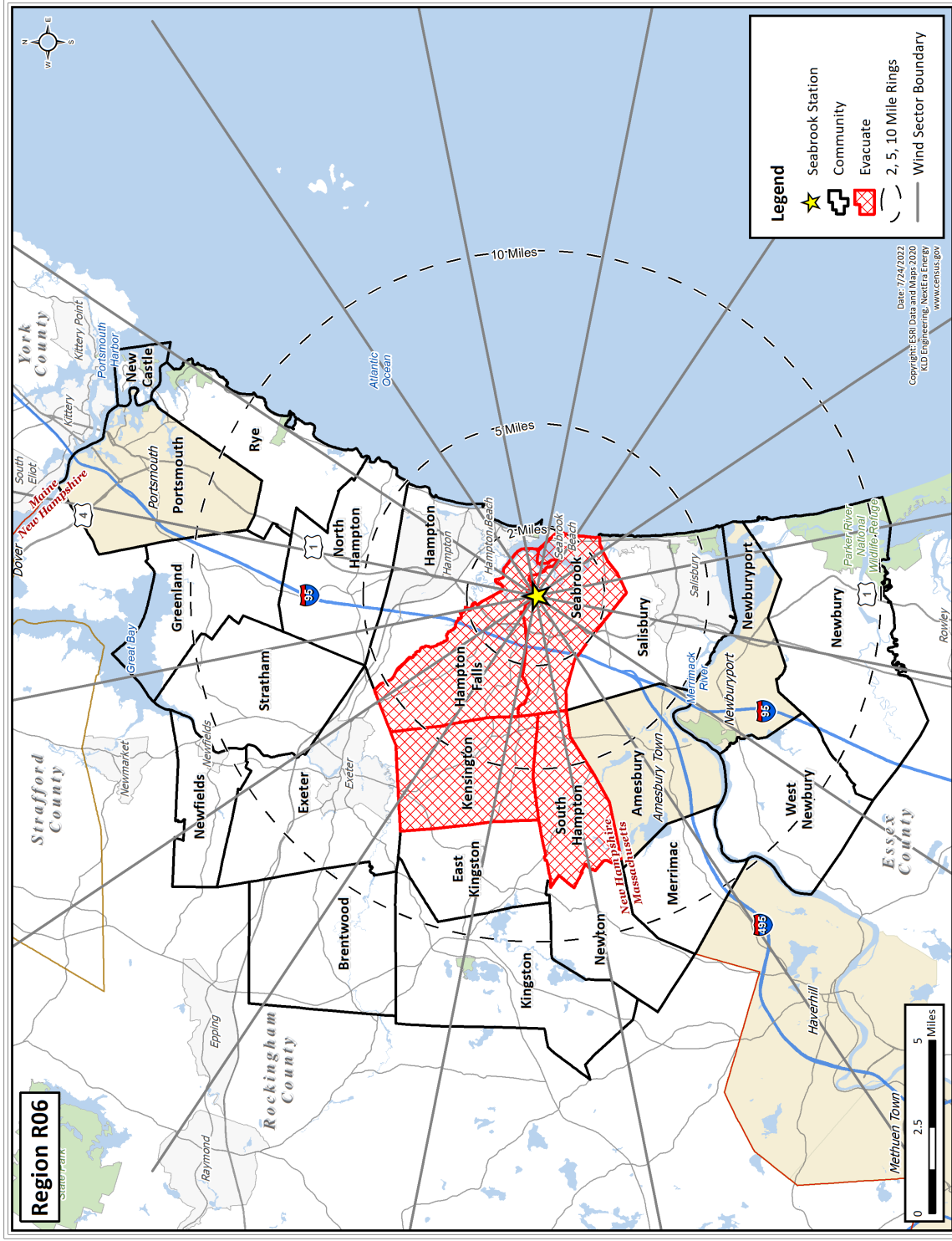


Figure H-6. Region R06

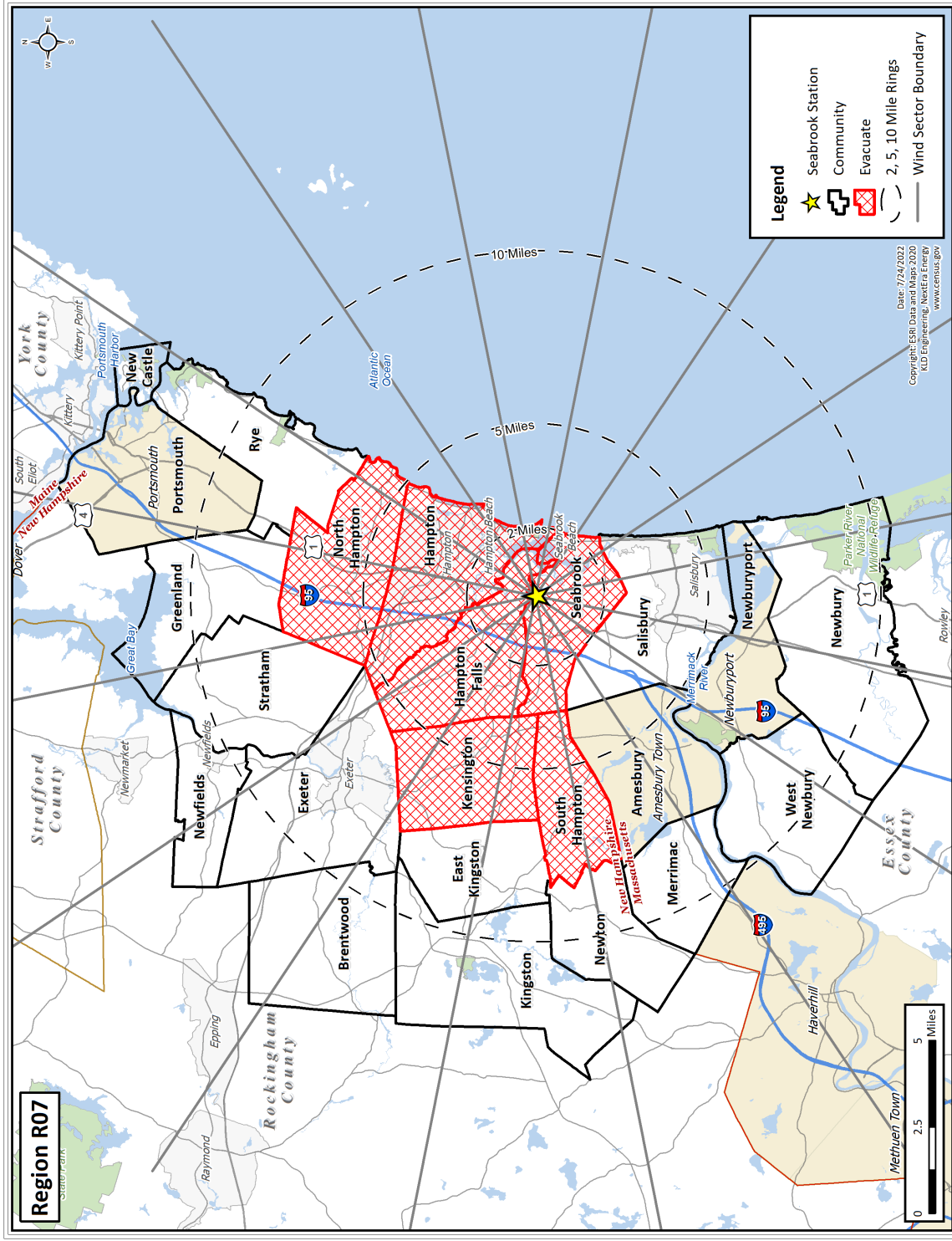


Figure H-7. Region R07

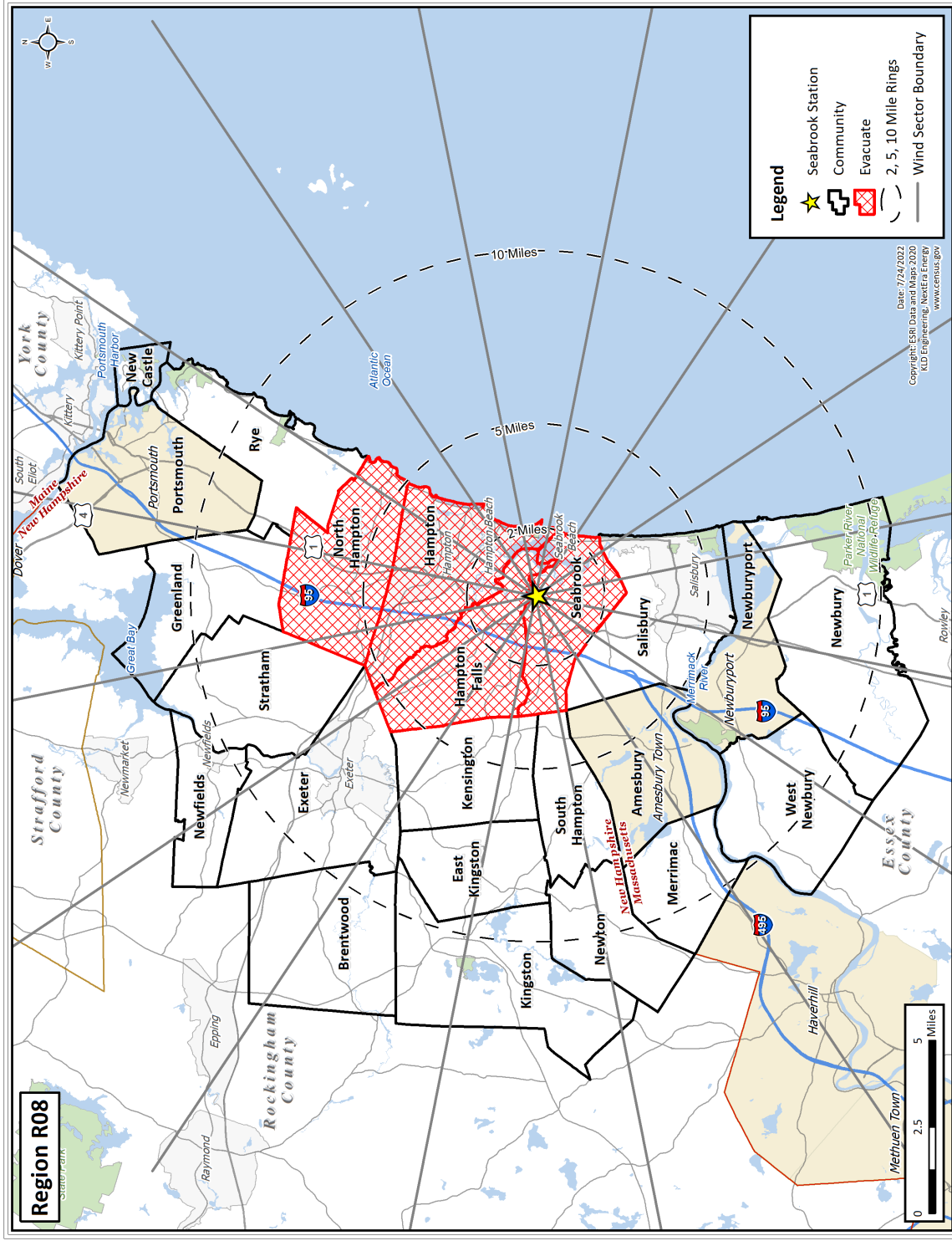


Figure H-8. Region R08

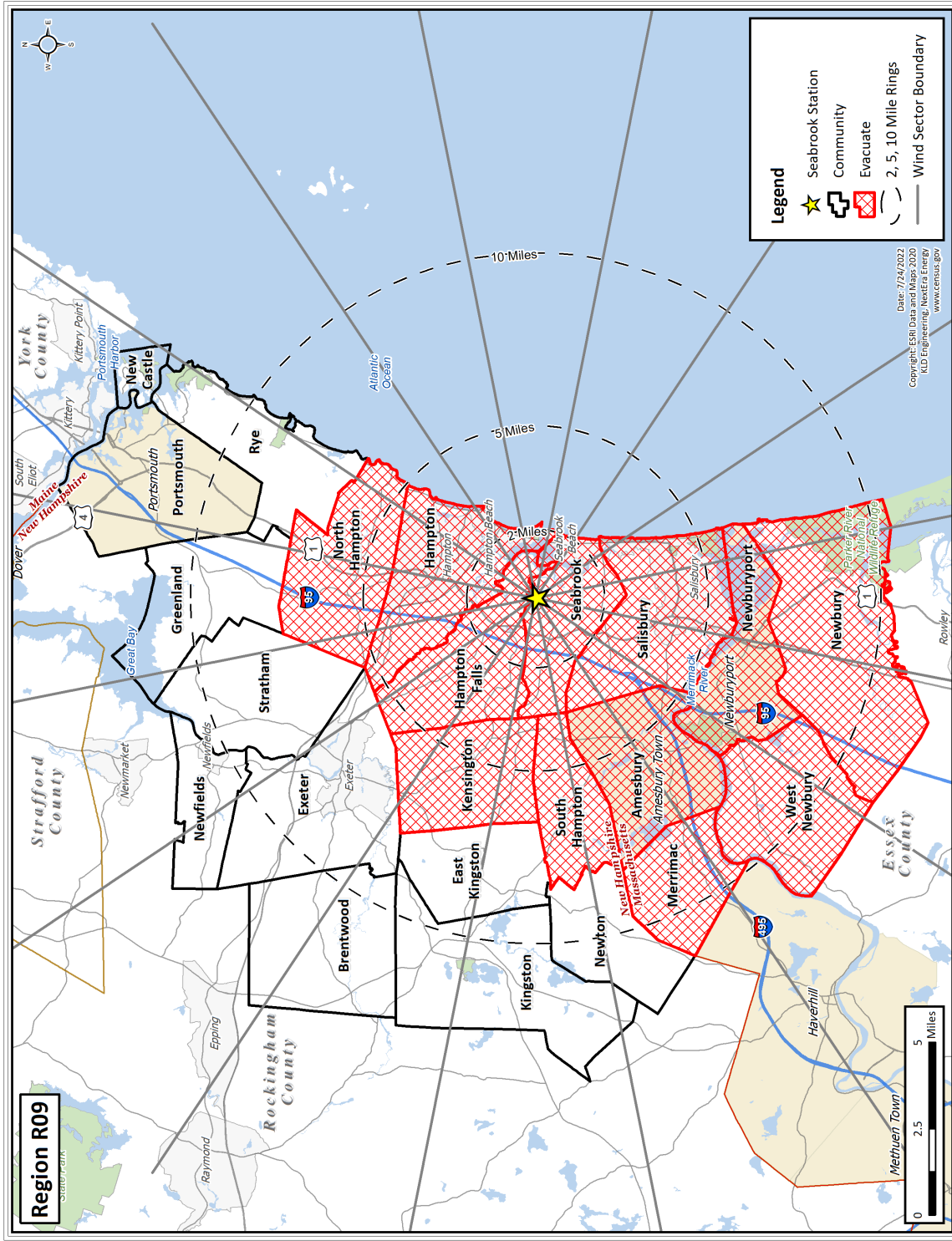


Figure H-9. Region R09

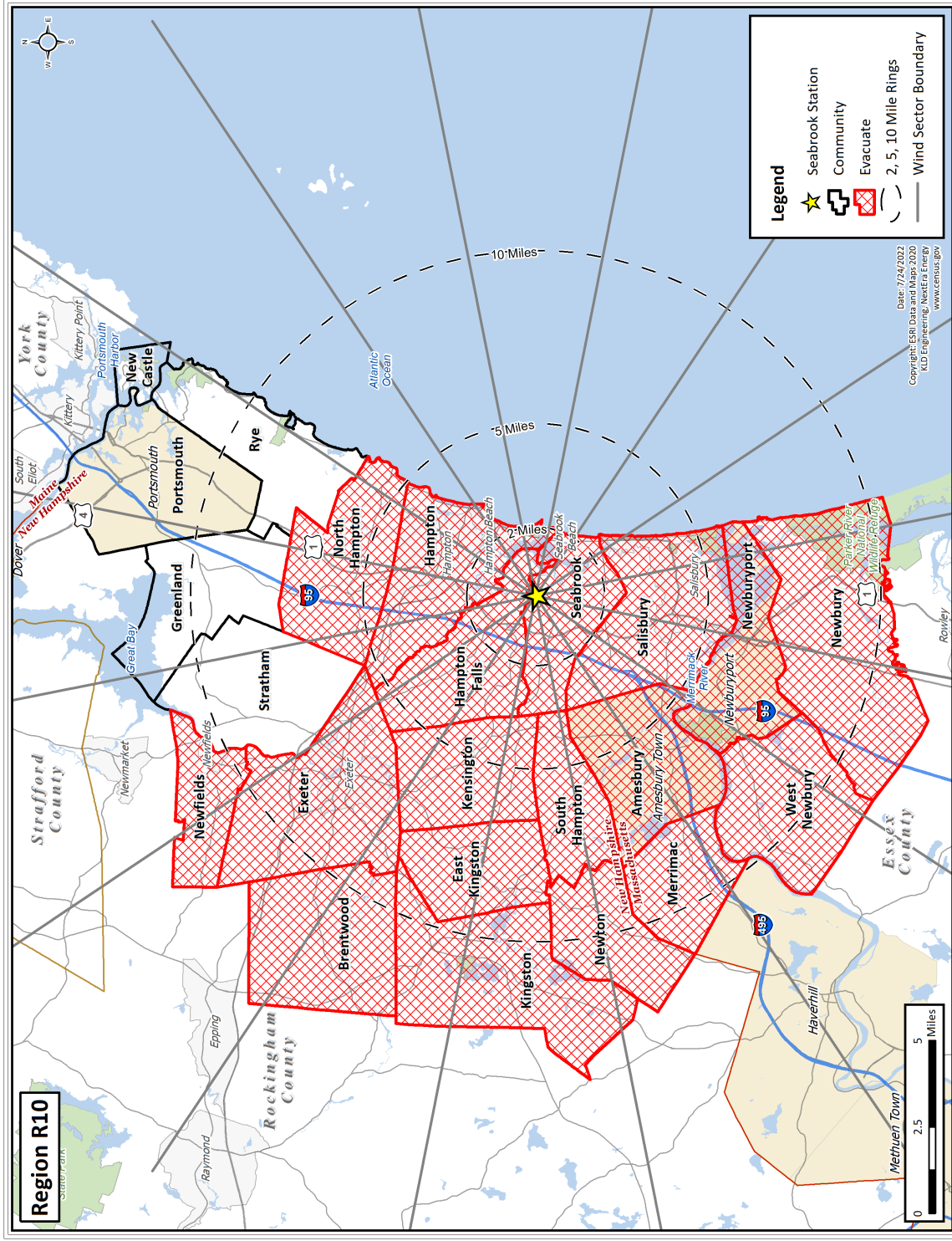


Figure H-10. Region R10

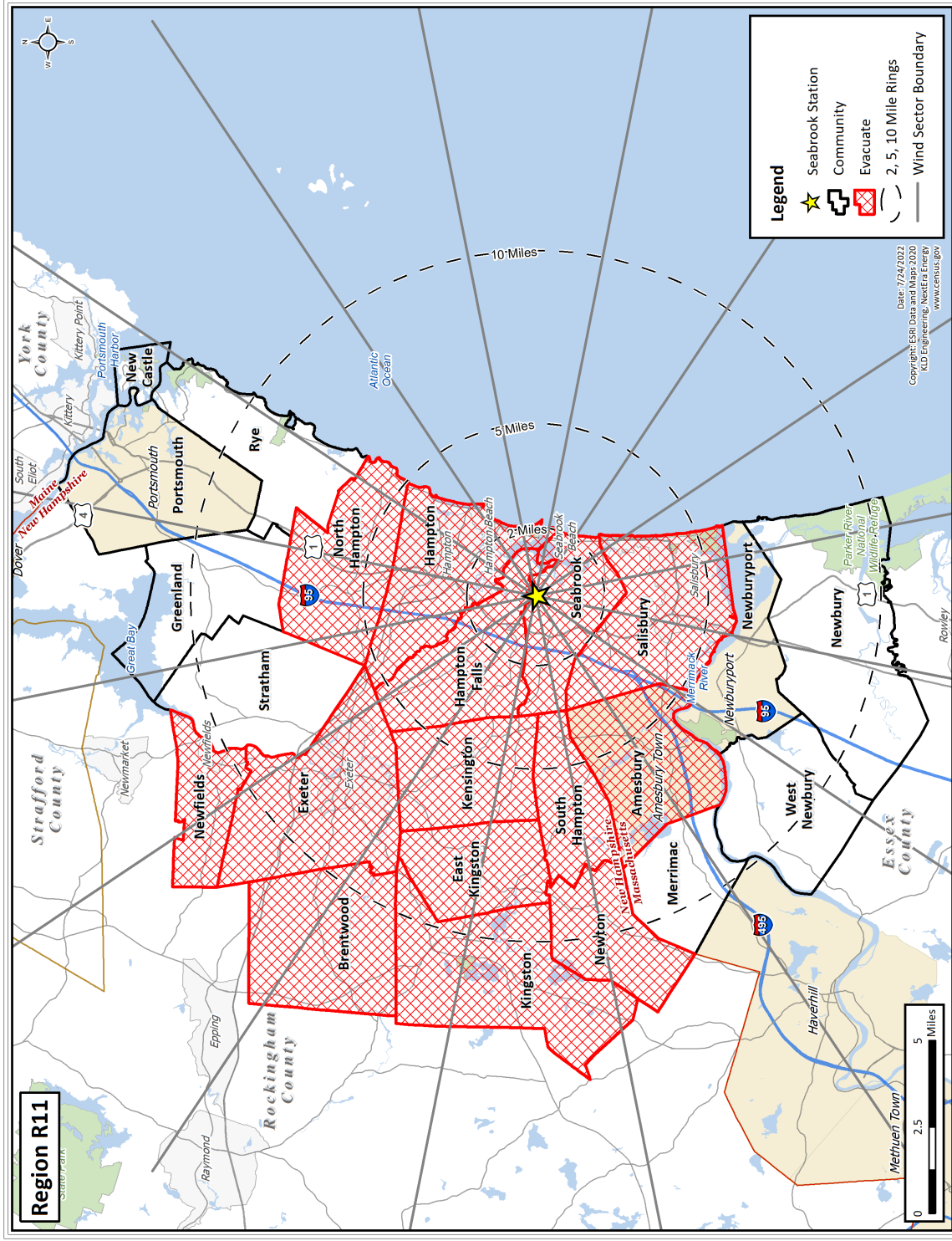


Figure H-11. Region R11

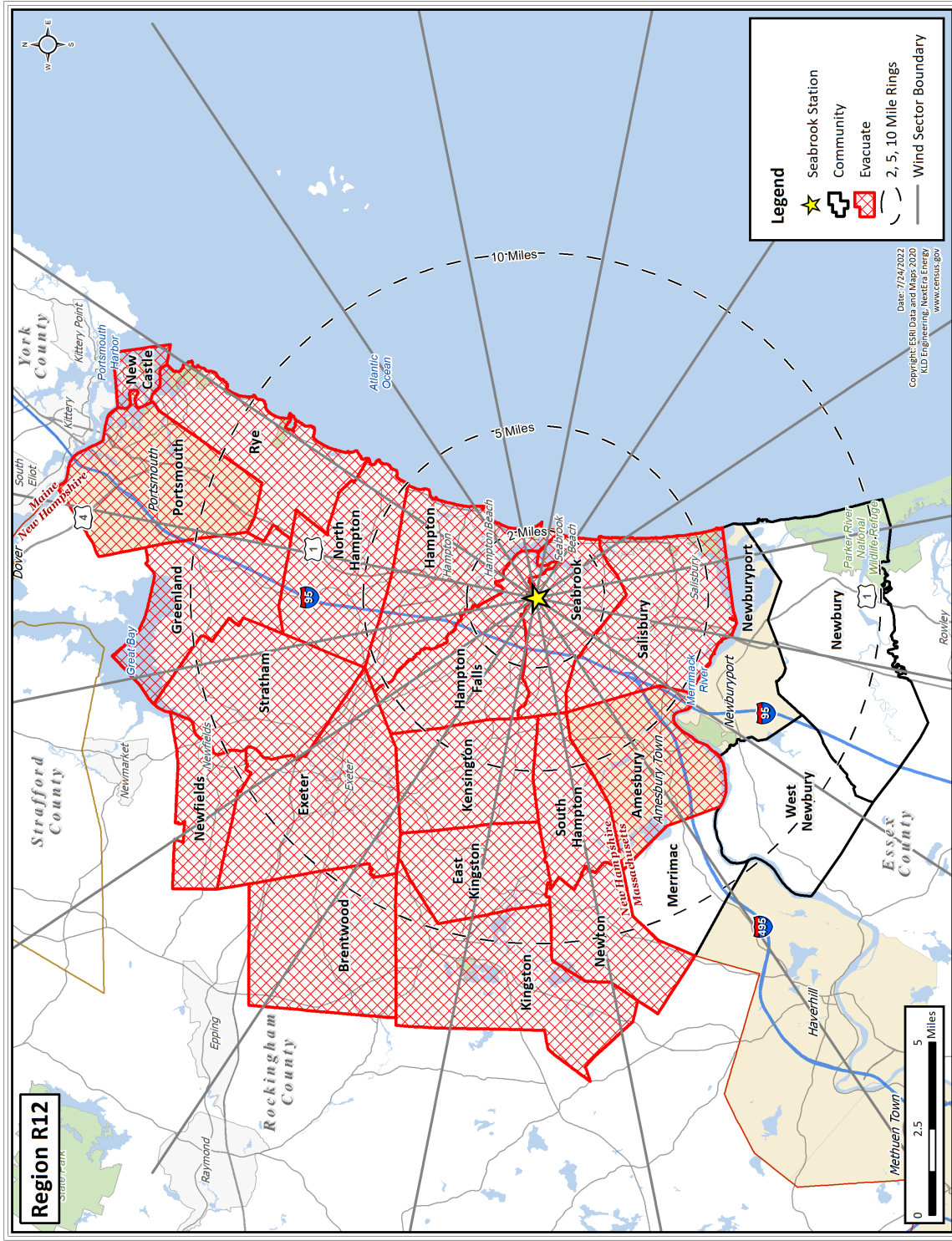


Figure H-12. Region R12

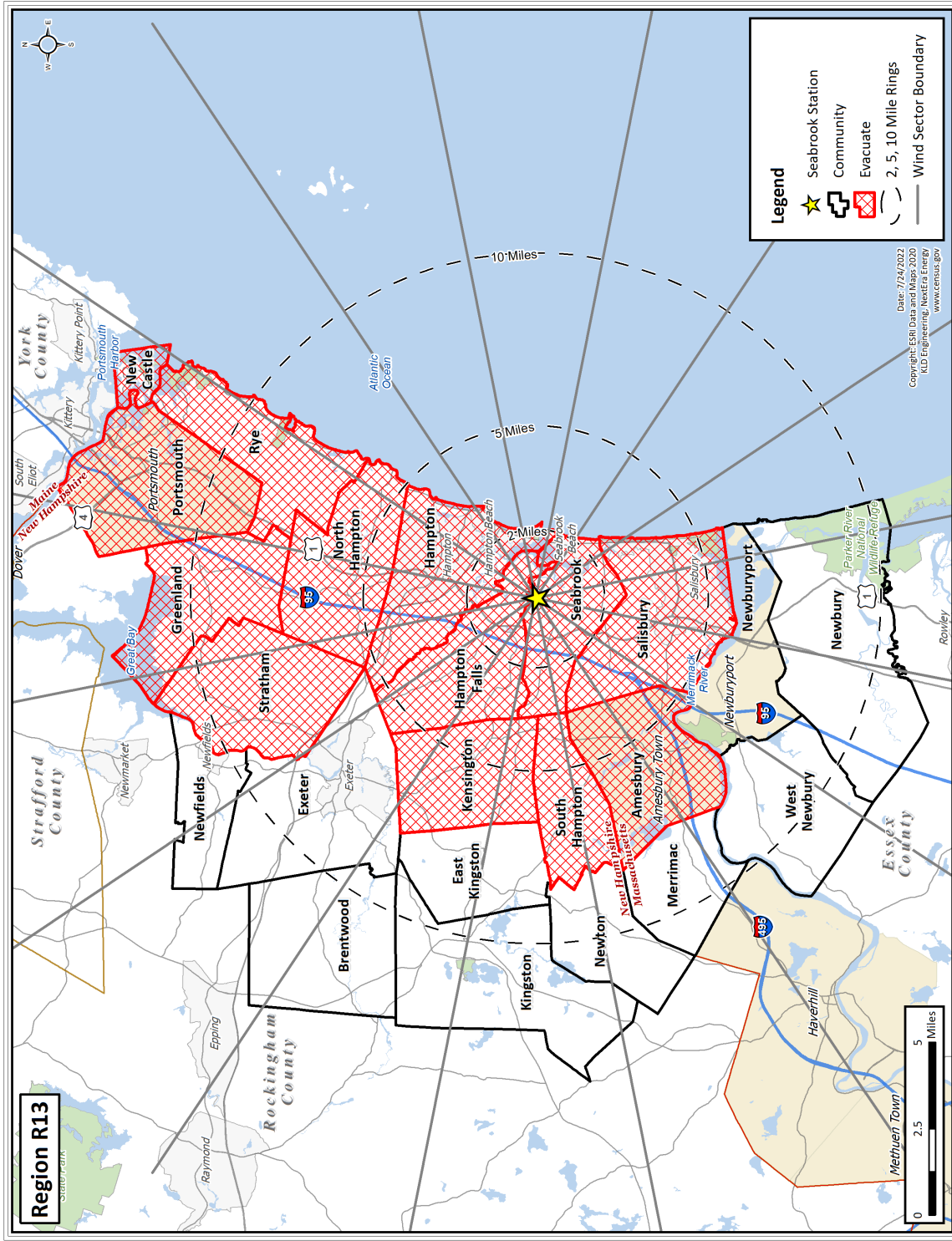


Figure H-13. Region R13

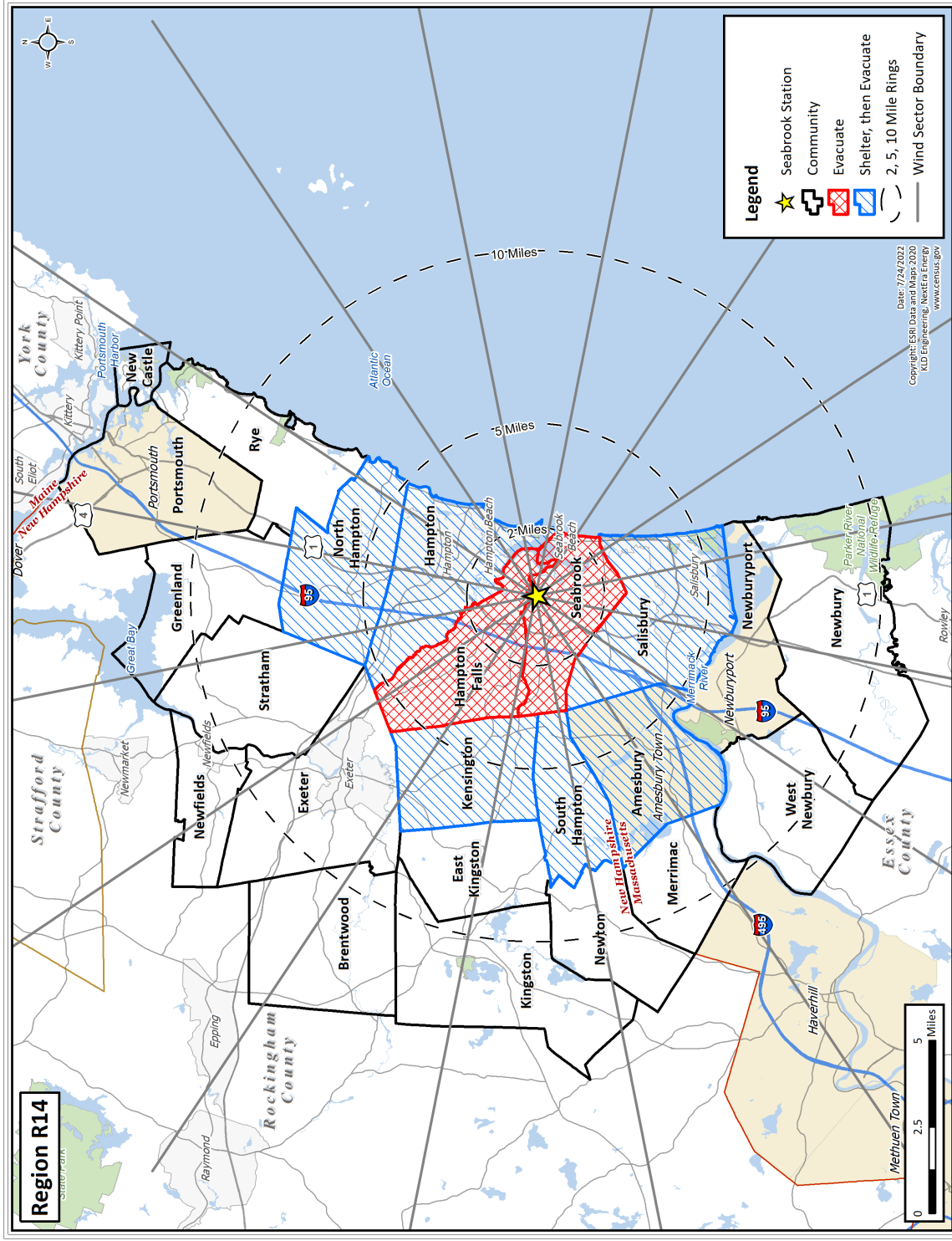


Figure H-14. Region R14

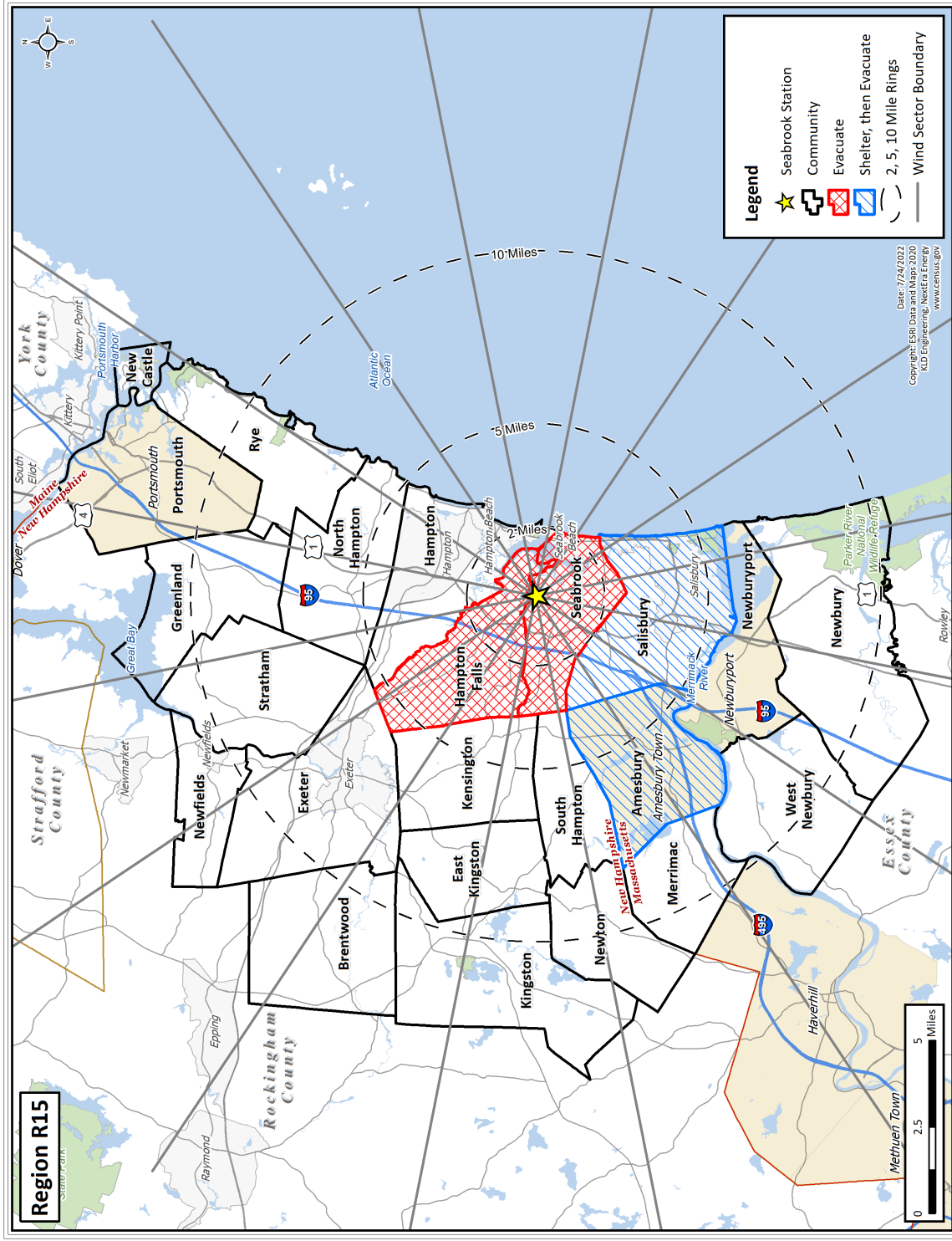


Figure H-15. Region R15

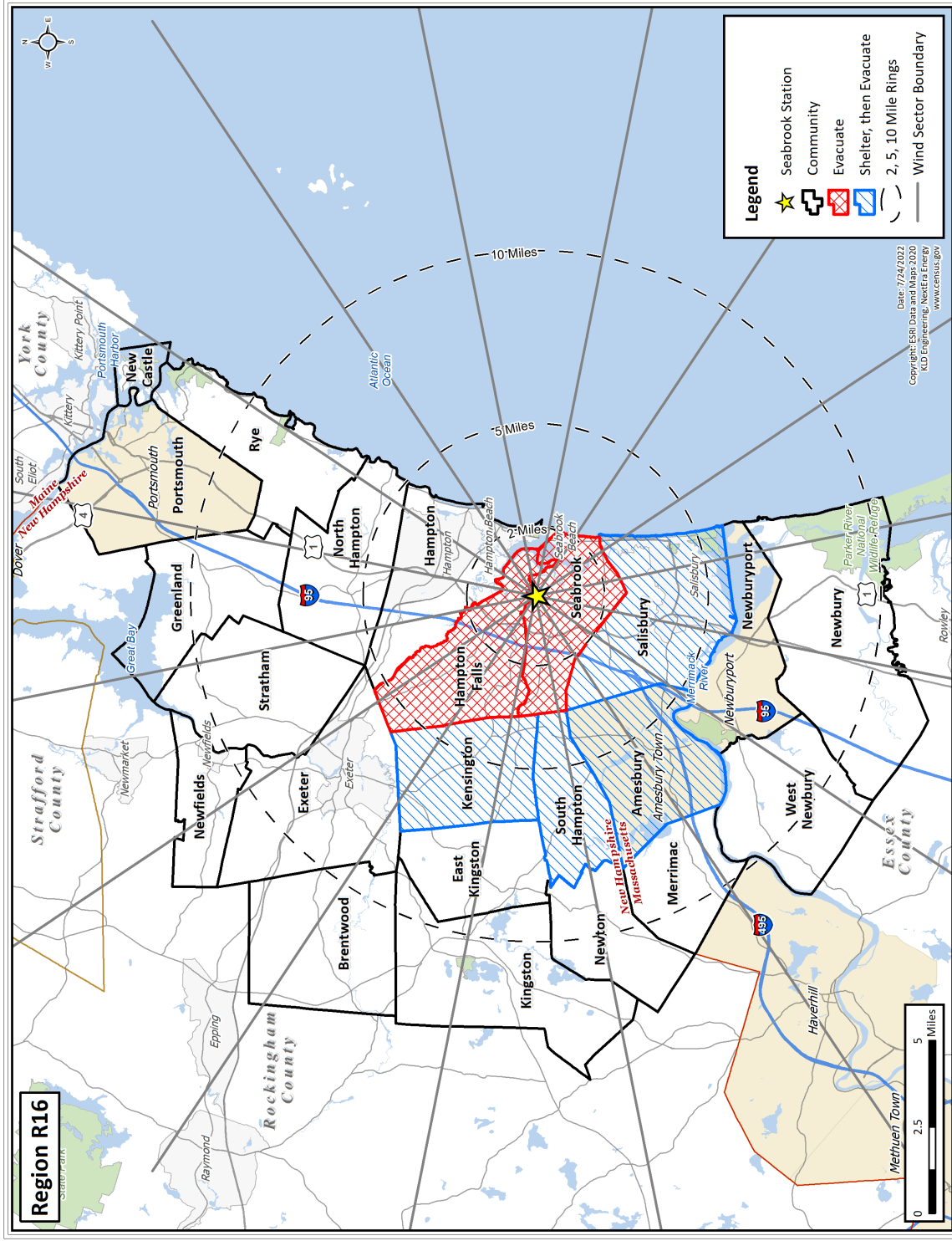


Figure H-16. Region R16

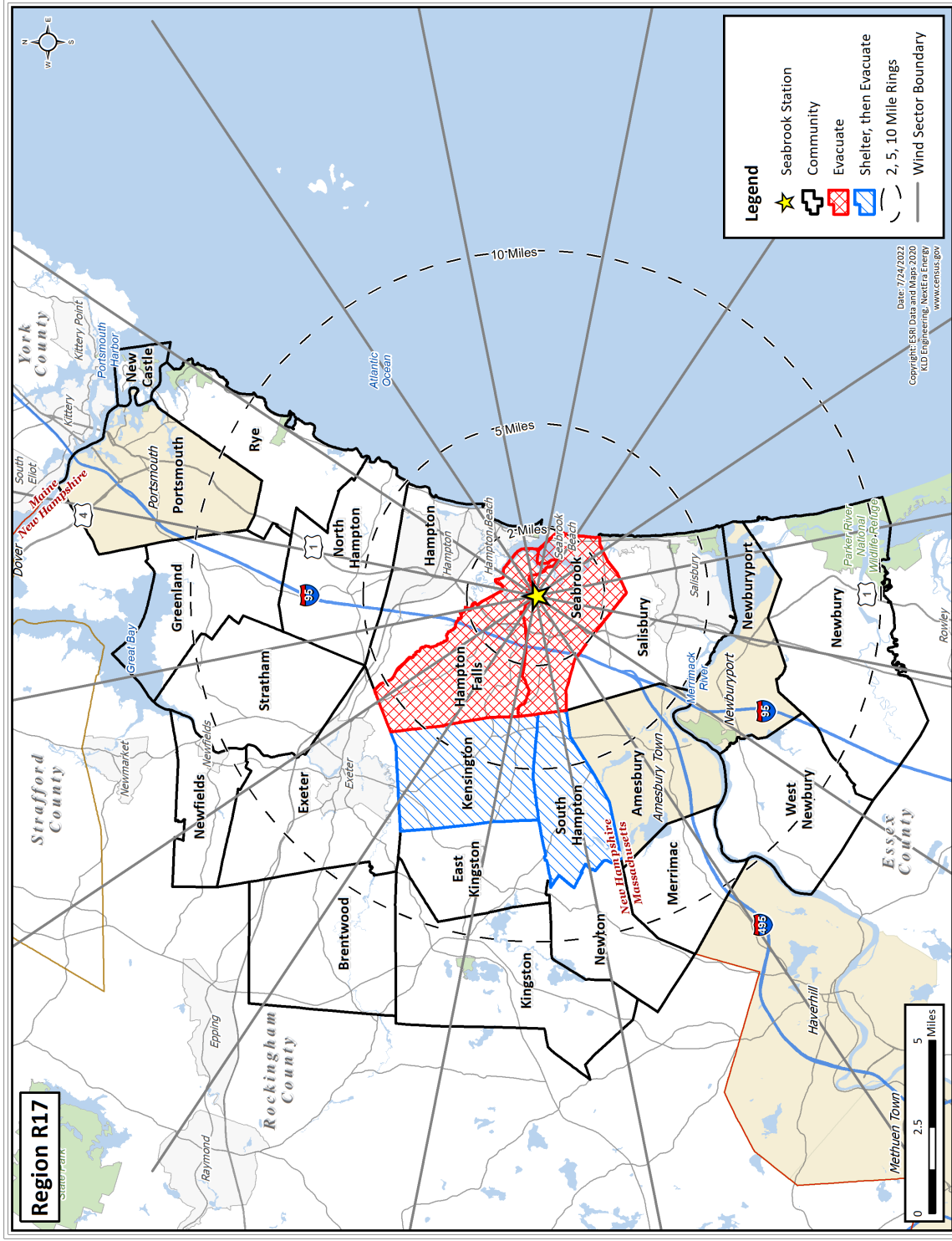


Figure H-17. Region R17

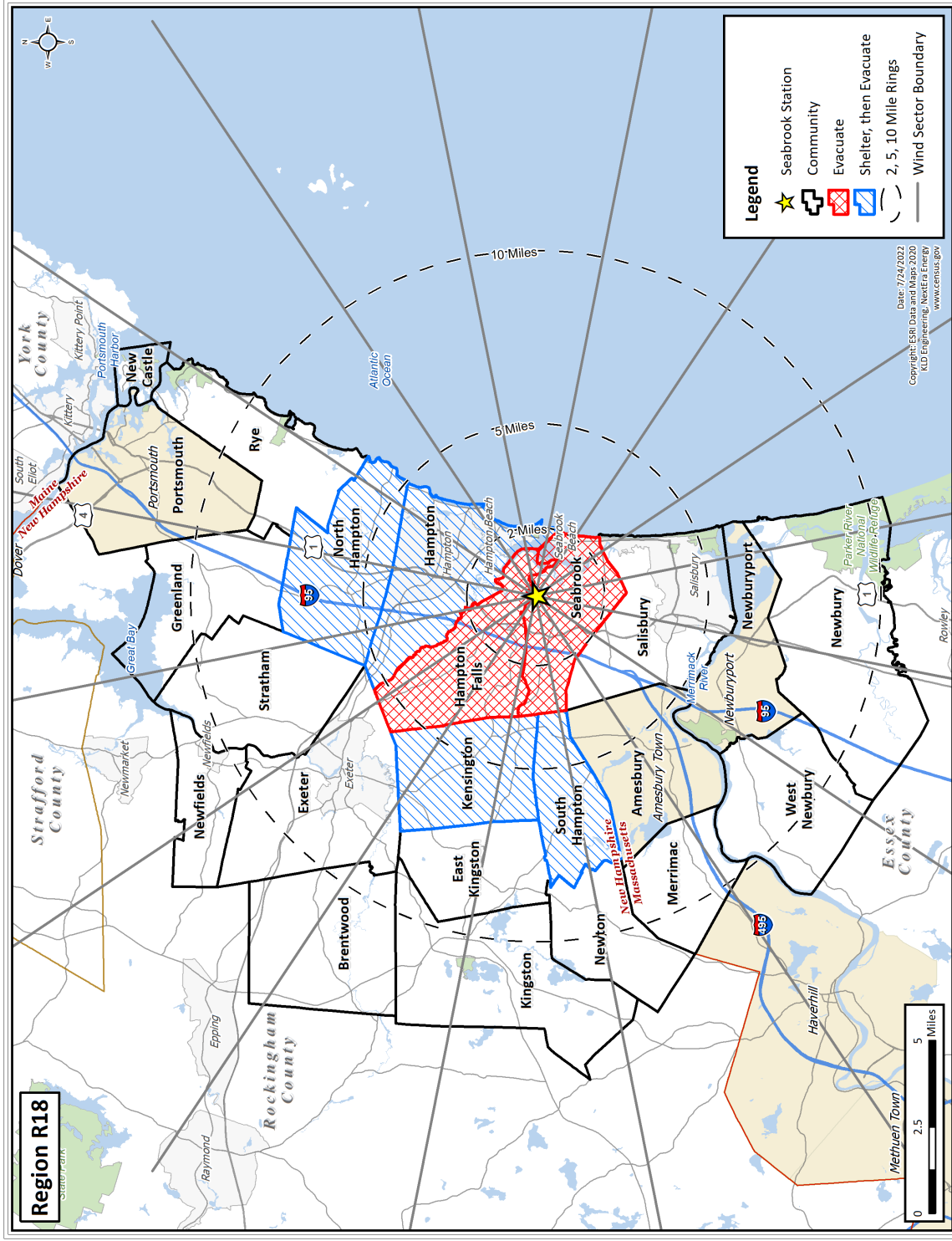


Figure H-18. Region R18

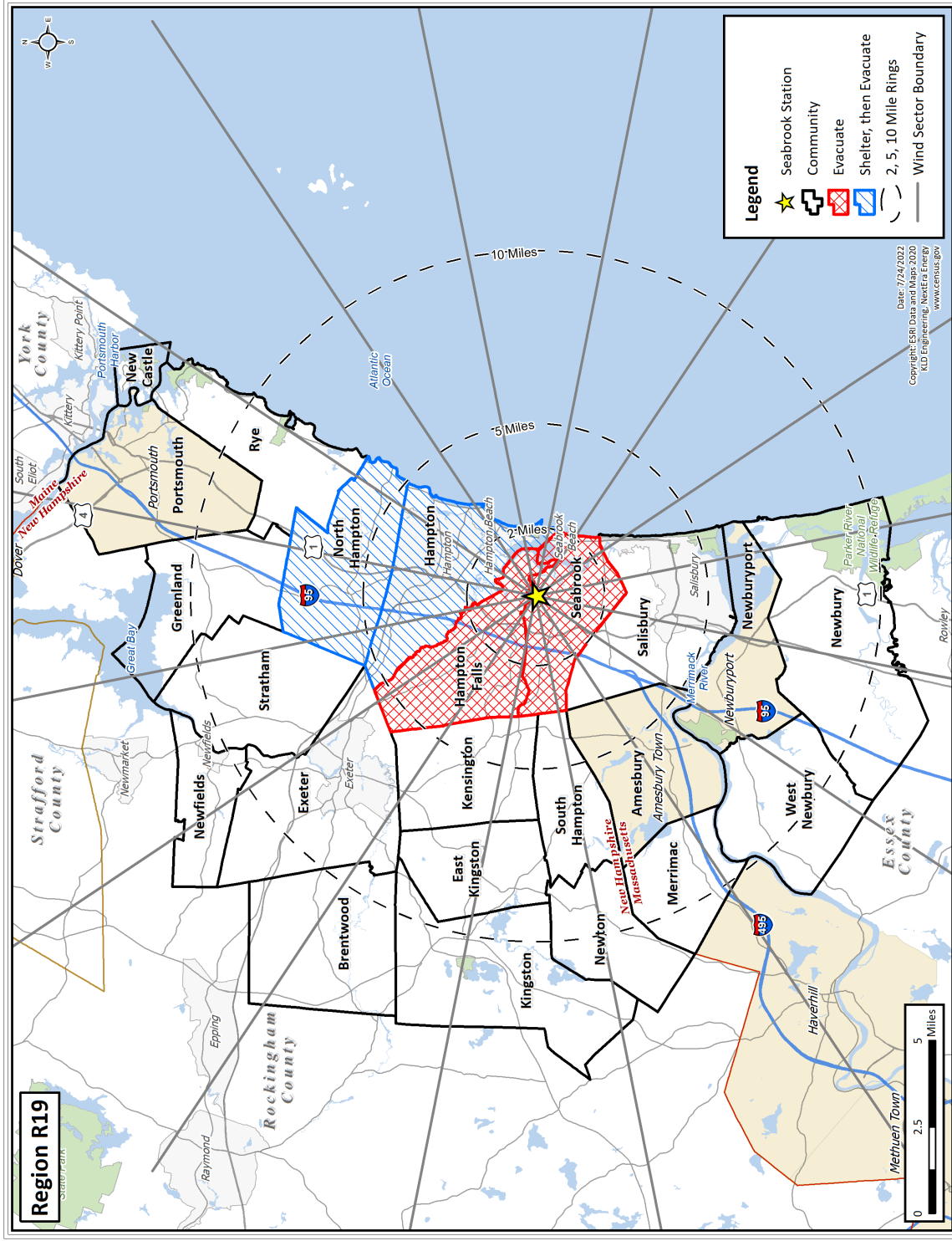


Figure H-19. Region R19

APPENDIX J

Representative Inputs to and Outputs from the DYNEV II System

J. REPRESENTATIVE INPUTS TO AND OUTPUTS FROM THE DYNEV II SYSTEM

This appendix presents data input to and output from the DYNEV II System.

Table J-1 provides source (vehicle loading) and destination information for several roadway segments (links) in the analysis network. In total, there are a total of 840 source links (origins) in the model. The source links are shown as centroid points in Figure J-1. On average, evacuees travel a straight-line distance of 6.55 miles to exit the network.

Table J-2 provides network-wide statistics (average travel time, average delay time¹, average speed and number of vehicles) for an evacuation of the entire EPZ (Region R03) for each scenario. Adverse weather scenarios (Scenarios 2, 4, 7, 8, 10, and 11) exhibit slower average speeds, higher delays, and longer average travel times than comparable good weather scenarios. When comparing Scenario 13 (special event) and Scenario 5, the additional vehicles from the special event slightly lower the average speeds, cause longer delays and increase the travel time. When comparing Scenario 14 (roadway closure) and Scenario 1, the lane closure on New Hampshire State Highway 101 westbound lowers the average speeds, cause longer delays and increases the travel time.

Table J-3 provided statistics (average speed and travel time) for the major evacuation routes – US-4, SR-101, I-495, I-95, and US-1 – for an evacuation of the entire EPZ (Region R03) under Scenario 1 conditions. As discussed in Section 7.3 and shown in Figures 7-3 through 7-8, SR-101 westbound, I-95 southbound and northbound, and US-1 southbound and northbound experiences significant congestion within the EPZ for the first 4 to 5 hours of the evacuation. As such, the average speeds are comparably slower (and travel times longer) on these roads traveling in these directions than other major evacuation routes for 4 to 5 hours.

Table J-4 provides the number of vehicles discharged and the cumulative percent of total vehicles discharged for each link exiting the analysis network for an evacuation of the entire EPZ (Region R03) under Scenario 1 conditions. Refer to the figures in Appendix K for maps showing the geographic location of each link.

Figure J-2 through Figure J-15 plot the trip generation time versus the ETE for each of the 14 Scenarios considered. The distance between the trip generation and ETE curves is the travel time. Plots of trip generation versus ETE are indicative of the level of traffic congestion during evacuation. For low population density sites, the curves are close together, indicating short travel times and minimal traffic congestion. For higher population density sites, the curves are farther apart indicating longer travel times and the presence of traffic congestion. As seen in Figure J-2 through Figure J-15, the curves are spatially separated as a result of the traffic congestion in the EPZ, specifically in Community of Portsmouth, which was discussed in detail in Section 7.3.

¹ Computed as the difference of the average travel time and the average ideal travel time under free flow conditions.

Table J-1. Sample Simulation Model Input

Link Number	Upstream Node	Downstream Node	Vehicles Entering Network on this Link	Directional Preference	Destination Nodes	Destination Capacity
1391	956	957	16	W	8061	4,500
					8675	1,700
					8821	1,275
535	308	307	472	N	8051	4,500
					8001	1,275
					8050	6,750
701	434	433	51	N	8567	1,700
					8550	1,700
					8301	1,700
931	620	728	151	NW	8550	1,700
					8301	1,700
					8551	1,700
1141	789	790	233	NW	8550	1,700
					8301	1,700
					8551	1,700
1343	929	928	286	S	8855	4,500
					8090	6,750
					8856	1,275
1559	1070	1061	116	SW	8855	4,500
					8090	6,750
					8064	1,275
1737	1215	1216	66	SW	8855	4,500
					8090	6,750
					8821	1,275
2038	1462	1463	111	SW	8855	4,500
					8090	6,750
					8064	1,275
2264	1636	1405	185	SW	8855	4,500
					8090	6,750
					8064	1,275

Table J-2. Selected Model Outputs for the Evacuation of the Entire EPZ (Region R03)

Scenario	1	2	3	4	5	6	7
Network-Wide Average Travel Time (Min/Veh-Mi)	4.3	5.1	3.7	4.4	3.6	3.9	4.7
Network-Wide Delay Time (Min/Veh-Mi)	3.1	3.8	2.4	3.1	2.3	2.6	3.5
Network-Wide Average Speed (mph)	13.9	11.8	16.3	13.6	16.9	15.3	12.7
Total Vehicles Exiting Network	178,406	179,372	157,317	158,239	134,542	168,238	168,911
Scenario	8	9	10	11	12	13	14
Network-Wide Average Travel Time (Min/Veh-Mi)	5.4	3.1	3.8	4.2	3.2	3.9	4.6
Network-Wide Delay Time (Min/Veh-Mi)	4.1	1.8	2.5	2.9	1.9	2.6	3.3
Network-Wide Average Speed (mph)	11.1	19.3	15.9	14.2	18.7	15.4	13.0
Total Vehicles Exiting Network	169,750	142,607	143,318	143,383	125,043	159,879	178,516

Table J-3. Average Speed (mph) and Travel Time (min) for Major Evacuation Routes (Region R03, Scenario 1)

Route Name	Length (miles)	Elapsed Time (hours)															
		1:00		2:00		3:00		4:00		5:00		6:00		6:05			
		Speed (mph)	Travel Time (min)	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time		
US-4 Southbound	5.8	64.5	5.4	64.5	5.4	64.5	5.4	64.5	5.4	64.5	5.4	64.5	5.4	64.5	5.4	64.5	5.4
SR-101 Eastbound	14.4	69.9	12.4	69.9	12.4	70.0	12.4	70.0	12.4	70.0	12.4	70.0	12.4	70.0	12.4	70.0	12.4
SR-101 Westbound	14.4	39.9	21.7	12.6	68.5	6.9	126.4	11.8	73.3	30.2	28.7	70.0	12.4	70.0	12.4	70.0	12.4
I-495 Northbound	19.3	70.0	16.6	70.0	16.6	70.0	16.6	70.0	16.6	70.0	16.6	70.0	16.6	70.0	16.6	70.0	16.6
I-495 Southbound	19.5	57.6	20.3	18.6	63.0	16.4	71.4	21.8	53.6	70.0	16.7	70.0	16.7	70.0	16.7	70.0	16.7
I-95 Northbound	35.8	64.0	33.6	41.4	51.9	48.6	44.3	67.8	31.7	70.7	30.4	70.8	30.4	70.8	30.4	70.8	30.4
I-95 Southbound	35.8	63.8	33.7	43.2	49.7	46.5	46.2	68.5	31.3	70.8	30.4	70.8	30.4	70.8	30.3	70.8	30.3
US-1 Southbound	35.0	20.1	104.8	11.4	184.1	10.9	192.7	26.8	78.5	41.0	51.3	46.6	45.1	46.8	45.1	46.8	45.1
US-1 Northbound	35.0	12.5	168.4	8.9	235.5	8.2	255.7	18.1	116.0	31.1	67.5	46.8	44.9	46.8	44.9	46.8	44.9

Table J-4. Simulation Model Outputs at Network Exit Links for Region R03, Scenario 1

Network Exit Link	Upstream Node	Downstream Node	Elapsed Time (hours)						
			1:00	2:00	3:00	4:00	5:00	6:00	6:05
			Cumulative Vehicles Discharged by the Indicated Time						
			Cumulative Percent of Vehicles Discharged by the Indicated Time						
I-95 Northbound	50	1653	6,165	12,387	18,563	24,165	27,848	28,458	28,458
			22%	18%	17%	17%	17%	16%	16%
Spaulding Tpke Northbound	52	51	3,967	8,017	12,067	16,117	20,167	22,258	22,258
			14%	12%	11%	11%	12%	13%	13%
SR-236 Northbound	153	1722	381	1,207	1,972	2,761	3,351	3,538	3,538
			1%	2%	2%	2%	2%	2%	2%
SR-152 Westbound	550	1682	712	2,160	3,664	5,041	5,739	5,919	5,924
			3%	3%	3%	4%	3%	3%	3%
SR-97 Westbound	1097	1856	424	1,483	2,648	3,573	4,119	4,126	4,126
			1%	2%	2%	3%	2%	2%	2%
US-1 Southbound	1267	1662	883	2,033	3,182	4,331	5,483	6,205	6,205
			3%	3%	3%	3%	3%	3%	3%
SR-1A Southbound	1299	1300	23	155	265	297	301	301	301
			0%	0%	0%	0%	0%	0%	0%
SR-133 Eastbound	1299	1837	174	727	1,075	1,189	1,208	1,209	1,209
			1%	1%	1%	1%	1%	1%	1%
SR-101 Westbound	1671	1669	3,332	7,405	11,537	15,587	19,712	22,334	22,374
			12%	11%	11%	11%	12%	13%	13%
SR-102 Southbound	1674	1675	299	1,035	1,854	2,583	2,789	2,792	2,792
			1%	2%	2%	2%	2%	2%	2%
SR-108 Northbound	1737	1735	373	816	1,097	1,305	1,502	1,560	1,560
			1%	1%	1%	1%	1%	1%	1%
SR-213 Westbound	1854	1855	798	1,784	2,773	3,537	3,999	4,024	4,024
			3%	3%	3%	3%	2%	2%	2%
SR-11 Westbound	1859	1685	539	1,688	2,838	3,987	5,136	5,966	5,966
			2%	3%	3%	3%	3%	3%	3%
SR-27 Westbound	1864	509	355	887	1,306	1,727	2,023	2,377	2,406
			1%	1%	1%	1%	1%	1%	1%
SR-125 Northbound	1885	1683	303	1,250	2,208	2,929	3,508	3,738	3,738
			1%	2%	2%	2%	2%	2%	2%
US-4 Westbound	1886	301	120	345	569	769	1,006	1,064	1,064
			0%	1%	1%	1%	1%	1%	1%
US-1 Northbound	1890	1654	834	1,983	3,132	4,282	5,431	5,945	5,945
			3%	3%	3%	3%	3%	3%	3%
SR-125 Southbound	1900	1686	309	1,347	2,287	3,042	3,884	4,306	4,335
			1%	2%	2%	2%	2%	2%	2%
I-495 Southbound	1905	90	2,231	6,210	10,379	16,253	20,676	20,969	20,991
			8%	9%	10%	11%	12%	12%	12%
I-95 Southbound	1922	3	6,283	14,578	23,230	28,255	30,031	30,501	30,501
			22%	22%	22%	20%	18%	17%	17%

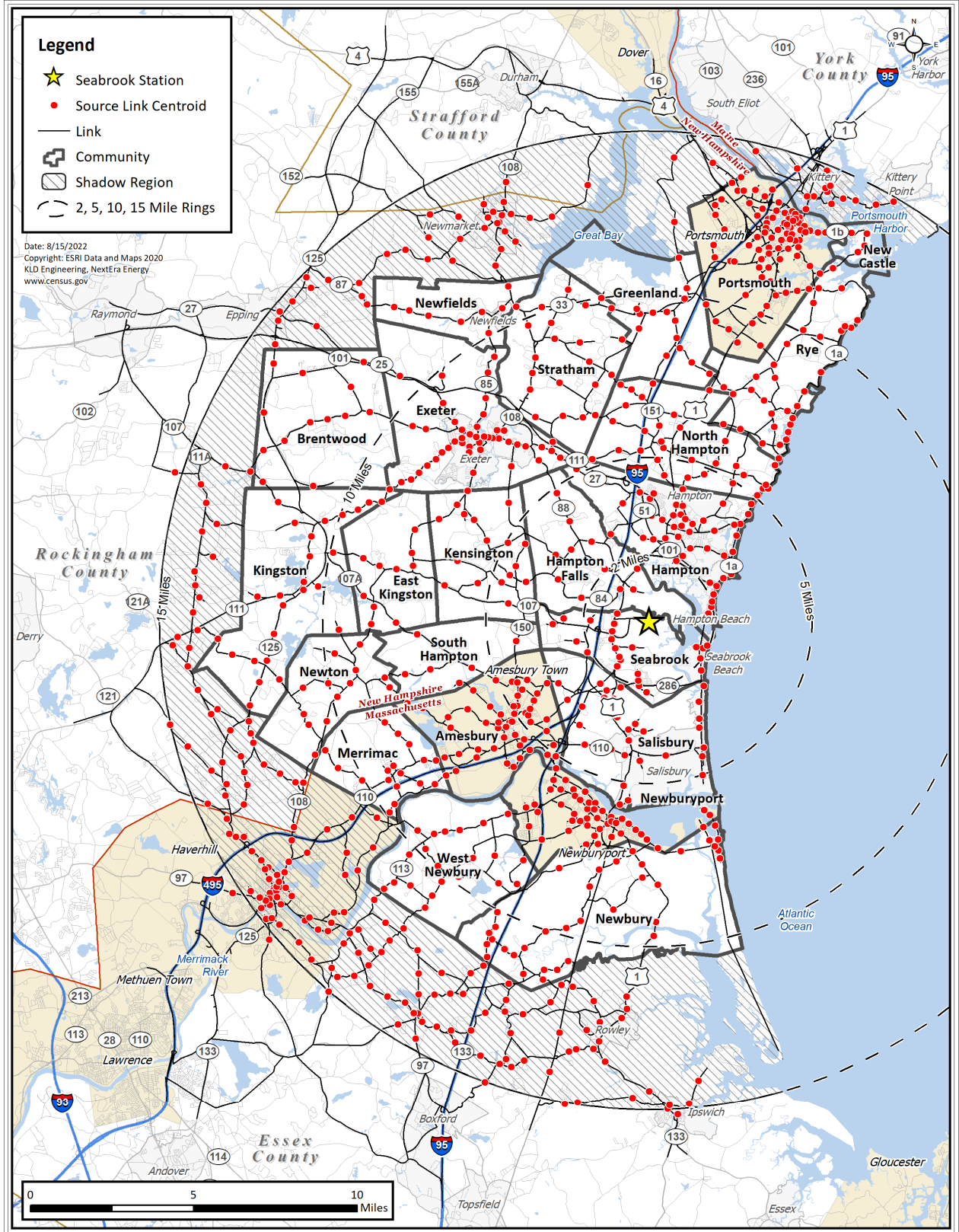


Figure J-1. Network Sources/Origins

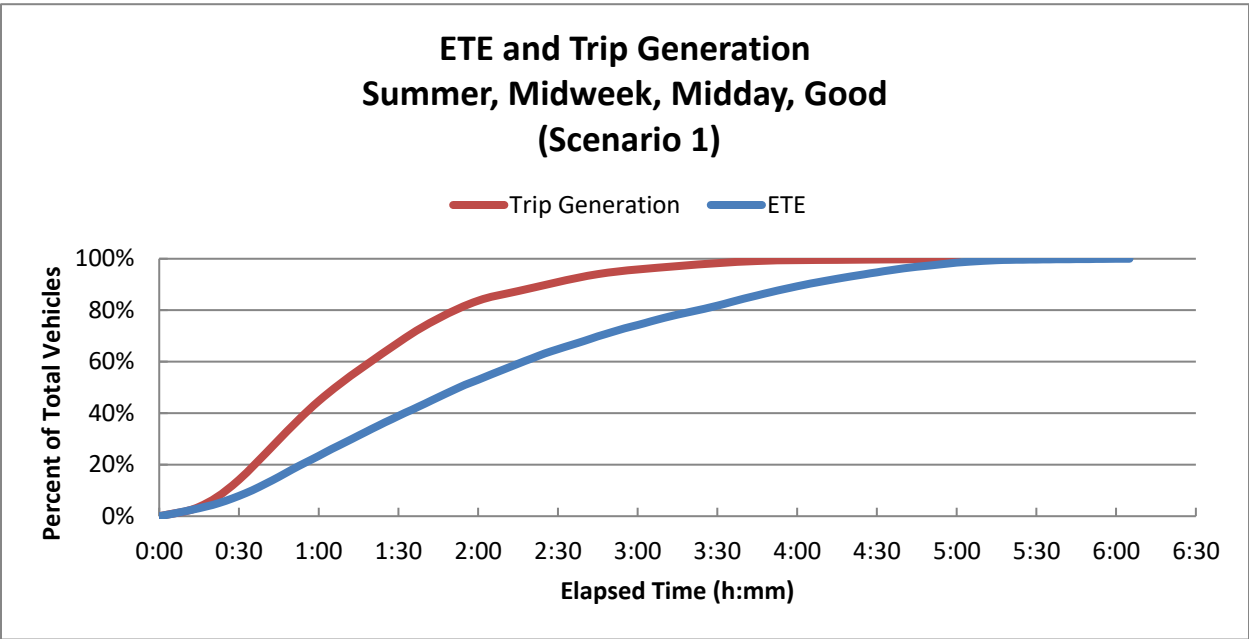


Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1)

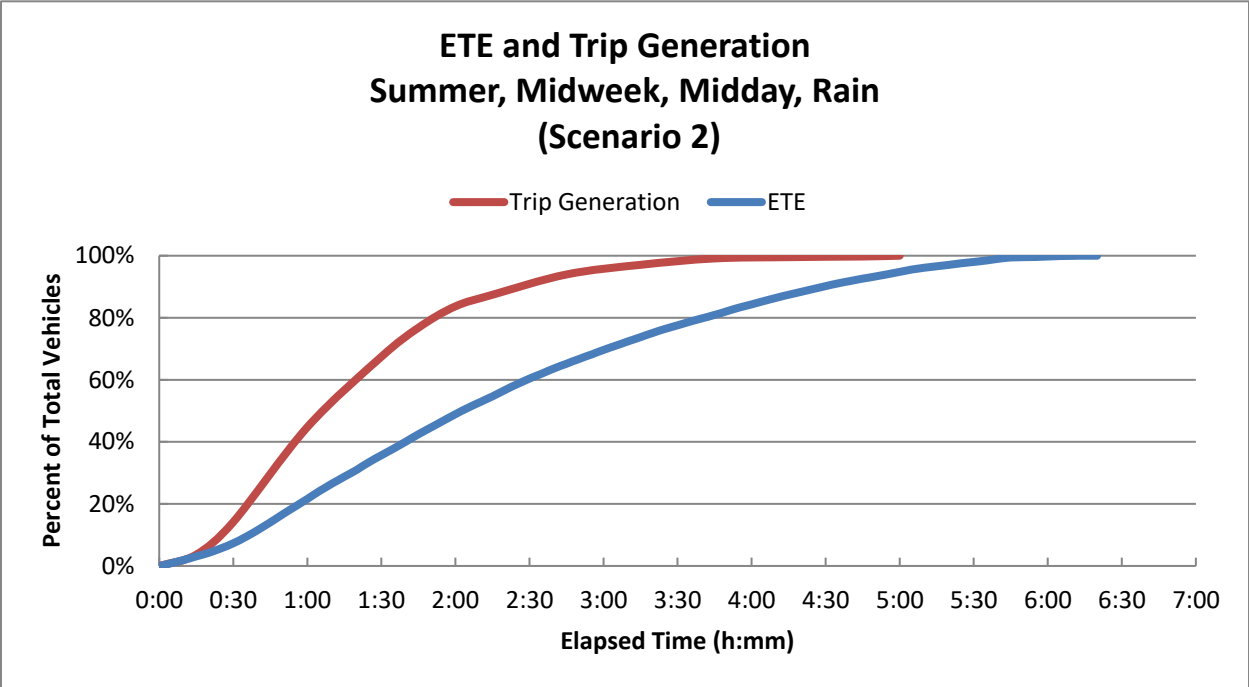


Figure J-3. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2)

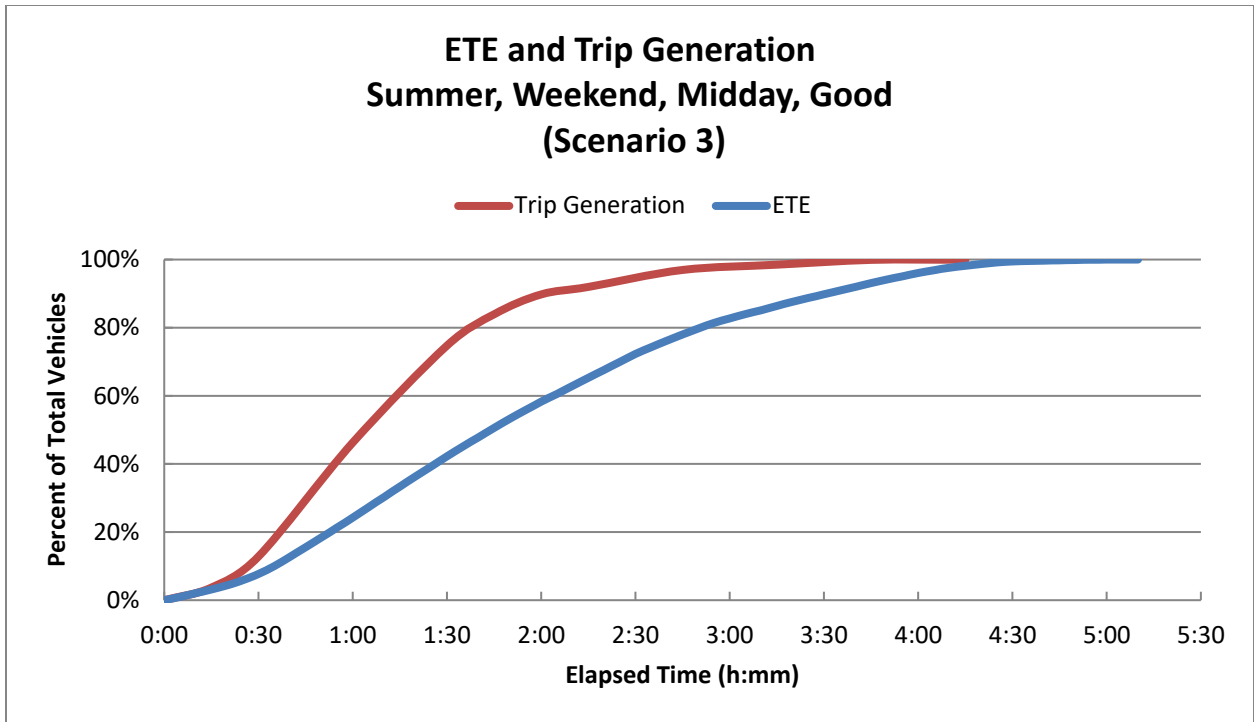


Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3)

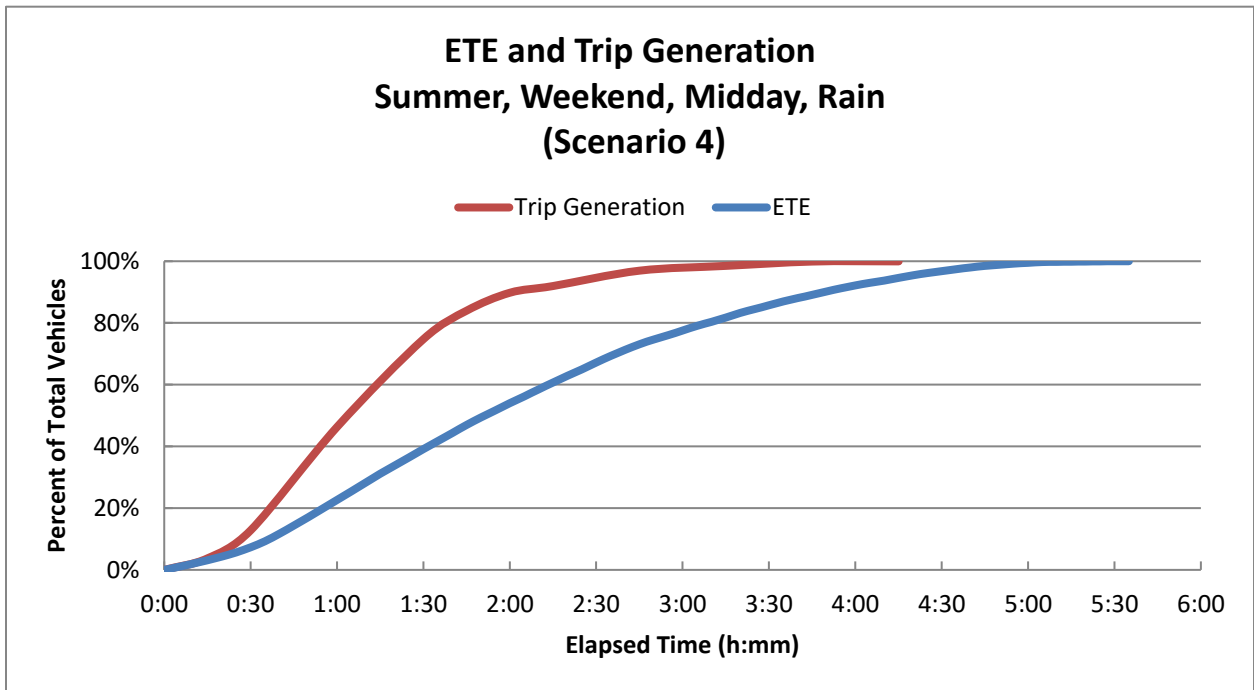


Figure J-5. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4)

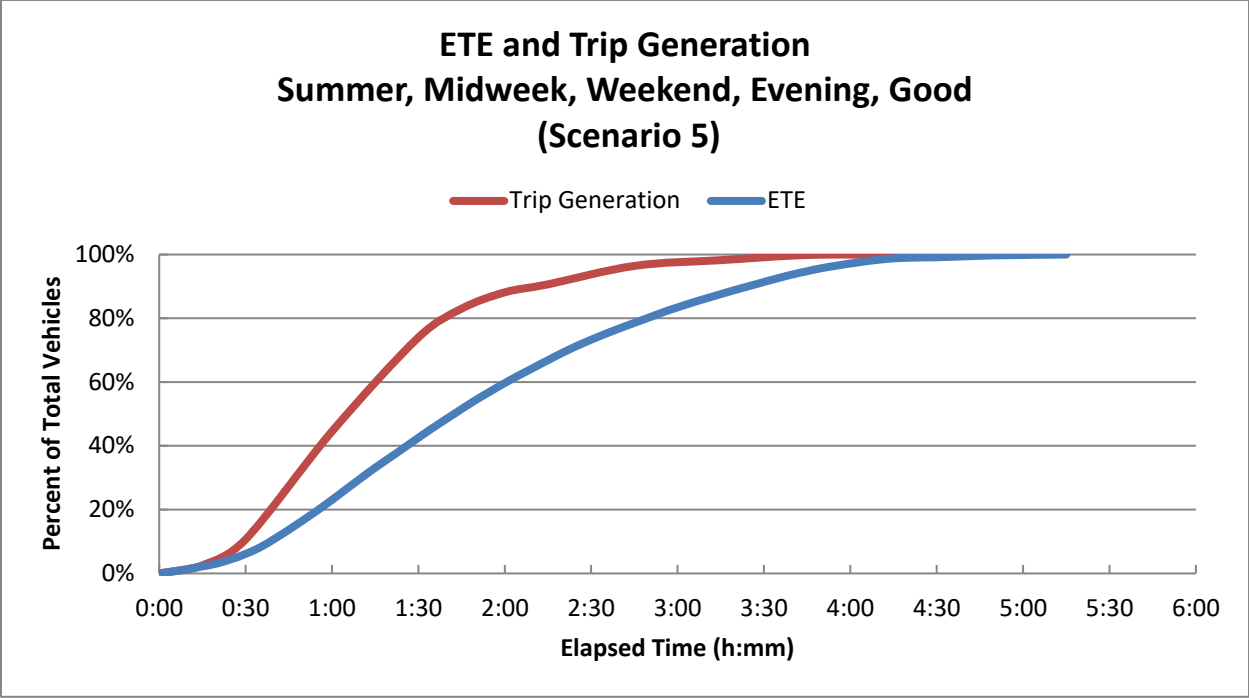


Figure J-6. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5)

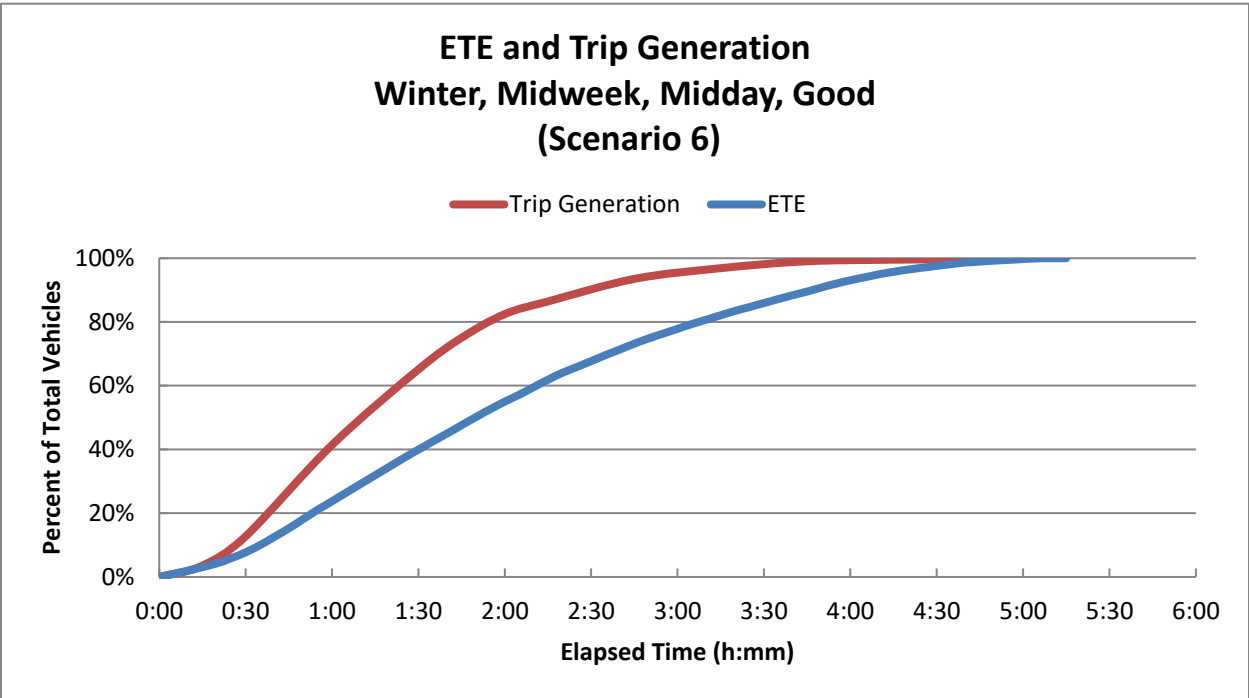


Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6)

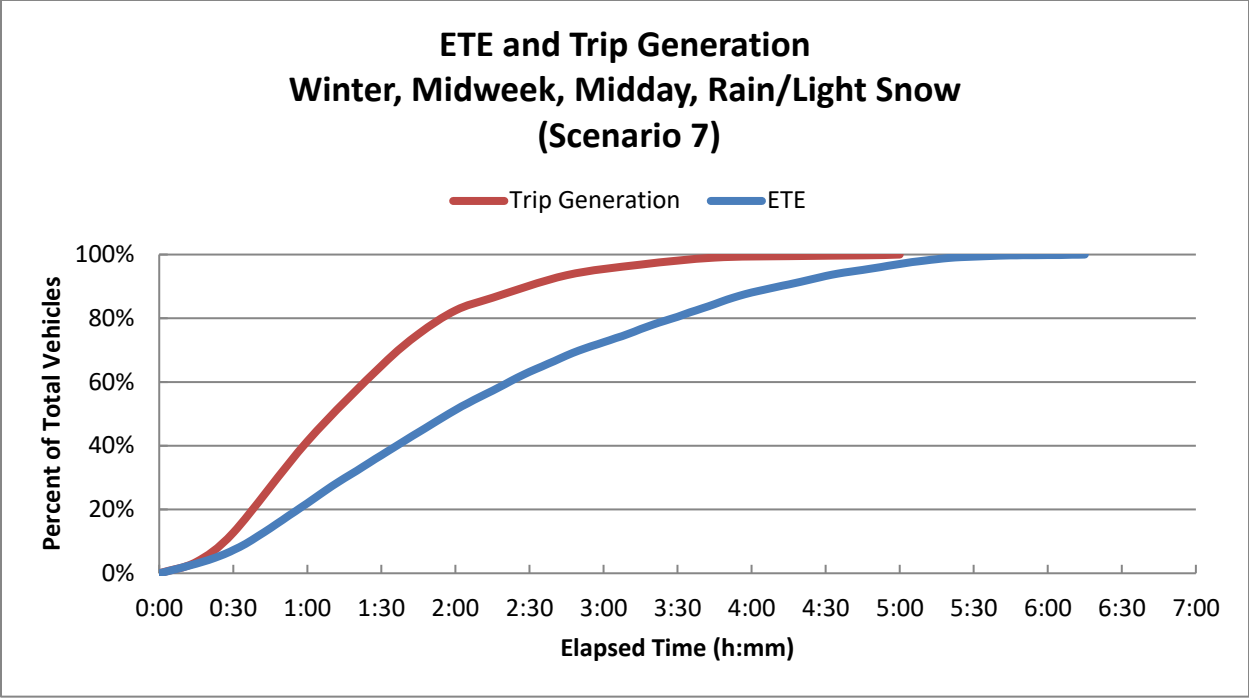


Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Rain/Light Snow (Scenario 7)

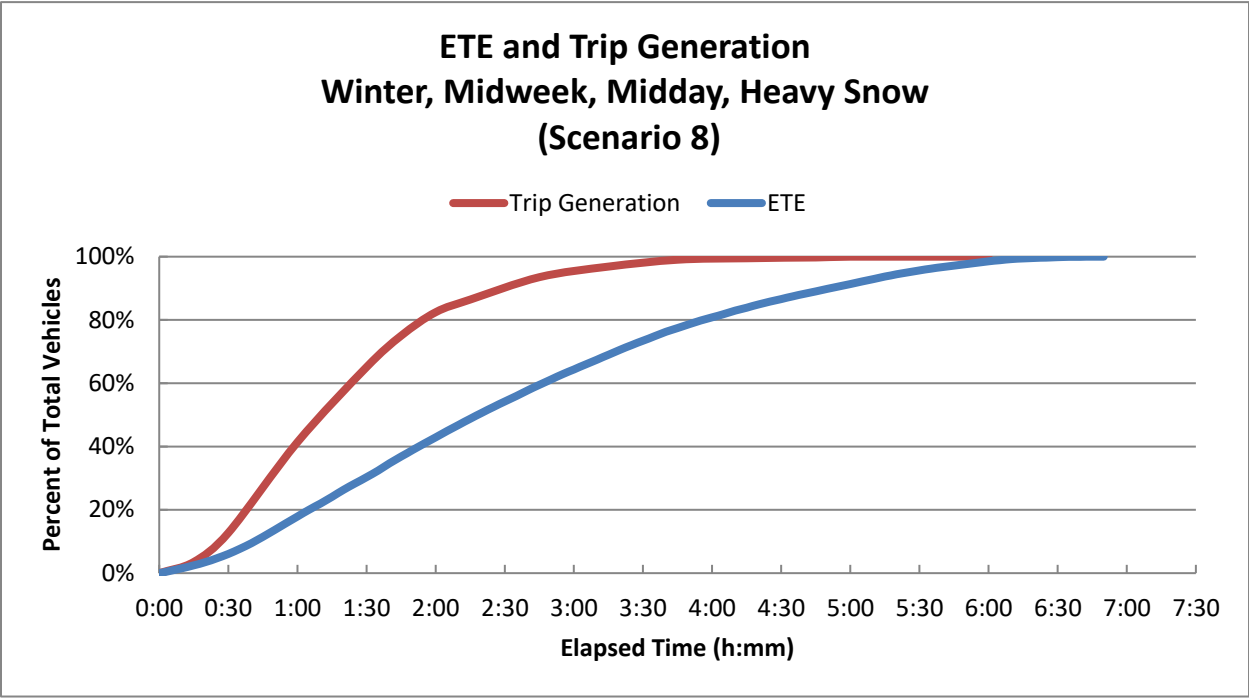


Figure J-9. ETE and Trip Generation: Winter, Midweek, Midday, Heavy Snow (Scenario 8)

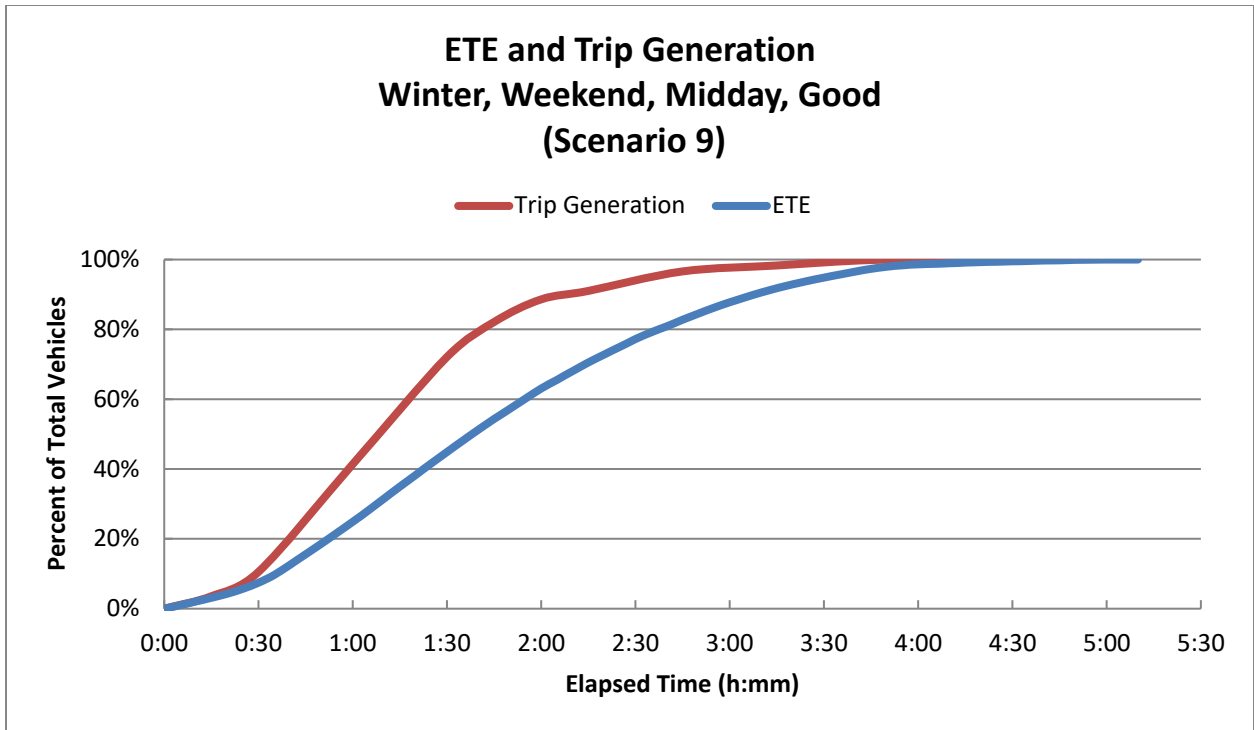


Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 9)

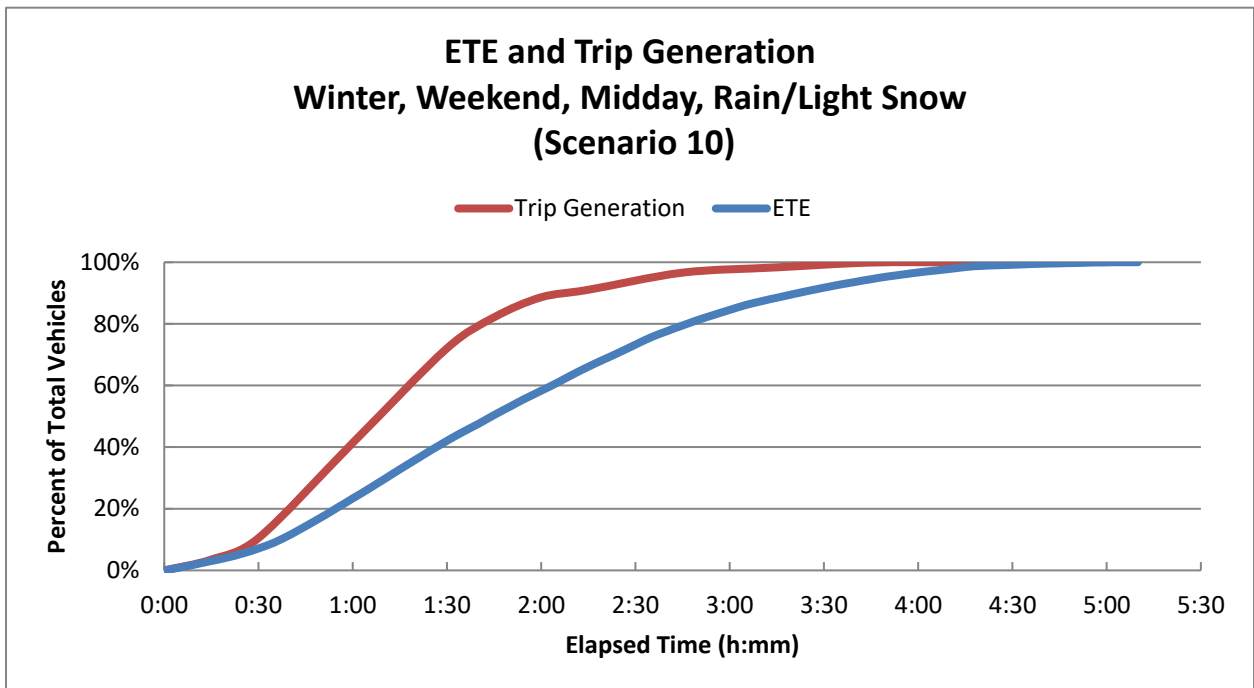


Figure J-11. ETE and Trip Generation: Winter, Weekend, Midday, Rain/Light Snow (Scenario 10)

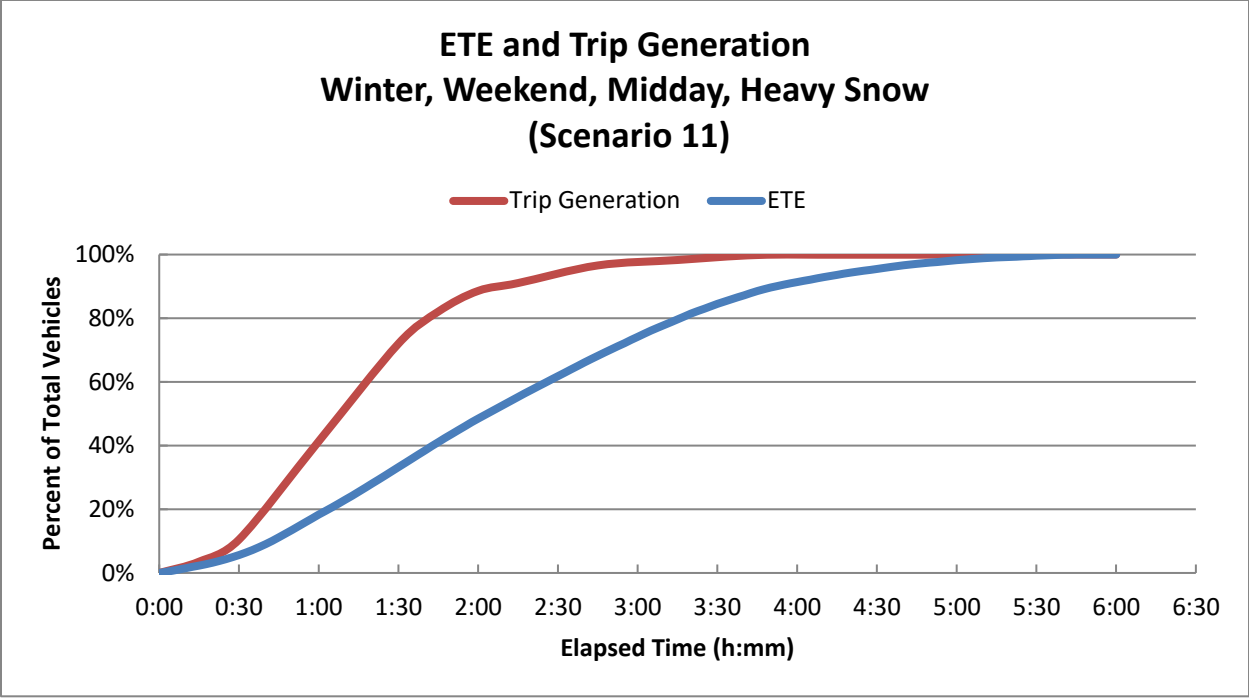


Figure J-12. ETE and Trip Generation: Winter, Weekend, Midday, Heavy Snow (Scenario 11)

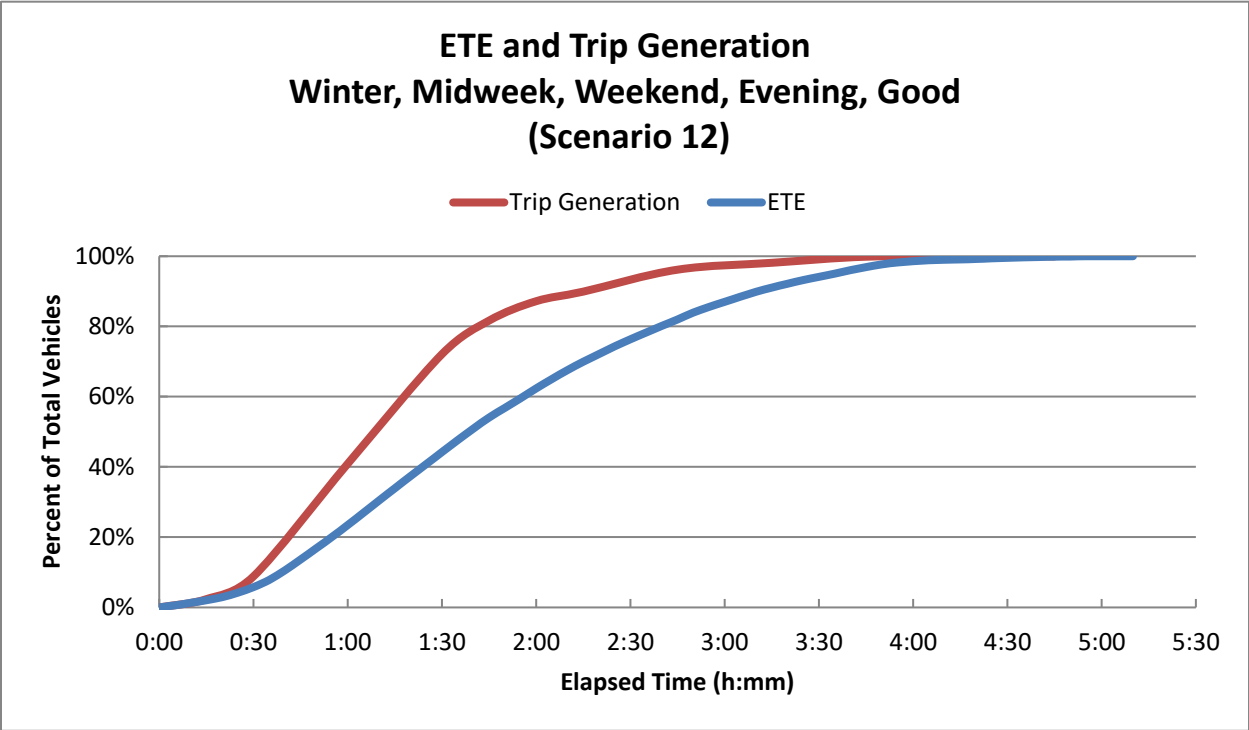


Figure J-13. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 12)

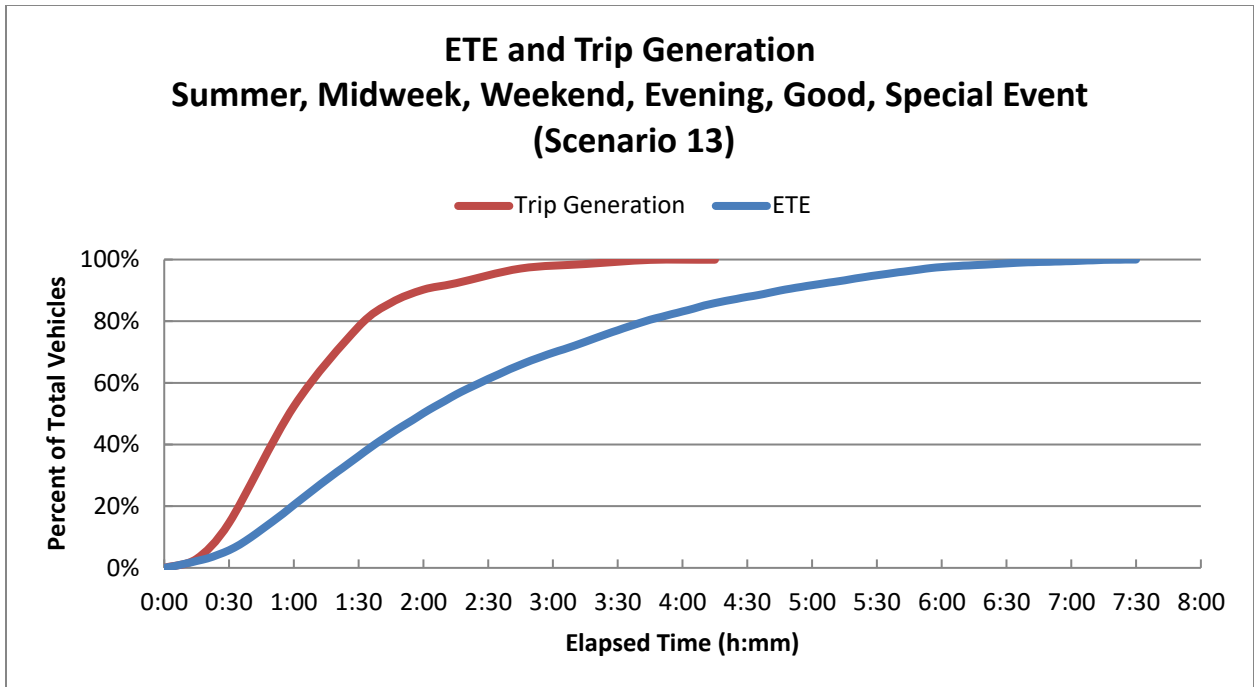


Figure J-14. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather, Special Event (Scenario 13)

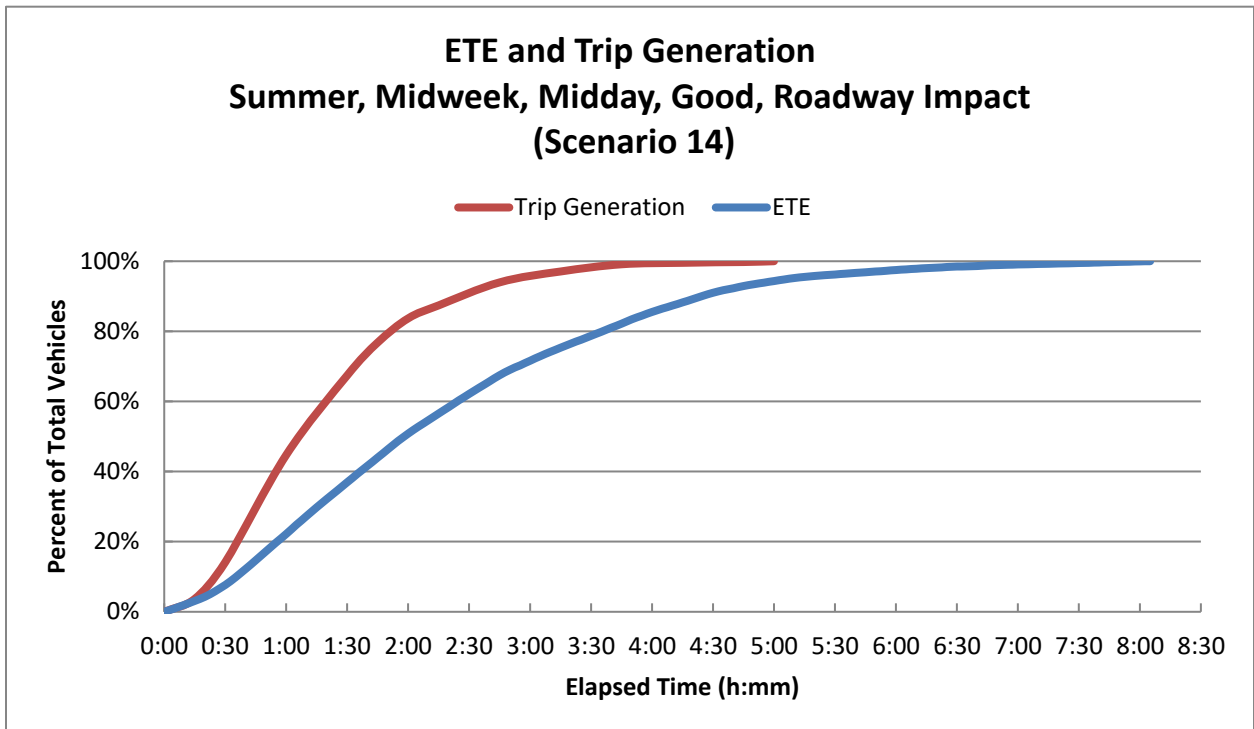


Figure J-15. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather, Roadway Impact (Scenario 14)

APPENDIX K

Evacuation Roadway Network

K. EVACUATION ROADWAY NETWORK

As discussed in Section 1.3, a link-node analysis network was constructed to model the roadway network within the study area. Figure K-1 provides an overview of the link-node analysis network. The figure has been divided up into 63 more detailed figures (Figure K-2 through Figure K-64) which show each of the links and nodes in the network.

The analysis network was calibrated using the observations made during the field surveys conducted in March 2021.

Table K-1 summarizes the number of nodes by the type of control (stop sign, yield sign, pre-timed signal, actuated signal, traffic and/or access control point [TCP/ACP], uncontrolled).

Table K-1. Summary of Nodes by the Type of Control

Control Type	Number of Nodes
Uncontrolled	1,331
Pretimed	1
Actuated	131
Stop	207
TCP/ACP	228
Yield	22
Total:	1,920

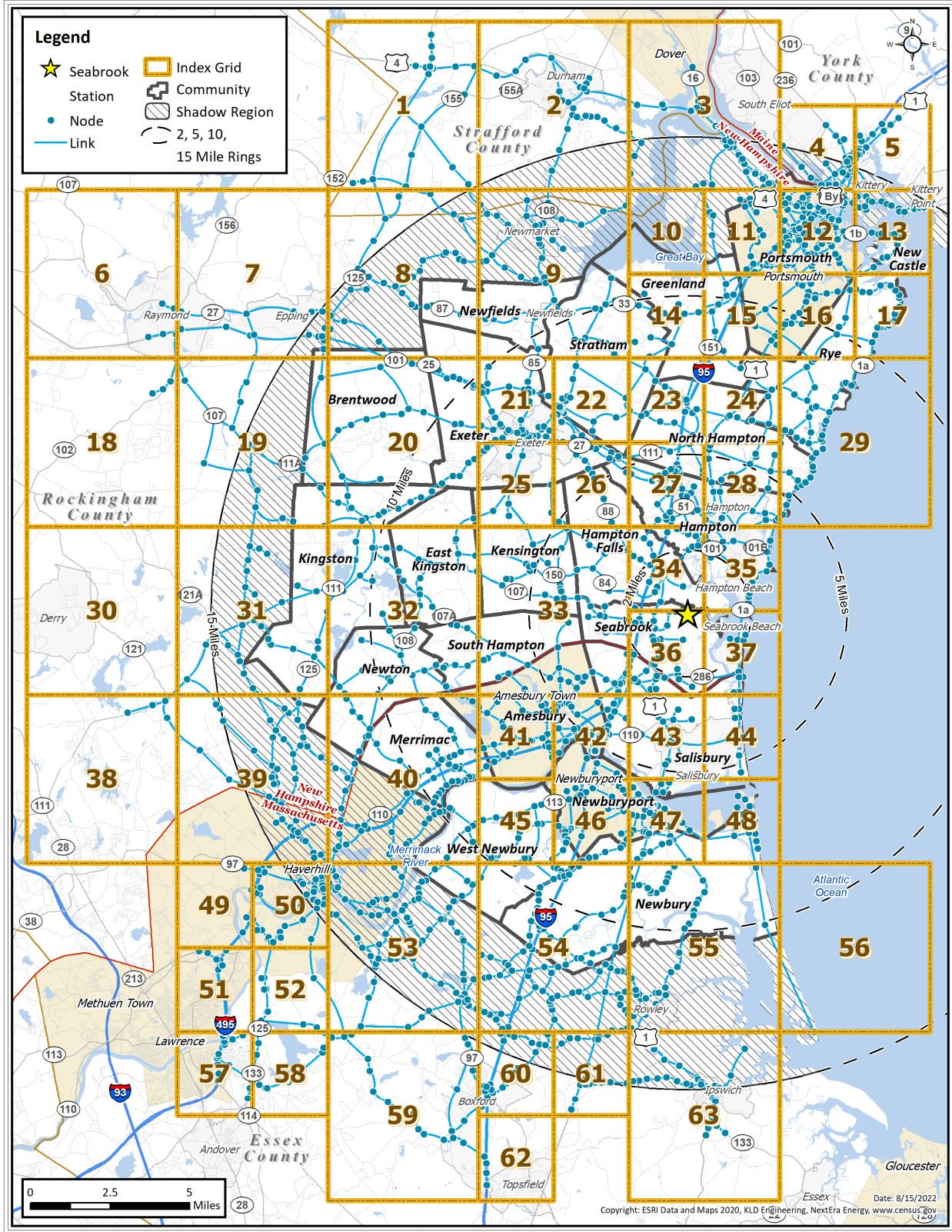


Figure K-1. Seabrook Station Link-Node Analysis Network

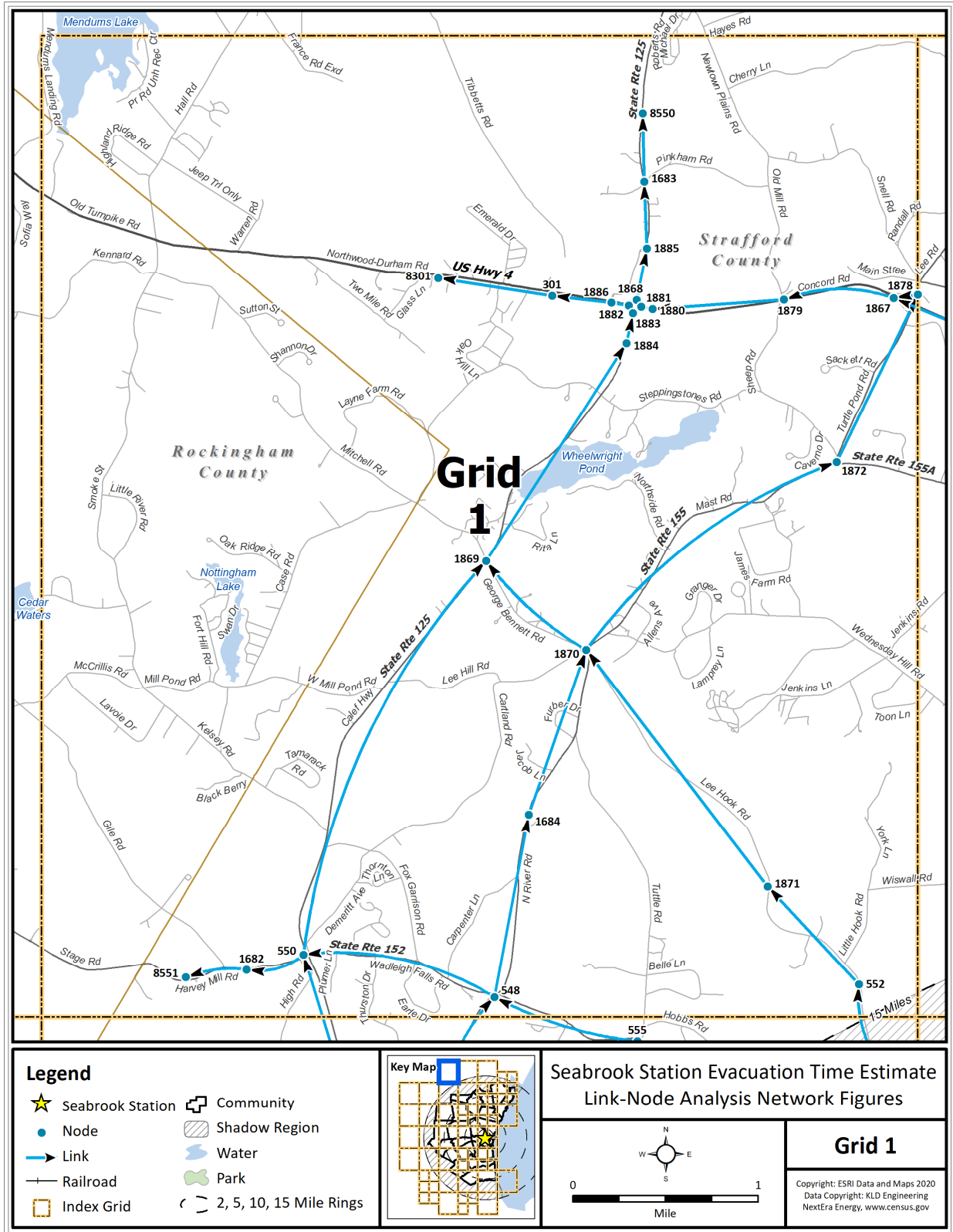


Figure K-2. Link-Node Analysis Network – Grid 1

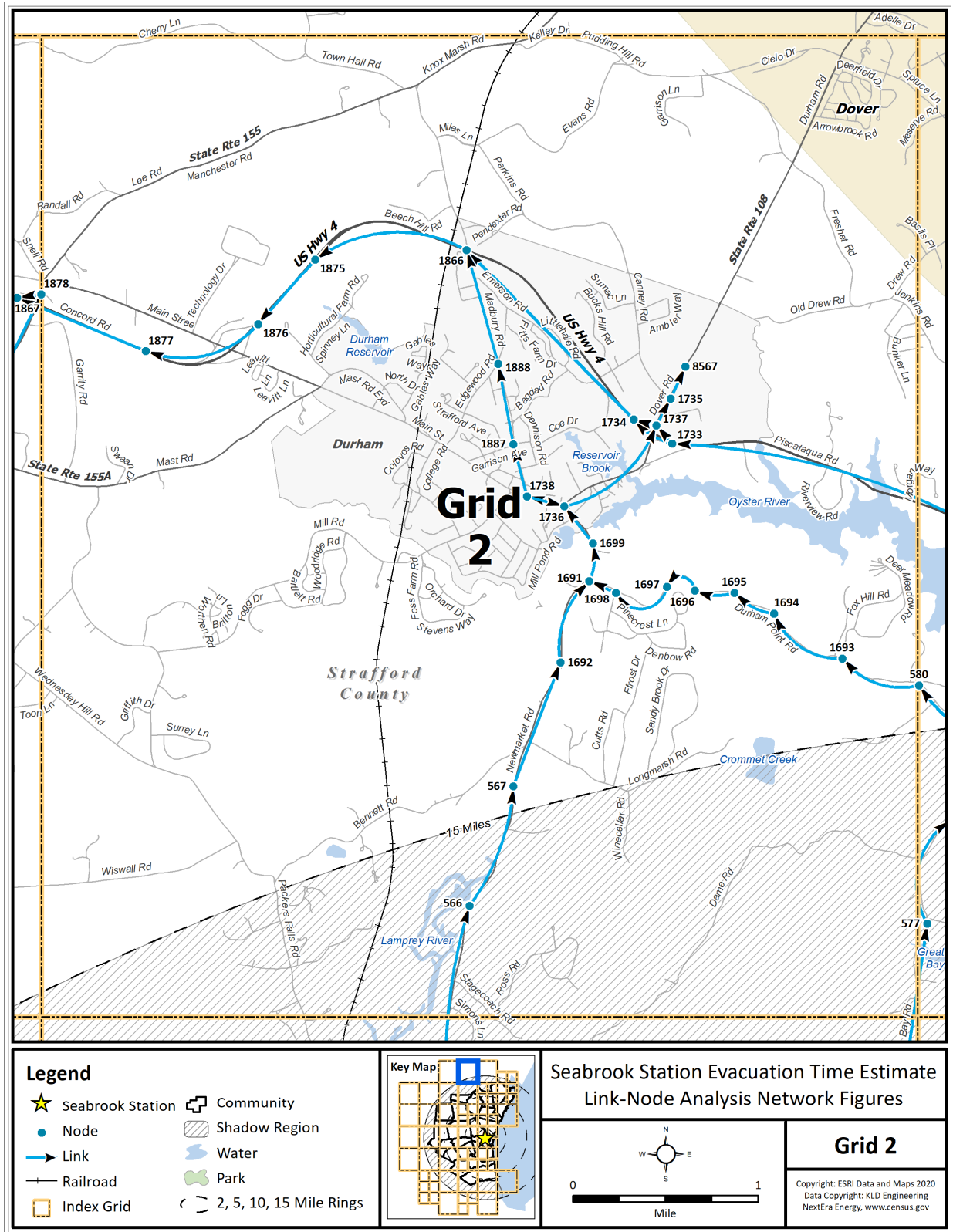


Figure K-3. Link-Node Analysis Network – Grid 2

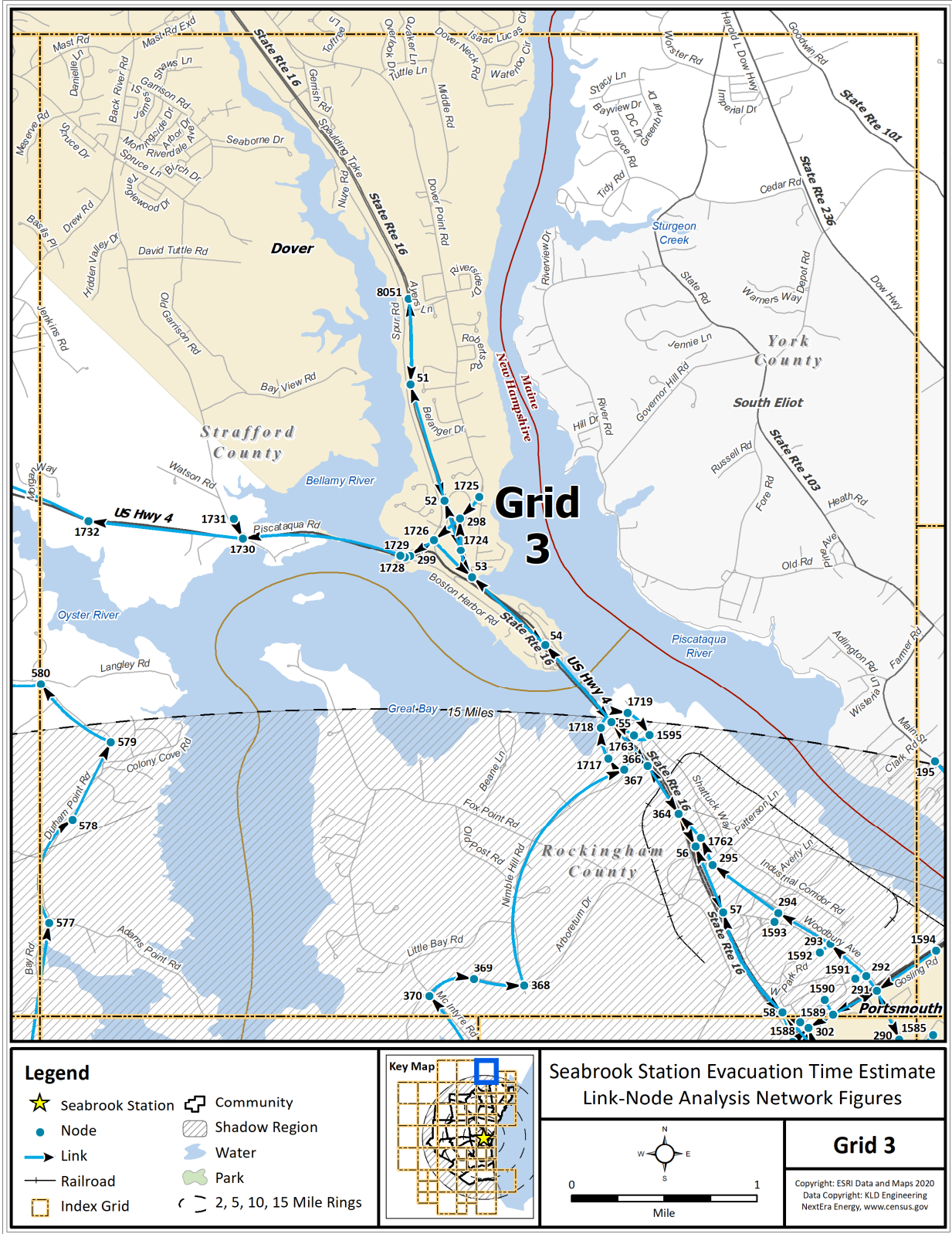


Figure K-4. Link-Node Analysis Network – Grid 3

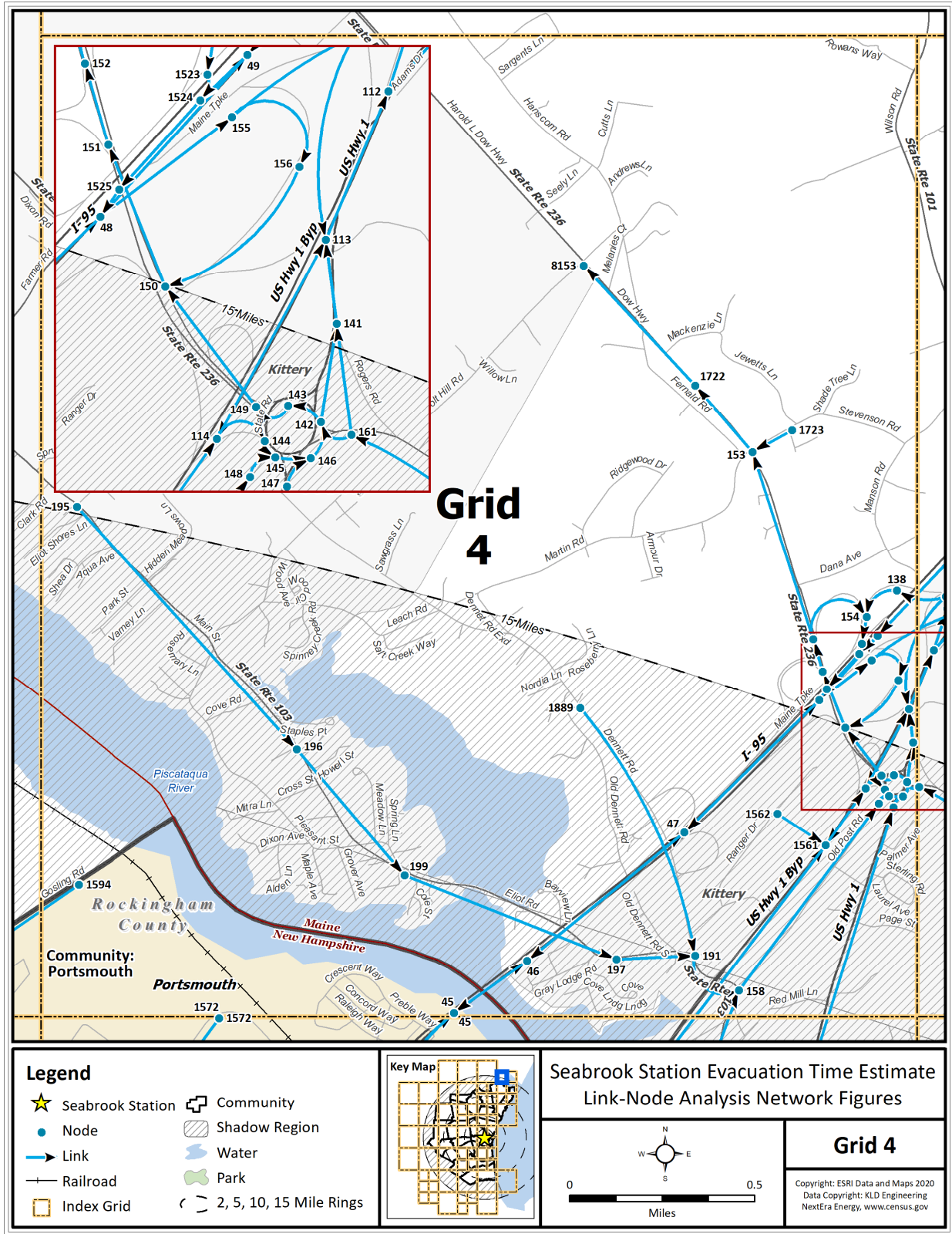


Figure K-5. Link-Node Analysis Network – Grid 4

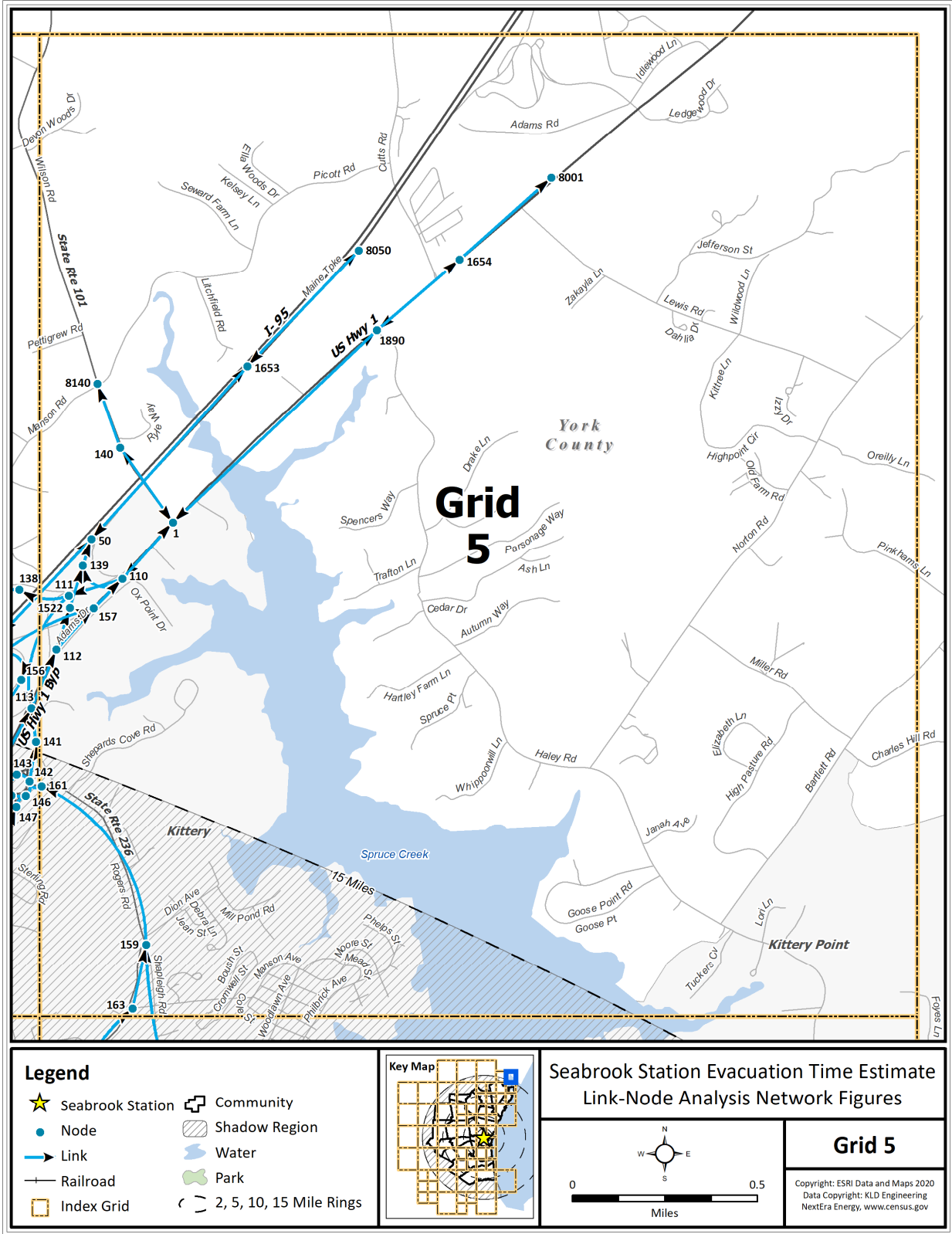


Figure K-6. Link-Node Analysis Network – Grid 5

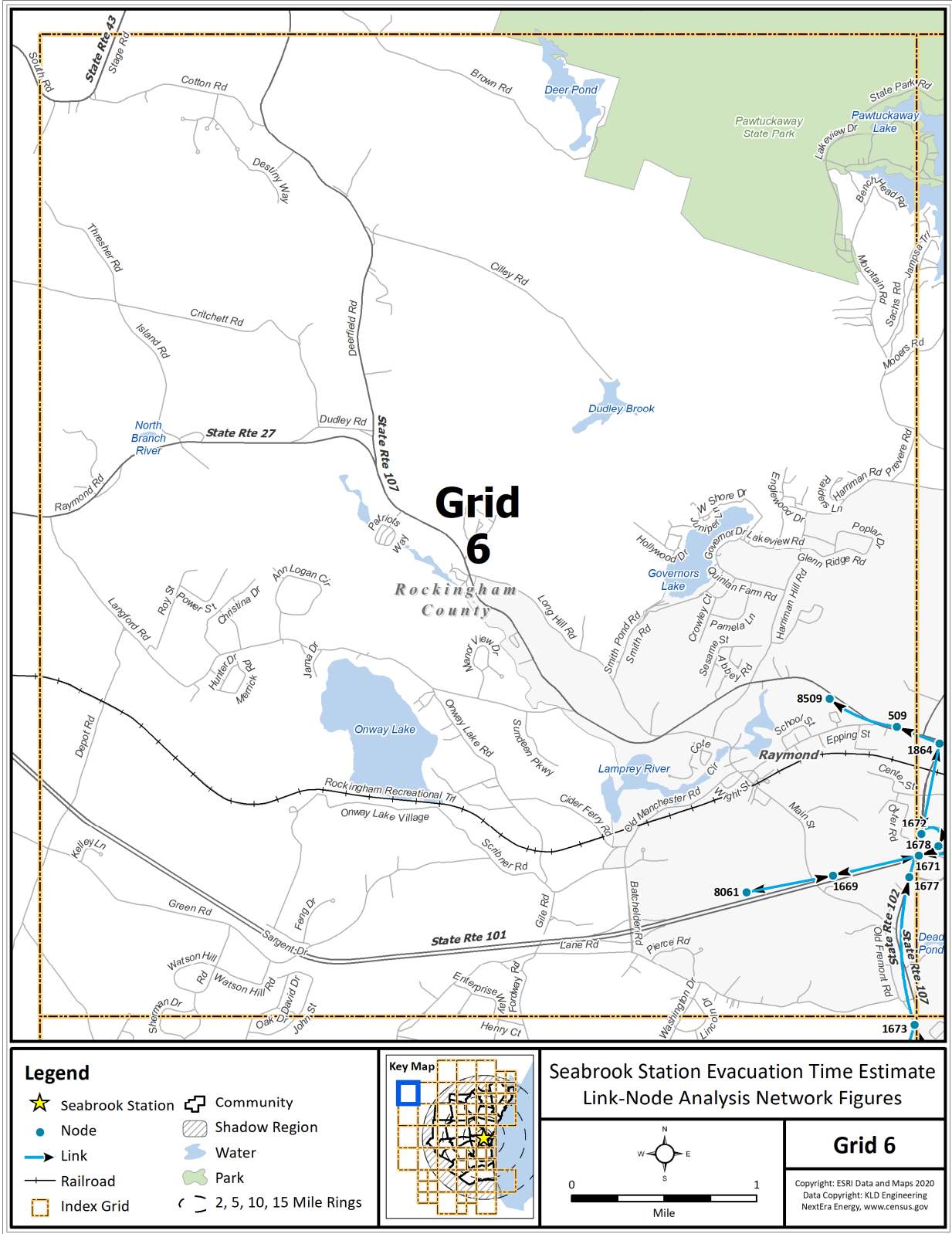


Figure K-7. Link-Node Analysis Network – Grid 6

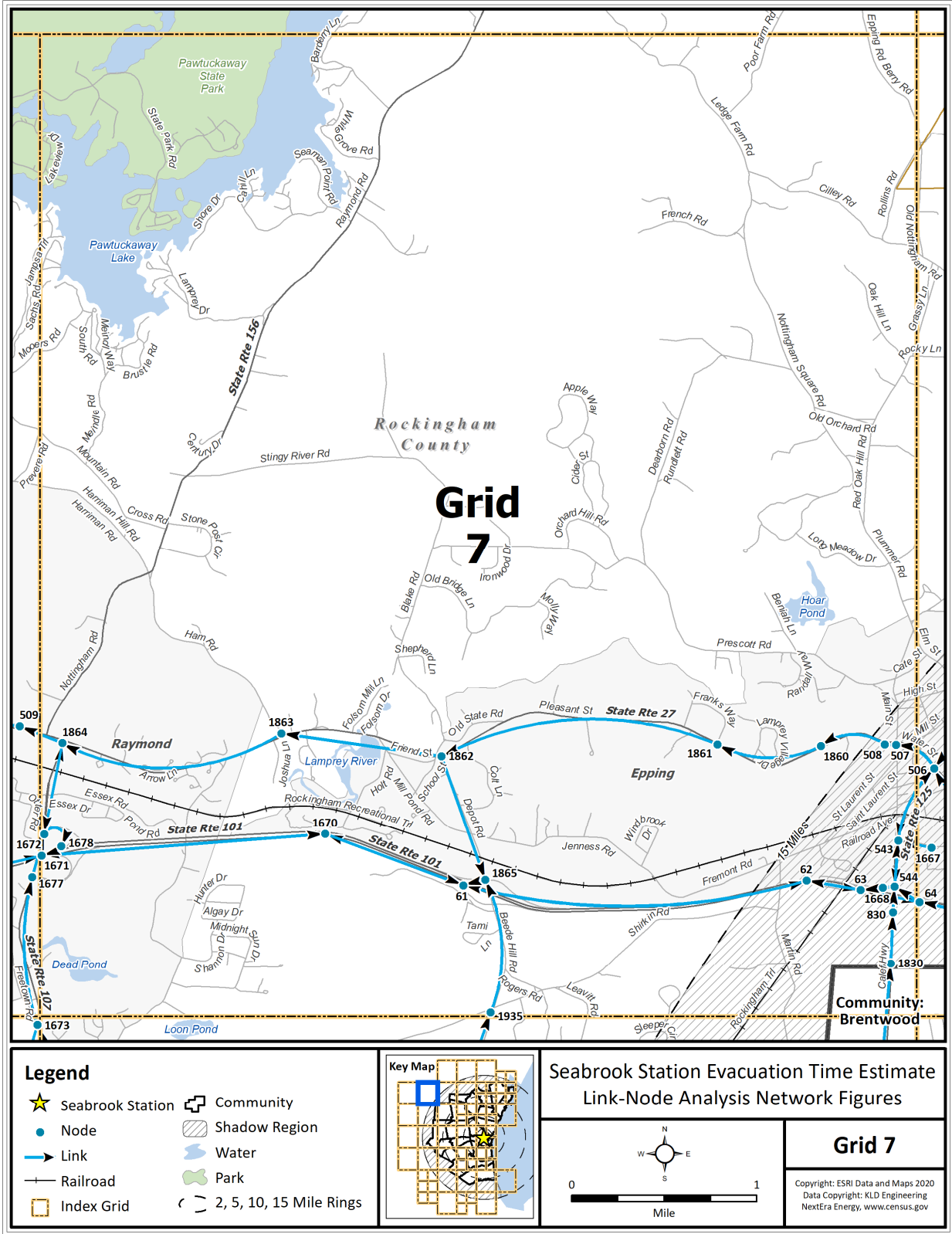


Figure K-8. Link-Node Analysis Network – Grid 7

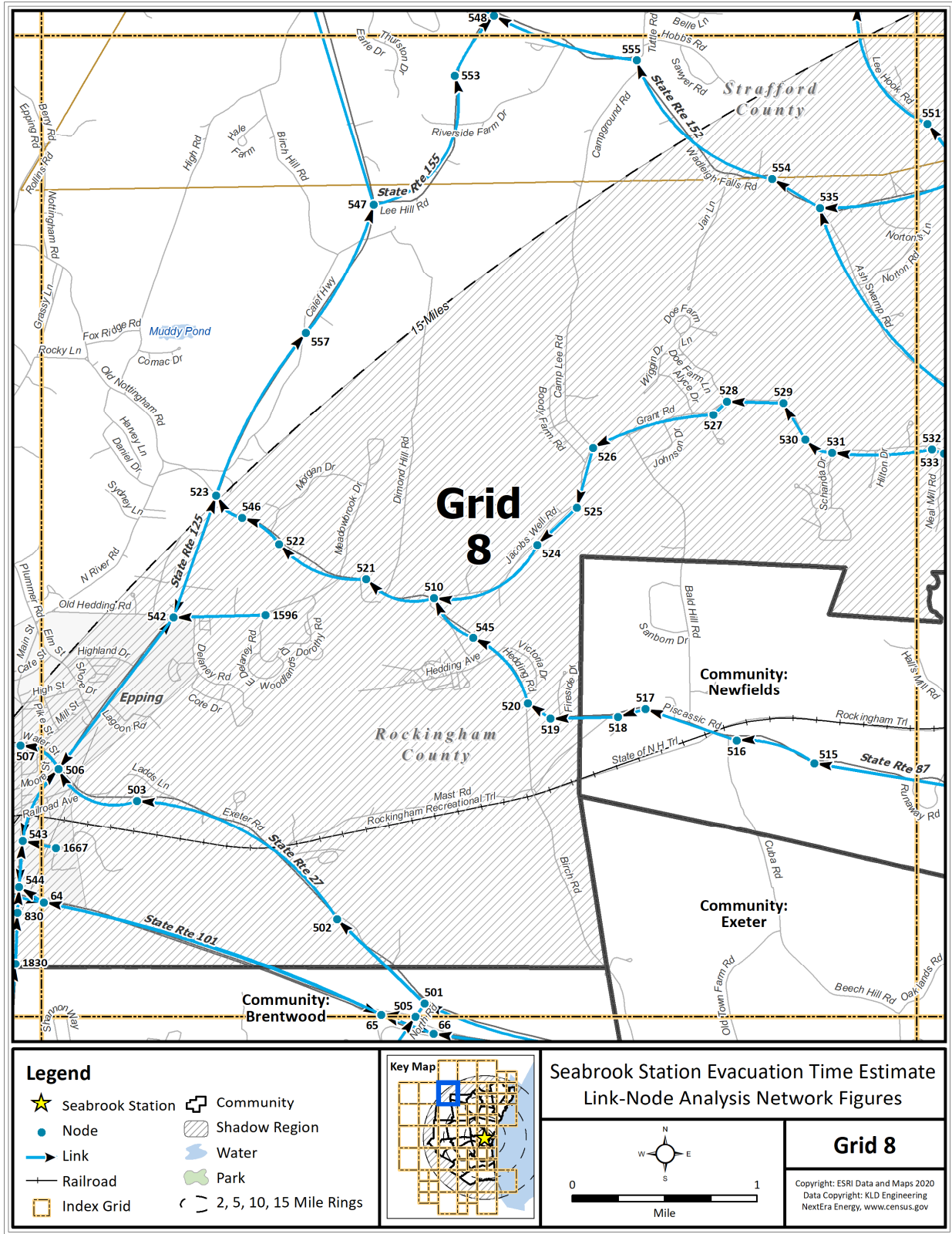


Figure K-9. Link-Node Analysis Network – Grid 8

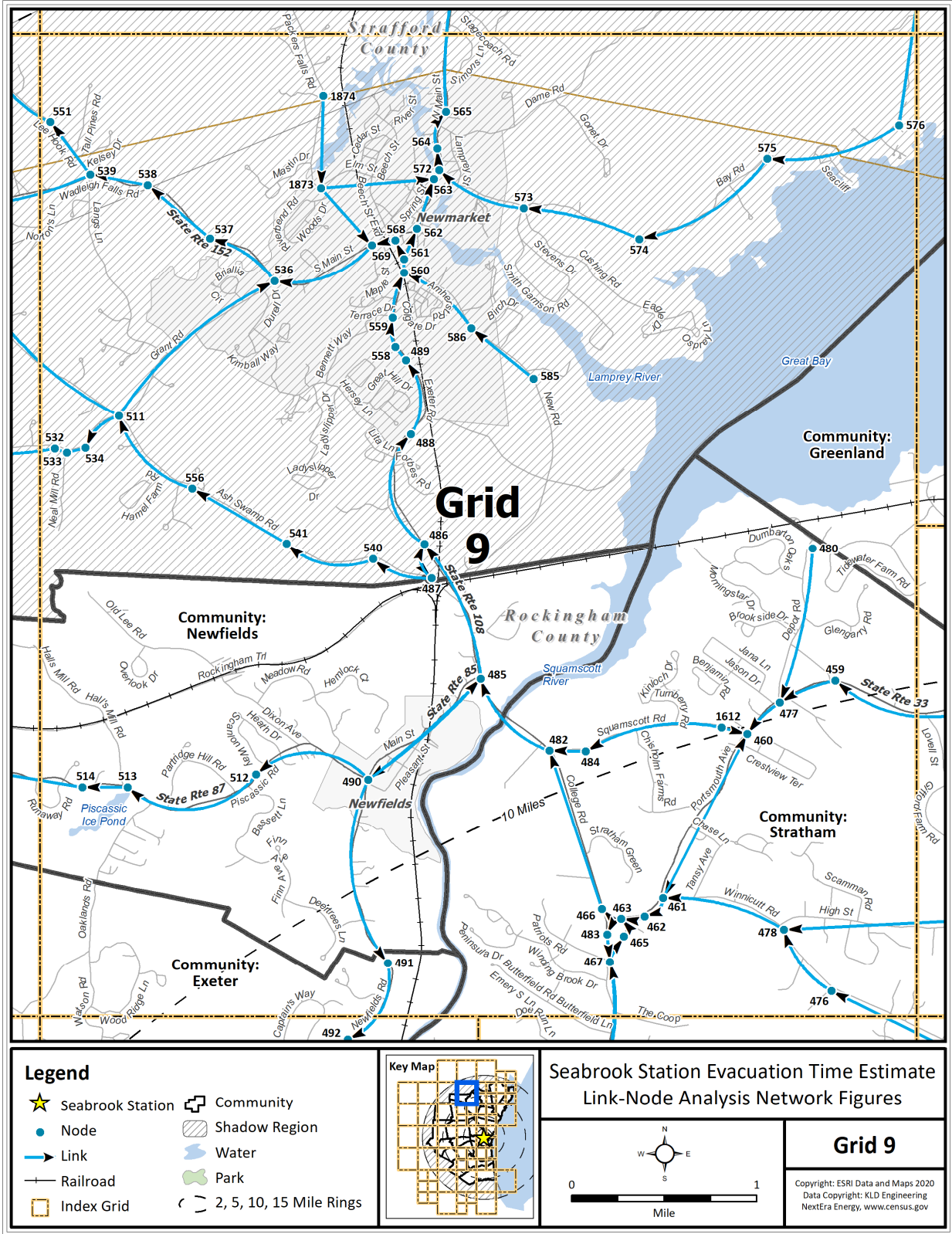


Figure K-10. Link-Node Analysis Network – Grid 9

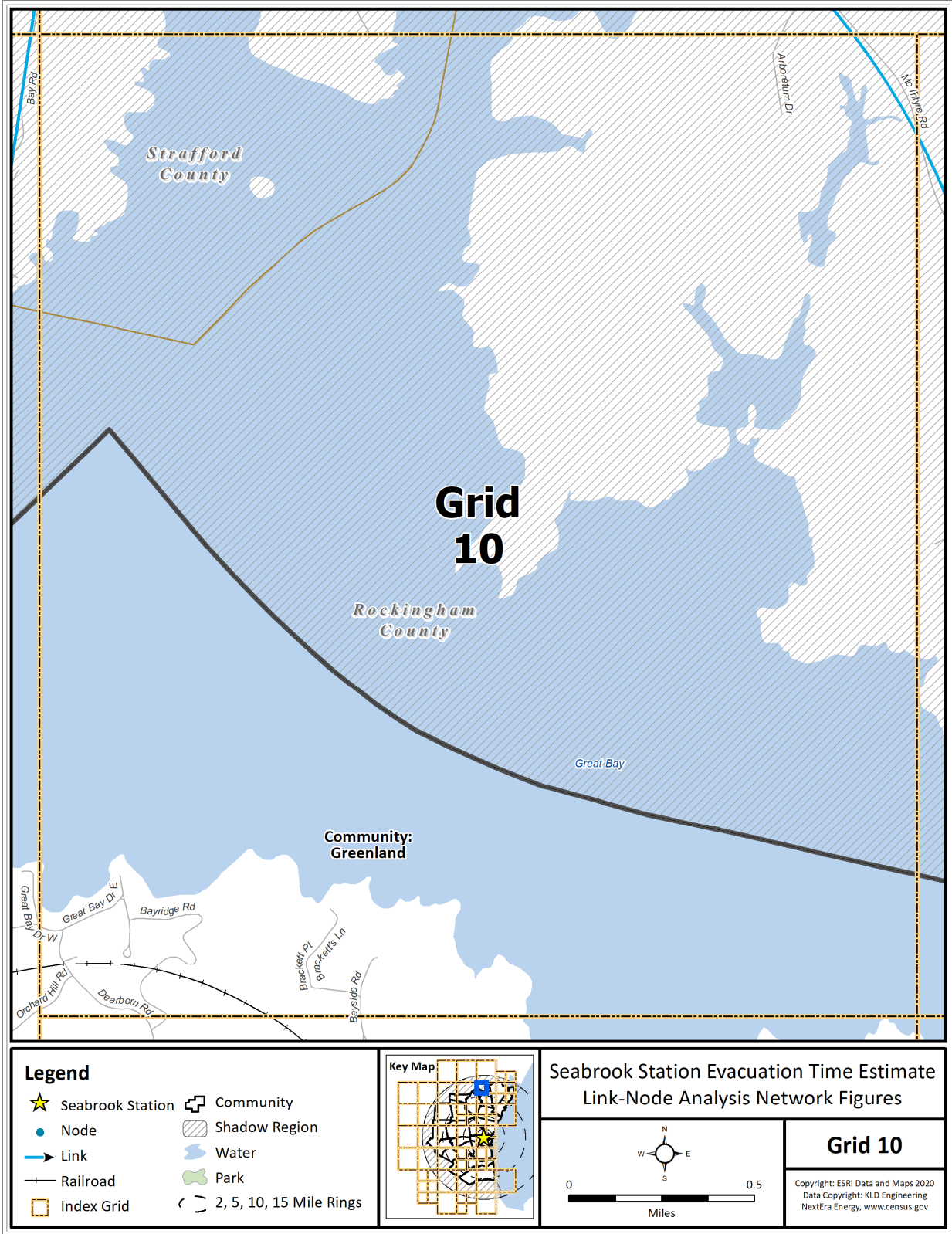


Figure K-11. Link-Node Analysis Network – Grid 10

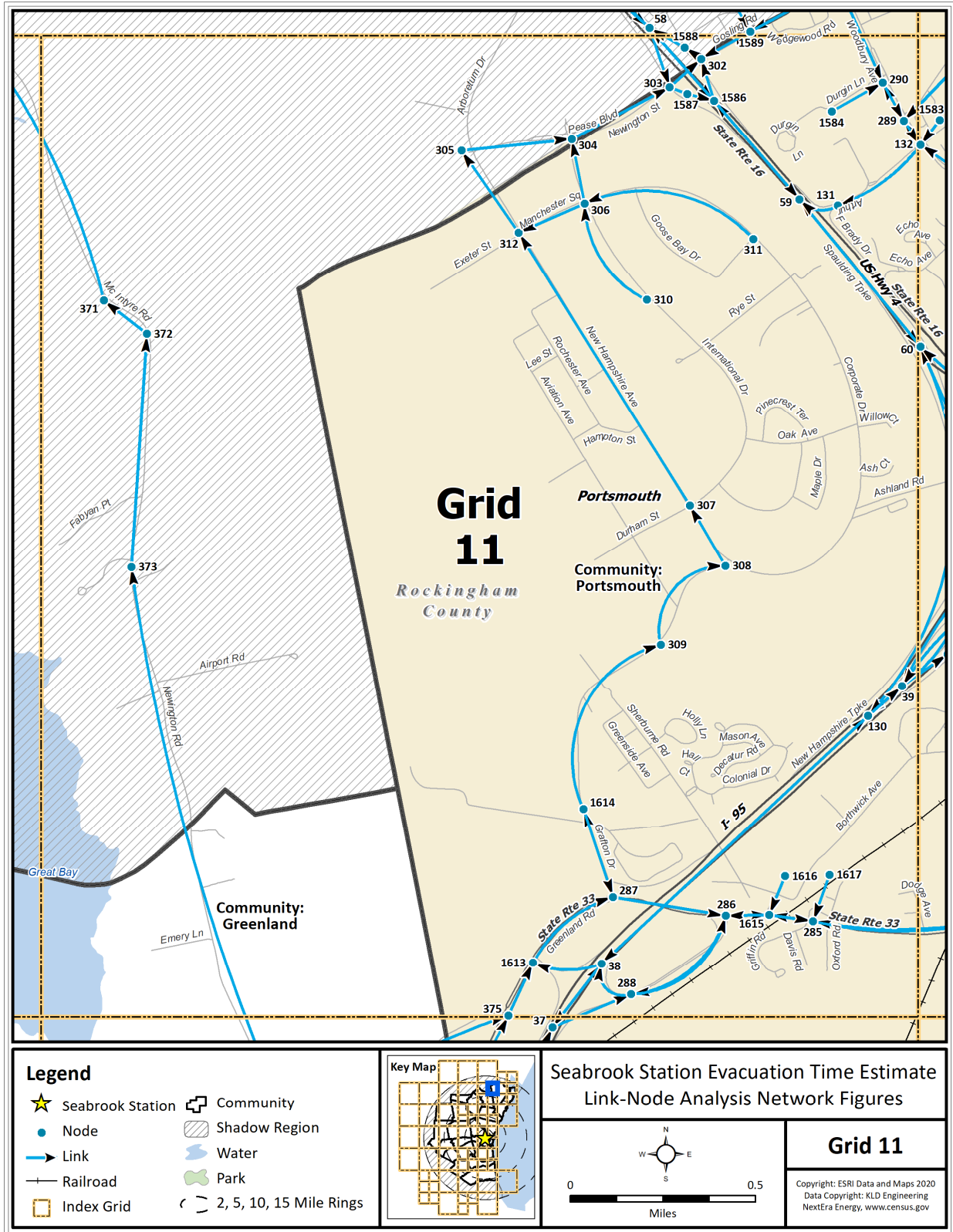


Figure K-12. Link-Node Analysis Network – Grid 11

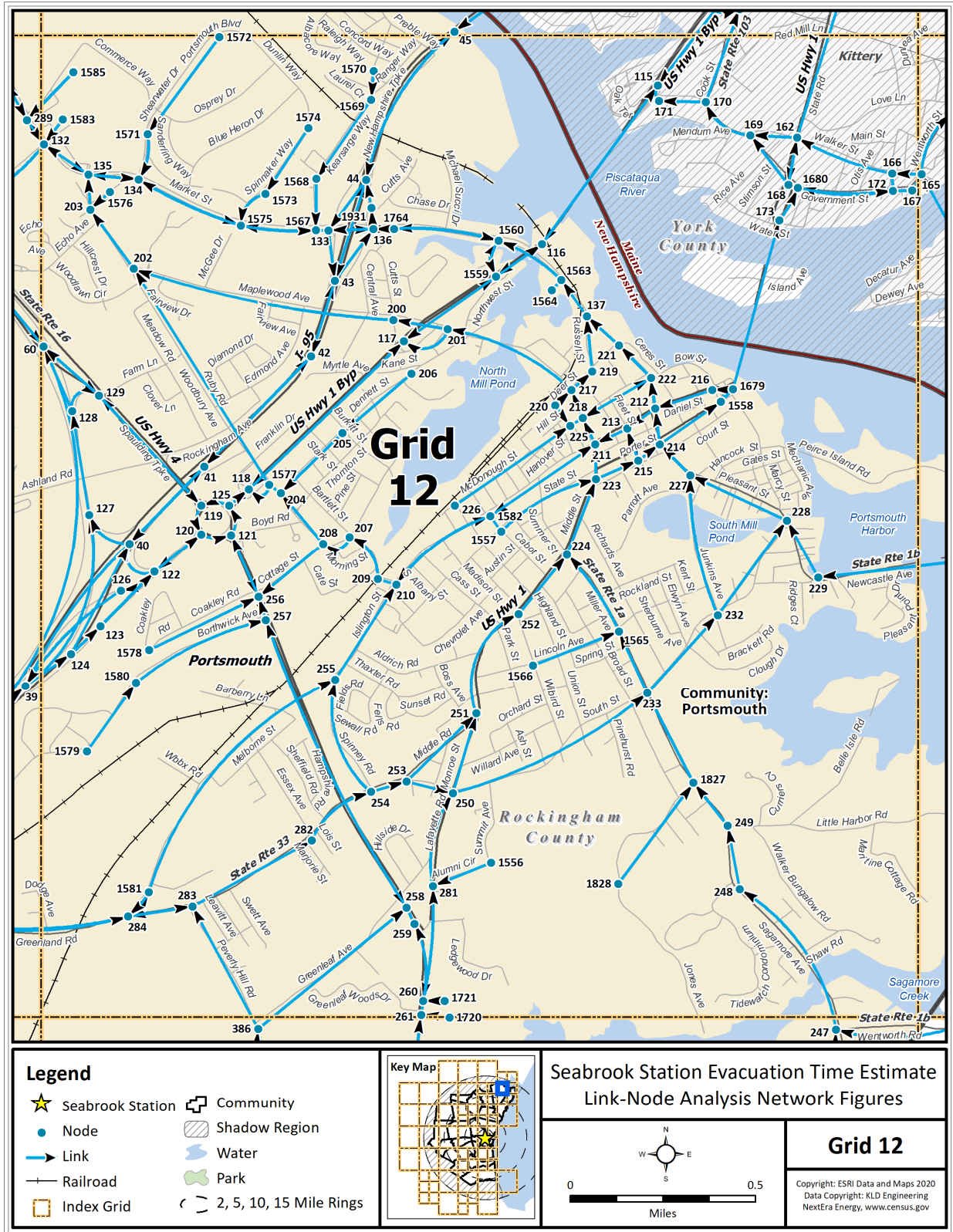


Figure K-13. Link-Node Analysis Network – Grid 12

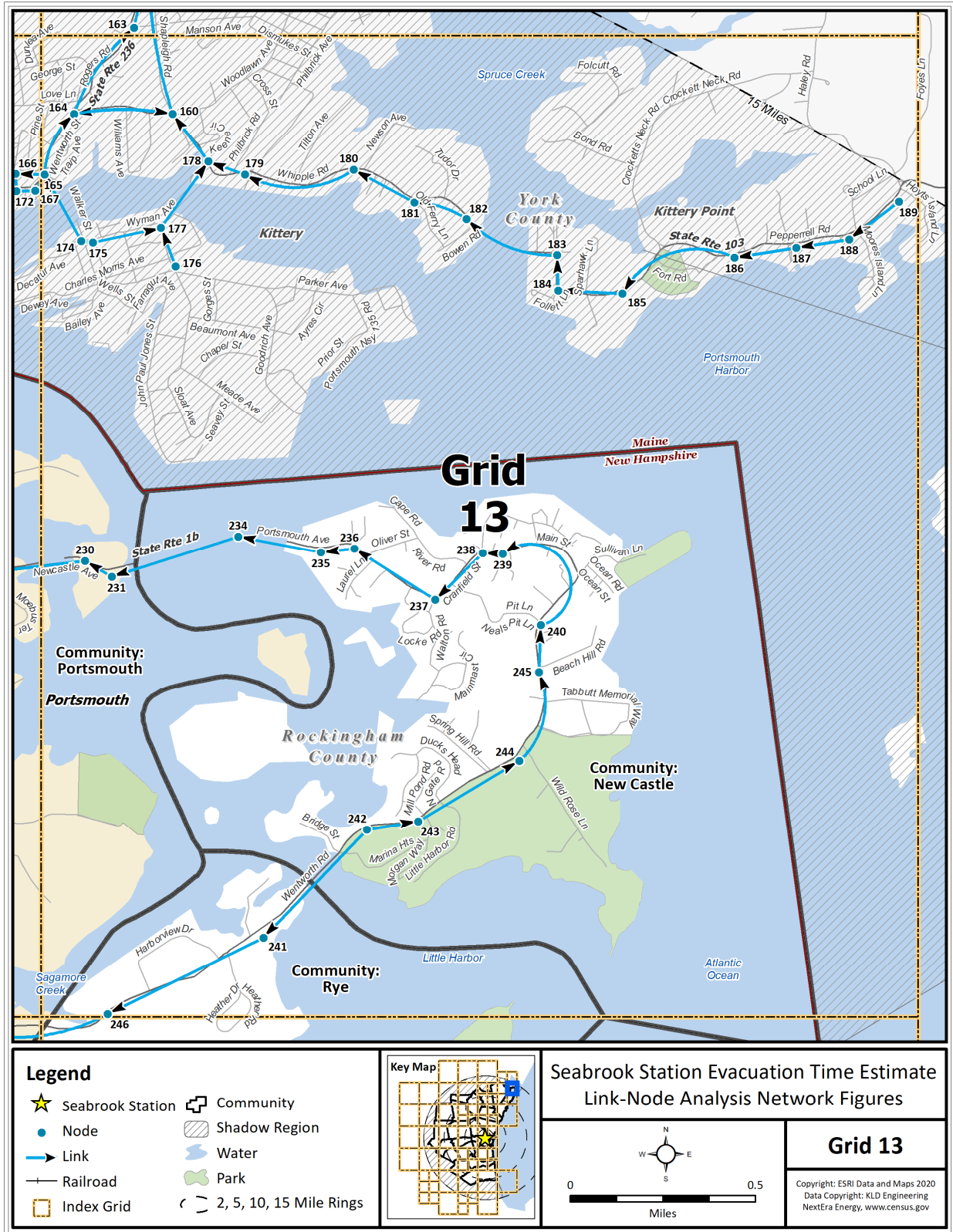


Figure K-14. Link-Node Analysis Network – Grid 13

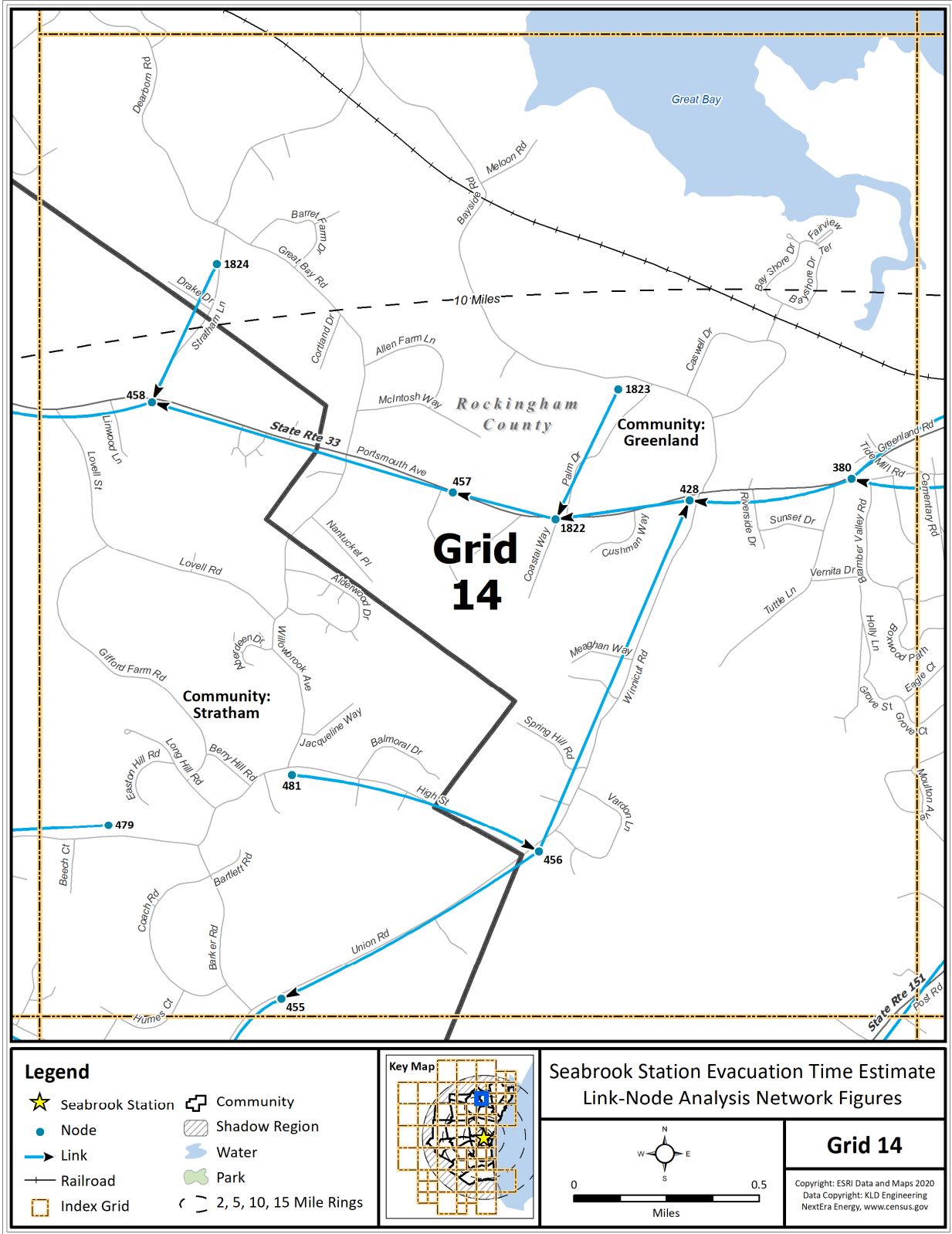


Figure K-15. Link-Node Analysis Network – Grid 14

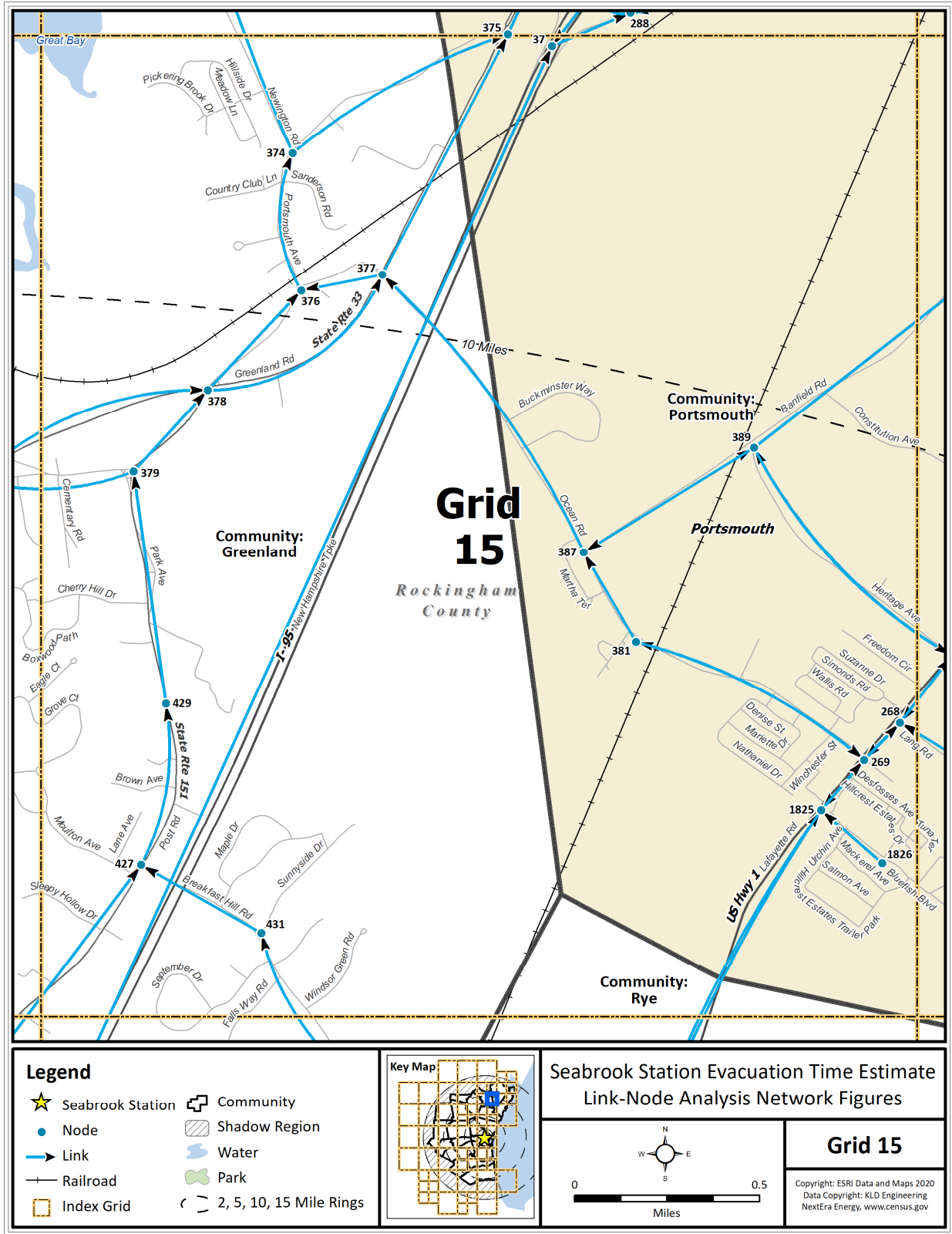


Figure K-16. Link-Node Analysis Network – Grid 15

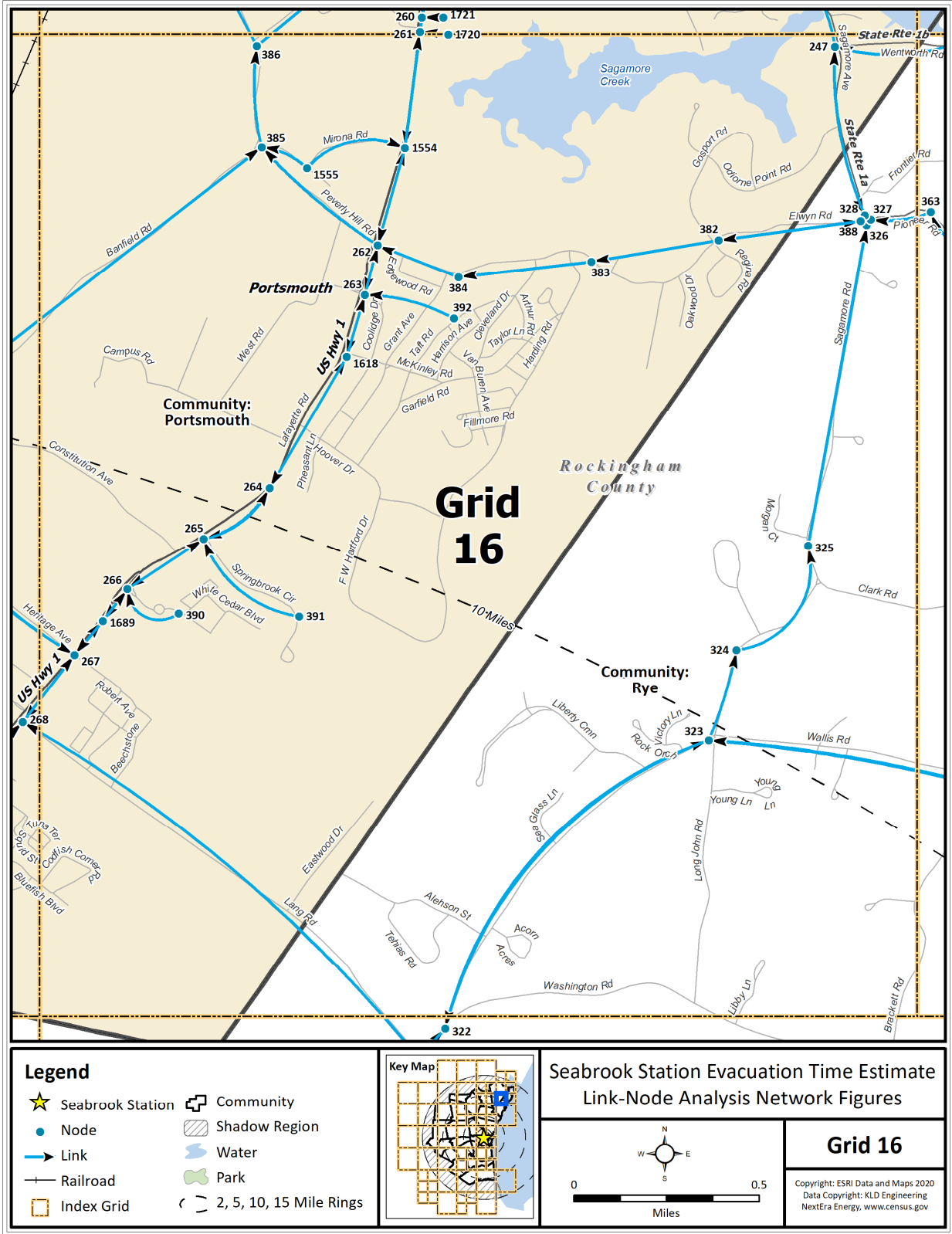


Figure K-17. Link-Node Analysis Network – Grid 16

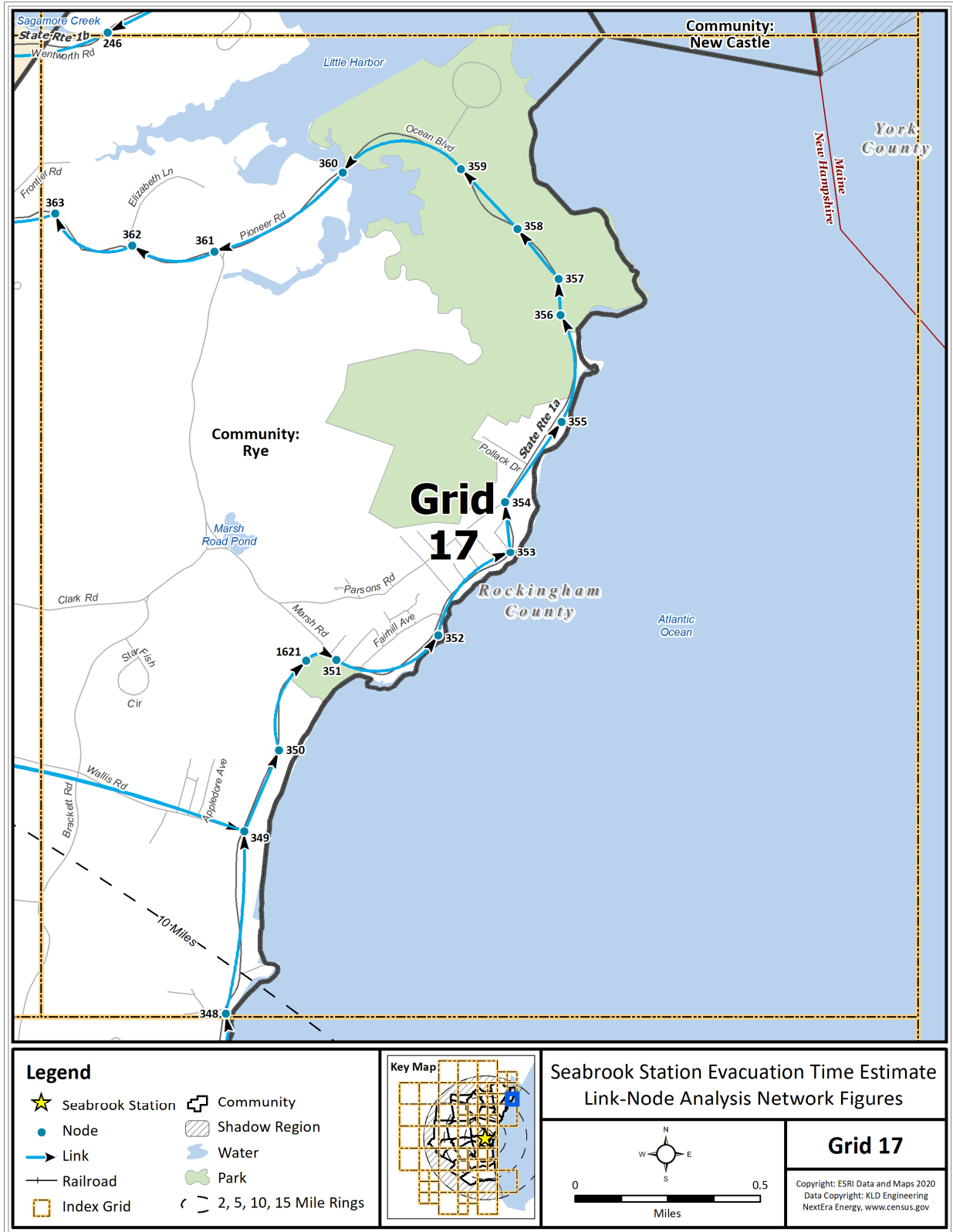


Figure K-18. Link-Node Analysis Network – Grid 17

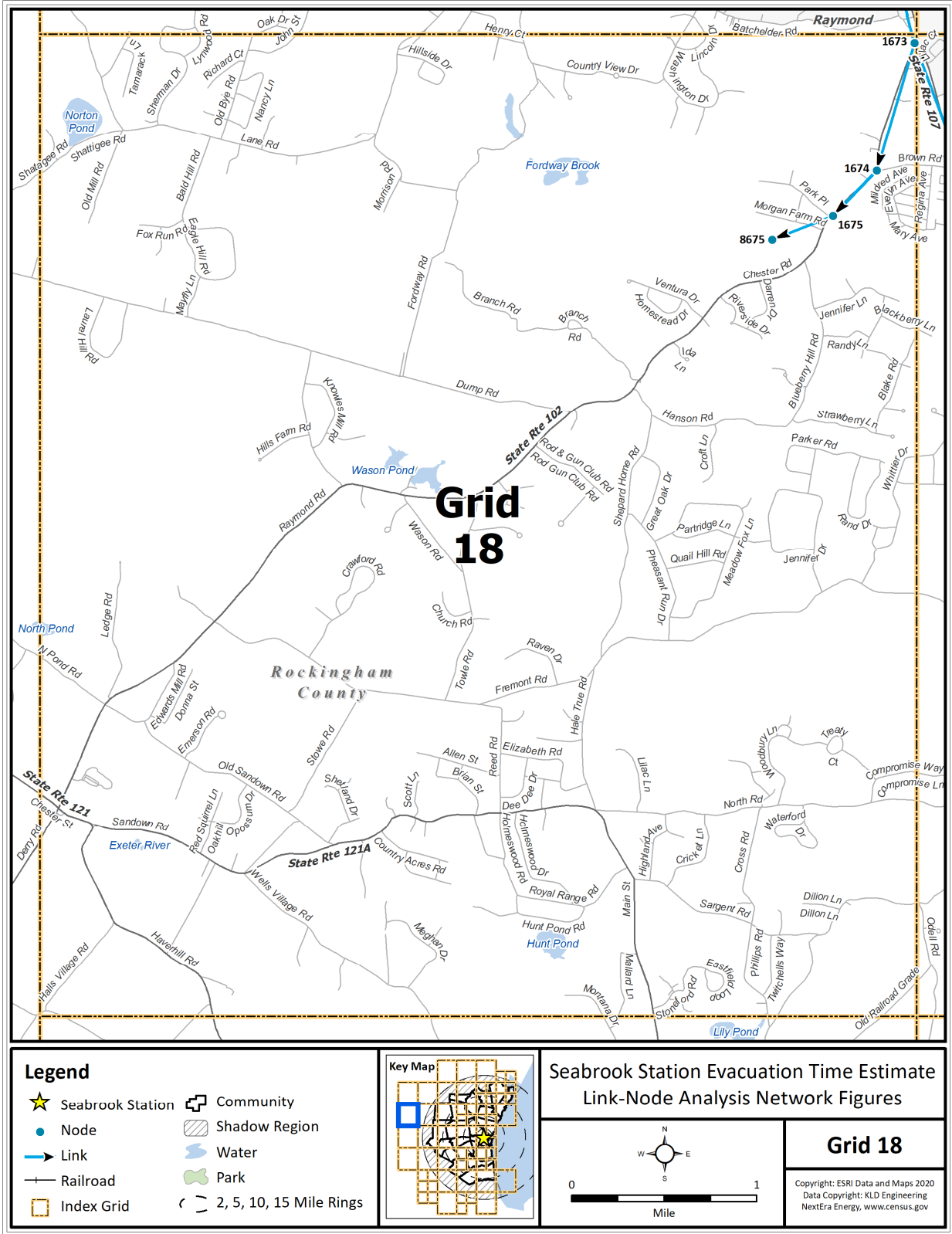


Figure K-19. Link-Node Analysis Network – Grid 18

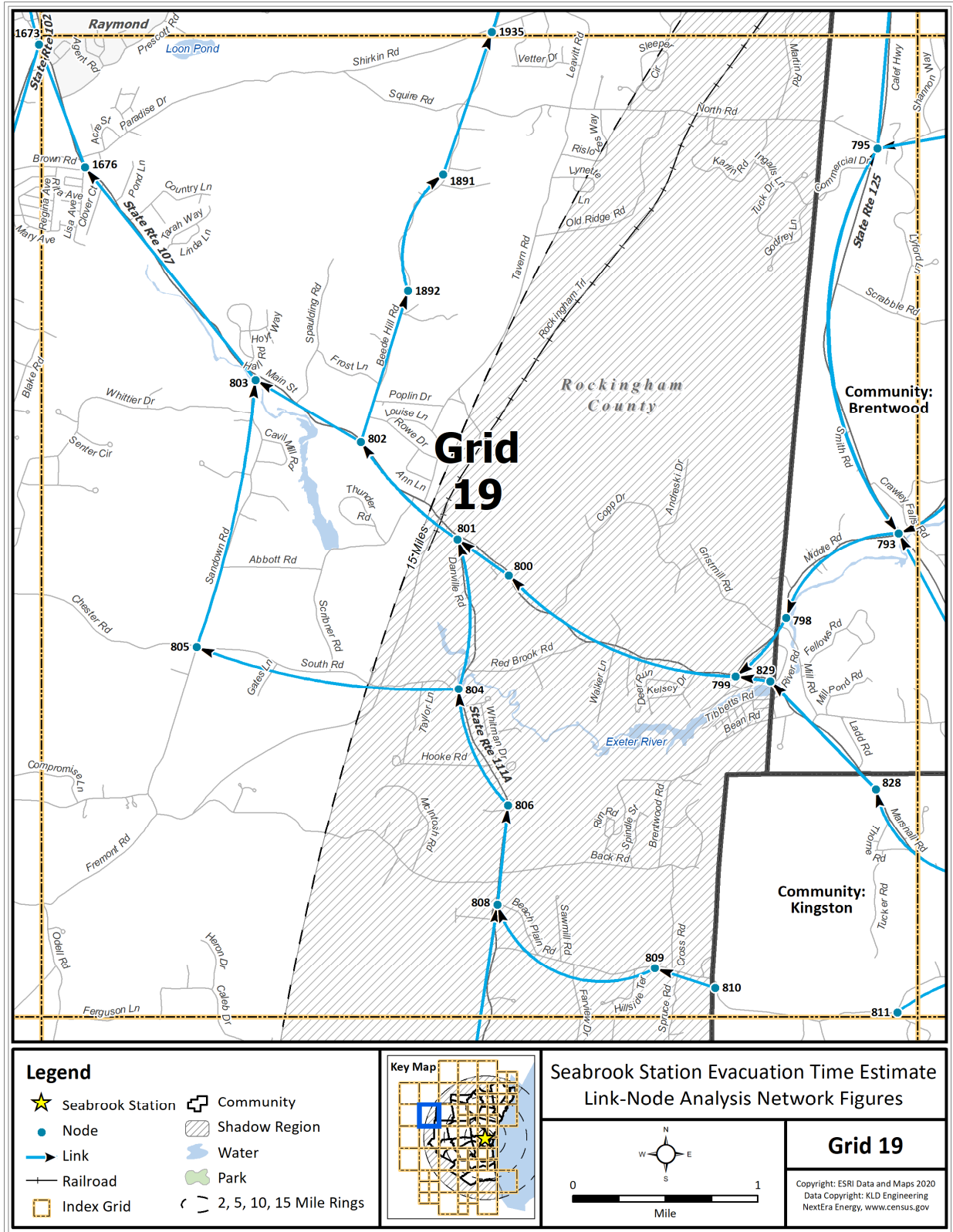


Figure K-20. Link-Node Analysis Network – Grid 19

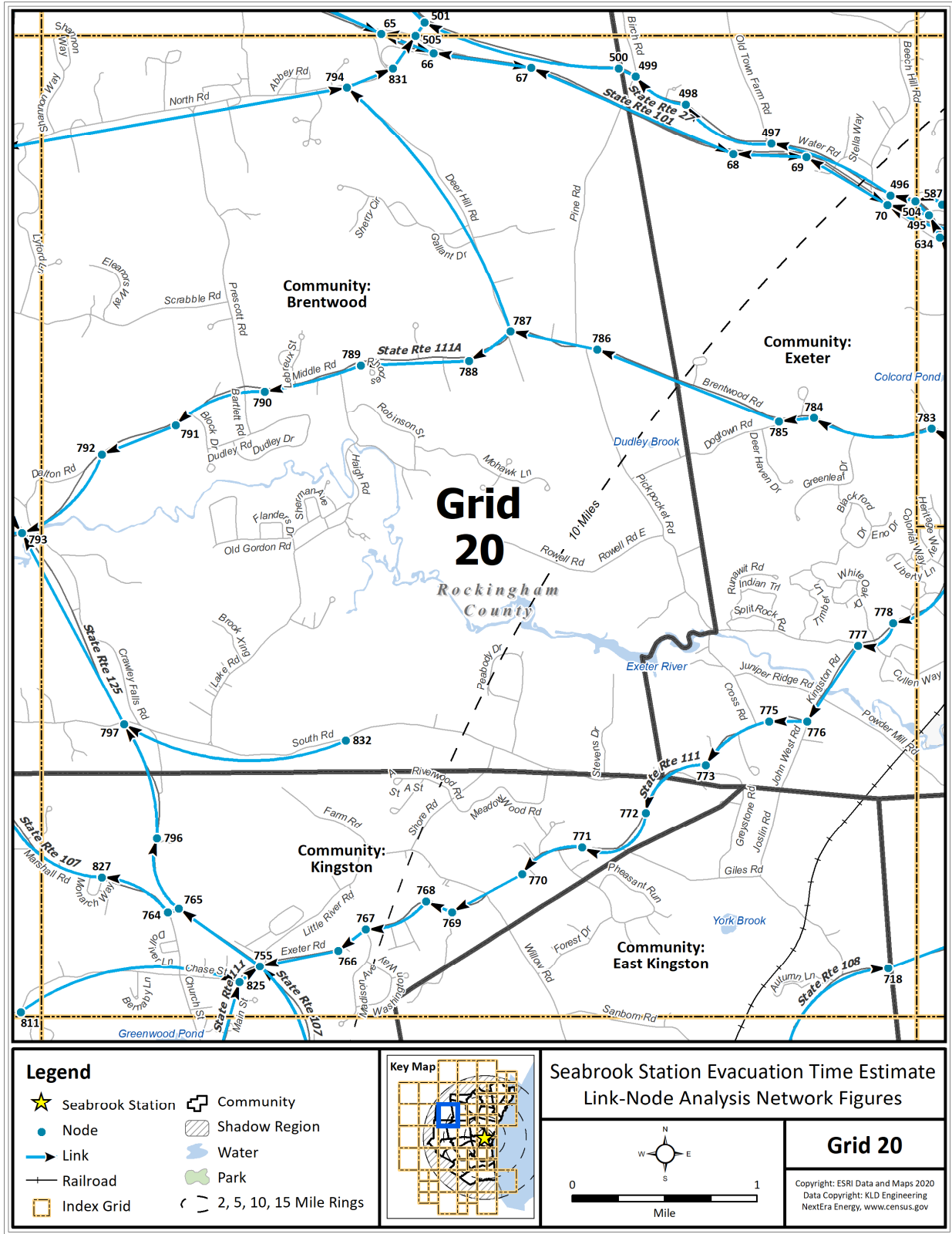


Figure K-21. Link-Node Analysis Network – Grid 20

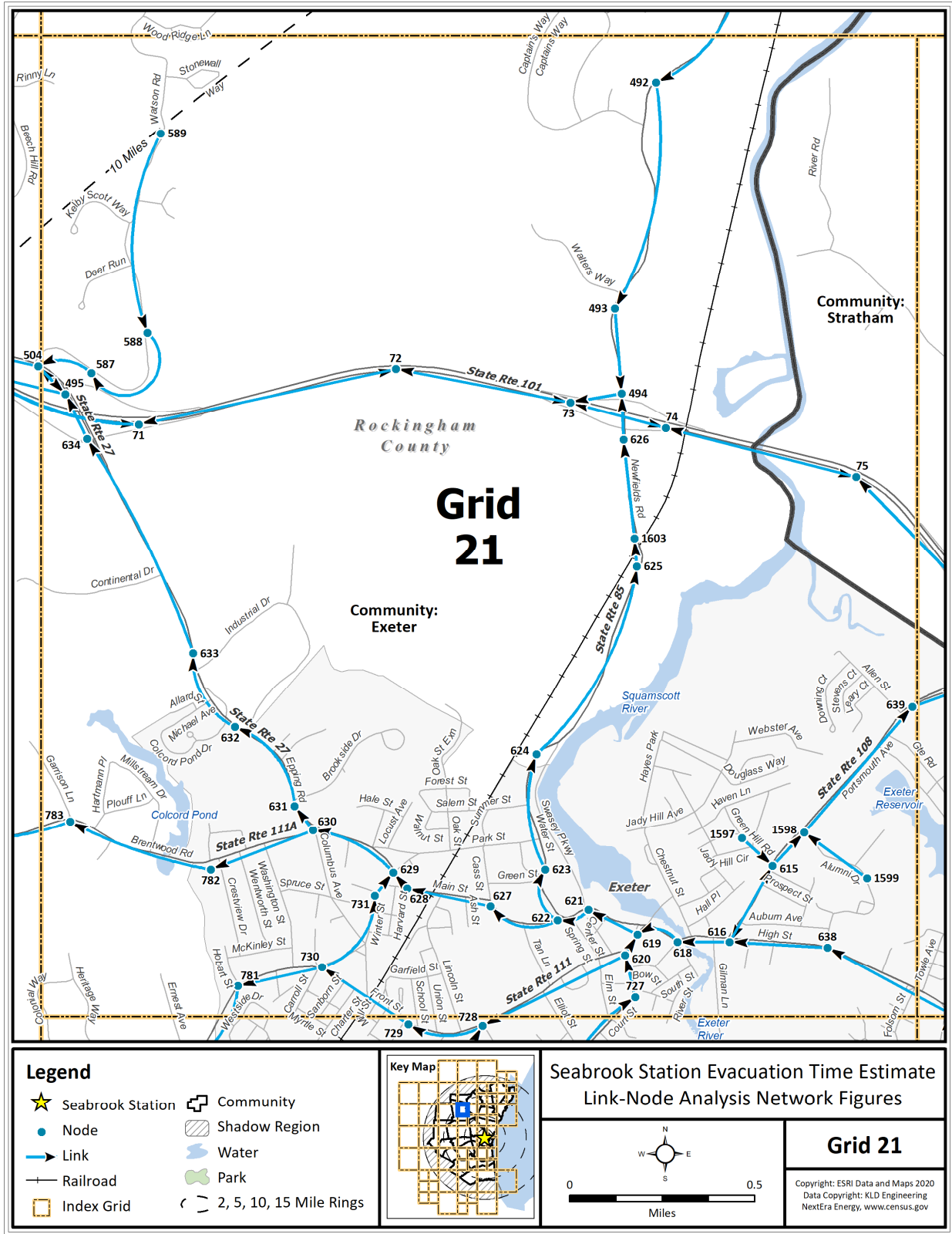


Figure K-22. Link-Node Analysis Network – Grid 21

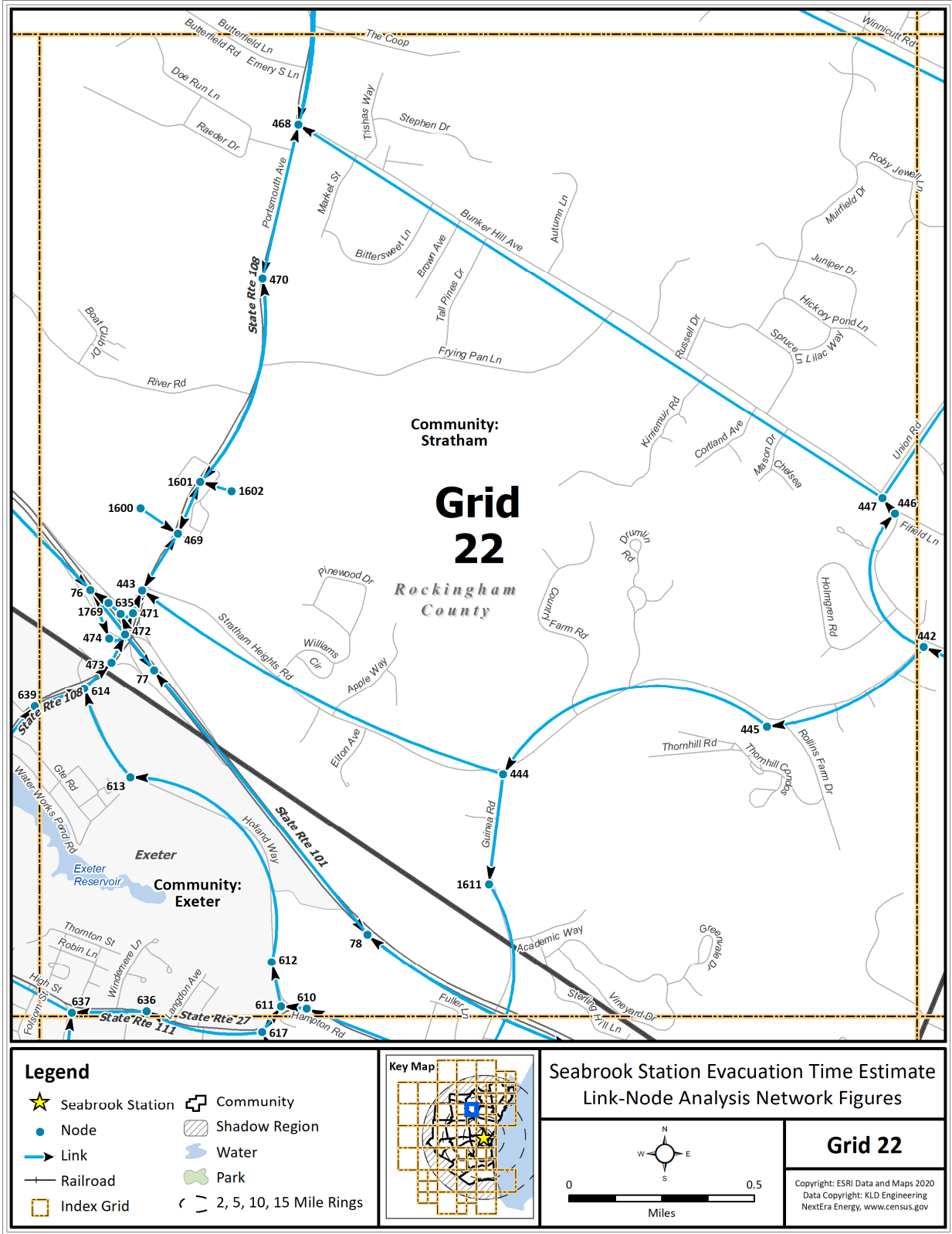


Figure K-23. Link-Node Analysis Network – Grid 22

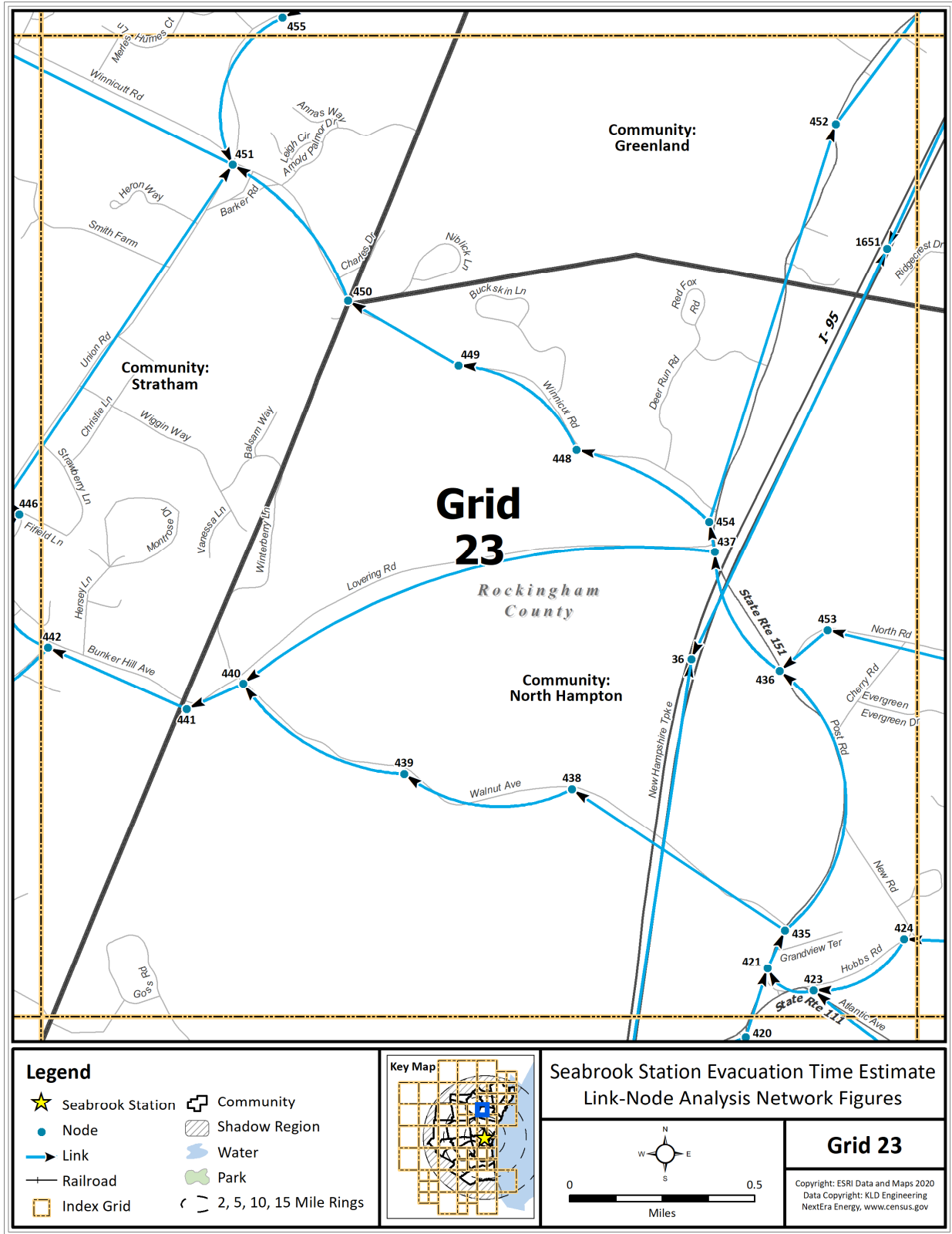


Figure K-24. Link-Node Analysis Network – Grid 23

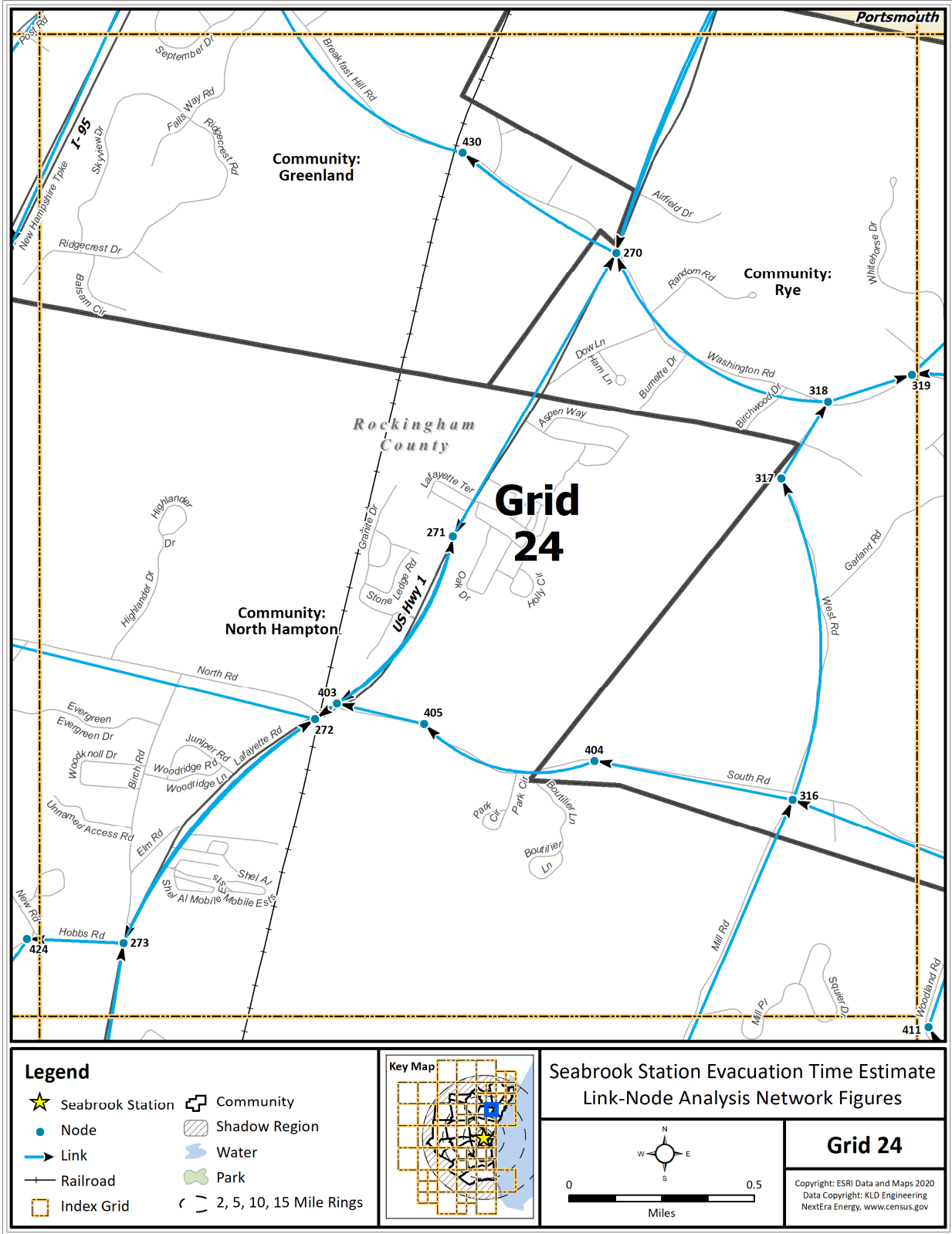


Figure K-25. Link-Node Analysis Network – Grid 24

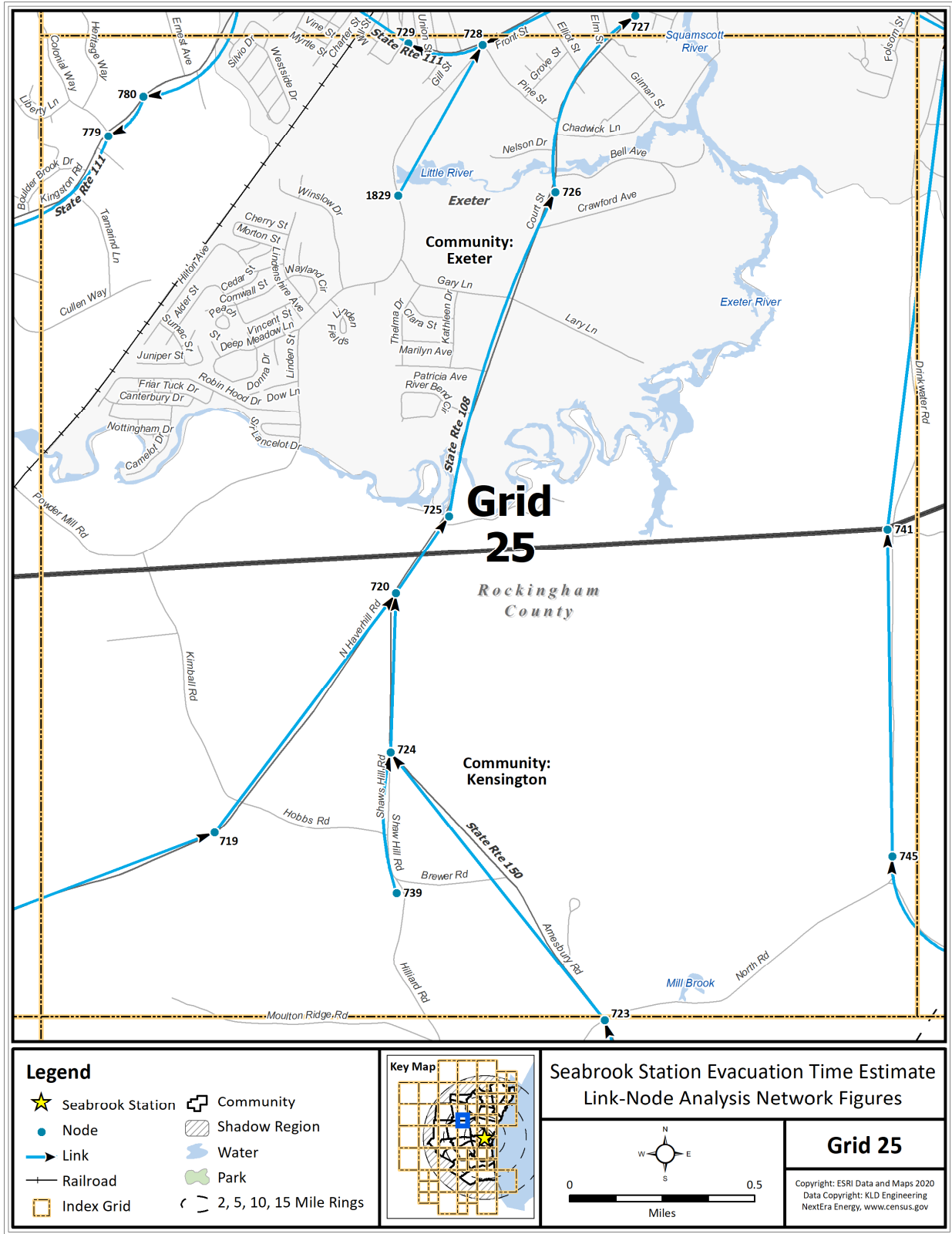


Figure K-26. Link-Node Analysis Network – Grid 25

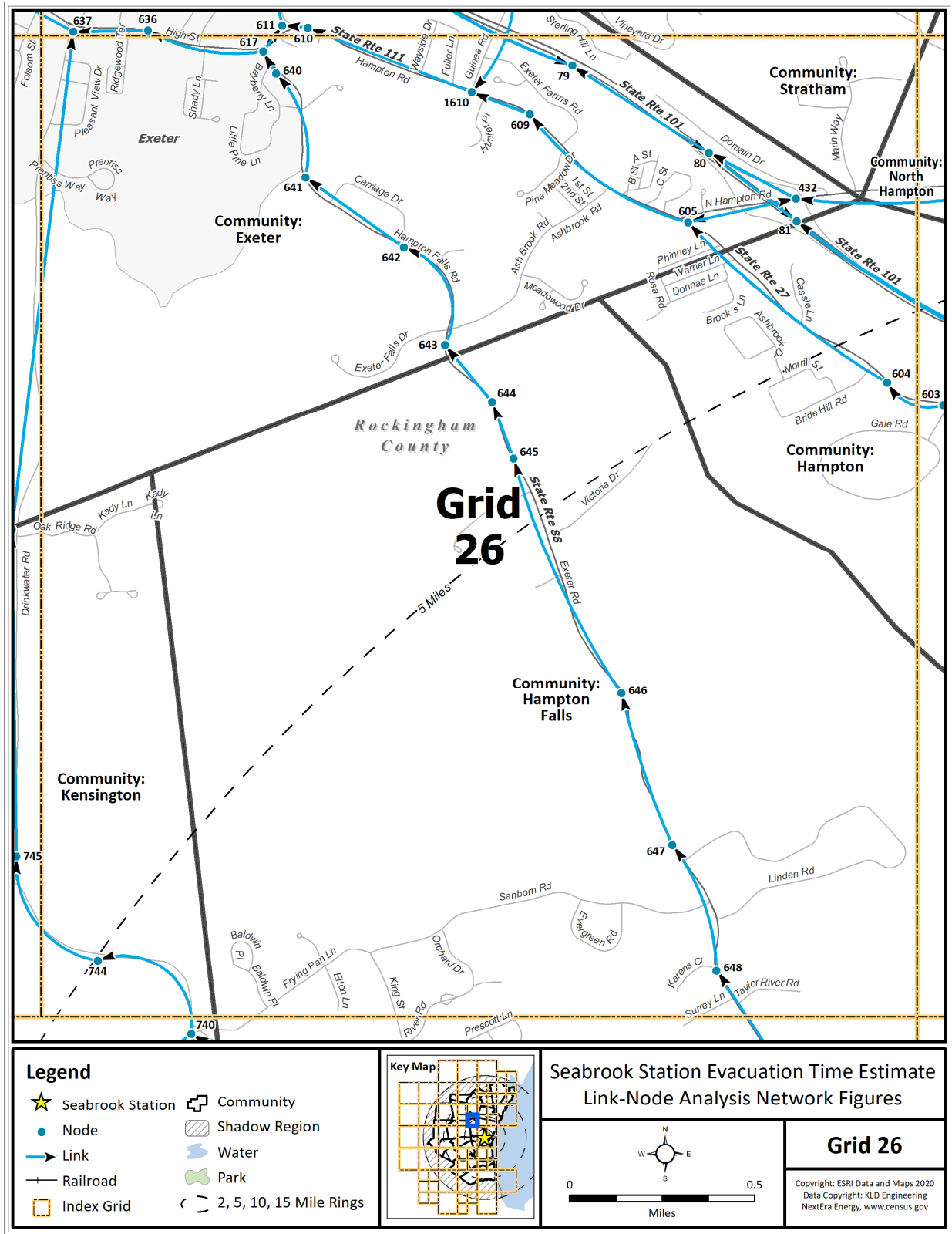


Figure K-27. Link-Node Analysis Network – Grid 26

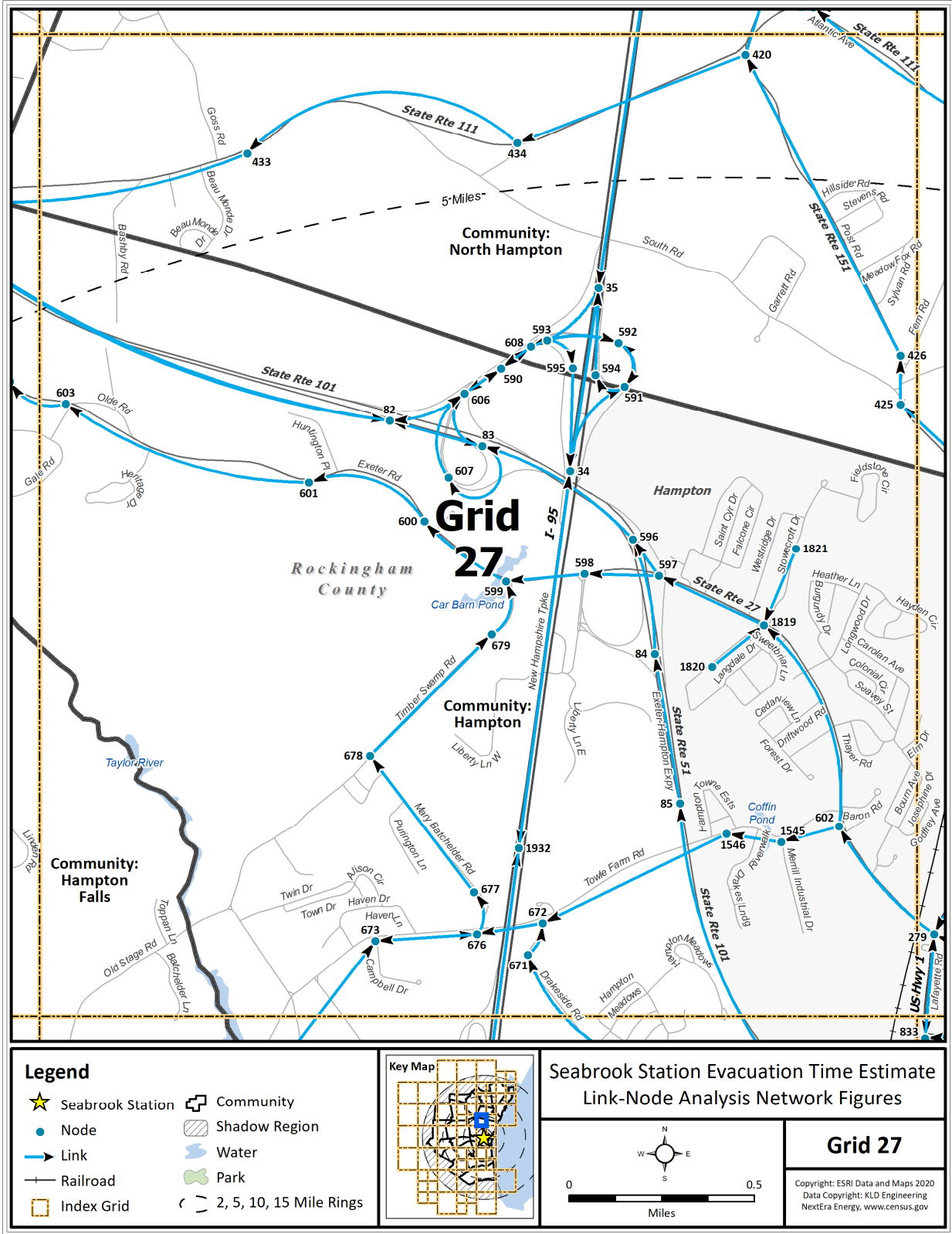


Figure K-28. Link-Node Analysis Network – Grid 27

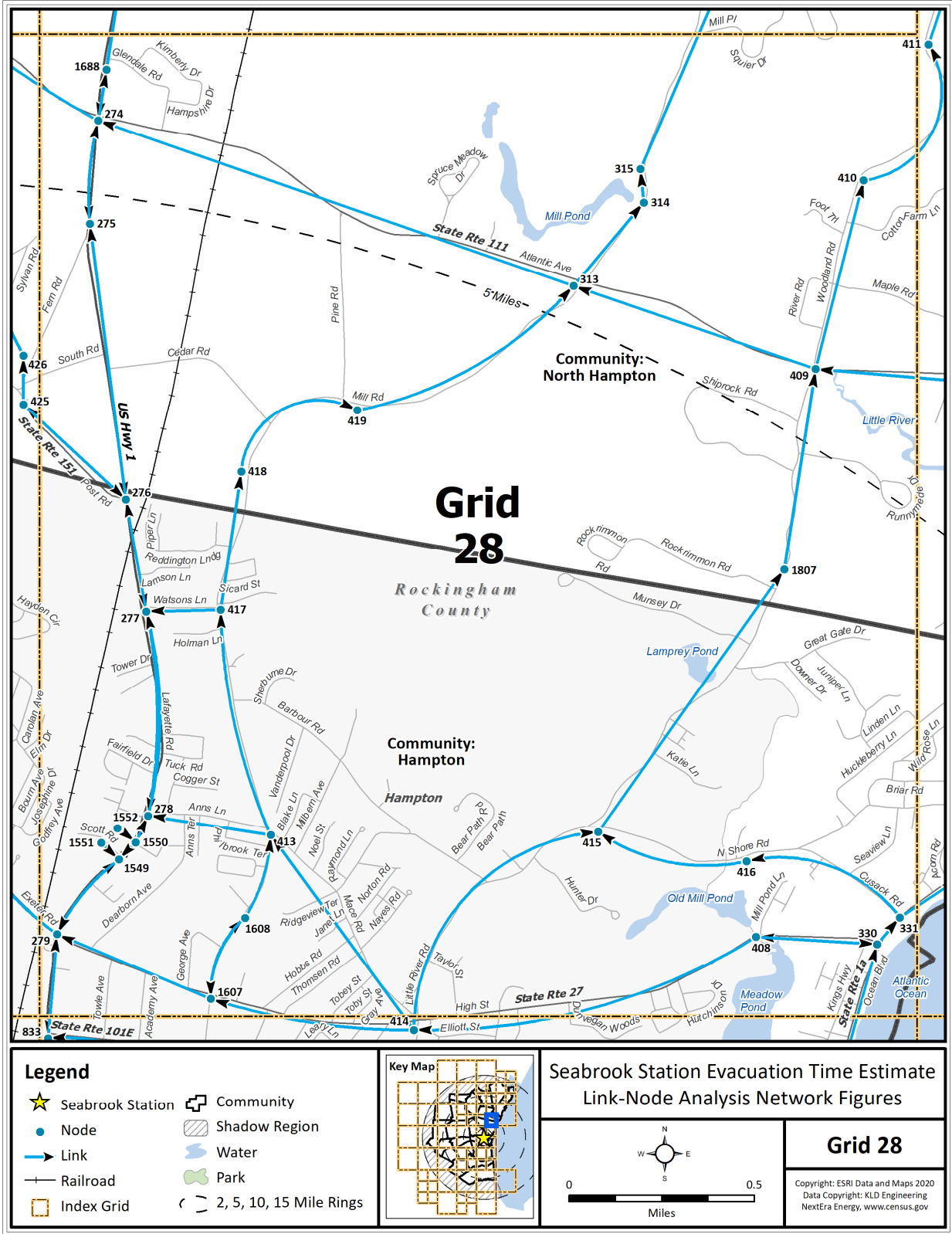


Figure K-29. Link-Node Analysis Network – Grid 28

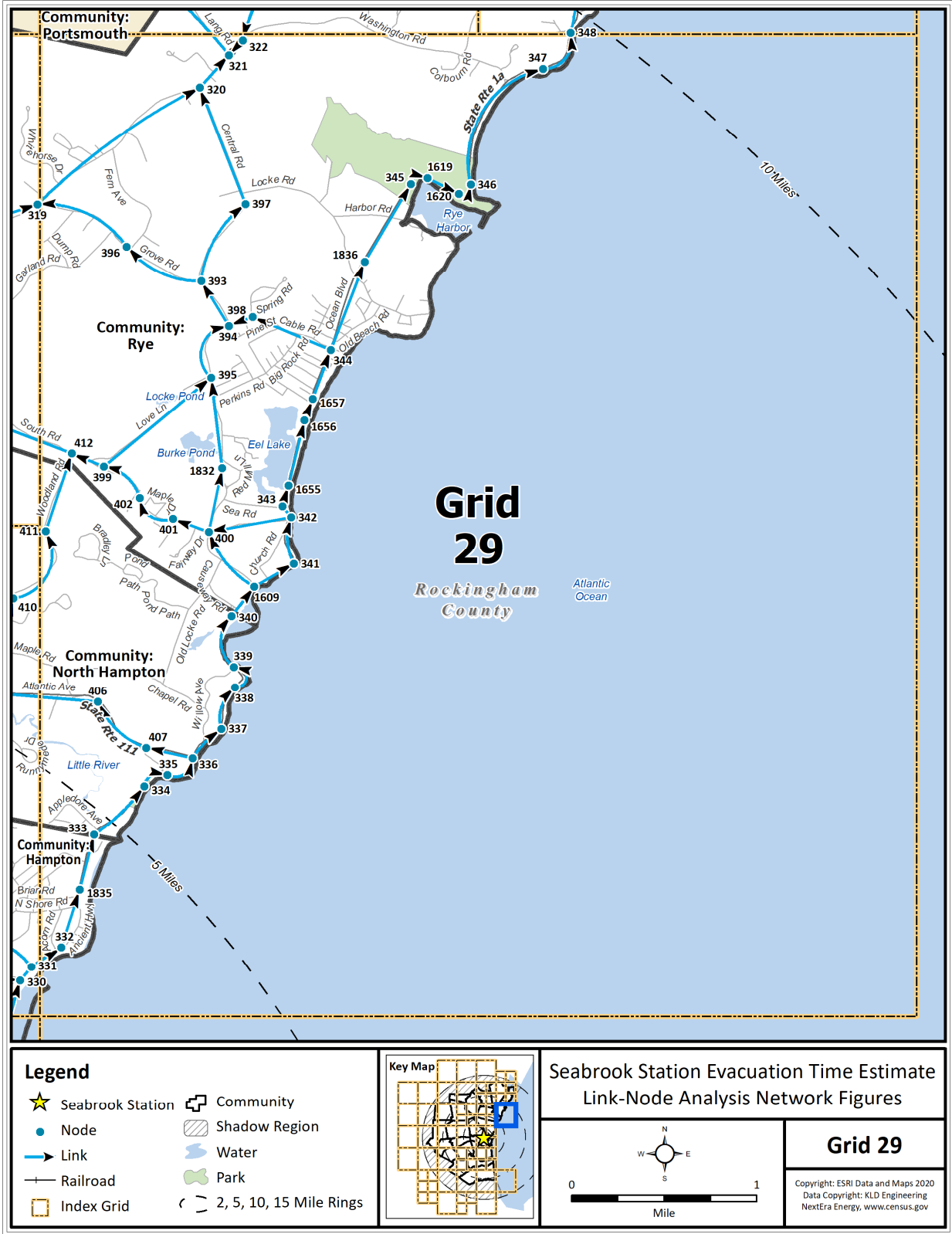


Figure K-30. Link-Node Analysis Network – Grid 29

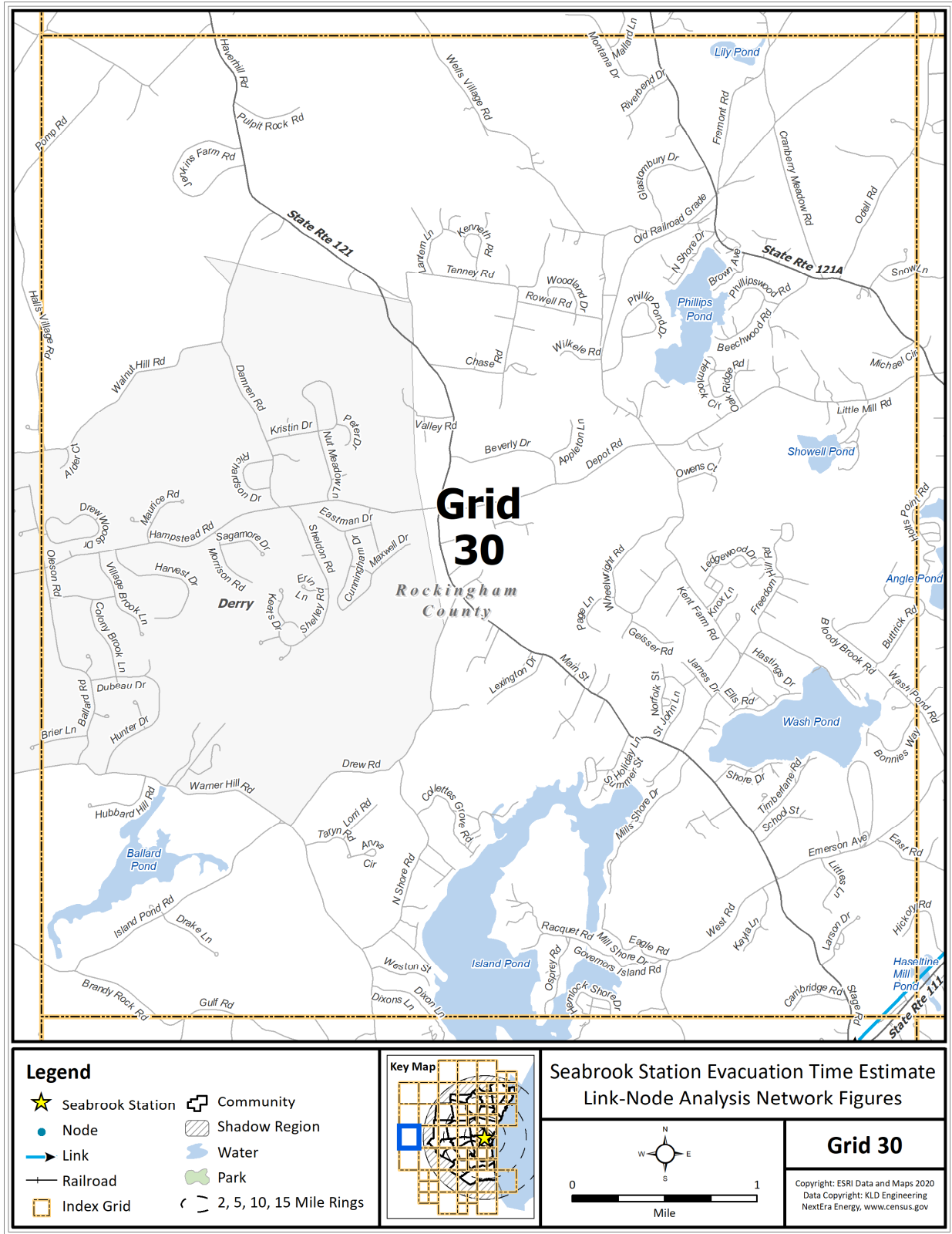


Figure K-31. Link-Node Analysis Network – Grid 30

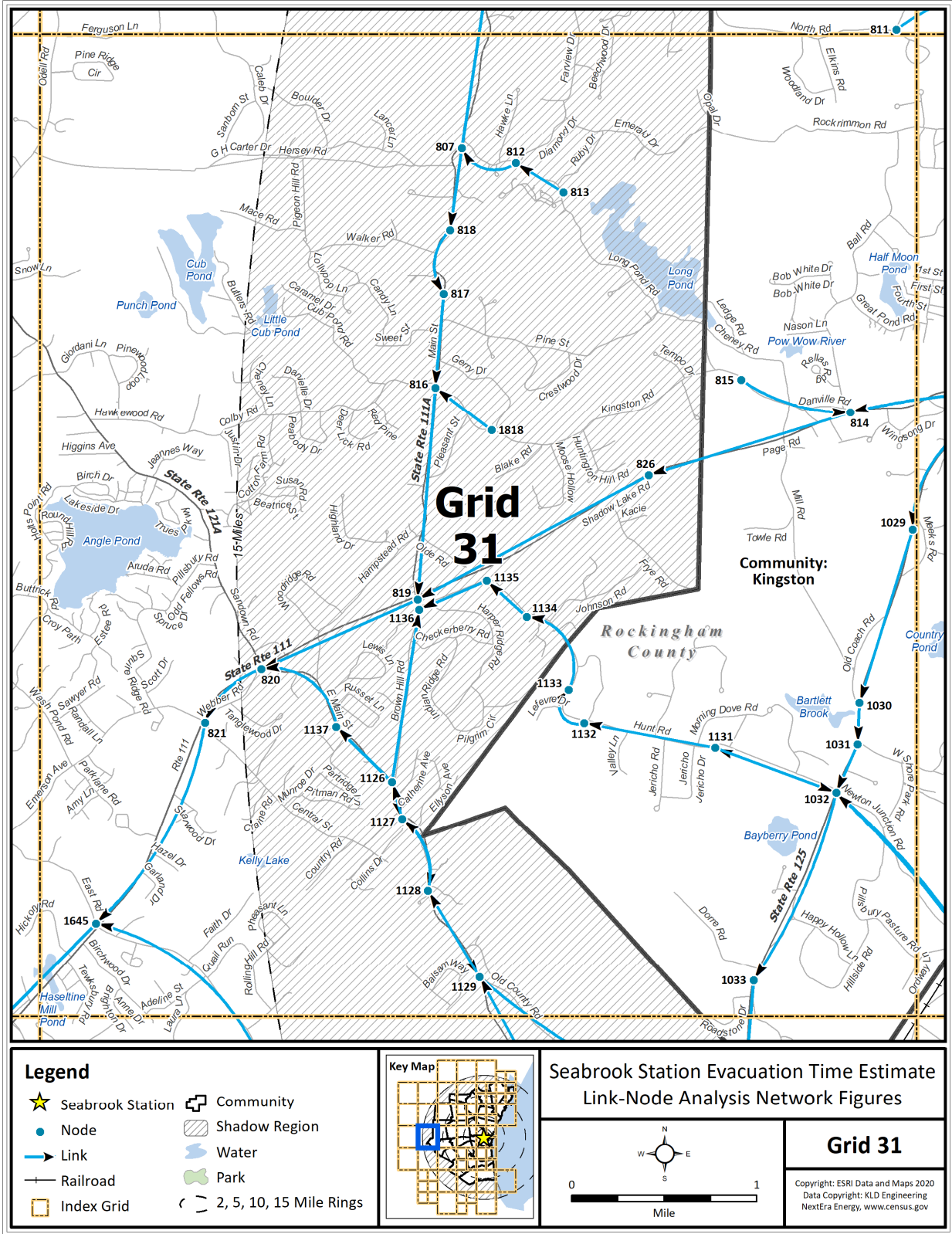


Figure K-32. Link-Node Analysis Network – Grid 31

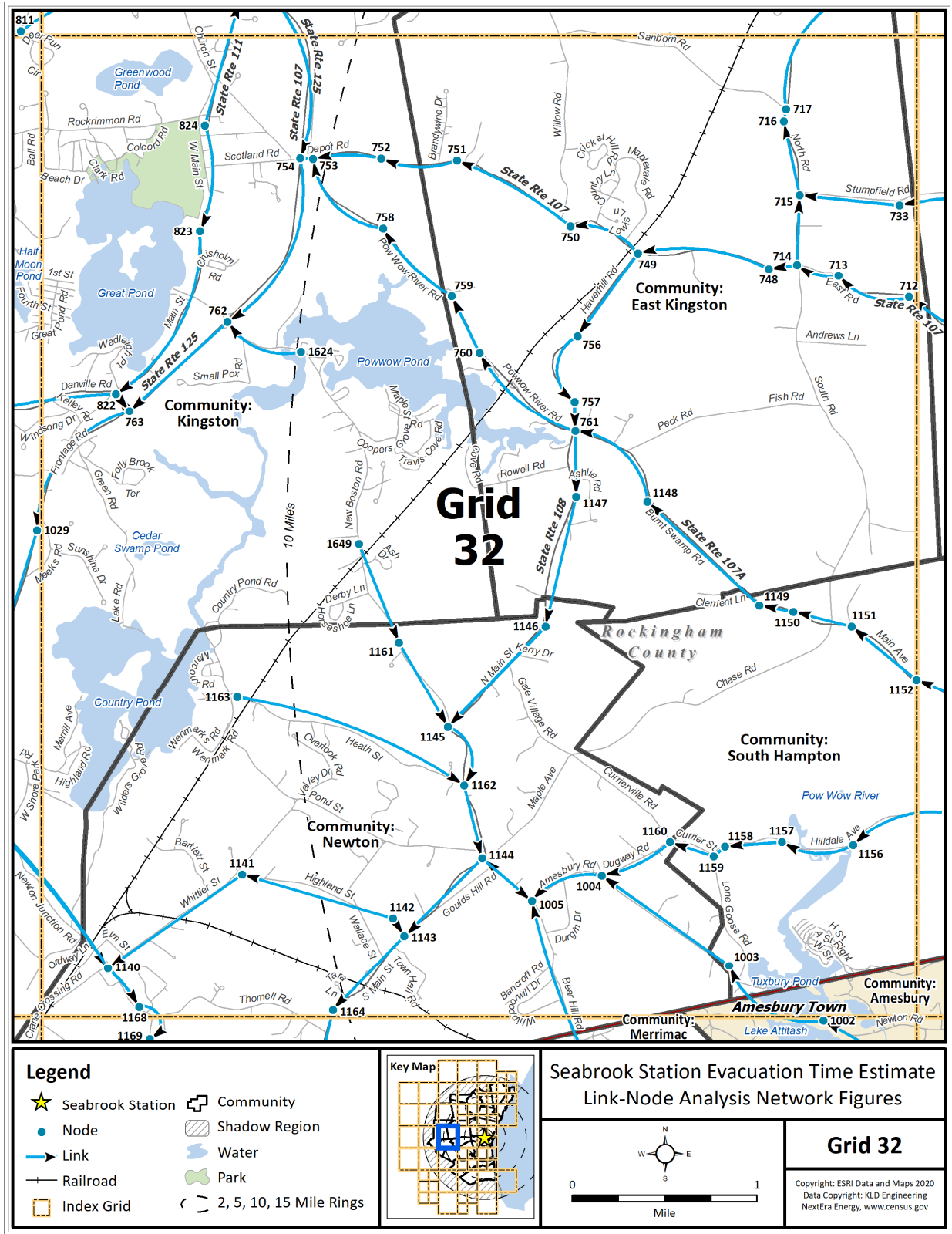


Figure K-33. Link-Node Analysis Network – Grid 32

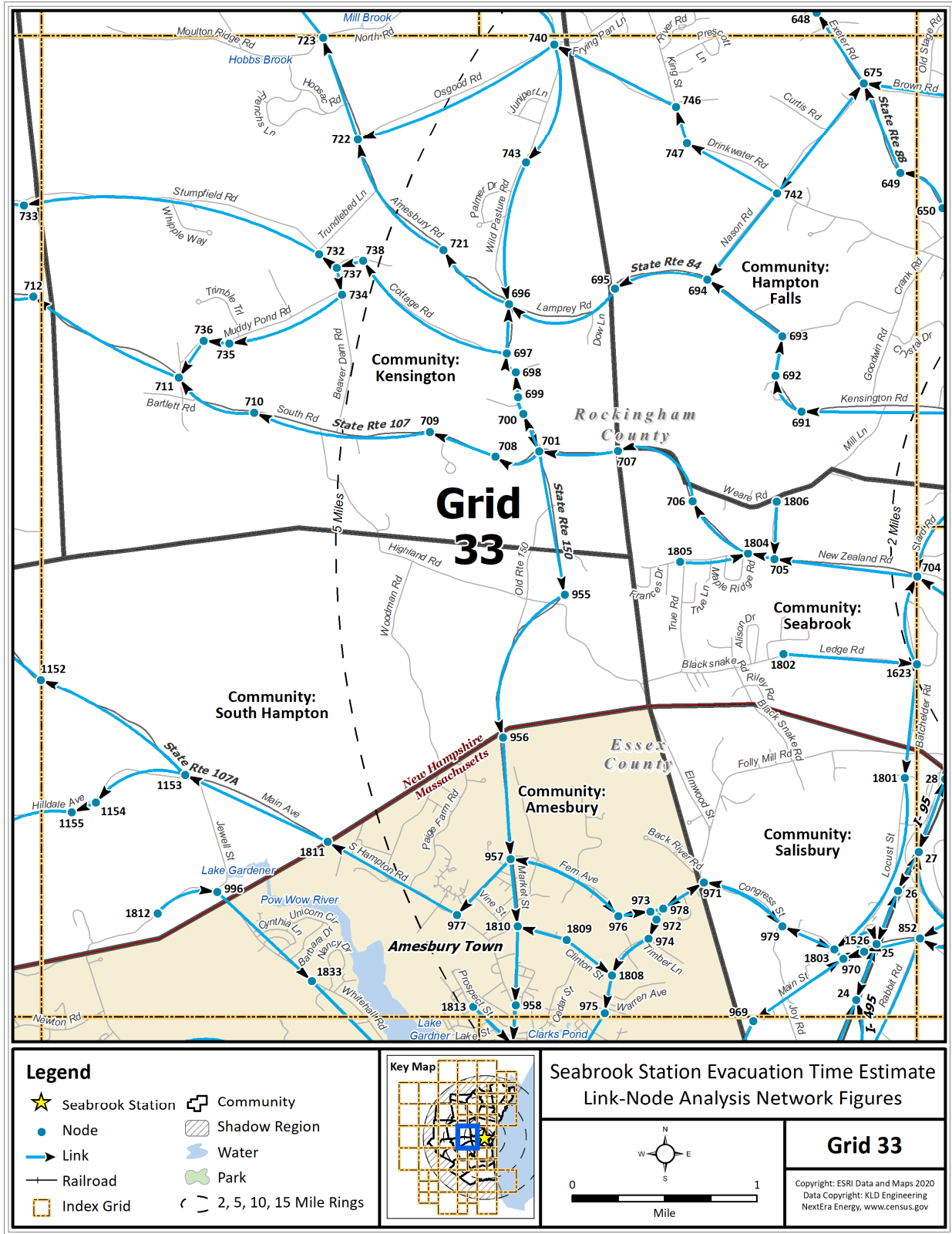


Figure K-34. Link-Node Analysis Network – Grid 33

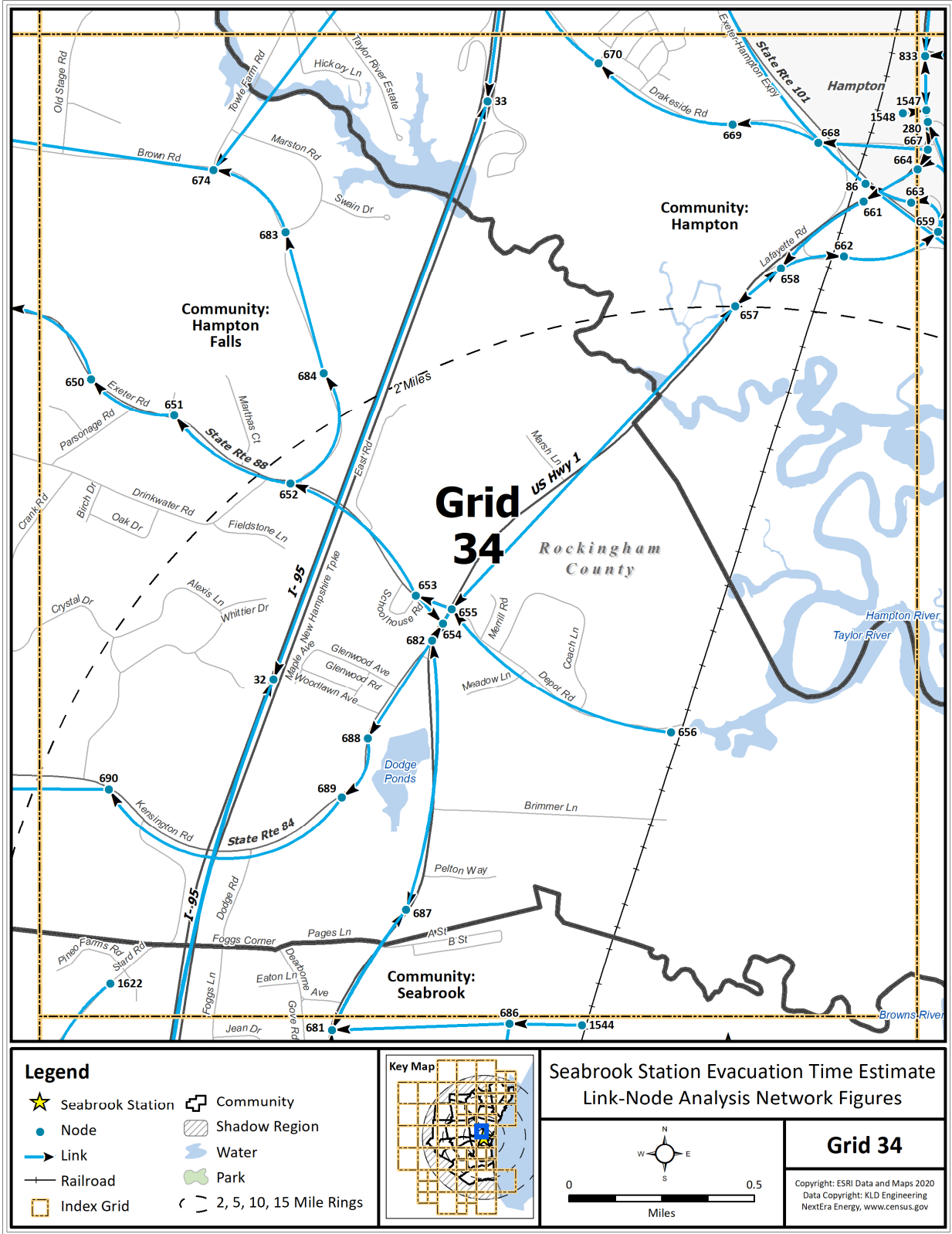


Figure K-35. Link-Node Analysis Network – Grid 34

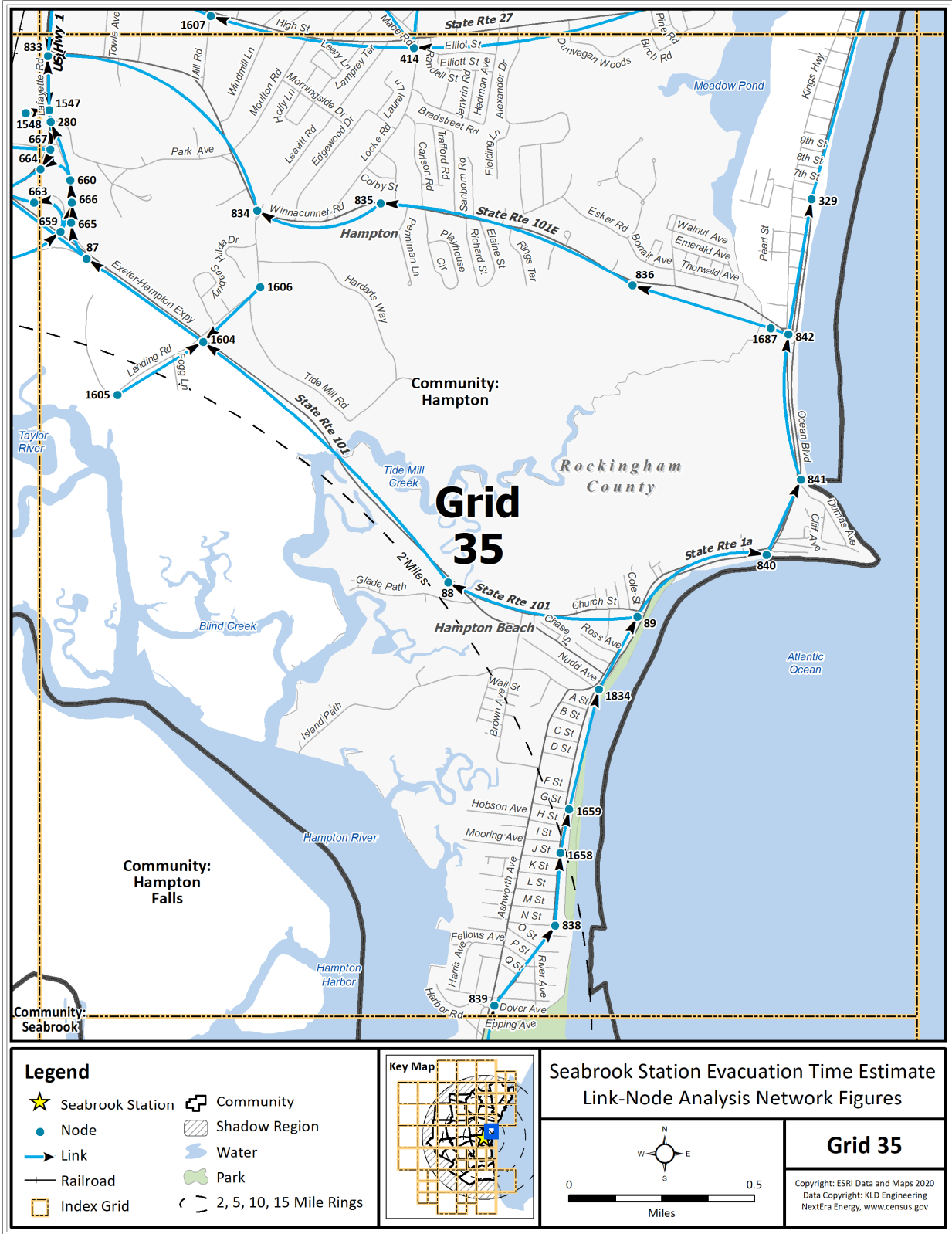


Figure K-36. Link-Node Analysis Network – Grid 35

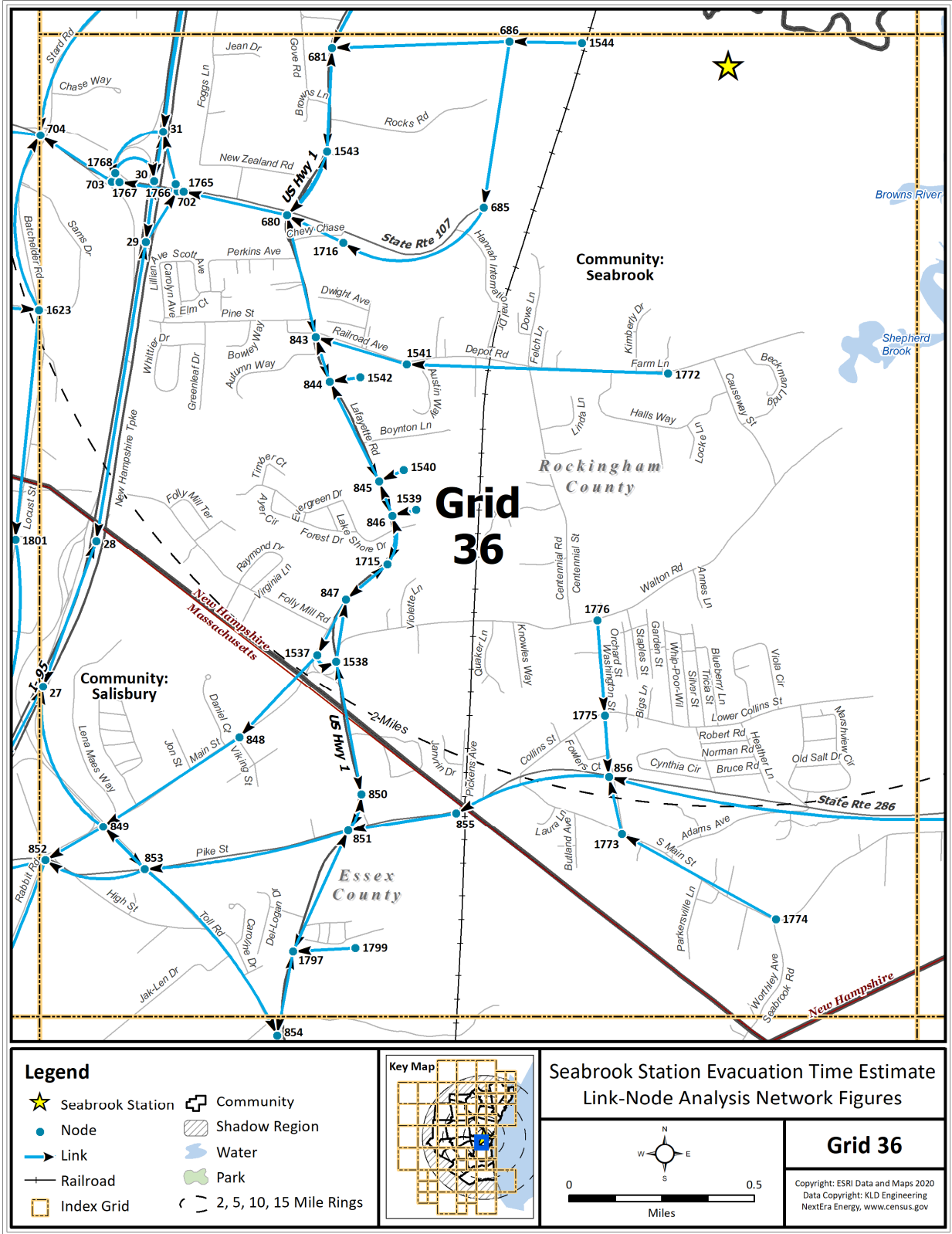


Figure K-37. Link-Node Analysis Network – Grid 36

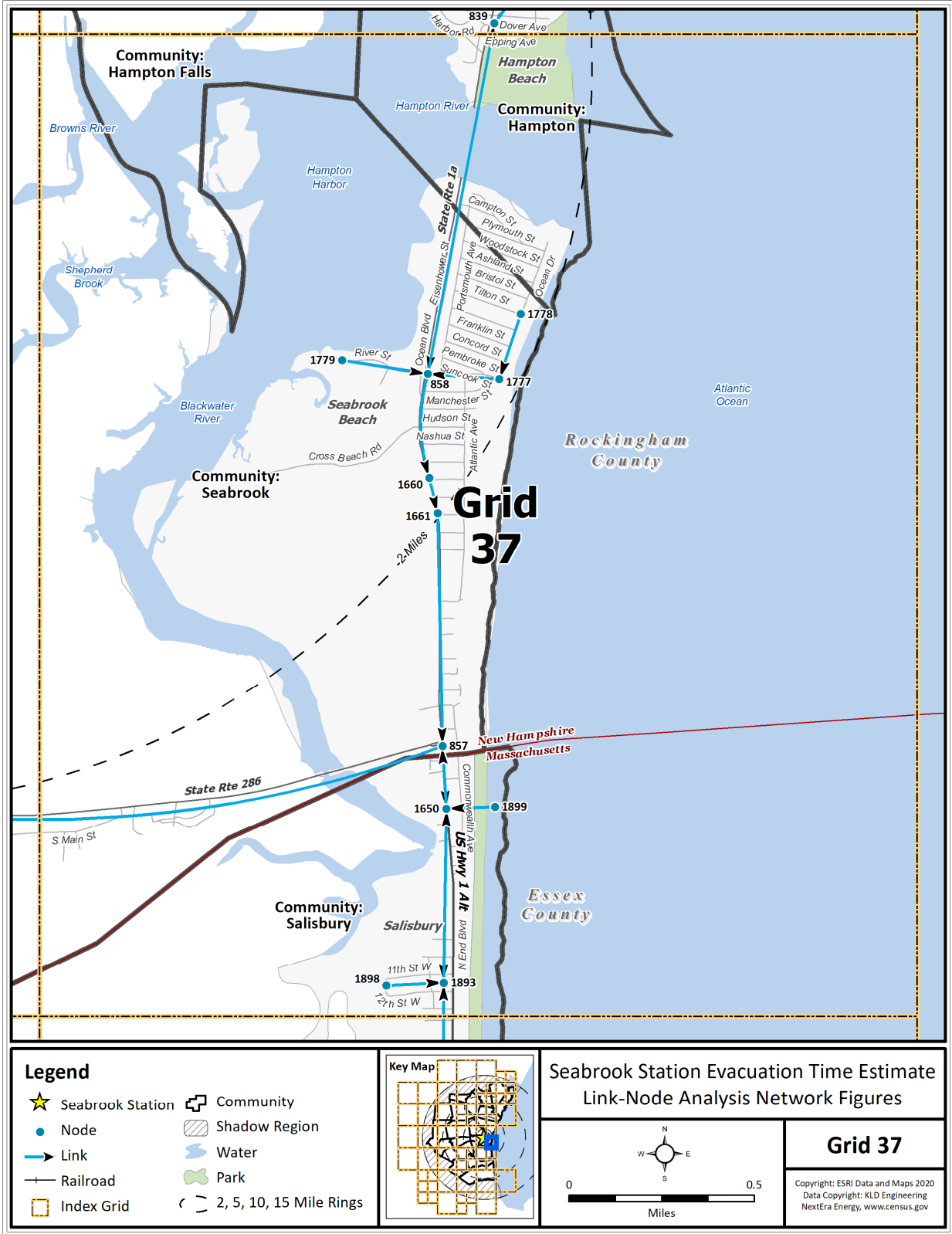


Figure K-38. Link-Node Analysis Network – Grid 37

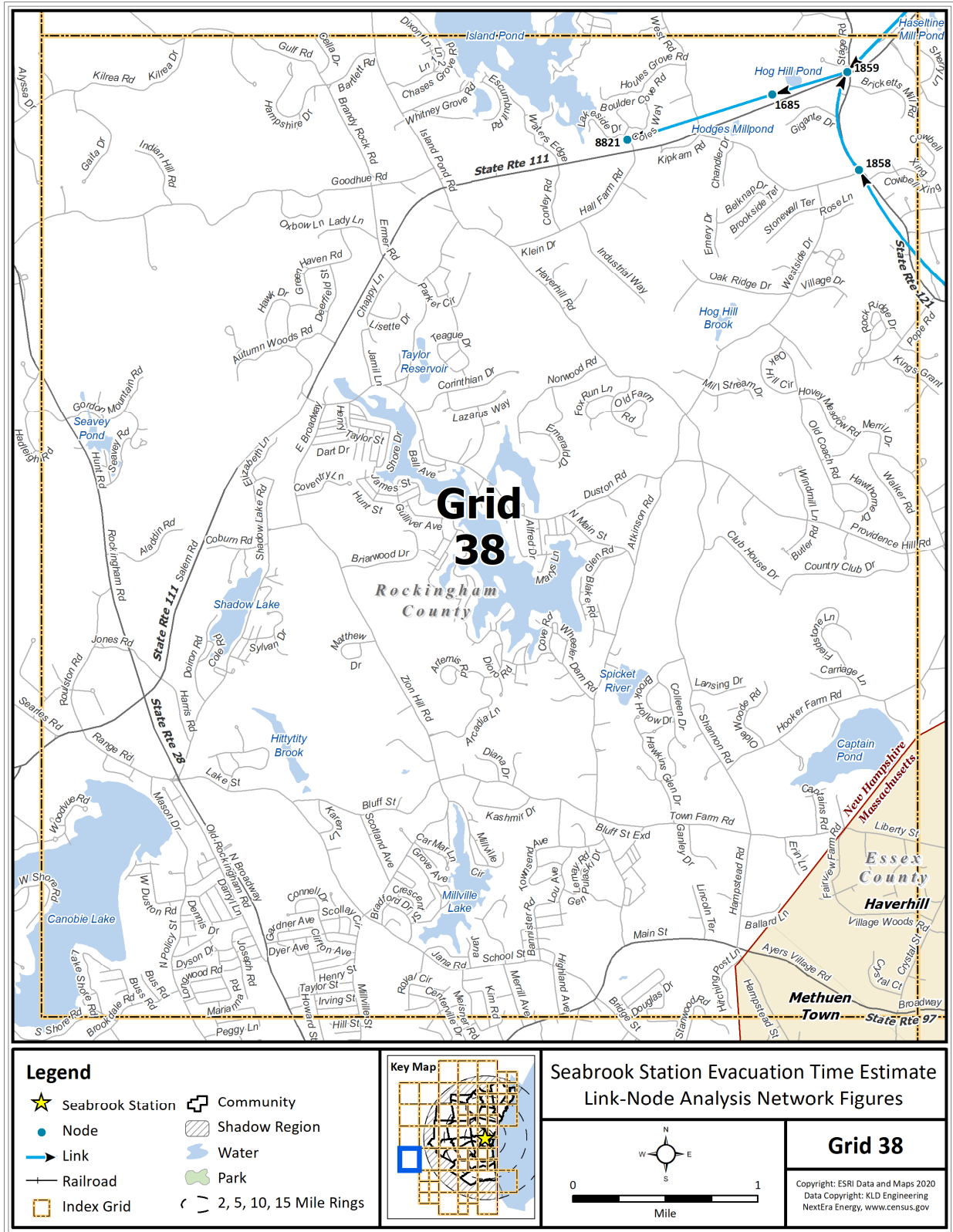


Figure K-39. Link-Node Analysis Network – Grid 38

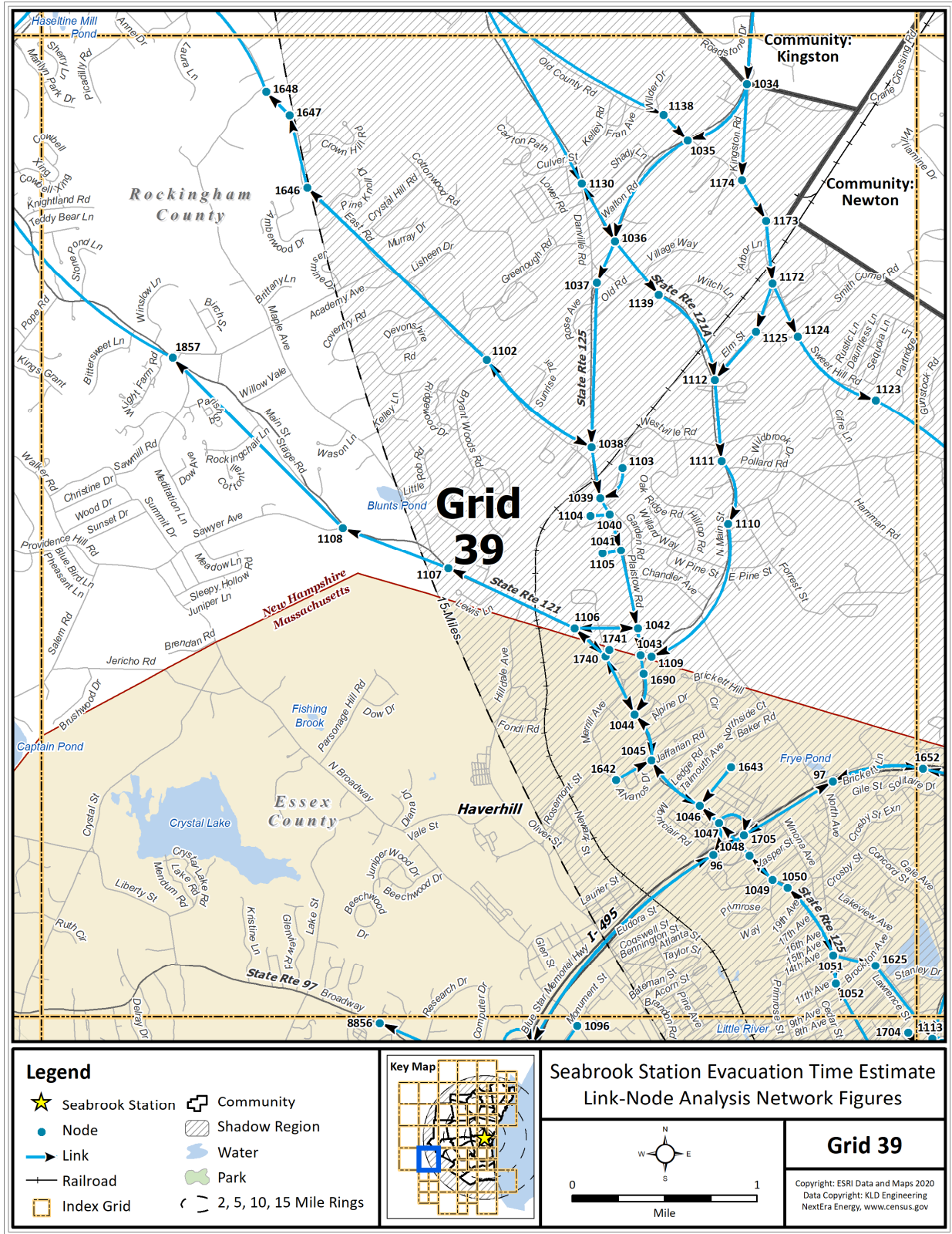


Figure K-40. Link-Node Analysis Network – Grid 39

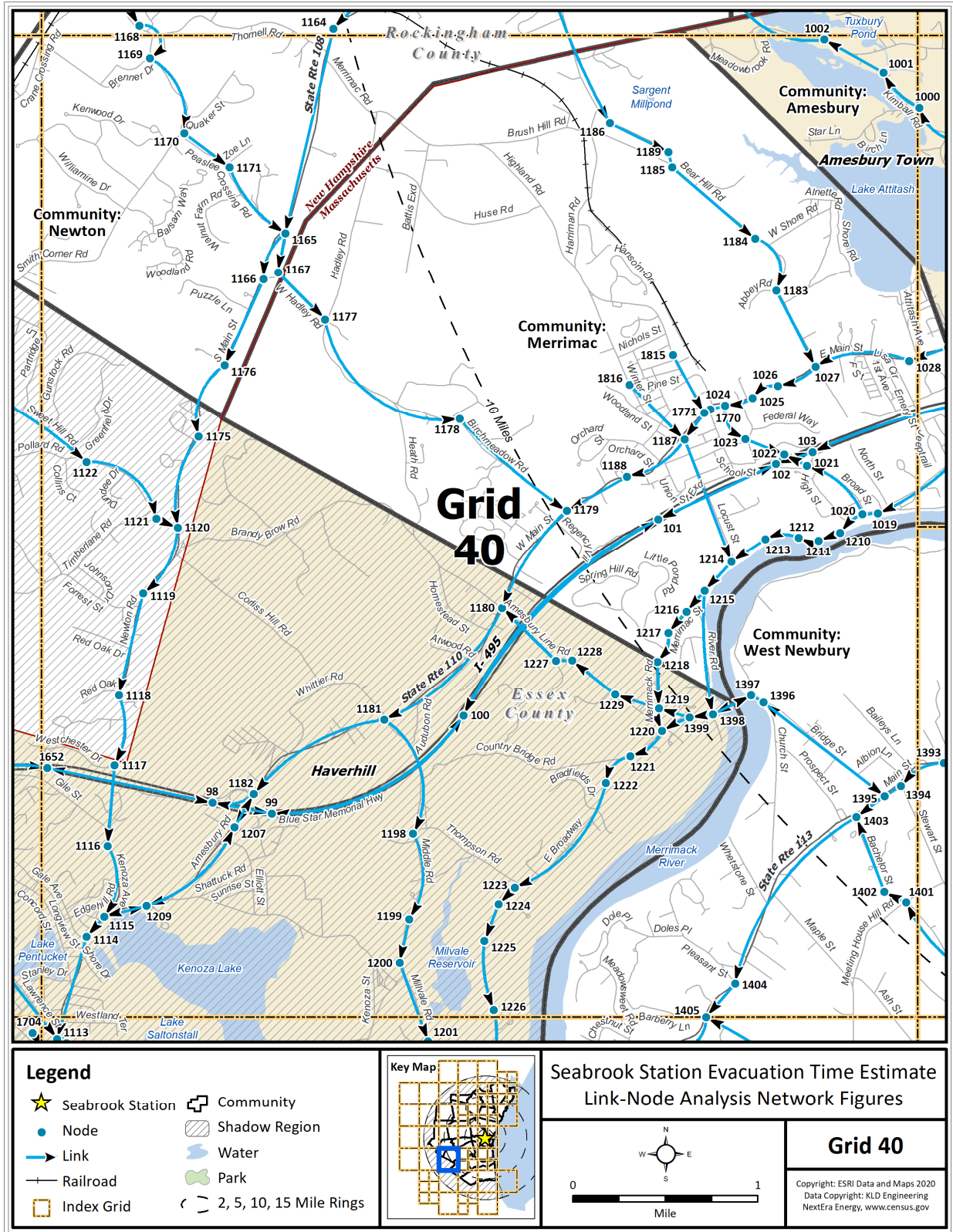


Figure K-41. Link-Node Analysis Network – Grid 40

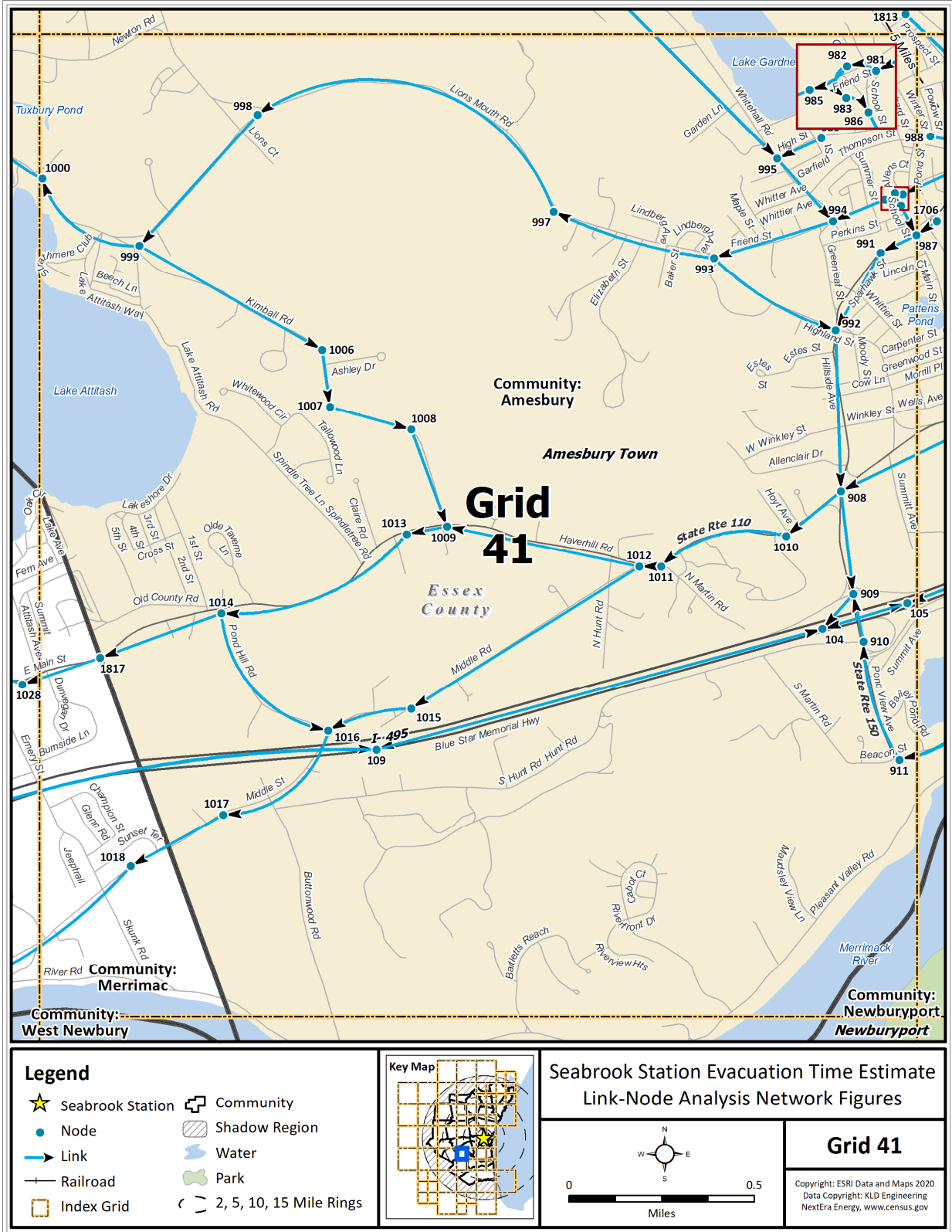


Figure K-42. Link-Node Analysis Network – Grid 41

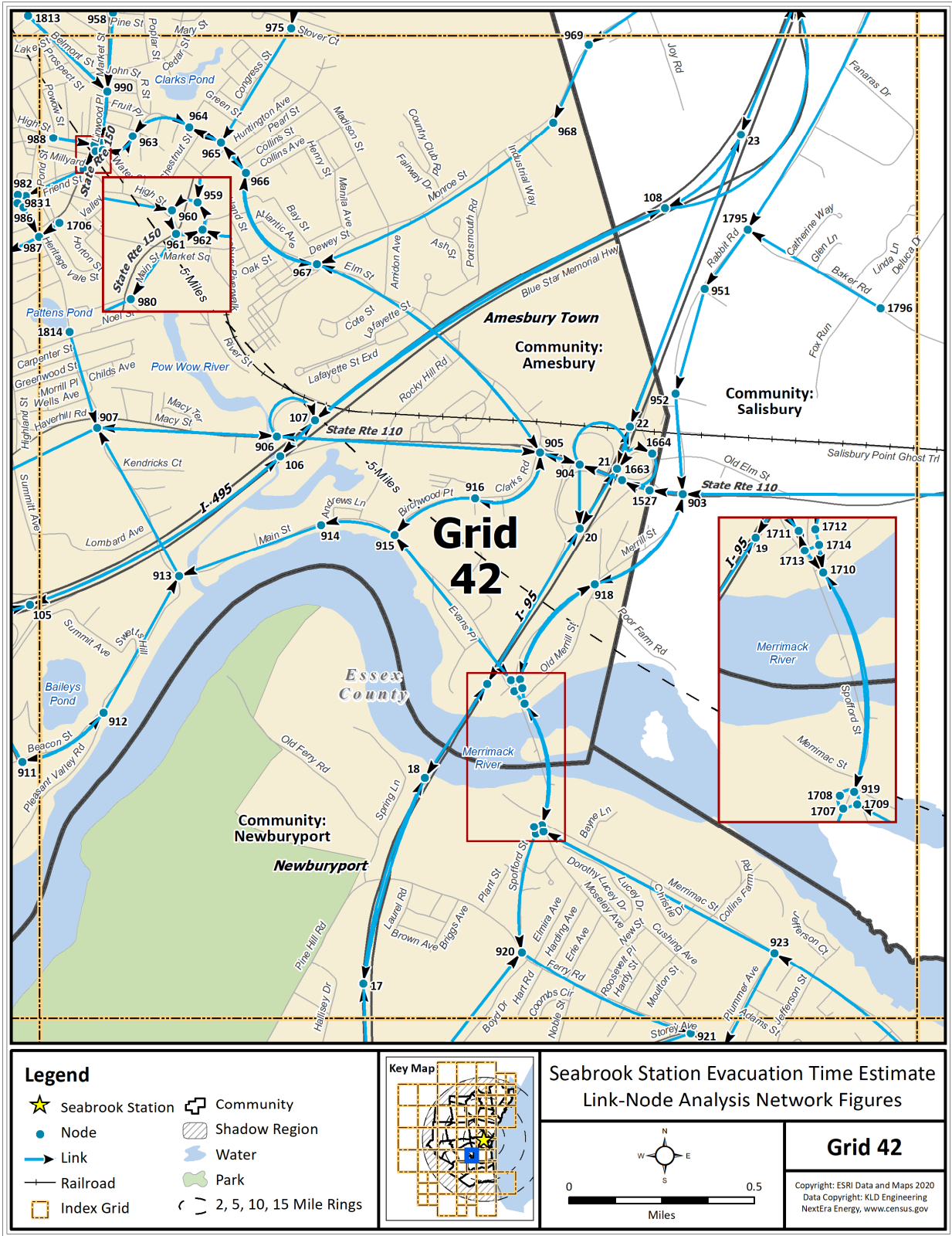


Figure K-43. Link-Node Analysis Network – Grid 42

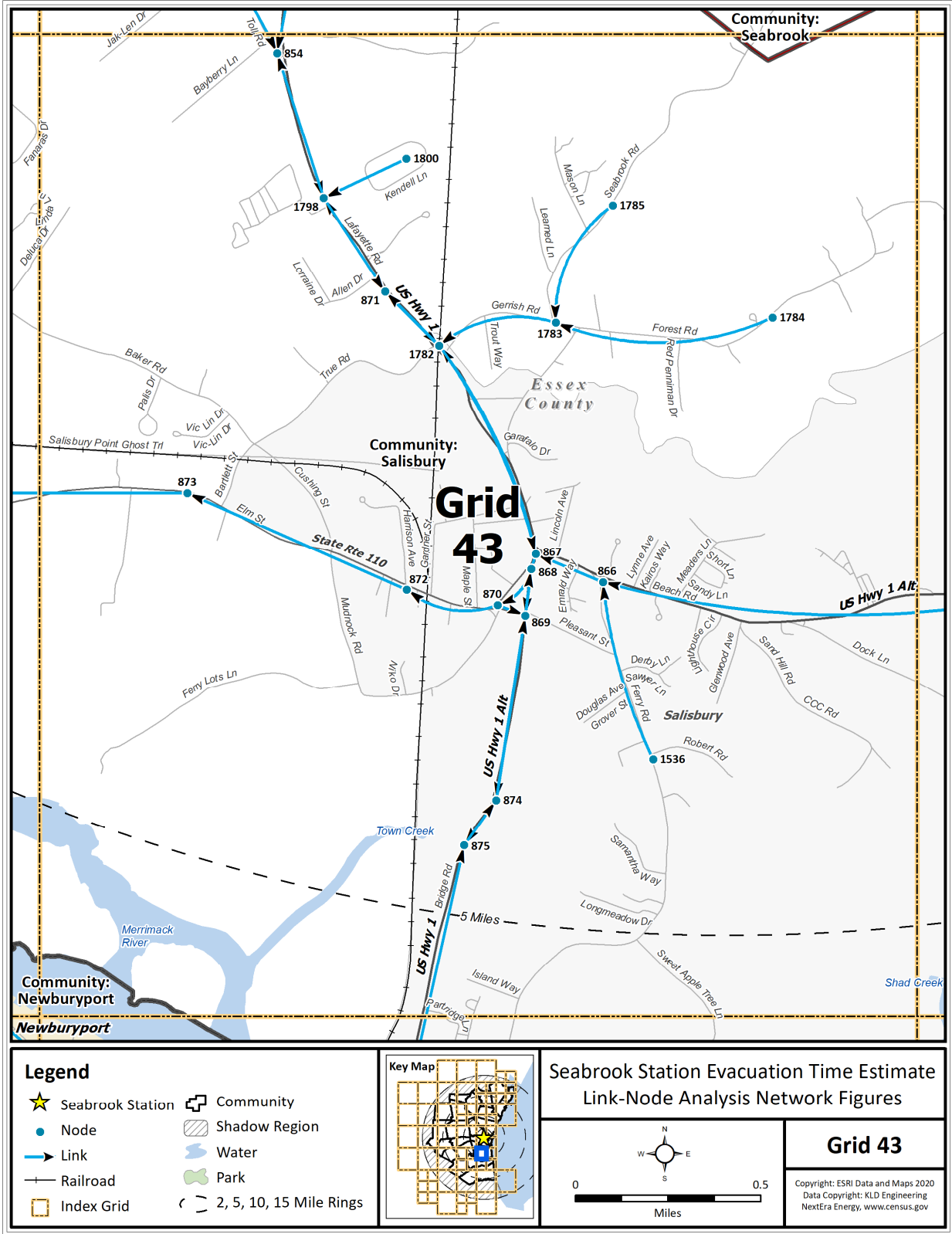


Figure K-44. Link-Node Analysis Network – Grid 43

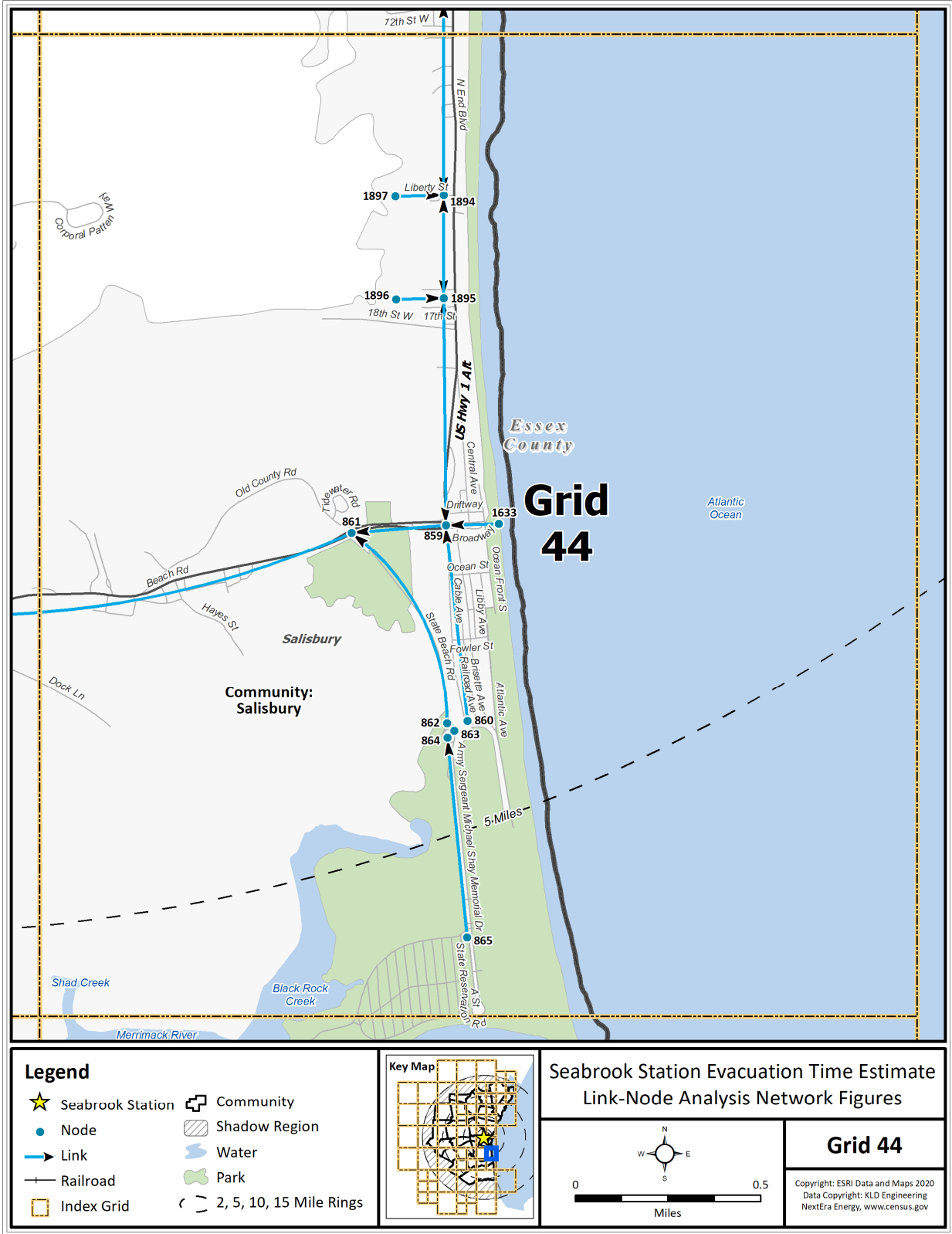


Figure K-45. Link-Node Analysis Network – Grid 44

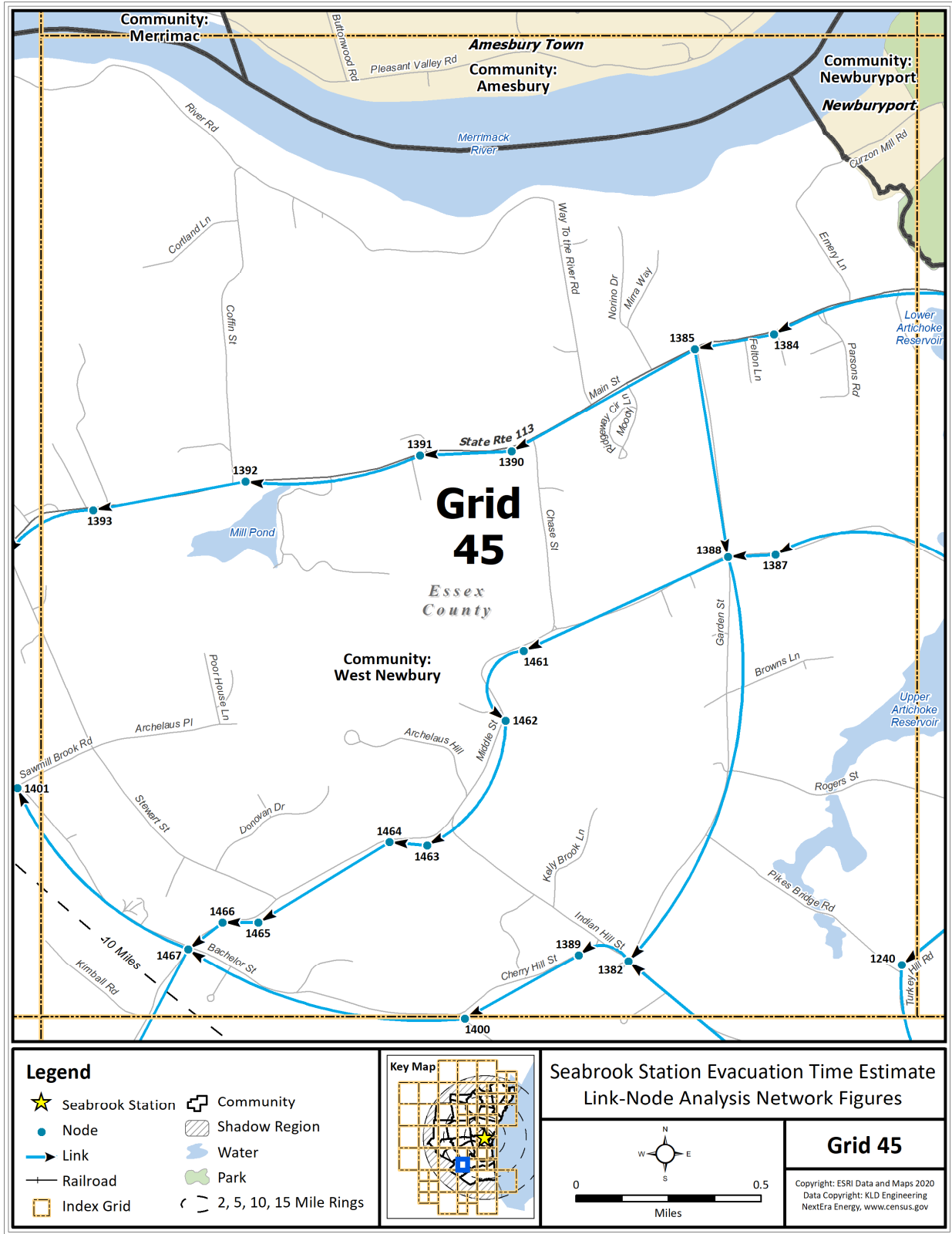


Figure K-46. Link-Node Analysis Network – Grid 45

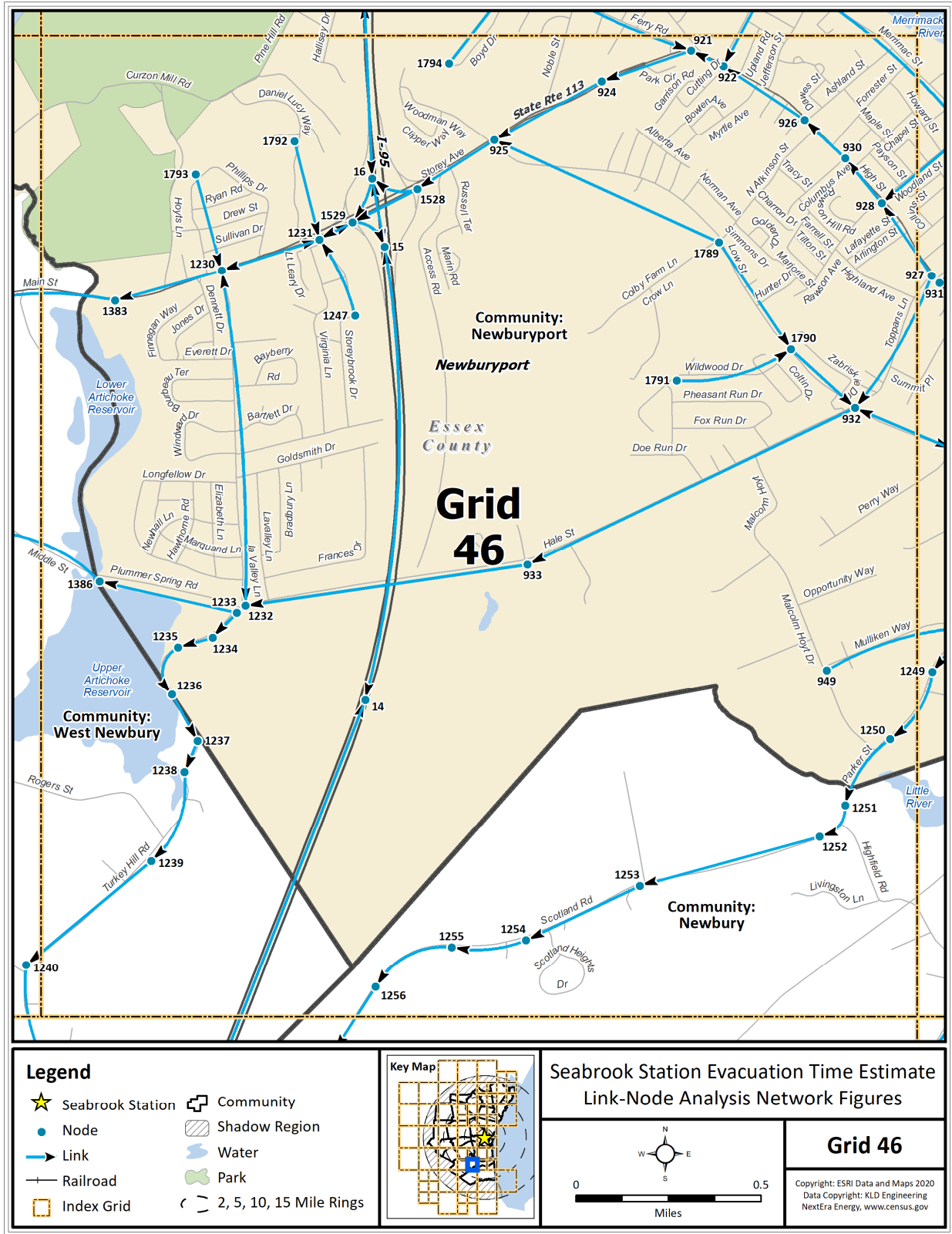


Figure K-47. Link-Node Analysis Network – Grid 46

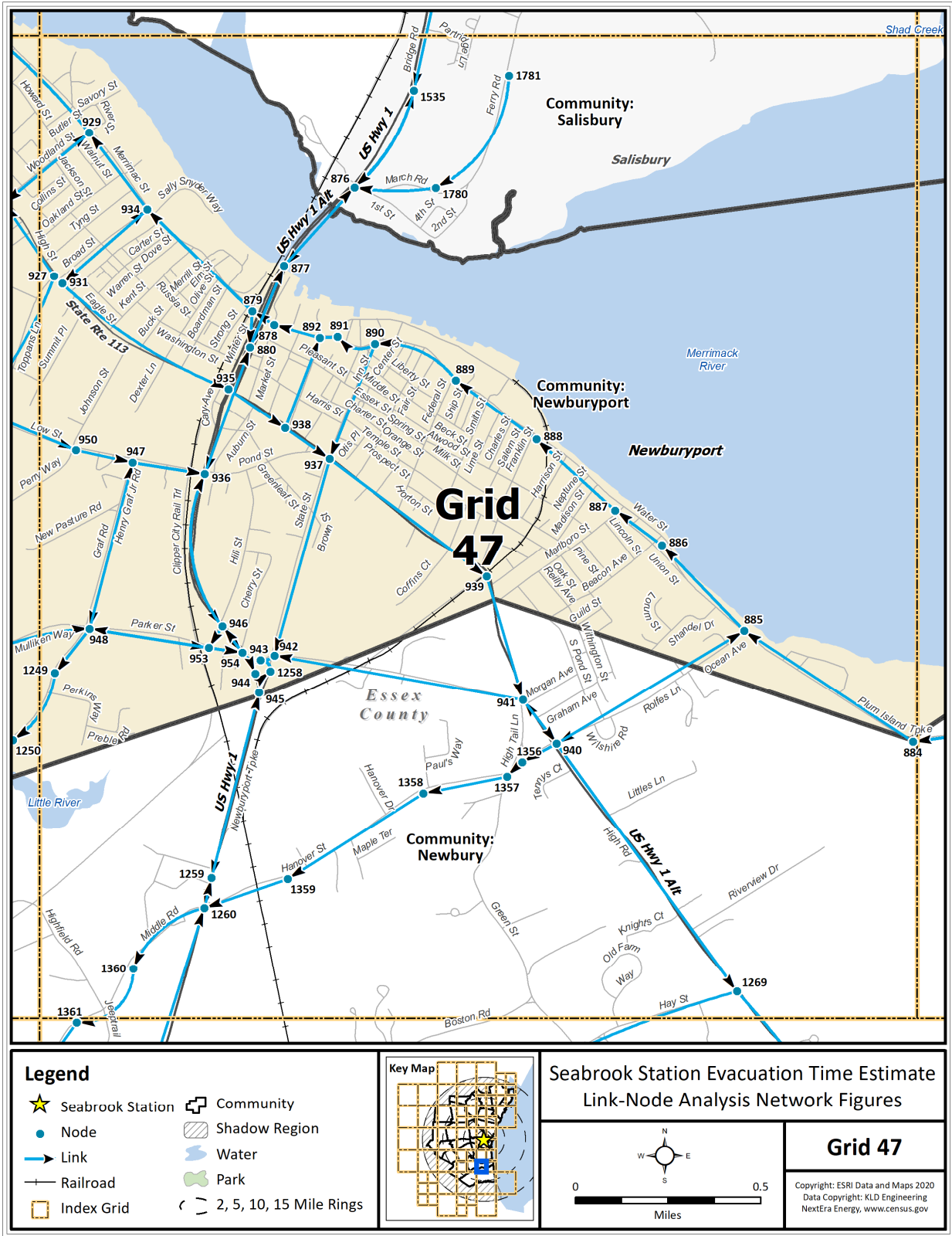


Figure K-48. Link-Node Analysis Network – Grid 47

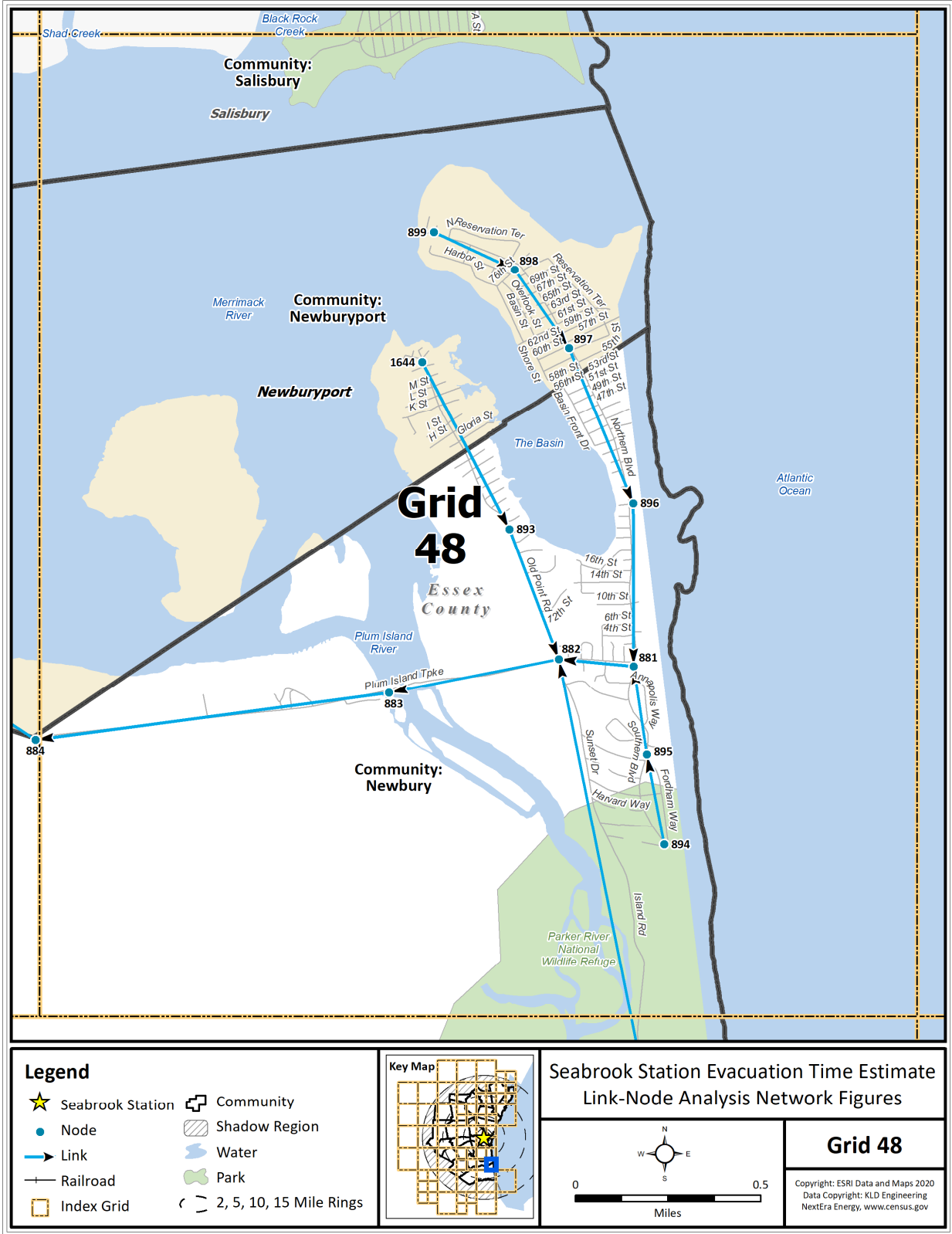


Figure K-49. Link-Node Analysis Network – Grid 48

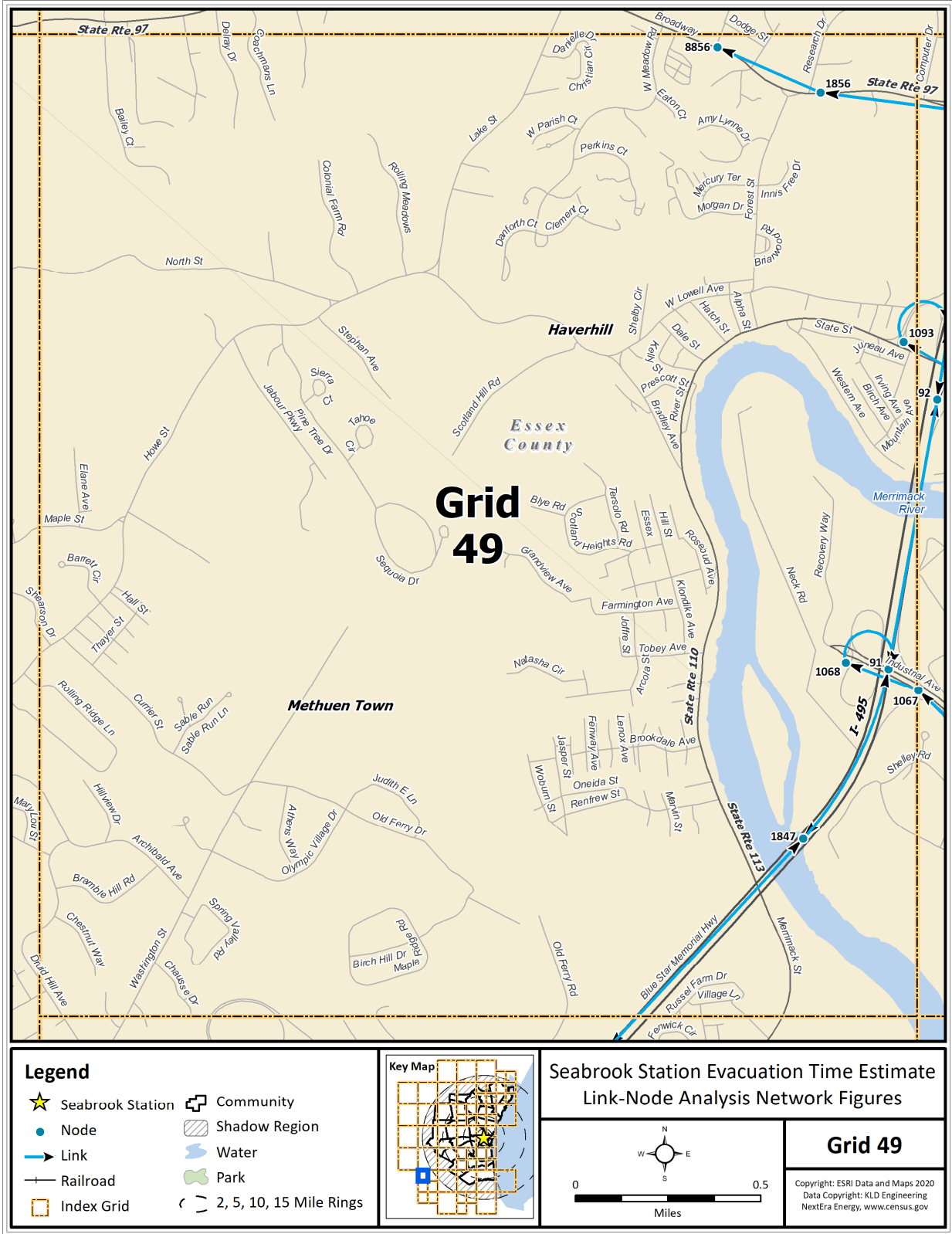


Figure K-50. Link-Node Analysis Network – Grid 49

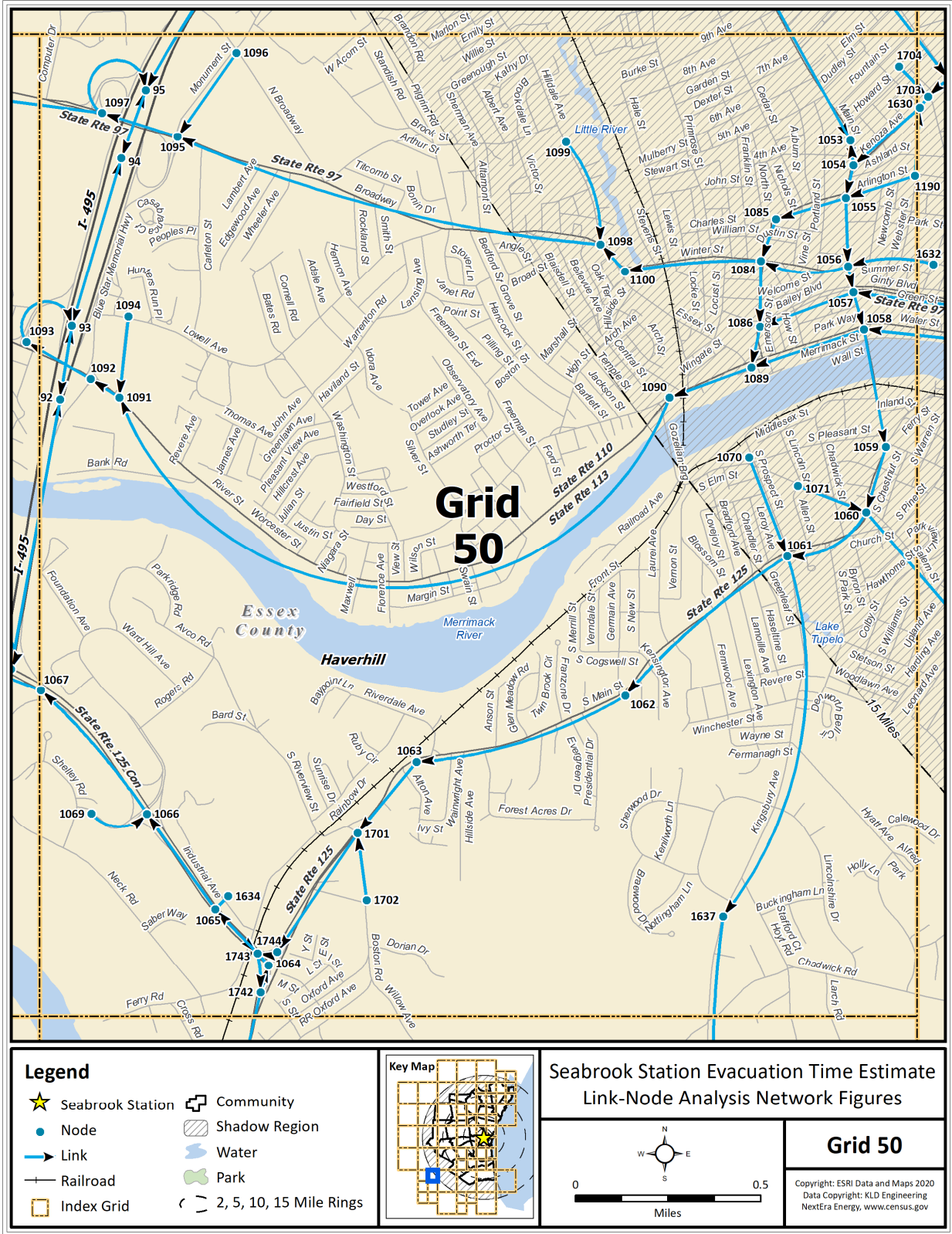


Figure K-51. Link-Node Analysis Network – Grid 50

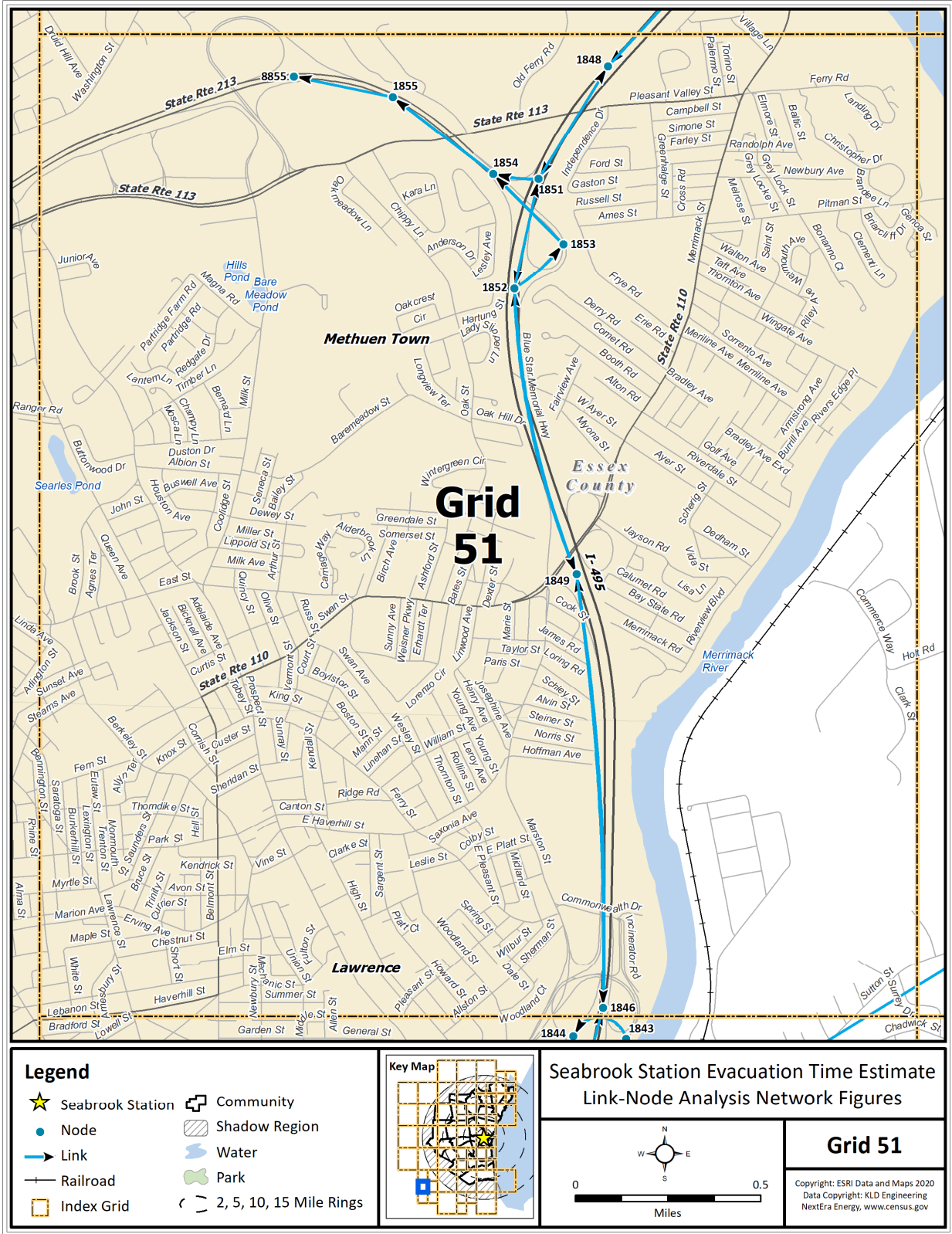


Figure K-52. Link-Node Analysis Network – Grid 51

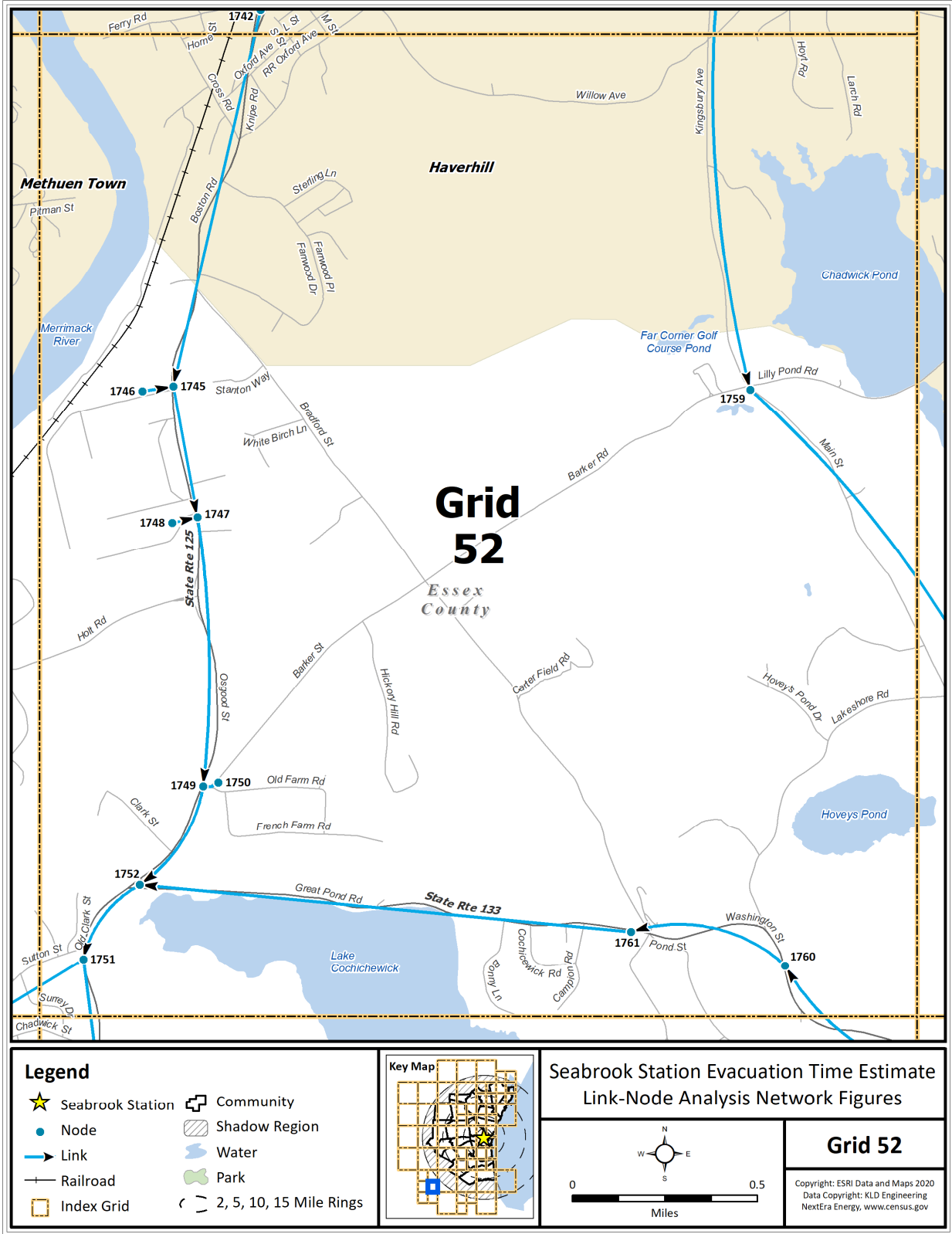


Figure K-53. Link-Node Analysis Network – Grid 52

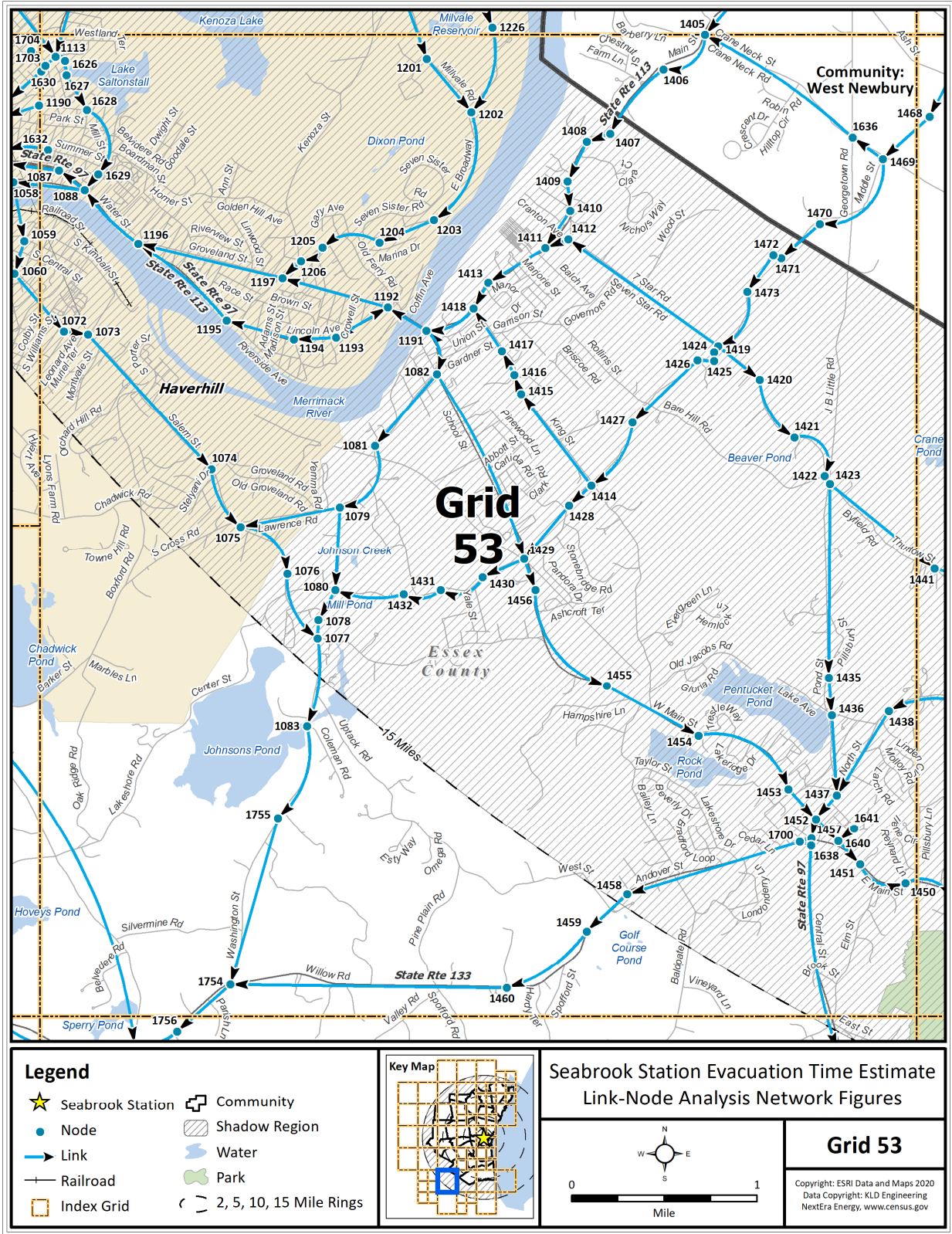


Figure K-54. Link-Node Analysis Network – Grid 53

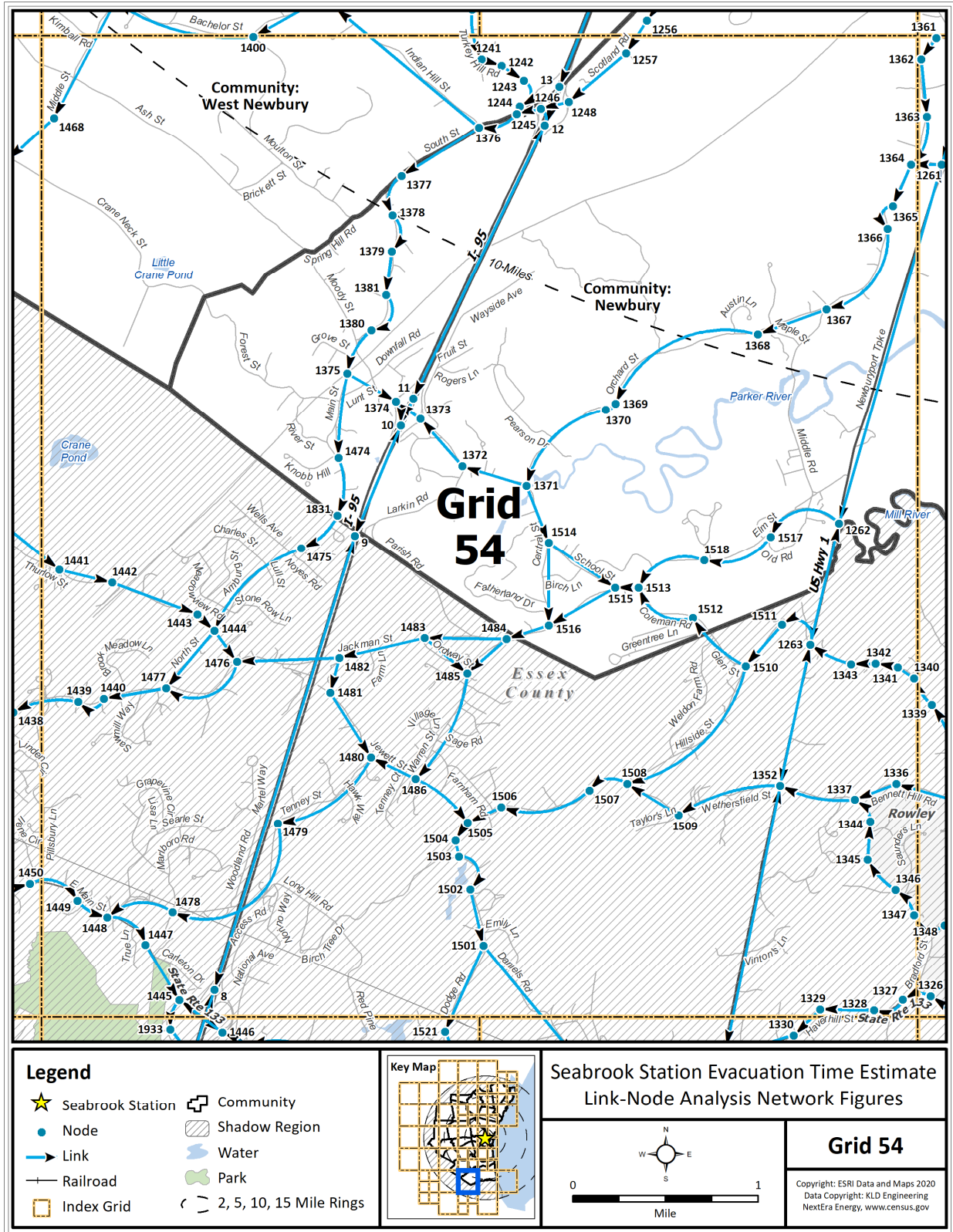


Figure K-55. Link-Node Analysis Network – Grid 54

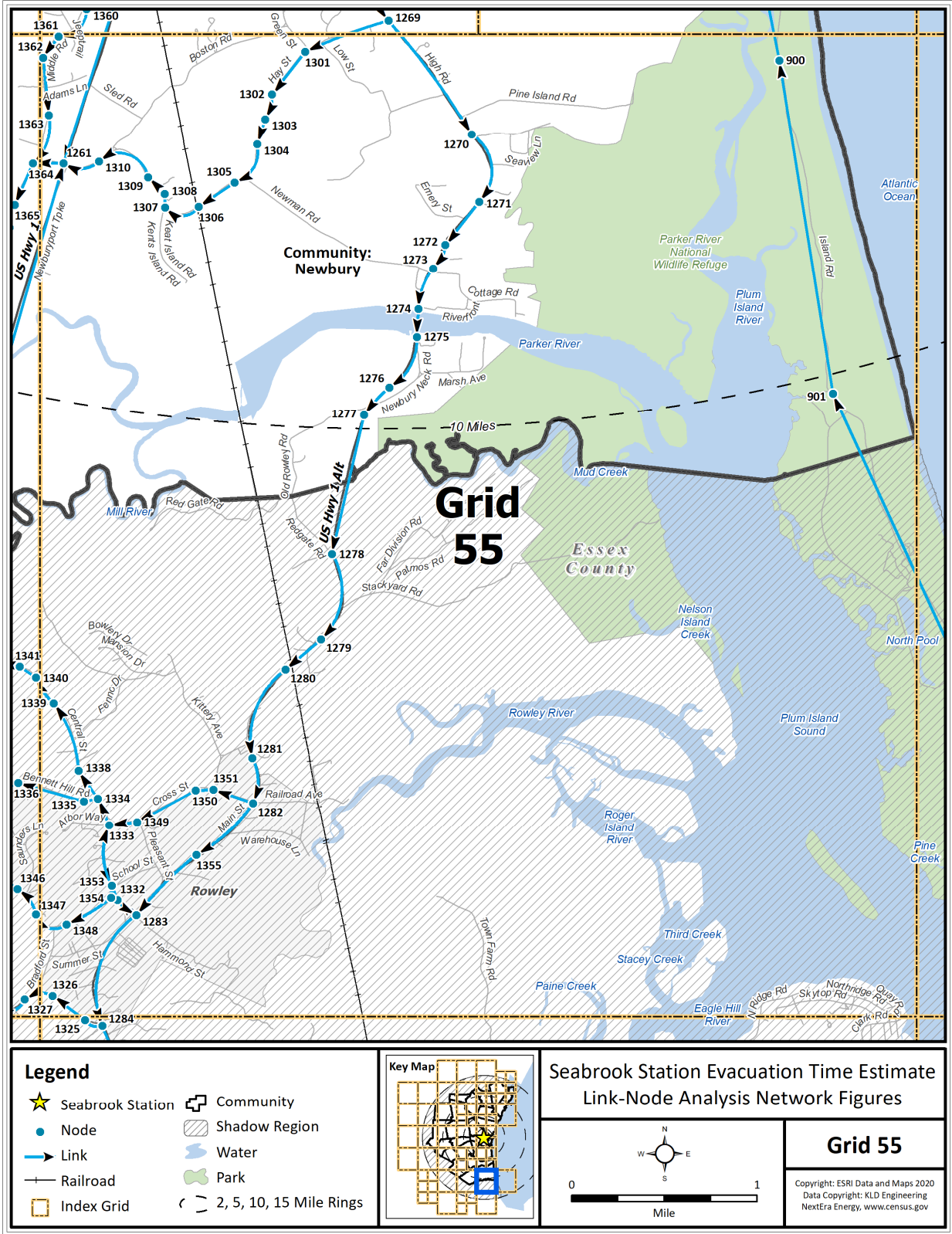


Figure K-56. Link-Node Analysis Network – Grid 55

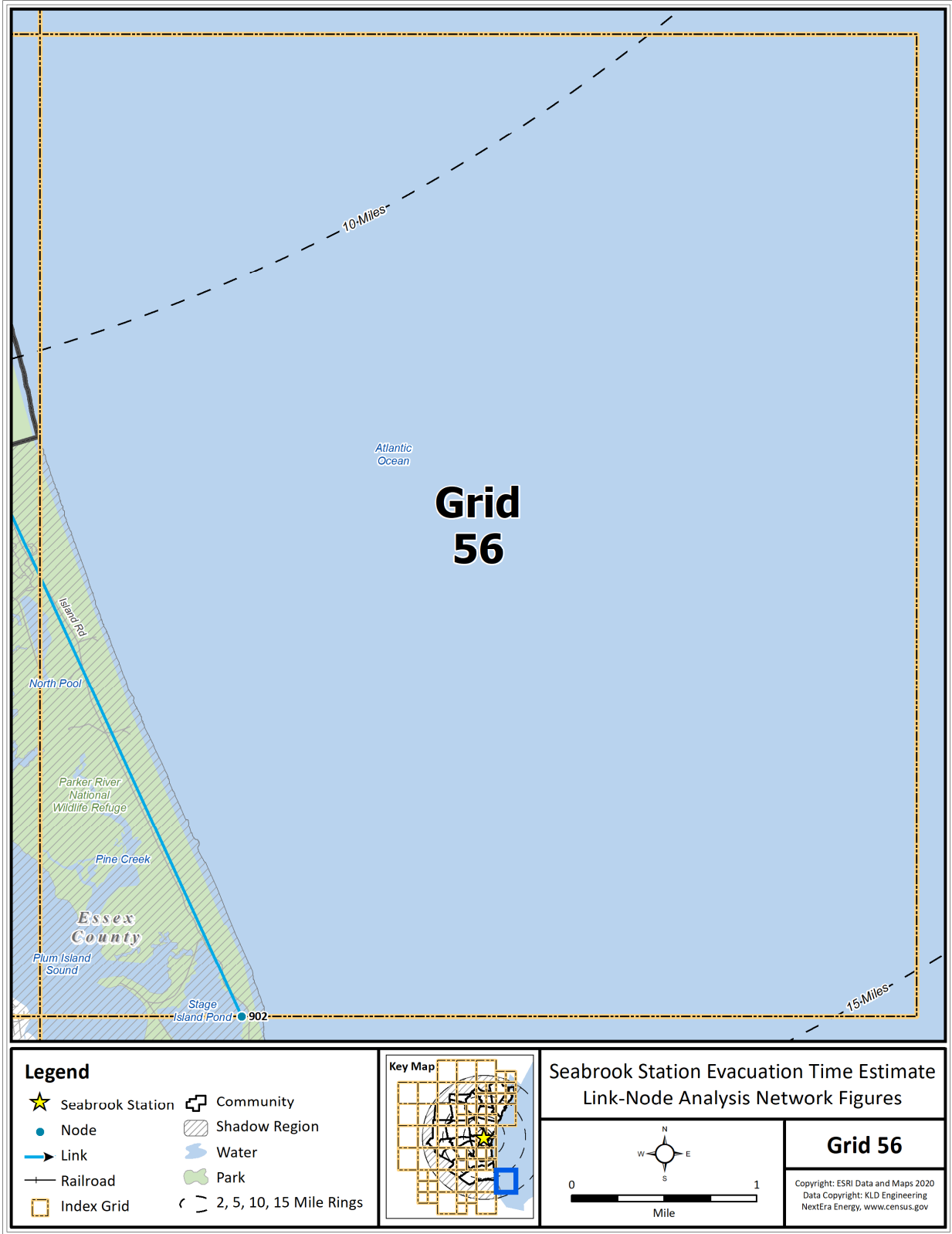


Figure K-57. Link-Node Analysis Network – Grid 56

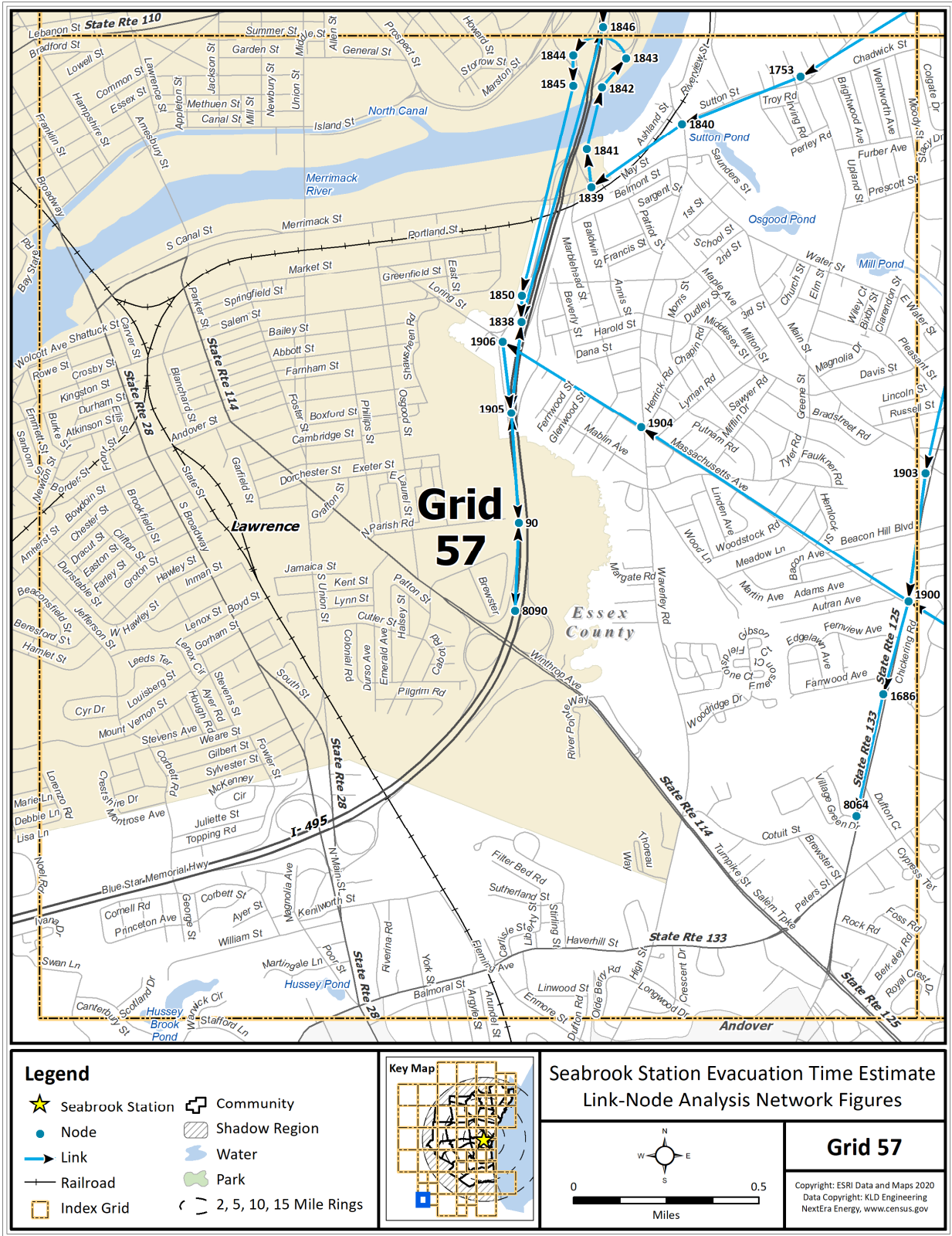


Figure K-58. Link-Node Analysis Network – Grid 57

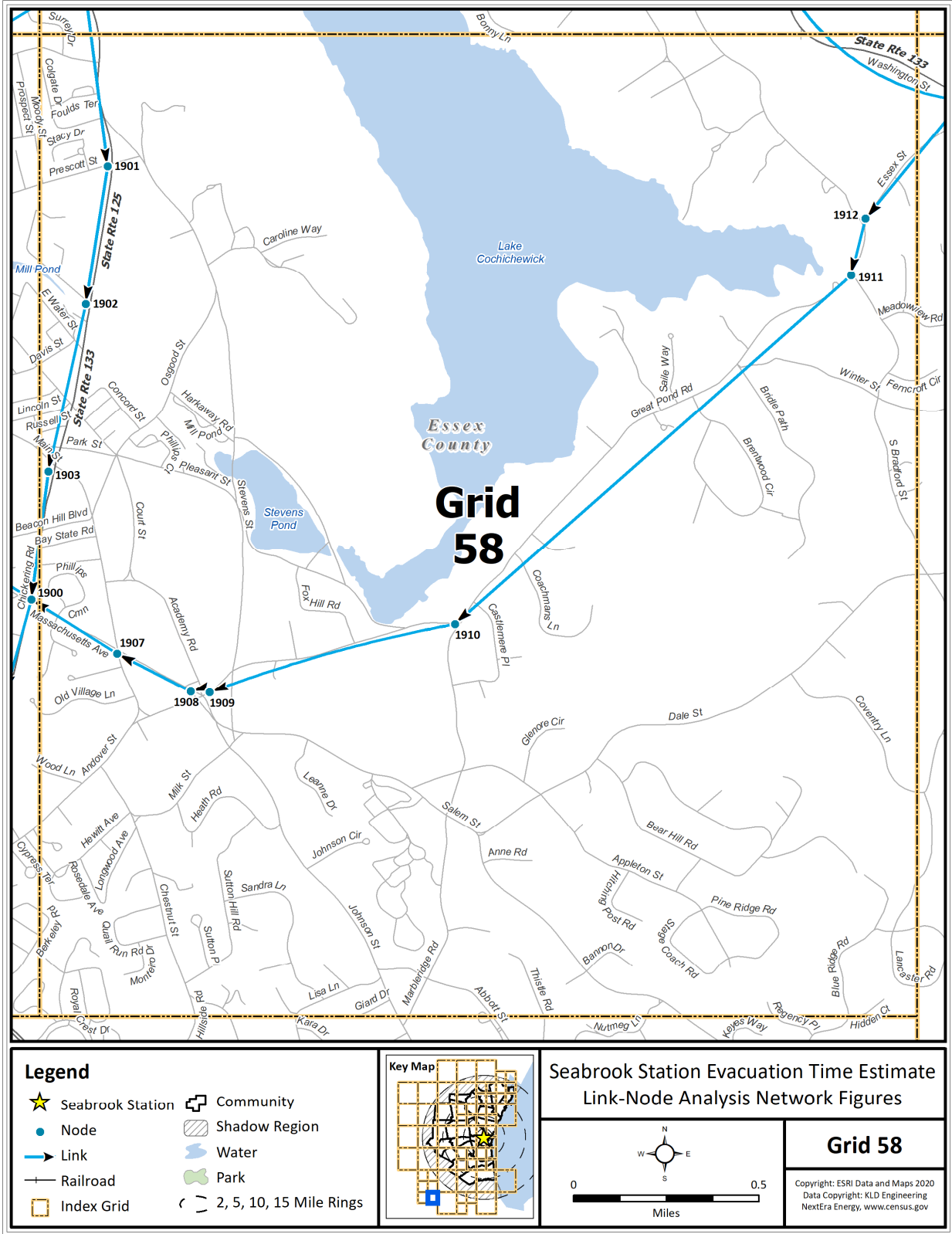


Figure K-59. Link-Node Analysis Network – Grid 58

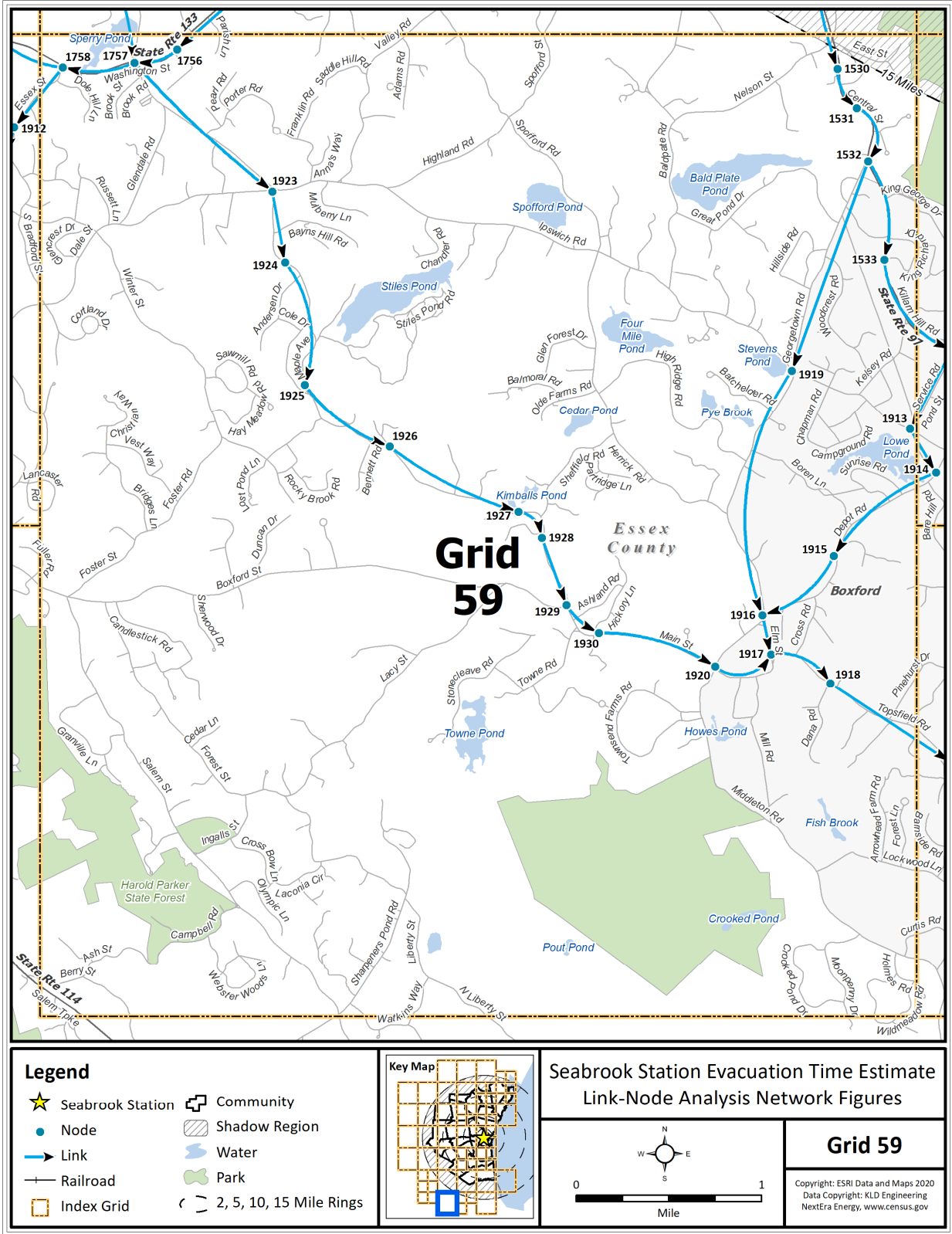


Figure K-60. Link-Node Analysis Network – Grid 59

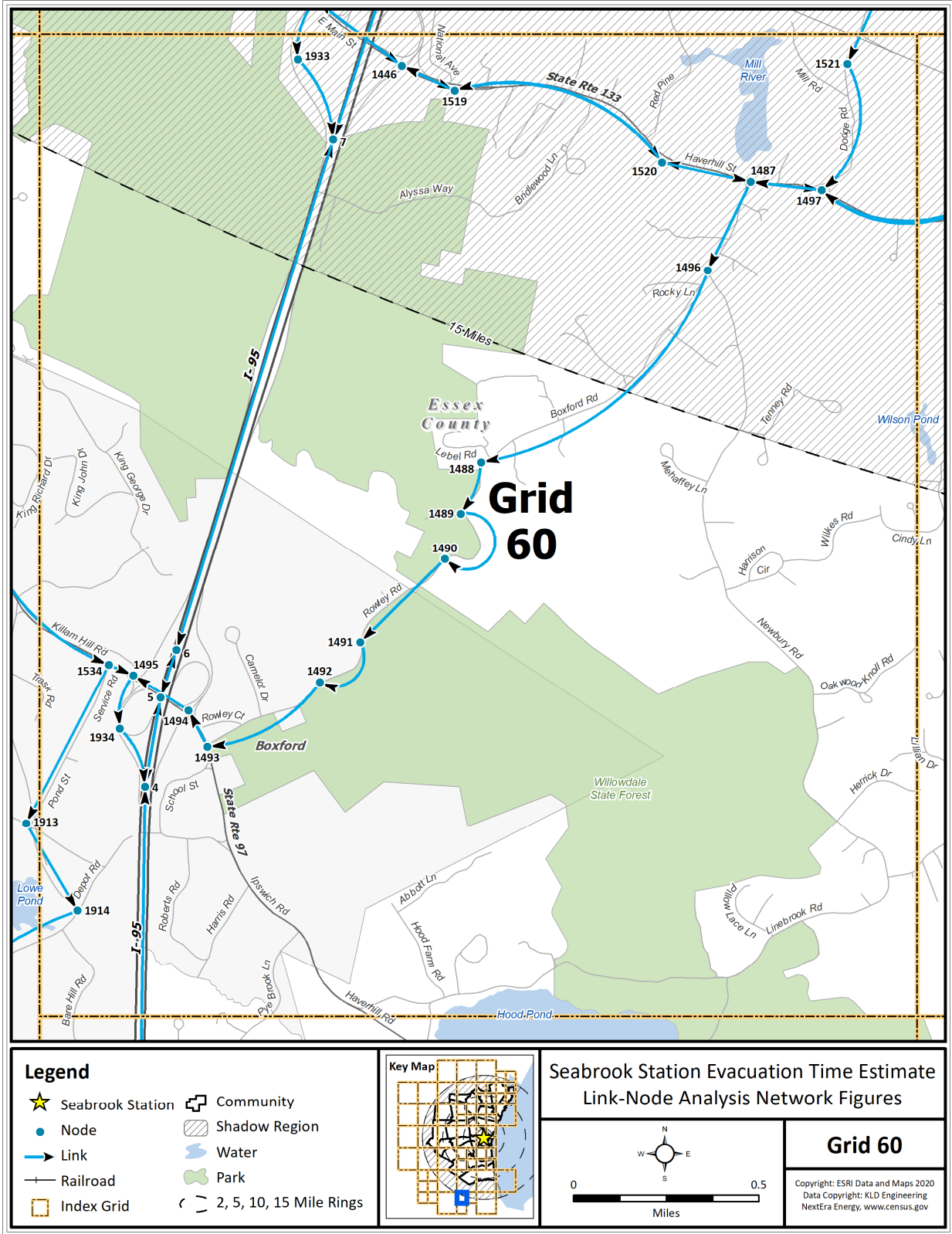


Figure K-61. Link-Node Analysis Network – Grid 60

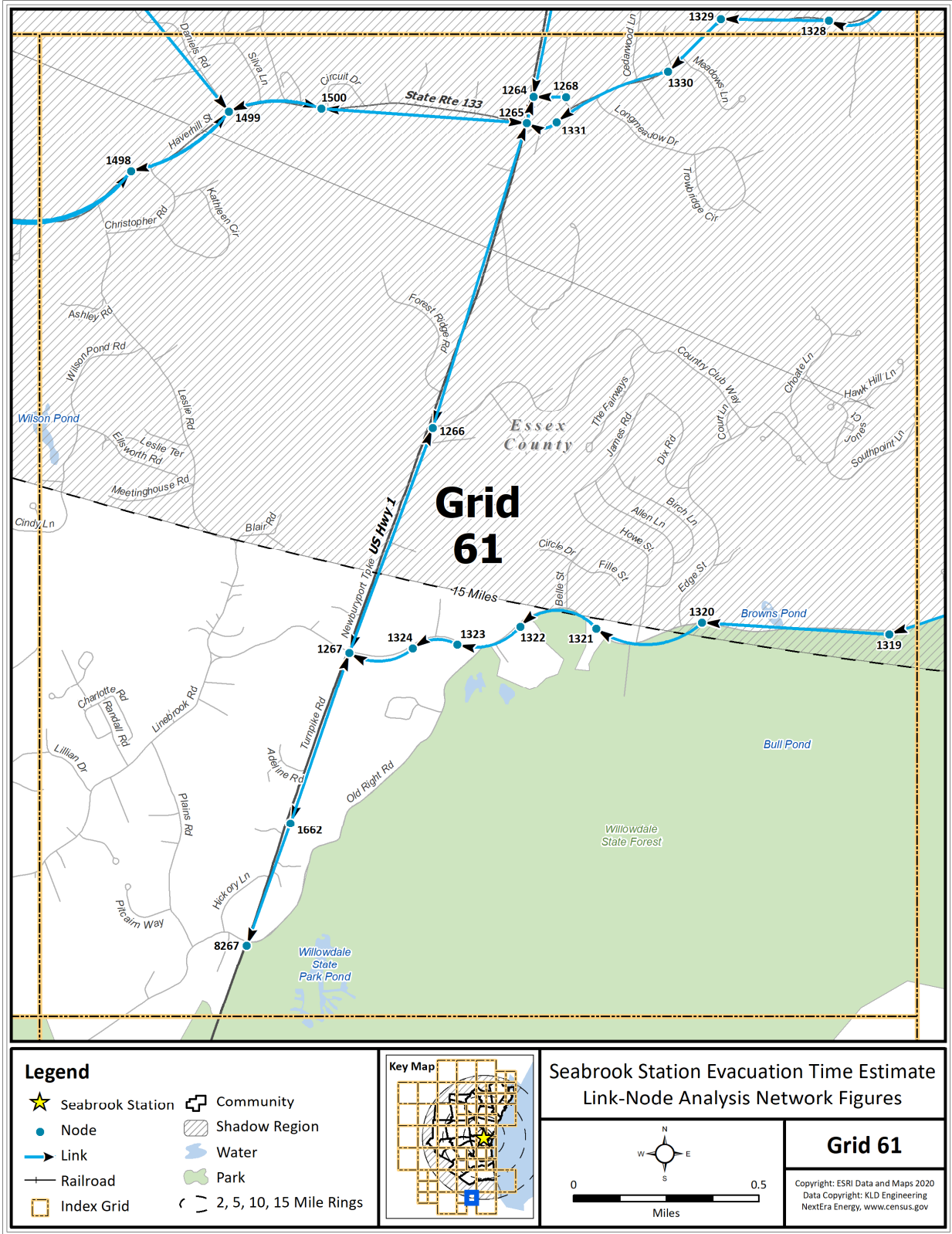


Figure K-62. Link-Node Analysis Network – Grid 61

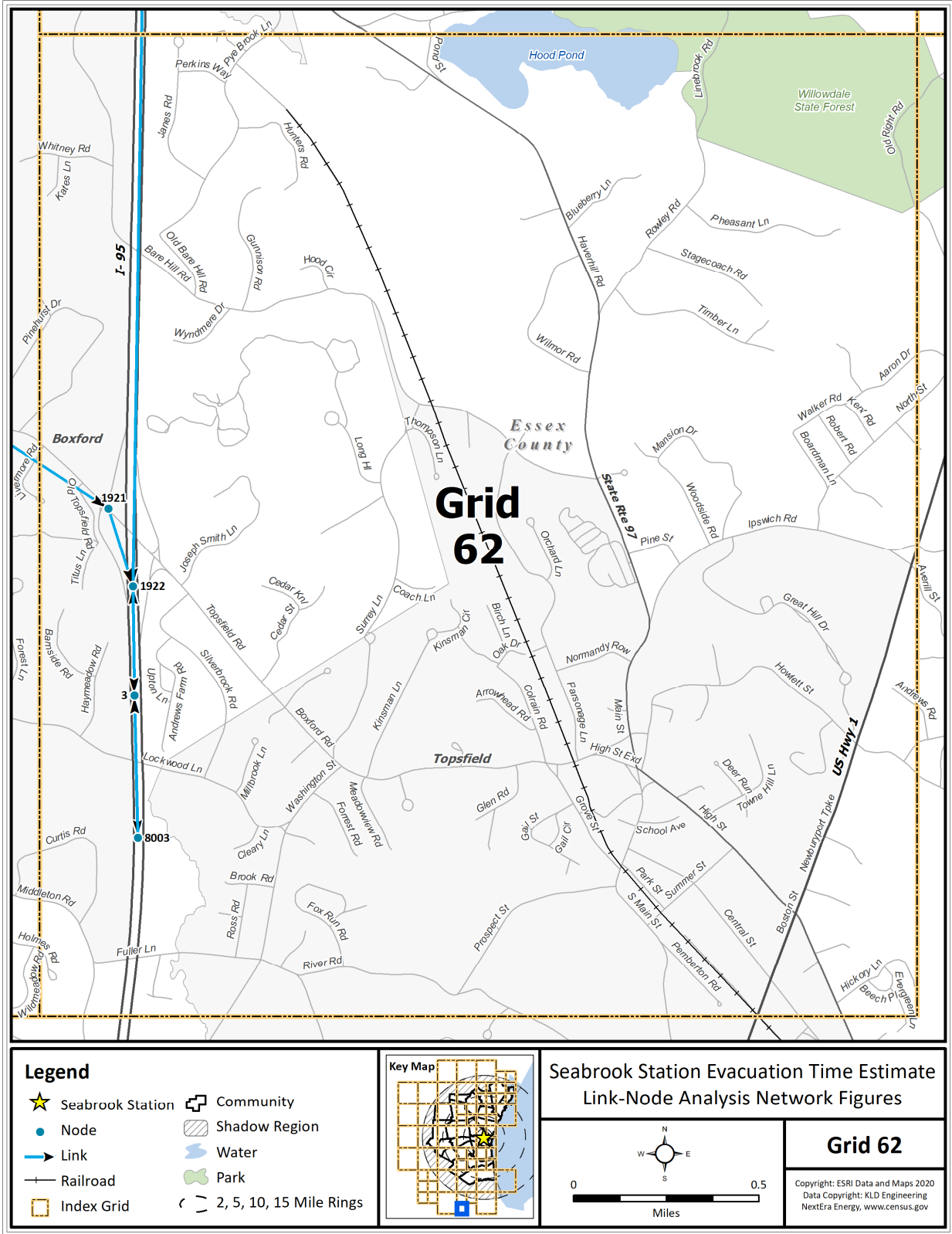


Figure K-63. Link-Node Analysis Network – Grid 62

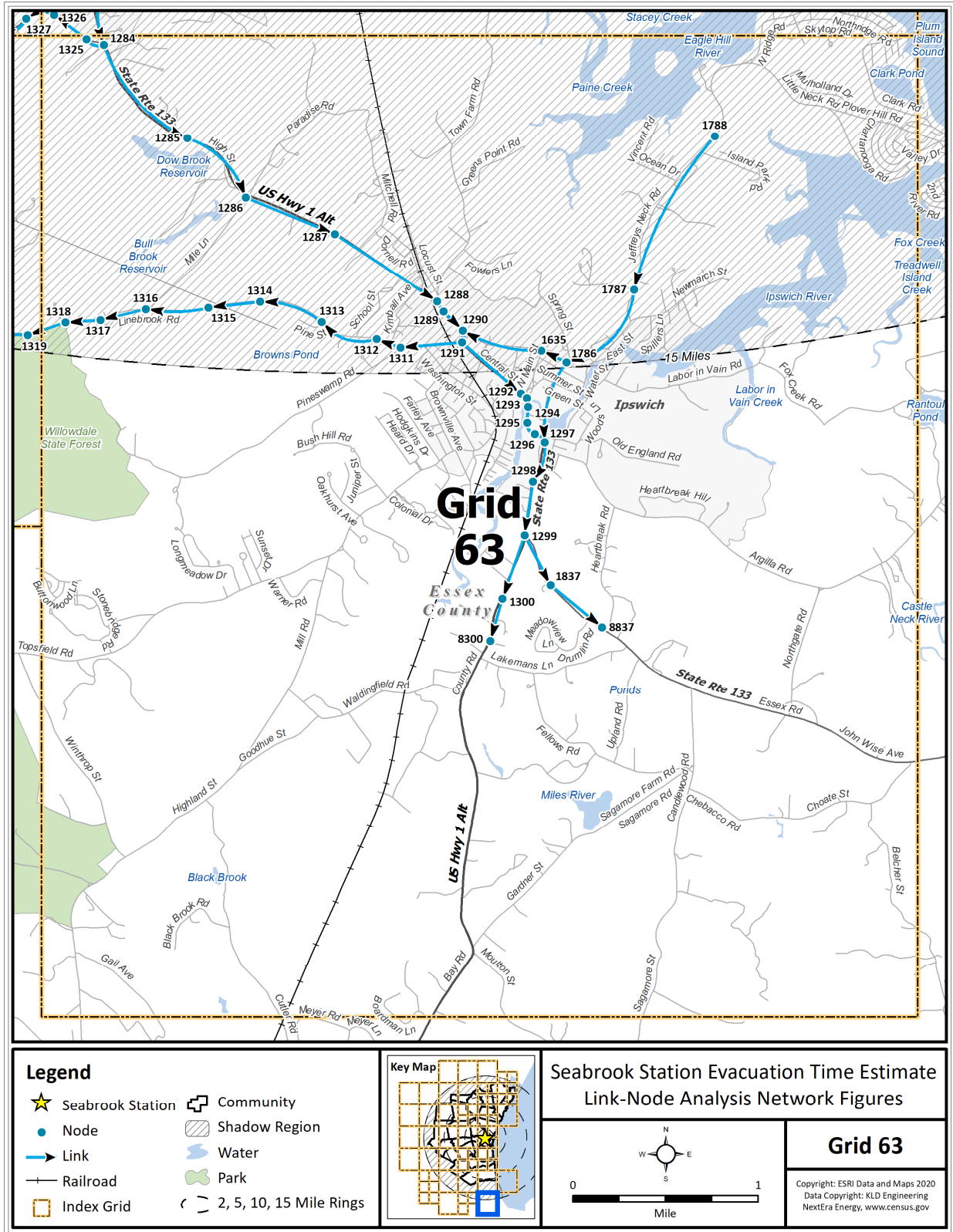


Figure K-64. Link-Node Analysis Network – Grid 63

APPENDIX L
ERPA Boundaries

L. ERPA BOUNDARIES

- ERPA A State: New Hampshire
Comprised of the following Communities: Seabrook and Hampton Falls
- ERPA B State: Massachusetts
Comprised of the following Communities: Amesbury and Salisbury
- ERPA C State: New Hampshire
Comprised of the following Communities: Kensington and South Hampton
- ERPA D State: New Hampshire
Comprised of the following Communities: Hampton and North Hampton
- ERPA E State: Massachusetts
Comprised of the following Communities: Merrimac, Newburyport, Newbury, and West Newbury
- ERPA F State: New Hampshire
Comprised of the following Communities: Brentwood, East Kingston, Exeter, Newfields, Newton, and Kingston
- ERPA G State: New Hampshire
Comprised of the following Communities: Greenland, Stratham, Rye, New Castle, and Portsmouth

APPENDIX M

Evacuation Sensitivity Studies

M. EVACUATION SENSITIVITY STUDIES

This appendix presents the results of a series of sensitivity analyses. These analyses are designed to identify the sensitivity of the ETE to changes in some base evacuation conditions.

M.1 Effect of Changes in Trip Generation Time

A sensitivity study was performed to determine whether changes in the estimated trip generation time have an effect on the ETE for the entire EPZ. Specifically, if the tail of the mobilization distribution were truncated (i.e., if those who responded most slowly to the ATE, could be persuaded to respond much more rapidly), or if the tail were elongated (i.e., spreading out the departure of evacuees to limit the demand during peak times) how would the ETE be affected? The case considered was Scenario 1, Region 3; a summer, midweek, midday, with good weather evacuation of the entire EPZ. Table M-1 presents the results of this study.

If evacuees mobilize one hour quicker, the 90th percentile ETE is reduced by 5 minutes and the 100th percentile ETE is reduced by 15 minutes – both not significant changes. If evacuees mobilize one hour slower, both the 90th and 100th percentile ETEs are increased by 5 minutes each – not a significant change.

As discussed in Section 7.3, traffic congestion within the full EPZ clears (i.e., all highways within EPZ operate at Level of Service A) at 6 hours and 5 minutes after the ATE, 65 minutes after the completion of trip generation time. As such, congestion dictates the 90th and 100th percentile ETEs rather than trip generation time and changes in trip generation time have minimal impact to ETE. See Table M-1.

M.2 Effect of Changes in the Number of People in the Shadow Region Who Relocate

A sensitivity study was conducted to determine the effect on ETE of changes in the percentage of people who decide to relocate from the Shadow Region. The case considered was Scenario 1, Region 3; a summer, midweek, midday, with good weather evacuation of the entire EPZ. The movement of people in the Shadow Region has the potential to impede vehicles evacuating from an Evacuation Region within the EPZ. Refer to Sections 3.2 and 7.1 for additional information on population within the Shadow Region.

Table M-2 presents the ETE for each of the cases considered. The results show that eliminating (0%) shadow evacuation reduces the 90th percentile ETE by 5 minutes and the 100th percentile ETE by 30 minutes. Doubling (40%) the shadow evacuation has no effect on the 90th percentile ETE and increases the 100th by 35 minutes. Tripling (60%) the shadow evacuation increases the 90th and 100th percentile ETEs by 10 minutes and 1 hour and 25 minutes, respectively. Quadrupling (80%) the shadow percentage increases the 90th percentile ETE by 15 minutes and the 100th percentile ETE is increased by 2 hours and 55 minutes. A full evacuation (100%) of the Shadow Region increases the 90th percentile ETE by 15 minutes and the 100th percentile ETE by 4 hours. The results show that shadow evacuation has only a slight impact on the 90th percentile ETE while it has a significant impact on the 100th percentile ETE.

Note the demographic survey results presented in Appendix F indicate that about 16% of households would elect to evacuate if advised to shelter, which is slightly lower than the base assumption of 20% non-compliance suggested in the NUREG/CR-7002, Rev. 1. A sensitivity study was run using 16% shadow evacuation and the 90th percentile ETE was reduced by 5 minutes (not a significant change) and 100th percentile ETE remained the same.

There is significant traffic congestion in the EPZ during an evacuation. The Shadow Region is heavily populated within the major population centers outside the EPZ – Haverhill, Kittery, and the outskirts of Dover. Therefore, the ETE is very sensitive to any addition in the number shadow evacuees. Care should be given on the evacuation shadow percentage during an emergency. The general public should be educated to only evacuate if they are told to so.

M.3 Effect of Changes in EPZ Resident Population

A sensitivity study was conducted to determine the effect on ETE of changes in the resident population within the study area (EPZ plus Shadow Region). As population in the study area changes over time, the time required to evacuate the public may increase, decrease, or remain the same. Since the ETE is related to the demand to capacity ratio present within the study area, changes in population will cause the demand side of the equation to change and could impact ETE.

As per the NRC's response to the Emergency Planning Frequently Asked Question (EPFAQ) 2013-001, the ETE population sensitivity study must be conducted to determine what percentage increase in permanent resident population causes an increase in the 90th percentile ETE of 25% or 30 minutes, whichever is less. The sensitivity study must use the scenario with the longest 90th percentile ETE (excluding the roadway impact scenario and the special event scenario if it is a one day per year special event).

Thus, the sensitivity study was conducted using the following planning assumptions:

1. The percent change in the permanent resident population within the study area was increased by up to 17%. Changes in population were applied to permanent residents only (as per federal guidance), in both the EPZ and in the Shadow Region.
2. The transportation infrastructure (as presented in Appendix K) remained fixed; the presence of future proposed roadway changes and/or highway capacity improvements was not considered.
3. The study was performed for the 2-Mile Region (R01), 5-Mile Region (R02), and the entire EPZ (R03).
4. The scenario (excluding roadway impact and special event) with yielded the longest 90th percentile ETE values was selected as the case to be considered in this sensitivity study (Scenario 8 – winter, midweek, midday, with heavy snow).

Table M-3 presents the results of the sensitivity study. Section IV of Appendix E to 10 CFR Part 50, and NUREG/CR-7002, Rev. 1, Section 5.4, require licensees to provide an updated ETE analysis to the NRC when a population increase within the EPZ causes the longest 90th percentile ETE values (for the 2-Mile Region, 5-Mile Region or entire EPZ) to increase by 25% or

30 minutes, whichever is less. All base ETE values are at least 2 hours; thus, 25% of these base ETE is always greater than 30 minutes. Therefore, 30 minutes is the lesser and is the criterion for updating.

Those percent population changes which result in 90th percentile ETE changes greater than or equal to 30 minutes are highlighted in red in Table M-3 – a 17% or greater increase in the EPZ permanent resident population (includes 20% of the Shadow Region permanent resident population). NextEra Energy will have to estimate the EPZ population on an annual basis. If the EPZ population increases by 17% or more, an updated ETE analysis will be needed.

M.4 Effect of Changes in Average Household Size

As discussed in Appendix F, the average household size obtained from the demographic survey results was 2.75 people per household. The difference between the Census data (2.34 people per household) and survey data is 17.5%, which exceeds the sampling error of 5.23%. It was decided to use the results from the demographic survey (2.75) for the ETE study. A sensitivity study was performed to determine how sensitive the ETE is to changes in the average household size. It should be noted that only resident and shadow vehicles were changed for this sensitivity study. The case considered was Scenario 1, a summer, midweek, midday, with good weather evacuation of the 2-Mile Region, 5-Mile Region, and entire EPZ. Table M-4 presents the results of this study.

Decreasing the average household size (increasing the total number of evacuating vehicles) by about 17.5% increases the 90th percentile ETE by at most 25 minutes (Region R03) and increases the 100th percentile ETE by at most 45 minutes (Region R03) – a significant change. As stated above in Section M.2, the ETE is sensitive to the change in the number of evacuating vehicles, including the number of evacuating vehicles inside the EPZ. Any increase in vehicles could significantly impact the ETE. Public outreach and education of the public on the need to evacuate as a family in a single vehicle to decrease the demand on the roadways should be considered.

M.5 Enhancements in Evacuation Time

This appendix documents sensitivity studies on critical variables that could impact ETE. Possible improvements to ETE are further discussed below:

- Prolonging the trip generation time by an hour increases both the 90th and 100th percentile ETEs by 5 minutes – not a significant change. Reducing the trip generation time does not result in a significant change at the 90th or 100th percentile ETE (at most 15 minutes). The ETE is primarily dictated by congestion and changes in the time to mobilize will do little to reduce the ETE (Section M.1).
- Increasing the percent shadow evacuation can have a significant impact on ETE (Section M.2). Public outreach should be considered to inform those people within the EPZ (and potentially beyond the EPZ) that if they are not advised to evacuate, they should not, otherwise adversely impacting evacuees from within the EPZ affecting the ETE.

- Population growth results in more evacuating vehicles which could significantly increase ETE (Section M.3). Public outreach to inform those people within the EPZ to evacuate as a family in a single vehicle would reduce the number of evacuating vehicles and could reduce ETE or offset the impact of population growth.

Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study

Trip Generation Period	Evacuation Time Estimate for Entire EPZ	
	90 th Percentile	100 th Percentile
4 Hours	4:00	5:50
5 Hours (Base)	4:05	6:05
6 Hours	4:10	6:10

Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study

Percent Shadow Evacuation	Evacuating Shadow Vehicles ¹	Evacuation Time Estimate for Entire EPZ	
		90 th Percentile	100 th Percentile
0	0	4:00	5:35
16 (survey)	10,451	4:00	6:05
20 (Base)	13,422	4:05	6:05
40	26,844	4:05	6:40
60	53,688	4:15	7:30
80	80,532	4:20	9:00
100	107,376	4:20	10:05

¹ The Evacuating Shadow Vehicles, in Table M-2, represent the residents and employees who will spontaneously decide to relocate during the evacuation. The basis, for the base values shown, is a 20% relocation of shadow residents along with a proportional percentage of shadow employees. See Section 6 for further discussion.

Table M-3. ETE Variation with Population Change

EPZ and 20% Shadow Permanent Resident Population	Base	Population Change		
		15%	16%	17%
	194,027	223,131	225,071	227,012
ETE (hrs:min) for the 90 th Percentile				
Region	Base	Population Change		
		15%	16%	17%
2-MILE	2:25	2:25	2:25	2:25
5-MILE	3:05	3:15	3:15	3:15
FULL EPZ	4:50	5:10	5:15	5:20
ETE (hrs:min) for the 100 th Percentile				
Region	Base	Population Change		
		15%	16%	17%
2-MILE	6:05	6:05	6:05	6:05
5-MILE	6:10	6:15	6:15	6:15
FULL EPZ	6:30	7:35	7:35	8:00

Table M-4. ETE Results for the Change in Average Household Size

EPZ and 20% Shadow Permanent Resident Vehicles	Base Case Average Household Size (2.75 people per household)		Sensitivity Case Average Household Size (2.34 people per household)	
	98,780	Vehicles	116,088	Vehicles
ETE for the 90 th Percentile				
Region	Base Case		Sensitivity Case	
2-MILE	2:10		2:10	
5-MILE	2:45		3:00	
FULL EPZ	4:05		4:30	
ETE for the 100 th Percentile				
Region	Base Case		Sensitivity Case	
2-MILE	5:00		5:05	
5-MILE	5:05		5:15	
FULL EPZ	6:05		6:50	

APPENDIX N

ETE Criteria Checklist

N. ETE CRITERIA CHECKLIST

Table N-1. ETE Review Criteria Checklist

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
1.0 Introduction		
a. The emergency planning zone (EPZ) and surrounding area is described.	Yes	Section 1
b. A map is included that identifies primary features of the site including major roadways, significant topographical features, boundaries of counties, and population centers within the EPZ.	Yes	Figures 1-1, 3-1, 6-1
c. A comparison of the current and previous ETE is provided including information similar to that identified in Table 1-1, "ETE Comparison."	Yes	Table 1-3
1.1 Approach		
a. The general approach is described in the report as outlined in Section 1.1, "Approach."	Yes	Section 1.1, Section 1.3, Appendix D, Table 1-1
1.2 Assumptions		
a. Assumptions consistent with Table 1-2, "General Assumptions," of NUREG/CR-7002 are provided and include the basis to support use.	Yes	Section 2
1.3 Scenario Development		
a. The scenarios in Table 1-3, "Evacuation Scenarios," are developed for the ETE analysis. A reason is provided for use of other scenarios or for not evaluating specific scenarios.	Yes	Section 6, Table 6-3

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
1.4 Evacuation Planning Areas		
a. A map of the EPZ with emergency response planning areas (ERPAs) is included.	Yes	Figure 3-1, Figure 6-1
1.4.1 Keyhole Evacuation		
a. A table similar to Table 1-4 “Evacuation Areas for a Keyhole Evacuation”, is provided identifying the ERPAs considered for each ETE calculation by downwind direction.	Yes	Table 6-2, Table 7-6, Table H-2
1.4.2 Staged Evacuation		
a. The approach used in development of a staged evacuation is discussed.	Yes	Section 7.2
b. A table similar to Table 1-5, “Evacuation Areas for a Staged Evacuation,” is provided for staged evacuations identifying the ERPAs considered for each ETE calculation by downwind direction.	Yes	Table 6-2, Table 7-6, Table H-2
2.0 Demand Estimation		
a. Demand estimation is developed for the four population groups (permanent residents of the EPZ, transients, special facilities, and schools).	Yes	Section 3
2.1 Permanent Residents and Transient Population		
a. The U.S. Census is the source of the population values, or another credible source is provided.	Yes	Section 3.1
b. The availability date of the census data is provided.	Yes	Section 3.1
c. Population values are adjusted as necessary for growth to reflect population estimates to the year of the ETE.	Yes	N/A - 2020 used as the base year of the analysis

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
d. A sector diagram, similar to Figure 2-1, "Population by Sector," is included showing the population distribution for permanent residents.	Yes	Figure 3-2
2.1.1 Permanent Residents with Vehicles		
a. The persons per vehicle value is between 1 and 3 or justification is provided for other values.	Yes	Section 3.1
2.1.2 Transient Population		
a. A list of facilities that attract transient populations is included, and peak and average attendance for these facilities is listed. The source of information used to develop attendance values is provided.	Yes	Section 3.3, Table E-6 through Table E-11
b. Major employers are listed.	Yes	Section 3.4, Table E-5
c. The average population during the season is used, itemized and totaled for each scenario.	Yes	Table 3-4, Table 3-5 and Appendix E itemize the peak transient population and employee estimates. These estimates are multiplied by the scenario specific percentages provided in Table 6-4 to estimate average transient population by scenario – see Table 6-5.
d. The percentage of permanent residents assumed to be at facilities is estimated.	Yes	Section 3.3 and Section 3.4
e. The number of people per vehicle is provided. Numbers may vary by scenario, and if so, reasons for the variation are discussed.	Yes	Section 3.3 and Section 3.4

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
f. A sector diagram is included, similar to Figure 2-1, "Population by Sector", is included showing the population distribution for the transient population.	Yes	Figure 3-6 (transients) and Figure 3-8 (employees)
2.2 Transit Dependent Permanent Residents		
a. The methodology (e.g., surveys, registration programs) used to determine the number of transit dependent residents is discussed.	Yes	Section 3.6
b. The State and local evacuation plans for transit dependent residents are used in the analysis.	Yes	Section 8.1
c. The methodology used to determine the number of people with disabilities and those with access and functional needs who may need assistance and do not reside in special facilities is provided. Data from local/county registration programs are used in the estimate.	Yes	Section 3.9
d. Capacities are provided for all types of transportation resources. Bus seating capacity of 50 percent is used or justification is provided for higher values.	Yes	Item 3 of Section 2.4
e. An estimate of the transit dependent population is provided.	Yes	Section 3.6, Table 3-7, Table 3-13
f. A summary table showing the total number of buses, ambulances, or other transport assumed available to support evacuation is provided. The quantification of resources is detailed enough to ensure that double counting has not occurred.	Yes	Table 3-14, Table 8-1

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
2.3 Special Facility Residents		
a. Special facilities, including the type of facility, location, and average population, are listed. Special facility staff is included in the total special facility population.	Yes	Table E-4 lists all medical facilities by facility name, location, and average population. Staff estimates were not provided.
b. The method of obtaining special facility data is discussed.	Yes	Section 3.5
c. An estimate of the number and capacity of vehicles assumed available to support the evacuation of the facility is provided.	Yes	Table 3-6
d. The logistics for mobilizing specially trained staff (e.g., medical support or security support for prisons, jails, and other correctional facilities) are discussed when appropriate.	Yes	Section 8.1 – under Evacuation of Medical Facilities Correctional Facilities within the EPZ shelter in place
2.4 Schools		
a. A list of schools including name, location, student population, and transportation resources required to support the evacuation, is provided. The source of this information should be identified.	Yes	Table 3-8 through Table 3-10, Table E-1 through Table E-3, Section 3.7
b. Transportation resources for elementary and middle schools are based on 100 percent of the school capacity.	Yes	Section 3.7
c. The estimate of high school students who will use personal vehicle to evacuate is provided and a basis for the values used is given.	Yes	Section 3.7
d. The need for return trips is identified.	Yes	Section 8.1

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
2.5 Other Demand Estimate Considerations		
2.5.1 Special Events		
a. A complete list of special events is provided including information on the population, estimated duration, and season of the event.	Yes	Section 3.8
b. The special event that encompasses the peak transient population is analyzed in the ETE.	Yes	Section 3.8
c. The percentage of permanent residents attending the event is estimated.	Yes	Section 3.8
2.5.2 Shadow Evacuation		
a. A shadow evacuation of 20 percent is included consistent with the approach outlined in Section 2.5.2, "Shadow Evacuation".	Yes	Item 7 of Section 2.2, Figure 2-1 and Figure 7-1, Section 3.2
b. Population estimates for the shadow evacuation in the shadow region beyond the EPZ are provided by sector.	Yes	Section 3.2, Table 3-3, Figure 3-4
c. The loading of the shadow evacuation onto the roadway network is consistent with the trip generation time generated for the permanent resident population.	Yes	Section 5 – Table 5-9 (footnote)
2.5.3 Background and Pass Through Traffic		
a. The volume of background traffic and pass-through traffic is based on the average daytime traffic. Values may be reduced for nighttime scenarios.	Yes	Section 3.10 and Section 3.11

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
b. The method of reducing background and pass-through traffic is described.	Yes	Section 2.2 – Assumptions 11 and 13 Section 2.5 Section 3.10 and Section 3.11 Table 6-4 – External Through Traffic footnote
c. Pass-through traffic is assumed to have stopped entering the EPZ about two (2) hours after the initial notification.	Yes	Section 2.5
2.6 Summary of Demand Estimation		
a. A summary table is provided that identifies the total populations and total vehicles used in the analysis for permanent residents, transients, transit dependent residents, special facilities, schools, shadow population, and pass-through demand in each scenario.	Yes	Table 3-13, Table 3-14, and Table 6-5
3.0 Roadway Capacity		
a. The method(s) used to assess roadway capacity is discussed.	Yes	Section 4
3.1 Roadway Characteristics		
a. The process for gathering roadway characteristic data is described including the types of information gathered and how it is used in the analysis.	Yes	Section 1.3, Appendix D
b. Legible maps are provided that identify nodes and links of the modeled roadway network similar to Figure A-1, “Roadway Network Identifying Nodes and Links,” and Figure A-2, “Grid Map Showing Detailed Nodes and Links.”	Yes	Appendix K

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
3.2 Model Approach		
a. The approach used to calculate the roadway capacity for the transportation network is described in detail, and the description identifies factors that are expressly used in the modeling.	Yes	Section 4
b. Route assignment follows expected evacuation routes and traffic volumes.	Yes	Appendix B and Appendix C
c. A basis is provided for static route choices if used to assign evacuation routes.	N/A	Static route choices are not used to assign evacuation routes. Dynamic traffic assignment is used.
d. Dynamic traffic assignment models are described including calibration of the route assignment.	Yes	Appendix B and Appendix C
3.3 Intersection Control		
a. A list that includes the total numbers of intersections modeled that are unsignalized, signalized, or manned by response personnel is provided.	Yes	Table K-1
b. The use of signal cycle timing, including adjustments for manned traffic control, is discussed.	Yes	Section 4, Appendix G
3.4 Adverse Weather		
a. The adverse weather conditions are identified.	Yes	Assumption 2 and 3 of Section 2.6
b. The speed and capacity reduction factors identified in Table 3-1, "Weather Capacity Factors," are used or a basis is provided for other values, as applicable to the model.	Yes	Table 2-3
c. The calibration and adjustment of driver behavior models for adverse weather conditions are described, if applicable.	N/A	Driver behavior is not adjusted for adverse weather conditions.

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
d. The effect of adverse weather on mobilization is considered and assumptions for snow removal on streets and driveways are identified, when applicable.	Yes	Table 2-3
4.0 Development of Evacuation Times		
4.1 Traffic Simulation Models		
a. General information about the traffic simulation model used in the analysis is provided.	Yes	Section 1.3, Table 1-3, Appendix B, Appendix C
b. If a traffic simulation model is not used to perform the ETE calculation, sufficient detail is provided to validate the analytical approach used.	N/A	Not applicable since a traffic simulation model was used.
4.2 Traffic Simulation Model Input		
a. Traffic simulation model assumptions and a representative set of model inputs are provided.	Yes	Section 2, Appendix J
b. The number of origin nodes and method for distributing vehicles among the origin nodes are described.	Yes	Appendix J, Appendix C
c. A glossary of terms is provided for the key performance measures and parameters used in the analysis.	Yes	Appendix A
4.3 Trip Generation Time		
a. The process used to develop trip generation times is identified.	Yes	Section 5
b. When surveys are used, the scope of the survey, area of the survey, number of participants, and statistical relevance are provided.	Yes	Appendix F
c. Data used to develop trip generation times are summarized.	Yes	Appendix F, Section 5

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
d. The trip generation time for each population group is developed from site-specific information.	Yes	Section 5
e. The methods used to reduce uncertainty when developing trip generation times are discussed, if applicable.	Yes	Appendix F
4.3.1 Permanent Residents and Transient Population		
a. Permanent residents are assumed to evacuate from their homes but are not assumed to be at home at all times. Trip generation time includes the assumption that a percentage of residents will need to return home before evacuating.	Yes	Section 5 discusses trip generation for households with and without returning commuters. Table 6-4 presents the percentage of households with returning commuters and the percentage of households either without returning commuters or with no commuters. Appendix F presents the percent households who will await the return of commuters. Section 2.3, Assumption 3
b. The trip generation time accounts for the time and method to notify transients at various locations.	Yes	Section 5
c. The trip generation time accounts for transients potentially returning to hotels before evacuating.	Yes	Section 5, Figure 5-1
d. The effect of public transportation resources used during special events where a large number of transients are expected is considered.	Yes	Section 3.8 Public Transportation is not provided for the special event and was therefore not considered.

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
4.3.2 Transit Dependent Permanent Residents		
a. If available, existing and approved plans and bus routes are used in the ETE analysis.	N/A	Established bus routes do not exist. Section 8.1 under Evacuation of Transit-Dependent Population
b. The means of evacuating ambulatory and non-ambulatory residents are discussed.	Yes	Section 8.1 under Evacuation of Transit-Dependent Population, Section 8.2
c. Logistical details, such as the time to obtain buses, brief drivers and initiate the bus route are used in the analysis.	Yes	Section 8.1, Figure 8-1
d. The estimated time for transit dependent residents to prepare and then travel to a bus pickup point, including the expected means of travel to the pickup point, is described.	Yes	Section 8.1 under Evacuation of Transit-Dependent Population
e. The number of bus stops and time needed to load passengers are discussed.	Yes	Section 8.1, Table 8-5 through Table 8-7
f. A map of bus routes is included.	Yes	Figure 10-2 through Figure 10-6
g. The trip generation time for non-ambulatory persons including the time to mobilize ambulances or special vehicles, time to drive to the home of residents, time to load, and time to drive out of the EPZ, is provided.	Yes	Section 8.2
h. Information is provided to support analysis of return trips, if necessary.	Yes	Section 8.1 and 8.2
4.3.3 Special Facilities		
a. Information on evacuation logistics and mobilization times is provided.	Yes	Section 2.4, Section 8.1, Table 8-8 through Table 8-10

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
b. The logistics of evacuating wheelchair and bed bound residents are discussed.	Yes	Section 8.1, Table 8-8 through Table 8-10
c. Time for loading of residents is provided.	Yes	Section 2.4, Section 8.1, Table 8-8 through Table 8-10
d. Information is provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed.	Yes	Section 8.1
e. Discussion is provided on whether special facility residents are expected to pass through the reception center before being evacuated to their final destination.	Yes	Section 8.1
f. Supporting information is provided to quantify the time elements for each trip, including destinations if return trips are needed.	Yes	Section 8.1
4.3.4 Schools		
a. Information on evacuation logistics and mobilization times is provided.	Yes	Section 2.4, Section 8.1, Table 8-2 through Table 8-4
b. Time for loading of students is provided.	Yes	Section 2.4, Section 8.1, Table 8-2 through Table 8-4
c. Information is provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed.	Yes	Section 8.1
d. If used, reception centers should be identified. A discussion is provided on whether students are expected to pass through the reception center before being evacuated to their final destination.	Yes	Section 8.1, Table 10-3

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
<p>e. Supporting information is provided to quantify the time elements for each trip, including destinations if return trips are needed.</p>	Yes	Section 8.1, Table 8-2 through Table 8-4
4.4 Stochastic Model Runs		
<p>a. The number of simulation runs needed to produce average results is discussed.</p>	N/A	DYNEV does not rely on simulation averages or random seeds for statistical confidence. For DYNEV/DTRAD, it is a meso-scopic simulation and uses dynamic traffic assignment model to obtain the "average" (stable) network work flow distribution. This is different from microscopic simulation, which is monte-carlo random sampling by nature relying on different seeds to establish statistical confidence. Refer to Appendix B for more details.
<p>b. If one run of a single random seed is used to produce each ETE result, the report includes a sensitivity study on the 90 percent and 100 percent ETE using 10 different random seeds for evacuation of the full EPZ under Summer, Midweek, Daytime, Normal Weather conditions.</p>	N/A	
4.5 Model Boundaries		
<p>a. The method used to establish the simulation model boundaries is discussed.</p>	Yes	Section 4.5
<p>b. Significant capacity reductions or population centers that may influence the ETE and that are located beyond the evacuation area or shadow region are identified and included in the model, if needed.</p>	Yes	Section 4.5

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
4.6 Traffic Simulation Model Output		
<p>a. A discussion of whether the traffic simulation model used must be in equilibrium prior to calculating the ETE is provided.</p>	Yes	Appendix B
<p>b. The minimum following model outputs for evacuation of the entire EPZ are provided to support review:</p> <ol style="list-style-type: none"> 1. Evacuee average travel distance and time. 2. Evacuee average delay time. 3. Number of vehicles arriving at each destination node. 4. Total number and percentage of evacuee vehicles not exiting the EPZ. 5. A plot that provides both the mobilization curve and evacuation curve identifying the cumulative percentage of evacuees who have mobilized and exited the EPZ. 6. Average speed for each major evacuation route that exits the EPZ. 	Yes	<ol style="list-style-type: none"> 1. Appendix J, Table J-2 2. Table J-2 3. Table J-4 4. None and 0%. 100 percent ETE is based on the time the last vehicle exits the evacuation zone 5. Figures J-2 through J-15 (one plot for each scenario considered) 6. Table J-3
<p>c. Color coded roadway maps are provided for various times (e.g., at 2, 4, 6 hrs.) during a full EPZ evacuation scenario, identifying areas where congestion exists.</p>	Yes	Figure 7-3 through Figure 7-8
4.7 Evacuation Time Estimates for the General Public		
<p>a. The ETE includes the time to evacuate 90 percent and 100 percent of the total permanent resident and transient population.</p>	Yes	Table 7-1 and Table 7-2
<p>b. Termination criteria for the 100 percent ETE are discussed, if not based on the time the last vehicle exits the evacuation zone.</p>	N/A	100 percent ETE is based on the time the last vehicle exits the evacuation zone.

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
c. The ETE for 100 percent of the general public includes all members of the general public. Any reductions or truncated data is explained.	Yes	Section 5.4.1 – truncating survey data to eliminate statistical outliers Table 7-2 – 100 th percentile ETE for general population
d. Tables are provided for the 90 and 100 percent ETEs similar to Table 4-3, “ETEs for a Staged Evacuation,” and Table 4-4, “ETEs for a Keyhole Evacuation.”	Yes	Table 7-3 and Table 7-4
e. ETEs are provided for the 100 percent evacuation of special facilities, transit dependent, and school populations.	Yes	Section 8
5.0 Other Considerations		
5.1 Development of Traffic Control Plans		
a. Information that responsible authorities have approved the traffic control plan used in the analysis are discussed.	Yes	Section 9, Appendix G
b. Adjustments or additions to the traffic control plan that affect the ETE is provided.	Yes	Section 9, Appendix G
5.2 Enhancements in Evacuation Time		
a. The results of assessments for enhancing evacuations are provided.	Yes	Appendix M
5.3 State and Local Review		
a. A list of agencies contacted is provided and the extent of interaction with these agencies is discussed.	Yes	Table 1-1

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
b. Information is provided on any unresolved issues that may affect the ETE.	Yes	Results of the ETE study were formally presented to state and local agencies at the final project meeting. Comments on the draft report were provided and were addressed in the final report. There are no unresolved issues.
5.4 Reviews and Updates		
a. The criteria for when an updated ETE analysis is required to be performed and submitted to the NRC is discussed.	Yes	Appendix M, Section M.3
5.4.1 Extreme Conditions		
a. The updated ETE analysis reflects the impact of EPZ conditions not adequately reflected in the scenario variations.	N/A	This ETE is being updated as a result of the availability of US Census Bureau decennial census data.
5.5 Reception Centers and Congregate Care Center		
a. A map of congregate care centers and reception centers is provided.	Yes	Figure 10-7