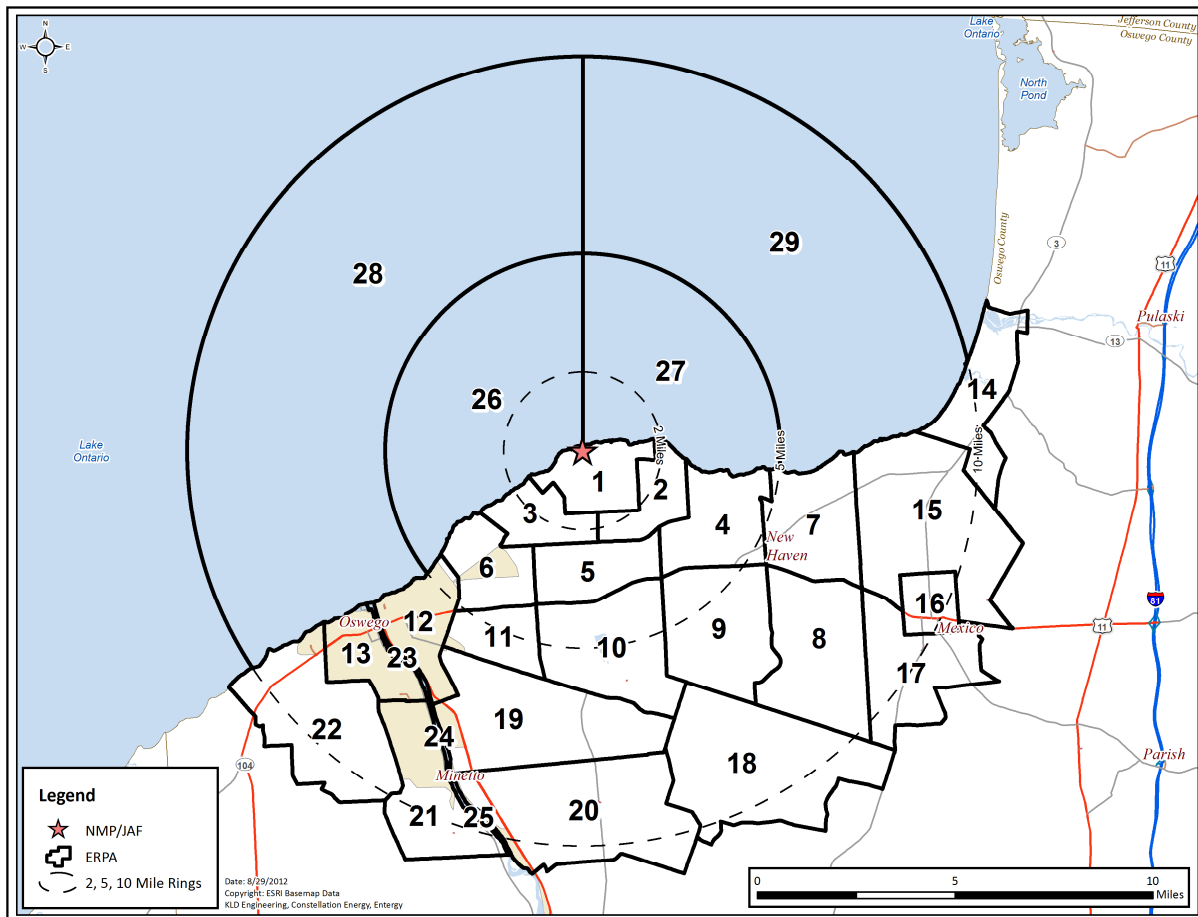


***Nine Mile Point Nuclear Station and James A. FitzPatrick Nuclear Power Plant***

***Development of Evacuation Time Estimates***



***Work performed for Constellation Energy and Entergy, by:***

**KLD Engineering, P.C.**  
**43 Corporate Drive**  
**Hauppauge, NY 11788**  
<mailto:kweinisch@kldcompanies.com>

## Table of Contents

1	INTRODUCTION .....	1-1
1.1	Overview of the ETE Process.....	1-1
1.2	The Locations of Nine Mile Point and James A. FitzPatrick .....	1-3
1.3	Preliminary Activities .....	1-5
1.4	Comparison with Prior ETE Study .....	1-9
2	STUDY ESTIMATES AND ASSUMPTIONS.....	2-1
2.1	Data Estimates .....	2-1
2.2	Study Methodological Assumptions .....	2-2
2.3	Study Assumptions.....	2-5
3	DEMAND ESTIMATION.....	3-1
3.1	Permanent Residents .....	3-2
3.2	Shadow Population .....	3-8
3.3	Transient Population .....	3-11
3.4	Employees .....	3-15
3.5	Special Facilities .....	3-19
3.6	Total Demand in Addition to Permanent Population .....	3-19
3.7	Special Event .....	3-20
3.8	Summary of Demand .....	3-20
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 NMP/JAF Study Area .....	4-6
4.3.1	Two-Lane Roads .....	4-6
4.3.2	Multi-Lane Highway .....	4-6
4.3.3	Freeways .....	4-7
4.3.4	Intersections .....	4-8
4.4	Simulation and Capacity Estimation .....	4-8
5	ESTIMATION OF TRIP GENERATION TIME.....	5-1
5.1	Background .....	5-1
5.2	Fundamental Considerations .....	5-3
5.3	Estimated Time Distributions of Activities Preceding Event 5 .....	5-6
5.4	Calculation of Trip Generation Time Distribution .....	5-12
5.4.1	Statistical Outliers .....	5-13
5.4.2	Staged Evacuation Trip Generation .....	5-16
5.4.3	Trip Generation for Waterways and Recreational Areas .....	5-18
6	DEMAND ESTIMATION FOR EVACUATION SCENARIOS .....	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 .....	7-3
7.5	Evacuation Time Estimate (ETE) Results .....	7-4
7.6	Guidance on Using ETE Tables .....	7-6
8	TRANSIT-DEPENDENT AND SPECIAL FACILITY EVACUATION TIME ESTIMATES .....	8-1
8.1	Transit Dependent People Demand Estimate.....	8-2
8.2	School Population – Transit Demand.....	8-4
8.3	Medical Facility Demand.....	8-4
8.4	Evacuation Time Estimates for Transit Dependent People .....	8-5
8.5	Special Needs Population.....	8-10
8.6	Correctional Facilities.....	8-11
9	TRAFFIC MANAGEMENT STRATEGY .....	9-1
10	EVACUATION ROUTES.....	10-1
11	SURVEILLANCE OF EVACUATION OPERATIONS .....	11-1
12	CONFIRMATION TIME .....	12-1

## List of Appendices

A.	GLOSSARY OF TRAFFIC ENGINEERING TERMS .....	A-1
B.	DYNAMIC TRAFFIC ASSIGNMENT AND DISTRIBUTION MODEL .....	B-1
C.	DYNEV TRAFFIC SIMULATION MODEL .....	C-1
C.1	Methodology.....	C-5
C.1.1	The Fundamental Diagram.....	C-5
C.1.2	The Simulation Model.....	C-5
C.1.3	Lane Assignment .....	C-13
C.2	Implementation .....	C-13
C.2.1	Computational Procedure.....	C-13
C.2.2	Interfacing with Dynamic Traffic Assignment (DTRAD) .....	C-16
D.	DETAILED DESCRIPTION OF STUDY PROCEDURE .....	D-1
E.	SPECIAL FACILITY DATA.....	E-1
F.	TELEPHONE SURVEY.....	F-1
F.1	Introduction .....	F-1
F.2	Survey Instrument and Sampling Plan .....	F-2
F.3	Survey Results .....	F-3
F.3.1	Household Demographic Results .....	F-3
F.3.2	Evacuation Response .....	F-8
F.3.3	Time Distribution Results.....	F-10
F.4	Conclusions .....	F-13
G.	TRAFFIC MANAGEMENT PLAN.....	G-1
G.1	Traffic Control Points .....	G-1

G.2	Access Control Points.....	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 Times .....	M-1
M.2	Effect of Changes in the Number of People in the Shadow Region Who Relocate .....	M-2
M.3	Effect of Changes in EPZ Resident Population .....	M-3
N.	ETE CRITERIA CHECKLIST .....	N-1

*Note: Appendix I intentionally skipped*

## List of Figures

Figure 1-1. Location of Nine Mile Point Nuclear Station and James A. FitzPatrick Nuclear Power Plant	1-4
Figure 1-2. NMP/JAF Link-Node Analysis Network	1-7
Figure 2-1. Voluntary Evacuation Methodology	2-4
Figure 3-1. NMP/JAF EPZ	3-3
Figure 3-2. Permanent Resident Population by Sector	3-6
Figure 3-3. Permanent Resident Vehicles by Sector	3-7
Figure 3-4. Shadow Population by Sector	3-9
Figure 3-5. Shadow Vehicles by Sector	3-10
Figure 3-6. Transient Population by Sector	3-13
Figure 3-7. Transient Vehicles by Sector	3-14
Figure 3-8. Employee Population by Sector	3-17
Figure 3-9. Employee Vehicles by Sector	3-18
Figure 4-1. Fundamental Diagrams	4-10
Figure 5-1. Events and Activities Preceding the Evacuation Trip	5-5
Figure 5-2. Evacuation Mobilization Activities	5-11
Figure 5-3. Comparison of Data Distribution and Normal Distribution	5-15
Figure 5-4. Comparison of Trip Generation Distributions	5-20
Figure 5-5. Comparison of Staged and Unstaged Trip Generation Distributions in the 2 to 5 Mile Region	5-22
Figure 6-1. NMP/JAF EPZ ERPAs	6-6
Figure 7-1. Voluntary Evacuation Methodology	7-20
Figure 7-2. NMP/JAF Shadow Region	7-21
Figure 7-3. Congestion Patterns at 30 Minutes after the Advisory to Evacuate	7-22
Figure 7-4. Congestion Patterns at 1 Hour, 30 minutes after the Advisory to Evacuate	7-23
Figure 7-5. Congestion Patterns at 2 Hours, 30 Minutes after the Advisory to Evacuate	7-24
Figure 7-6. Congestion Patterns at 3 Hours, 30 Minutes after the Advisory to Evacuate	7-25
Figure 7-7. Congestion Patterns at 3 Hours, 45 Minutes after the Advisory to Evacuate	7-26
Figure 7-8. Evacuation Time Estimates - Scenario 1 for Region R03	7-27
Figure 7-9. Evacuation Time Estimates - Scenario 2 for Region R03	7-27
Figure 7-10. Evacuation Time Estimates - Scenario 3 for Region R03	7-28
Figure 7-11. Evacuation Time Estimates - Scenario 4 for Region R03	7-28
Figure 7-12. Evacuation Time Estimates - Scenario 5 for Region R03	7-29
Figure 7-13. Evacuation Time Estimates - Scenario 6 for Region R03	7-29
Figure 7-14. Evacuation Time Estimates - Scenario 7 for Region R03	7-30
Figure 7-15. Evacuation Time Estimates - Scenario 8 for Region R03	7-30
Figure 7-16. Evacuation Time Estimates - Scenario 9 for Region R03	7-31
Figure 7-17. Evacuation Time Estimates - Scenario 10 for Region R03	7-31
Figure 7-18. Evacuation Time Estimates - Scenario 11 for Region R03	7-32
Figure 7-19. Evacuation Time Estimates - Scenario 12 for Region R03	7-32
Figure 7-20. Evacuation Time Estimates - Scenario 13 for Region R03	7-33
Figure 7-21. Evacuation Time Estimates - Scenario 14 for Region R03	7-33
Figure 8-1. Chronology of Transit Evacuation Operations	8-12
Figure 10-1. General Reception Center and Medical Host Facilities	10-2
Figure 10-2. Evacuation Route Map	10-3
Figure B-1. Flow Diagram of Simulation-DTRAD Interface	B-5

Figure C-1. Representative Analysis Network.....	C-4
Figure C-2. Fundamental Diagrams.....	C-6
Figure C-3. A UNIT Problem Configuration with $t_1 > 0$ .....	C-7
Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3) .....	C-15
Figure D-1. Flow Diagram of Activities.....	D-5
Figure E-1. Schools and Preschools within the EPZ.....	E-7
Figure E-2. Schools and Preschools within the City of Oswego .....	E-8
Figure E-3. Medical Facilities within the EPZ .....	E-9
Figure E-4. Major Employers within the EPZ.....	E-10
Figure E-5. Campgrounds, Recreational Facilities, and Commuter Schools within the EPZ .....	E-11
Figure E-6. Lodging Facilities within the EPZ.....	E-12
Figure E-7. Correctional Facilities within the EPZ .....	E-13
Figure F-1. Household Size in the EPZ.....	F-3
Figure F-2. Household Vehicle Availability.....	F-4
Figure F-3. Vehicle Availability - 1 to 5 Person Households.....	F-5
Figure F-4. Vehicle Availability - 6 to 9+ Person Households.....	F-5
Figure F-5. Household Ridesharing Preference.....	F-6
Figure F-6. Commuters in Households in the EPZ.....	F-7
Figure F-7. Modes of Travel in the EPZ .....	F-8
Figure F-8. Number of Vehicles Used for Evacuation .....	F-9
Figure F-9. Households Evacuating with Pets .....	F-9
Figure F-10. Time Required to Prepare to Leave Work/School .....	F-11
Figure F-11. Work to Home Travel Time .....	F-11
Figure F-12. Time to Prepare Home for Evacuation.....	F-12
Figure F-13. Time to Clear Driveway of 6"-8" of Snow .....	F-13
Figure G-1. Traffic and Access Control Points for Nine Mile Point/James a FitzPatrick .....	G-2
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 H-20. Region R20.....	H-23
Figure H-21. Region R21.....	H-24

Figure H-22 Region R22.....	H-25
Figure H-23 Region R23.....	H-26
Figure H-24 Region R24.....	H-27
Figure H-25 Region R25.....	H-28
Figure H-26 Region R26.....	H-29
Figure H-27 Region R27.....	H-30
Figure H-28 Region R28.....	H-31
Figure H-29 Region R29.....	H-32
Figure H-30 Region R30.....	H-33
Figure H-31 Region R31.....	H-34
Figure H-32 Region R32.....	H-35
Figure H-33 Region R33.....	H-36
Figure H-34 Region R34.....	H-37
Figure H-35 Region R35.....	H-38
Figure H-36 Region R36.....	H-39
Figure H-37 Region R37.....	H-40
Figure H-38 Region R38.....	H-41
Figure H-39 Region R39.....	H-42
Figure H-40 Region R40.....	H-43
Figure H-41 Region R41.....	H-44
Figure H-42 Region R42.....	H-45
Figure H-43 Region R43.....	H-46
Figure H-44 Region R44.....	H-47
Figure H-45 Region R45.....	H-48
Figure H-46 Region R46.....	H-49
Figure H-47 Region R47.....	H-50
Figure H-48 Region R48.....	H-51
Figure H-49 Region R49.....	H-52
Figure H-50 Region R50.....	H-53
Figure H-51 Region R51.....	H-54
Figure H-52 Region R52.....	H-55
Figure H-53 Region R53.....	H-56
Figure H-54 Region R54.....	H-57
Figure J-1. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1) .....	J-8
Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2) .....	J-8
Figure J-3. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3).....	J-9
Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4) .....	J-9
Figure J-5. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5) .....	J-10
Figure J-6. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6) .....	J-10
Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Rain (Scenario 7) .....	J-11
Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Snow (Scenario 8) .....	J-11
Figure J-9. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 9) .....	J-12
Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Rain (Scenario 10).....	J-12
Figure J-11. ETE and Trip Generation: Winter, Weekend, Midday, Snow (Scenario 11) .....	J-13
Figure J-12. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 12) .....	J-13

Figure J-13. ETE and Trip Generation: Summer, Weekend, Evening, Good Weather, Special Event (Scenario 13) .....	J-14
Figure J-14. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather, Roadway Impact (Scenario 14) .....	J-14
Figure K-1. Nine Mile Point/James A. FitzPatrick 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

## List of Tables

Table 1-1. Stakeholder Interaction .....	1-1
Table 1-2. Highway Characteristics .....	1-5
Table 1-3. ETE Study Comparisons.....	1-9
Table 2-1. Evacuation Scenario Definitions.....	2-3
Table 2-2. Model Adjustment for Adverse Weather.....	2-7
Table 3-1. EPZ Permanent Resident Population .....	3-4
Table 3-2. Permanent Resident Population and Vehicles by ERPA.....	3-5
Table 3-3. Shadow Population and Vehicles by Sector .....	3-8
Table 3-4. Summary of Transients and Transient Vehicles .....	3-12
Table 3-5. Summary of Non-EPZ Resident Employees and Employee Vehicles.....	3-16
Table 3-6. NMP/JAF EPZ External Traffic .....	3-20
Table 3-7. Summary of Population Demand.....	3-21
Table 3-8. Summary of Vehicle Demand.....	3-22
Table 5-1. Event Sequence for Evacuation Activities.....	5-3
Table 5-2. Time Distribution for Notifying the Public .....	5-6
Table 5-3. Time Distribution for Employees to Prepare to Leave Work .....	5-7
Table 5-4. Time Distribution for Commuters to Travel Home .....	5-8
Table 5-5. Time Distribution for Population to Prepare to Evacuate .....	5-9
Table 5-6. Time Distribution for Population to Clear 6"-8" of Snow .....	5-10
Table 5-7. Mapping Distributions to Events.....	5-12
Table 5-8. Description of the Distributions.....	5-13
Table 5-9. Trip Generation Histograms for the EPZ Population for Unstaged Evacuation .....	5-19
Table 5-10. Trip Generation Histograms for the EPZ Population for Staged Evacuation .....	5-21
Table 6-1. Description of Evacuation Regions.....	6-3
Table 6-2. Nine Mile Point PAR Logic.....	6-7
Table 6-3. James A. FitzPatrick PAR Logic .....	6-8
Table 6-4. Evacuation Scenario Definitions.....	6-9
Table 6-5. Percent of Population Groups Evacuating for Various Scenarios .....	6-10
Table 6-6. Vehicle Estimates by Scenario.....	6-11
Table 7-1. Time to Clear the Indicated Area of <u>90</u> Percent of the Affected Population .....	7-9
Table 7-2. Time to Clear the Indicated Area of 100 Percent of the Affected Population .....	7-12
Table 7-3. Time to Clear <u>90</u> Percent of the 2-Mile Area within the Indicated Region.....	7-15
Table 7-4. Time to Clear <u>100</u> Percent of the 2-Mile Area within the Indicated Region.....	7-16
Table 7-5. Description of Evacuation Regions.....	7-17
Table 8-1. Transit-Dependent Population Estimates .....	8-13
Table 8-2. School Population Demand Estimates .....	8-14
Table 8-3. School Reception Centers .....	8-15
Table 8-4. Medical Facility Transit Demand.....	8-16
Table 8-5. Summary of Transportation Resources .....	8-17
Table 8-6. Bus Route Descriptions .....	8-18
Table 8-7. School Evacuation Time Estimates – Good Weather .....	8-23
Table 8-8. School Evacuation Time Estimates – Rain.....	8-24
Table 8-9. School Evacuation Time Estimates – Snow .....	8-25
Table 8-10. Summary of Transit-Dependent Bus Routes.....	8-26
Table 8-11. Transit-Dependent Evacuation Time Estimates - Good Weather .....	8-28

Table 8-12. Transit-Dependent Evacuation Time Estimates - Rain .....	8-32
Table 8-13. Transit Dependent Evacuation Time Estimates - Snow .....	8-36
Table 8-14. Medical Facility Evacuation Time Estimates - Good Weather .....	8-40
Table 8-15. Medical Facility Evacuation Time Estimates - Rain .....	8-41
Table 8-16. Medical Facility Evacuation Time Estimates - Snow .....	8-42
Table 8-17. Homebound Special Needs Population Evacuation Time Estimates .....	8-43
Table 8-18. Correctional Facilities Evacuation Time Estimates .....	8-43
Table 12-1. Estimated Number of Telephone Calls Required for Confirmation of Evacuation .....	12-2
Table A-1. Glossary of Traffic Engineering Terms .....	A-1
Table C-1. Selected Measures of Effectiveness Output by DYNEV II .....	C-2
Table C-2. Input Requirements for the DYNEV II Model .....	C-3
Table C-3. Glossary.....	C-8
Table E-1. Schools, Preschools and Daycares within the EPZ .....	E-2
Table E-2. Medical Facilities within the EPZ.....	E-3
Table E-3. Major Employers within the EPZ.....	E-4
Table E-4. Recreational Attractions and Major Commuter Schools within the EPZ .....	E-5
Table E-5. Lodging Facilities within the EPZ .....	E-6
Table E-6. Correctional Facilities within the EPZ.....	E-6
Table F-1. NMP/JAF Telephone Survey Sampling Plan .....	F-2
Table H-1. Percent of Sub-Area Population Evacuating for Each Region.....	H-2
Table J-1. Characteristics of the Ten Highest Volume Signalized Intersections.....	J-2
Table J-2. Sample Simulation Model Input .....	J-3
Table J-3. Selected Model Outputs for the Evacuation of the Entire EPZ (Region R03) .....	J-4
Table J-4. Average Speed (mph) and Travel Time (min) for Major Evacuation Routes (Region R03, Scenario 1) .....	J-5
Table J-5. Simulation Model Outputs at Network Exit Links for Region R03, Scenario 1 .....	J-6
Table K-1. Evacuation Roadway Network Characteristics .....	K-35
Table K-2. Nodes in the Link-Node Analysis Network which are Controlled .....	K-86
Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study .....	M-1
Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study .....	M-2
Table M-3. ETE Variation with Population Change .....	M-4
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 Nine Mile Point Nuclear Station (NMP) and James A. FitzPatrick Nuclear Power Plant (JAF). NMP and JAF are located on adjacent parcels of land in Oswego County, New York. ETE are part of the required planning basis and provide Constellation Energy, Entergy as well as state and local 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:

- Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, November 2011.
- Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG-0654/FEMA-REP-1, Rev. 1, November 1980.
- Development of Evacuation Time Estimates for Nuclear Power Plants, NUREG/CR-6863, January 2005.
- 10CFR50, Appendix E – “Emergency Planning and Preparedness for Production and Utilization Facilities.”

### Overview of Project Activities

This project began in March, 2012 and extended over a period of 8 months. The major activities performed are briefly described in chronological sequence:

- Attended “kick-off” meetings with personnel from Constellation Energy, Entergy, and emergency management personnel representing state and county governments and law enforcement.
- Accessed U.S. Census Bureau data files for the year 2010. Studied Geographical Information Systems (GIS) maps of the area in the vicinity of the NMP/JAF, then conducted a detailed field survey of the highway network.
- Synthesized this information to create an analysis network representing the highway system topology and capacities within the Emergency Planning Zone (EPZ), plus a Shadow Region covering the region between the EPZ boundary and approximately 15 miles radially from the plants.
- Designed and sponsored a telephone survey of residents within the EPZ to gather focused data needed for this ETE study that were not contained within the census database. The survey instrument was reviewed and modified by the licensee and offsite response organization (ORO) personnel prior to the survey.
- Data collection forms (provided to the OROs at the kickoff meeting) were returned with

data pertaining to employment, transients, and special facilities in Oswego County. Telephone calls to specific facilities as well as internet based searches, supplemented the data provided.

- The traffic demand and trip-generation rates of evacuating vehicles were estimated from the gathered data. The trip generation rates reflected the estimated mobilization time (i.e., the time required by evacuees to prepare for the evacuation trip) computed using the results of the telephone survey of EPZ residents.
- Following federal guidelines, the EPZ is subdivided into 29 ERPAs. These ERPAs are then grouped within circular areas or “keyhole” configurations (circles plus radial sectors and site specific adjustments) that define a total of 54 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, Snow). One special event scenario involving the Harborfest fireworks display was considered. One roadway impact scenario was considered wherein a single lane was closed on SR 481 southbound for the duration of the evacuation.
- Staged evacuation was considered for those regions wherein the 2 mile radius and sectors downwind to 5 miles were evacuated.
- As per NUREG/CR-7002, the Planning Basis for the calculation of ETE is:
  - A rapidly escalating accident at the NMP/JAF that quickly assumes the status of General Emergency such that the Advisory to Evacuate 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 Advisory to Evacuate until a 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 the reception center located at the New York State Fairgrounds, 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.
- Evacuees who do not have access to a private vehicle will either ride-share with relatives, friends or neighbors, or be evacuated by buses provided as specified in the county evacuation plans. Those in special facilities will likewise be evacuated with public transit, as needed: bus, van, or ambulance, as required. Separate ETE are calculated for the transit-dependent evacuees, for homebound special needs population, and for those evacuated from special facilities.

### Computation of ETE

A total of 756 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 54 Evacuation Regions to evacuate from that Region, under the circumstances defined for one of the 14 Evacuation Scenarios ( $54 \times 14 = 756$ ). 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 Advisory to Evacuate applies only to those people occupying the specified impacted region. It is assumed that 100 percent 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.

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 plants), then simulate 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 percent and 100 percent, 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 90<sup>th</sup> percentile ETE have been identified as the values that should be considered when making protective action decisions

because the 100<sup>th</sup> 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.

The use of a public outreach (information) program to emphasize the need for evacuees to minimize the time needed to prepare to evacuate (secure the home, assemble needed clothes, medicines, etc.) should also be considered.

### Traffic Management

This study references the comprehensive traffic management plans provided by Oswego County; no additional traffic or access control measures have been 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.

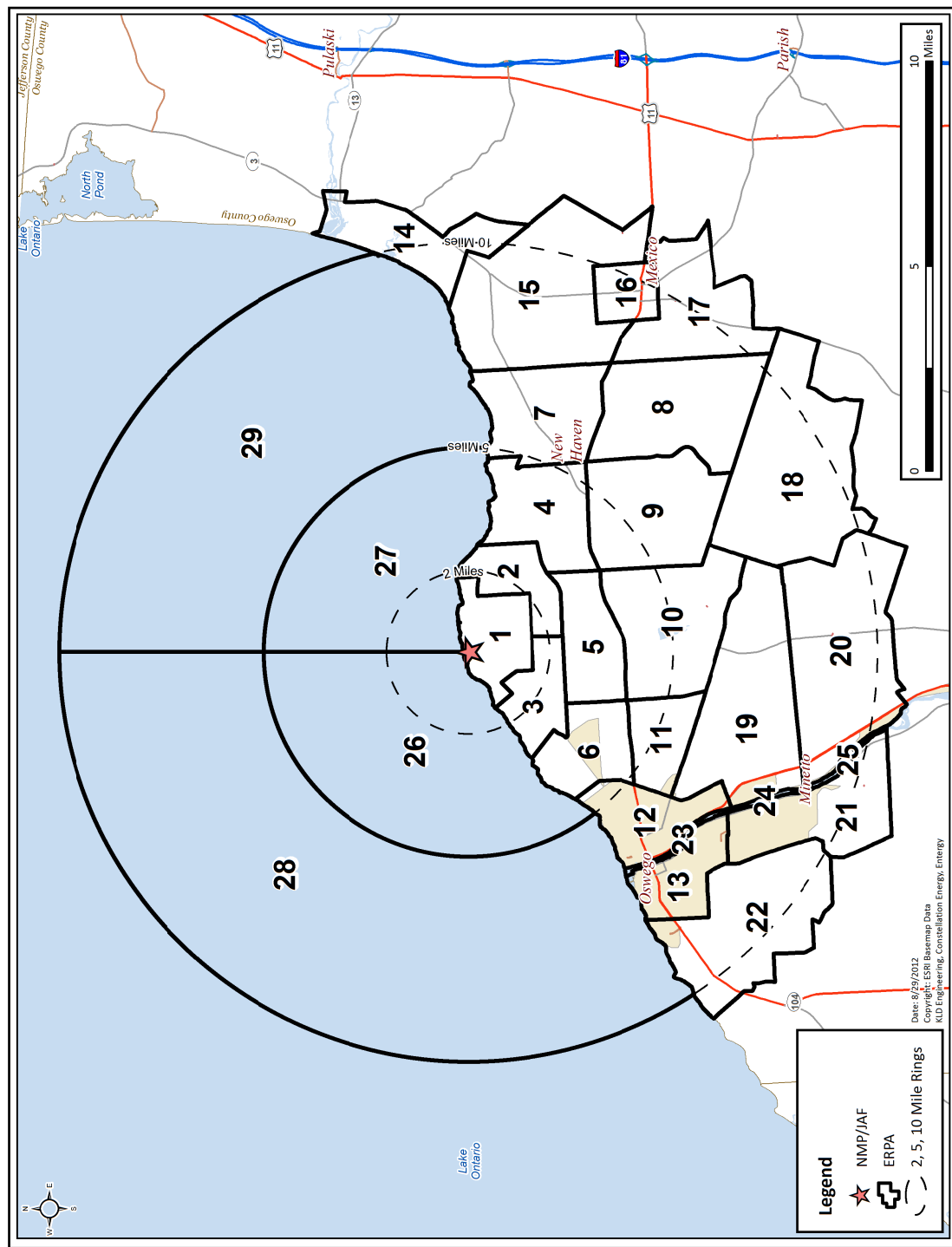
- Figure 6-1 displays a map of the NMP/JAF EPZ showing the layout of the 29 ERPAs that comprise, in aggregate, the EPZ.
- Table 3-1 presents the estimates of permanent resident population in each ERPA based on the 2010 Census data.
- Table 6-1 defines each of the 54 Evacuation Regions in terms of their respective groups of ERPAs.
- Table 6-4 lists the Evacuation Scenarios.
- 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 percent 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 for un-staged and staged evacuations for the 90<sup>th</sup> and 100<sup>th</sup> percentiles, respectively.
- Table 8-7 presents ETE for the schoolchildren in good weather.
- Table 8-11 presents ETE for the transit-dependent population in good weather.
- Figure H-8 presents an example of an Evacuation Region (Region R08) to be evacuated under the circumstances defined in Table 6-1. Maps of all regions are provided in Appendix H.

### Conclusions

- General population ETE were computed for 756 unique cases – a combination of 54 unique Evacuation Regions and 14 unique Evacuation Scenarios. Table 7-1 and Table 7-2 document these ETE for the 90<sup>th</sup> and 100<sup>th</sup> percentiles. These ETE range from 1:30 (hr:min) to 5:15 at the 90<sup>th</sup> percentile.
- Inspection of Table 7-1 and Table 7-2 indicates that the ETE for the 100<sup>th</sup> percentile are significantly longer than those for the 90<sup>th</sup> percentile. This is the result of the congestion within the EPZ. 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. See Figures 7-8 through 7-21.

- Inspection of Table 7-3 and Table 7-4 indicates that a staged evacuation provides no benefits to evacuees from within the 2 mile region and unnecessarily delays the evacuation of those beyond 2 miles (compare Regions R04 through R14 with R43 through R53 respectively and R02 with R54, in Tables 7-1 and 7-2). See Section 7.6 for additional discussion.
- Comparison of Scenarios 5 (summer, midweek/weekend, evening) and 13 (summer, weekend, evening) in Table 7-2 indicates that the special event raises the 90<sup>th</sup> percentile ETE by 2:45. See Section 7.5 for additional discussion.
- Comparison of Scenarios 1 and 14 in Table 7-1 indicates that the roadway closure – one lane southbound on SR 481 – does not materially impact ETE. See Section 7.5 for additional discussion.
- The Cities of Oswego and Fulton are the two most congested areas during an evacuation. The last locations in the EPZ to exhibit traffic congestion are SR 104 west of the City of Oswego and SR 481 north of the intersection with Oneida St in the City of Fulton. All congestion within the EPZ clears by 4 hours after the Advisory to Evacuate. See Section 7.3 and Figures 7-3 through 7-8.
- Separate ETE were computed for schools, medical facilities, transit-dependent persons, homebound special needs persons and correctional facilities. The average single-wave ETE for schools, medical facilities, transit dependents and correctional facilities are within a similar range as the general population ETE at the 90<sup>th</sup> percentile. ETE for homebound special needs persons does exceed the 90<sup>th</sup> percentile ETE for the general population. See Section 8.
- Table 8-5 indicates that there are scarcely enough buses, vans and ambulances available to evacuate the transit-dependent population within the EPZ in a single wave. However, mutual aid agreements would be invoked to address any potential shortfalls. See Sections 8.4 and 8.5.
- The general population, full EPZ ETE at the 90<sup>th</sup> percentile is insensitive to reductions in the base trip generation time of 3½ hours due to the traffic congestion within the EPZ. See Table M-1.
- The general population ETE is relatively insensitive to the voluntary evacuation of vehicles in the Shadow Region (tripling the shadow evacuation percentage only increases 90<sup>th</sup> percentile ETE by 5 minutes). See Table M-2.
- Population increase of 30% result in ETE changes which meet the criteria for updating ETE between decennial Censuses. See Section M.3.



**Table 3-1. EPZ Permanent Resident Population**

<b>ERPA</b>	<b>2000 Population</b>	<b>2010 Population</b>
<b>1</b>	188	173
<b>2</b>	469	469
<b>3</b>	418	343
<b>4</b>	634	687
<b>5</b>	836	804
<b>6</b>	873	915
<b>7</b>	753	699
<b>8</b>	785	718
<b>9</b>	627	597
<b>10</b>	1,119	1,023
<b>11</b>	2,008	1,916
<b>12</b>	7,756	7,960
<b>13</b>	10,236	10,223
<b>14</b>	289	193
<b>15</b>	1,177	1,105
<b>16</b>	1,572	1,624
<b>17</b>	614	587
<b>18</b>	1,135	1,030
<b>19</b>	1,513	1,316
<b>20</b>	1,695	1,783
<b>21</b>	1,786	1,782
<b>22</b>	5,234	5,940
<b>TOTAL</b>	<b>41,717</b>	<b>41,887</b>
<b>EPZ Population Growth:</b>		<b>0.41%</b>

Table 6-1. Description of Evacuation Regions

Region	Description	ERPA																											
R01	2-Mile Radius	x	x	x																							x	x	
R02	5-Mile Radius	x	x	x	x	x	x			x	x	x															x	x	
R03	Full EPZ	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Evacuate 2-Mile Radius and Downwind to 5 Miles																													
Region	Wind Direction From°	ERPA																											
N/A	96 to 233	See Region R01																											
R04	234 to 240	x	x	x				x																			x	x	
R05	241 to 262	x	x	x	x			x																			x	x	
R06	263 to 278	x	x	x	x			x																			x	x	
R07	279 to 292	x	x	x	x			x																			x	x	
R08	293 to 332	x	x	x	x			x																			x	x	
R09	333 to 349	x	x	x	x			x																			x	x	
R10	350 to 12	x	x	x			x			x	x	x															x	x	
R11	13 to 51	x	x	x			x			x	x	x															x	x	
R12	52 to 61	x	x	x			x				x																x	x	
R13	62 to 70	x	x	x																							x	x	
R14	71 to 95	x	x	x																							x	x	
Shelter-in-Place until 90% ETE for R01, then Evacuate		Area(s) Shelter-in-Place														Area(s) Evacuate													

Regions Specific to James A. FitzPatrick																															
Evacuate 2-Mile Radius and Downwind to 10 Miles																															
Region	Wind Direction From°	ERPA																													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
R15	214 to 233	x	x	x											x													x	x	x	
R16	234 to 240	x	x	x											x													x	x	x	
R17	241 to 254	x	x	x	x										x													x	x	x	
R18	255 to 262	x	x	x	x										x													x	x	x	
R19	263 to 278	x	x	x	x										x													x	x	x	
R20	279 to 292	x	x	x	x	x									x													x	x	x	
R21	293 to 305	x	x	x	x	x									x													x	x	x	
R22	306 to 311	x	x	x	x	x									x													x	x	x	
R23	312 to 332	x	x	x	x	x									x													x	x	x	
R24	333 to 340	x	x	x	x	x																						x	x	x	
R25	341 to 349	x	x	x	x																							x	x	x	
R26	350 to 356	x	x	x											x													x	x	x	
R27	357 to 12	x	x	x											x													x	x	x	
R28	13 to 20	x	x	x											x													x	x	x	
R29	21 to 51	x	x	x											x													x	x	x	
R30	52 to 56	x	x	x											x													x	x	x	
R31	57 to 61	x	x	x											x													x	x	x	
R32	62 to 70	x	x	x											x													x	x	x	
R33	71 to 89	x	x	x											x													x	x	x	
R34	90 to 95	x	x	x											x													x	x	x	
R35	96 to 146	x	x	x																								x	x	x	
R36	147 to 213	x	x	x																								x	x	x	
Shelter-in-Place until 90% ETE for R01, then Evacuate		Area(s) Shelter-in-Place														Area(s) Evacuate															

Regions Specific to Nine Mile Point																												
Evacuate 2-Mile Radius and Downwind to 5 Miles - Lake Breeze Adjusted (5 Mile Radius)																												
Region	Wind Direction From°	ERP A																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
N/A	115 to 222																											
N/A	223 to 240																											
N/A	241 to 262																											
N/A	263 to 278																											
N/A	279 to 311																											
R37	312 to 332	x	x	x	x	x	x	x	x	x	x	x	x													x	x	
R38	333 to 349	x	x	x	x	x	x	x	x	x	x	x	x													x	x	
N/A	350 to 356																											
R39	357 to 20	x	x	x	x	x	x	x	x	x	x	x	x													x	x	
N/A	21 to 51																											
N/A	52 to 61																											
R40	62 to 70	x	x	x			x				x	x														x	x	
N/A	71 to 89																											
R41	90 to 95	x	x	x		x	x					x	x													x	x	
R42	96 to 114	x	x	x		x	x					x	x													x	x	
Shelter-in-Place until 90% ETE for R01, then Evacuate																												
Area(s) Shelter-in-Place																												
Area(s) Evacuate																												
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 5 Miles																												
Region	Wind Direction From°	ERP A																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
N/A	96 to 233																											
R43	234 to 240	x	x	x				x																		x	x	
R44	241 to 262	x	x	x	x			x																		x	x	
R45	263 to 278	x	x	x	x			x																		x	x	
R46	279 to 292	x	x	x	x	x		x																		x	x	
R47	293 to 332	x	x	x	x	x		x			x															x	x	
R48	333 to 349	x	x	x	x	x				x	x	x														x	x	
R49	350 to 12	x	x	x		x	x			x	x	x														x	x	
R50	13 to 51	x	x	x	x	x	x			x	x	x														x	x	
R51	52 to 61	x	x	x	x	x	x					x														x	x	
R52	62 to 70	x	x	x			x					x														x	x	
R53	71 to 95	x	x	x			x																			x	x	
R54	5-Mile Region	x	x	x	x	x	x	x		x	x	x														x	x	
Shelter-in-Place until 90% ETE for R01, then Evacuate																												
Area(s) Shelter-in-Place																												
Area(s) Evacuate																												

**Table 6-4. Evacuation Scenario Definitions**

Scenario	Season <sup>1</sup>	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	None
8	Winter	Midweek	Midday	Snow	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain	None
11	Winter	Weekend	Midday	Snow	None
12	Winter	Midweek, Weekend	Evening	Good	None
13	Summer	Weekend	Evening	Good	Harborfest Fireworks
14	Summer	Midweek	Midday	Good	Roadway Impact – Lane Closure on SR 481 SB

<sup>1</sup> Winter assumes that school is in session (also applies to spring and autumn). Summer assumes that school is not in session.

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		Weekend		Midweek Weekend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Region	Midweek		Weekend		Midweek		Midweek		Midweek		Midweek		Midweek		Midweek	
	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain
Entire 2-Mile Region, 5-Mile Region, and EPZ																
R01	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R02	1:50	1:50	1:40	1:40	1:40	1:50	1:50	2:15	1:40	1:40	2:05	1:40	1:40	1:40	1:40	1:50
R03	2:40	2:50	2:35	2:50	2:25	2:55	3:05	3:35	2:30	2:40	3:00	2:25	5:10	2:40	2:40	2:40
2-Mile Region and Keyhole to 5 Miles																
R04	1:35	1:35	1:30	1:30	1:30	1:35	1:35	1:55	1:30	1:30	2:00	1:35	1:30	1:35	1:35	1:35
R05	1:35	1:35	1:30	1:30	1:35	1:40	1:40	2:00	1:35	1:35	2:00	1:35	1:35	1:35	1:35	1:35
R06	1:40	1:40	1:30	1:30	1:35	1:45	1:45	2:05	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:40
R07	1:45	1:45	1:35	1:35	1:35	1:45	1:45	2:05	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:45
R08	1:45	1:45	1:35	1:35	1:35	1:45	1:45	2:05	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:45
R09	1:50	1:50	1:40	1:40	1:40	1:50	1:50	2:15	1:40	1:40	2:10	1:40	1:40	1:40	1:40	1:50
R10	1:50	1:50	1:40	1:40	1:45	1:50	1:50	2:15	1:40	1:40	2:10	1:40	1:45	1:45	1:45	1:50
R11	1:50	1:50	1:40	1:40	1:40	1:50	1:50	2:10	1:45	1:45	2:10	1:45	1:40	1:40	1:40	1:50
R12	1:45	1:45	1:35	1:35	1:35	1:45	1:45	2:10	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:45
R13	1:45	1:45	1:35	1:35	1:35	1:45	1:45	2:05	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:45
R14	1:30	1:35	1:30	1:30	1:30	1:30	1:35	1:55	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30

	Summer		Summer		Summer		Winter				Winter				Winter		Summer		Summer	
	Midweek		Weekend		Midweek		Weekend		Midweek		Weekend		Midweek		Weekend		Midweek		Weekend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)		
Region	Midday		Midday		Evening		Midday		Midday		Midday		Midday		Evening		Special Event		Roadway Impact	
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Good Weather	Snow	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact			
2-Mile Region and Keyhole to EPZ Boundary (James A. FitzPatrick)																				
R15	1:40	1:40	1:30	1:30	1:35	1:40	1:40	2:00	1:35	1:35	2:05	1:35	1:35	1:40	1:35	1:35	1:40	1:40		
R16	1:40	1:45	1:35	1:40	1:35	1:45	1:45	2:05	1:35	1:35	2:05	1:35	1:35	1:40	1:35	1:35	1:40	1:40		
R17	1:45	1:45	1:40	1:50	1:35	1:50	1:50	2:10	1:35	1:40	2:05	1:40	1:35	1:40	1:40	1:35	1:45	1:45		
R18	1:45	1:50	1:50	1:50	1:35	1:50	1:50	2:10	1:35	1:40	2:05	1:40	1:35	1:40	1:40	1:35	1:45	1:45		
R19	1:50	1:50	1:45	1:55	1:35	1:50	1:55	2:15	1:35	1:40	2:05	1:40	1:35	1:40	1:40	1:35	1:50	1:50		
R20	1:50	1:50	1:45	1:50	1:40	1:50	1:55	2:15	1:40	1:40	2:10	1:40	1:40	1:40	1:40	1:40	1:50	1:50		
R21	1:50	1:50	1:45	1:50	1:40	1:50	1:55	2:15	1:40	1:40	2:10	1:40	1:40	1:40	1:40	1:40	1:50	1:50		
R22	1:50	1:55	1:45	1:50	1:40	1:55	1:55	2:15	1:40	1:40	2:10	1:40	1:40	1:40	1:40	1:45	1:50	1:50		
R23	1:50	1:55	1:45	1:50	1:40	1:55	1:55	2:15	1:40	1:40	2:10	1:40	1:40	1:40	1:40	1:45	1:50	1:50		
R24	1:50	1:55	1:40	1:45	1:40	1:55	1:55	2:15	1:40	1:40	2:10	1:40	1:40	1:40	1:40	1:45	1:50	1:50		
R25	1:50	1:55	1:40	1:45	1:40	1:55	1:55	2:15	1:40	1:40	2:10	1:40	1:40	1:40	1:40	1:50	1:50	1:50		
R26	2:45	2:55	2:45	2:50	2:30	3:00	3:15	3:40	2:35	2:45	3:05	2:30	2:45	3:05	2:30	5:10	2:45	2:45		
R27	2:40	2:55	2:40	2:50	2:35	3:05	3:15	3:35	2:30	2:45	3:05	2:30	2:45	3:05	2:30	5:15	2:40	2:40		
R28	2:45	2:55	2:40	2:50	2:35	3:00	3:10	3:40	2:35	2:45	3:05	2:30	2:45	3:05	2:30	5:10	2:45	2:45		
R29	2:40	2:55	2:45	2:50	2:30	3:00	3:20	3:40	2:30	2:40	3:00	2:30	2:40	3:00	2:30	5:10	2:45	2:45		
R30	2:40	2:55	2:40	2:50	2:30	3:00	3:15	3:40	2:35	2:40	3:05	2:30	2:40	3:05	2:30	5:10	2:40	2:40		
R31	2:35	2:45	2:30	2:45	2:25	2:55	3:15	3:35	2:25	2:35	2:50	2:20	2:35	2:50	2:20	5:05	2:35	2:35		
R32	2:35	2:45	2:30	2:45	2:25	2:55	3:05	3:30	2:25	2:35	2:55	2:20	2:35	2:55	2:20	5:05	2:35	2:35		
R33	2:35	2:50	2:30	2:40	2:20	2:55	3:10	3:25	2:20	2:30	2:55	2:20	2:30	2:55	2:20	5:00	2:35	2:35		
R34	1:35	1:35	1:30	1:30	1:35	1:35	1:35	2:00	1:35	1:35	2:05	1:35	1:35	2:05	1:35	1:35	1:35	1:35		
R35	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	2:00	1:30	1:30	1:30	1:30		
R36	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	2:00	1:30	1:30	1:30	1:30		

	Summer		Summer		Summer		Winter		Winter		Winter		Summer		Summer	
	Midweek		Weekend		Midweek Weekend		Midweek		Midweek		Weekend		Midweek Weekend		Weekend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		
Region	Midweek		Midweek		Evening		Midweek		Midweek		Midweek		Evening		Evening	
	Good Weather	Rain	Good Weather	Rain	Good Weather		Good Weather	Rain	Good Weather		Good Weather		Good Weather		Special Event	Roadway Impact
2-Mile Region and Downwind to 5 Miles - Lake Breeze Adjusted (Nine Mile Point)																
R37	1:50	1:50	1:40	1:40	1:40	1:50	1:50	2:15	1:40	1:40	2:05	1:40	1:40	1:50	1:40	1:50
R38	1:55	2:00	1:55	1:55	1:50	1:55	2:00	2:20	1:50	1:50	2:15	1:45	3:40	1:55	3:40	1:55
R39	1:50	1:50	1:40	1:40	1:40	1:50	1:50	2:15	1:40	1:45	2:10	1:40	1:40	1:50	1:40	1:50
R40	1:50	1:50	1:40	1:40	1:40	1:50	1:50	2:10	1:40	1:40	2:10	1:40	1:40	1:50	1:40	1:50
R41	2:00	2:00	1:55	1:55	1:45	1:55	2:00	2:20	1:50	1:50	2:15	1:50	3:45	2:00	3:45	2:00
R42	1:55	1:55	1:50	1:50	1:40	1:55	2:00	2:20	1:45	1:50	2:10	1:45	3:40	1:55	3:40	1:55
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																
R43	1:55	1:55	1:55	1:55	1:55	1:55	1:55	2:25	1:55	2:00	2:30	2:00	1:55	1:55	1:55	1:55
R44	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:00	2:00	2:00
R45	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:00	2:00	2:00
R46	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:00	2:00	2:00
R47	2:05	2:05	2:05	2:05	2:05	2:05	2:05	2:35	2:05	2:05	2:35	2:05	2:05	2:05	2:05	2:05
R48	2:10	2:15	2:10	2:15	2:10	2:10	2:15	2:45	2:10	2:15	2:45	2:10	2:10	2:10	2:10	2:10
R49	2:15	2:15	2:15	2:15	2:15	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:15	2:15	2:15
R50	2:15	2:15	2:15	2:15	2:15	2:15	2:15	2:45	2:15	2:20	2:50	2:15	2:15	2:15	2:15	2:15
R51	2:15	2:15	2:15	2:15	2:15	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:15	2:15	2:15
R52	2:05	2:05	2:05	2:10	2:10	2:05	2:10	2:40	2:10	2:10	2:40	2:10	2:10	2:10	2:10	2:05
R53	1:55	1:55	1:55	1:55	1:55	1:55	1:55	2:25	1:55	1:55	2:30	1:55	1:55	1:55	1:55	1:55
R54	2:15	2:15	2:15	2:15	2:15	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:15	2:15	2:15

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

	Summer			Summer			Winter			Winter			Winter			Summer			Summer		
	Midweek			Weekend			Midweek			Weekend			Midweek			Weekend			Weekend		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)							
Region	Midweek			Midweek			Midweek			Midweek			Midweek			Midweek			Midweek		
	Midweek			Midweek			Midweek			Midweek			Midweek			Midweek			Midweek		
	Midweek			Midweek			Midweek			Midweek			Midweek			Midweek			Midweek		
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)							
Entire 2-Mile Region, 5-Mile Region, and EPZ																					
R01	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30		3:30	3:30	3:30	3:30	3:30	3:30
R02	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R03	3:40	3:55	3:40	3:40	3:40	4:00	4:15	4:50	3:40	3:40	4:25	3:40	3:40	7:00		3:40	7:00	7:00	7:00	3:40	3:40
2-Mile Region and Keyhole to 5 Miles																					
R04	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R05	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R06	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R07	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R08	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R09	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R10	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R11	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R12	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R13	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35
R14	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35		3:35	3:35	3:35	3:35	3:35	3:35

	Summer		Summer		Summer	Winter			Winter			Winter	Summer	Summer	
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Region	Midday		Midday		Evening	Midday			Midday			Evening	Evening	Special Event	Roadway Impact
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather			
2-Mile Region and Keyhole to EPZ Boundary (James A. FitzPatrick)															
R15	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R16	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R17	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R18	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R19	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R20	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R21	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R22	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R23	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R24	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R25	3:40	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R26	3:40	3:50	3:45	3:40	3:40	3:40	4:05	4:50	4:50	3:40	3:40	4:25	3:40	7:15	3:40
R27	3:40	3:40	3:40	3:40	3:40	4:00	4:10	4:50	4:50	3:40	3:40	4:25	3:40	7:00	3:40
R28	3:40	3:45	3:45	3:40	3:40	4:00	4:10	4:50	4:50	3:40	3:40	4:25	3:40	7:20	3:40
R29	3:40	3:45	3:45	3:40	3:40	4:00	4:15	4:50	4:50	3:40	3:40	4:25	3:40	7:05	3:40
R30	3:40	3:45	3:45	3:40	3:40	4:00	4:10	4:45	4:45	3:40	3:40	4:25	3:40	7:05	3:40
R31	3:40	3:45	3:45	3:40	3:40	4:00	4:10	4:45	4:45	3:40	3:40	4:25	3:40	7:10	3:40
R32	3:40	3:45	3:45	3:40	3:40	4:00	4:05	4:35	4:35	3:40	3:40	4:25	3:40	7:10	3:40
R33	3:40	3:45	3:45	3:40	3:40	4:00	4:05	4:35	4:35	3:40	3:40	4:25	3:40	6:55	3:40
R34	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R35	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R36	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	4:25	3:40	3:40	4:25	3:40	3:40	3:40

	Summer		Summer		Summer		Winter				Winter		Winter		Summer		Summer	
	Midweek		Weekend		Midweek		Midweek				Weekend		Weekend		Midweek		Weekend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)				
Region	Midday		Midday		Evening		Midday				Midday		Evening		Evening		Special Event	
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Good Weather	Good Weather	Special Event	Special Event	Roadway Impact	
	2-Mile Region and Downwind to 5 Miles - Lake Breeze Adjusted (Nine Mile Point)																	
R37	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R38	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	5:50	3:35	3:35	3:35	
R39	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R40	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R41	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	5:50	3:35	3:35	3:35	
R42	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	5:45	3:35	3:35	3:35	
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																		
R43	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R44	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R45	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R46	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R47	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R48	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R49	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R50	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R51	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R52	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R53	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	
R54	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	3:35	3:35	3:35	

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

Scenario:	Summer		Summer		Summer		Winter		Winter		Winter		Summer		Summer	
	Midweek		Weekend		Midweek		Midweek		Midweek		Weekend		Midweek		Weekend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Good Weather	Evening	Special Event	Roadway Impact
Region	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Good Weather	Evening	Special Event	Roadway Impact
Entire 2-Mile Region, 5-Mile Region																
R01	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R02	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
2-Mile Region and Keyhole to 5 Miles																
R04	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R05	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R06	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R07	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R08	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R09	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R10	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R11	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R12	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R13	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
R14	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																
R43	1:30	1:30	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:35	1:45	1:30
R44	1:35	1:35	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:45	1:45	1:35
R45	1:35	1:35	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:45	1:45	1:35
R46	1:35	1:35	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:45	1:45	1:35
R47	1:35	1:35	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:45	1:45	1:35
R48	1:35	1:35	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:45	1:45	1:35
R49	1:30	1:30	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:30
R50	1:30	1:30	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:30
R51	1:30	1:30	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:30
R52	1:30	1:30	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:30
R53	1:30	1:30	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:30
R54	1:35	1:35	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:45	1:45	1:35

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

Scenario:	Summer		Summer		Summer		Winter		Winter		Winter		Summer		Summer	
	Midweek		Weekend		Midweek		Midweek		Weekend		Weekend		Midweek		Weekend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Region	Midweek		Weekend		Midweek		Midweek		Midweek		Midweek		Midweek		Midweek	
	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain
Entire 2-Mile Region, 5-Mile Region																
R01	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R02	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
2-Mile Region and Keyhole to 5 Miles																
R04	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R05	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R06	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R07	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R08	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R09	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R10	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R11	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R12	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R13	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R14	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																
R43	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R44	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R45	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R46	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R47	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R48	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R49	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R50	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R51	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R52	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R53	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30
R54	3:30	3:30	3:30	3:30	3:30	3:30	3:30	4:15	3:30	3:30	4:15	3:30	3:30	3:30	3:30	3:30

Table 8-7. School 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 R.C. (mi.)	Travel Time from EPZ Bdry to H.S. (min)	ETE to H.S. (hr:min)
Ontario Bible Conference	90	15	13.0	12.8	62	2:50	26.9	36	3:25
New Haven Elementary School	90	15	7.4	46.1	10	1:55	28.9	39	2:35
School Age Children Care Program	90	15	11.7	11.9	60	2:45	26.9	36	3:25
Charles E. Riley Elementary	90	15	6.8	7.8	53	2:40	26.9	36	3:15
Fitzhugh Park Elementary School	90	15	7.9	8.4	57	2:45	26.9	36	3:20
Headstart of Oswego	90	15	7.8	8.4	57	2:45	26.9	36	3:20
Little Luke's Childcare Center	90	15	7.3	8.1	55	2:40	26.9	36	3:20
Oswego Community Christian School	90	15	9.2	9.4	59	2:45	26.9	36	3:20
Trinity Catholic School	90	15	7.8	8.4	57	2:45	26.9	36	3:20
Children's Center of SUNY Oswego	90	15	9.7	10.0	59	2:45	26.9	36	3:20
Frederick Leighton Elementary School	90	15	9.1	8.9	62	2:50	26.9	36	3:25
Kingsford Park Elementary	90	15	6.7	20.9	20	2:05	26.8	36	2:45
Oswego High School	90	15	8.6	8.8	59	2:45	26.9	36	3:20
Oswego Middle School	90	15	5.2	18.7	17	2:05	26.8	36	2:40
Oswego YMCA School's Out Program	90	15	6.7	19.6	21	2:10	26.8	36	2:45
Mexico Elementary School	90	15	4.5	48.8	6	1:55	30.4	41	2:35
Mexico High School	90	15	4.8	47.2	7	1:55	30.4	41	2:35
Mexico Middle School	90	15	5.0	46.6	7	1:55	30.4	41	2:35
Oswego County BOCES	90	15	5.0	46.6	7	1:55	31.4	42	2:35
Minetto Elementary School	90	15	2.2	48.2	3	1:50	26.8	36	2:25
SUNY Oswego	90	15	9.9	9.8	62	2:50	26.9	36	3:25
Maximum for EPZ:						2:50	Maximum:		
Average for EPZ:						2:25	Average:		

Table 8-11. Transit-Dependent Evacuation Time Estimates – Good Weather

Route Number	Bus Number	One-Wave						Distance to R. C. (miles)	Two-Wave					
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)		Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
1	1	90	18.5	13.9	80	30	3:20	26.9	36	5	10	82	30	6:05
2	1	90	16.6	14.0	71	30	3:15	26.9	36	5	10	77	30	5:55
3	1	90	16.2	45.9	21	30	2:25	28.9	39	5	10	79	30	5:10
4	1	90	9.7	46.4	13	30	2:15	28.9	39	5	10	63	30	4:45
5	1	90	8.7	44.6	12	30	2:15	28.9	39	5	10	60	30	4:40
6	1	90	9.9	47.3	13	30	2:15	28.9	39	5	10	63	30	4:45
7	1	90	10.2	46.7	13	30	2:15	30.4	41	5	10	66	30	4:50
8	1	90	9.2	47.3	12	30	2:15	30.4	41	5	10	63	30	4:45
9	1	90	10.4	43.2	14	30	2:15	30.4	41	5	10	67	30	4:50
10	1	90	8.3	45.6	11	30	2:15	30.4	41	5	10	61	30	4:45
11	1	90	10.3	52.2	12	30	2:15	30.4	41	5	10	66	30	4:50
12	1	90	11.1	9.0	74	30	3:15	26.9	36	5	10	64	30	5:40
13	1	90	12.5	10.1	75	30	3:15	26.9	36	5	10	67	30	5:45
14	1	90	17.1	10.8	95	30	3:35	26.9	36	5	10	79	30	6:15
15	1	90	17.7	12.2	87	30	3:30	26.9	36	5	10	81	30	6:15
16	1	90	19.0	13.4	85	30	3:30	26.9	36	5	10	83	30	6:15
17	1	90	7.1	47.4	9	30	2:10	28.9	39	5	10	56	30	4:30
18	1	90	10.4	47.4	13	30	2:15	28.9	39	5	10	64	30	4:45
19	1	90	9.8	46.6	13	30	2:15	35.4	47	5	10	73	30	5:00
20	1	90	8.9	48.4	11	30	2:15	35.4	47	5	10	69	30	5:00

	Route Number	Bus Number	One-Wave					Distance to R. C. (miles)	Two-Wave						
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)		ETE (hr:min)	Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
	21	1	90	16.3	36.6	27	30	2:30	35.4	47	5	10	92	30	5:35
	22	1	90	12.1	45.0	16	30	2:20	30.4	41	5	10	71	30	5:00
	23	1	90	8.3	45.0	11	30	2:15	30.4	41	5	10	61	30	4:45
	24	1	90	6.9	48.4	9	30	2:10	35.4	47	5	10	64	30	4:50
	25	1	90	10.5	11.1	57	30	3:00	26.9	36	5	10	62	30	5:25
	26	1	90	11.2	11.2	60	30	3:00	26.9	36	5	10	64	30	5:25
	27	1	90	9.9	8.0	74	30	3:15	26.9	36	5	10	61	30	5:40
	28	1	90	8.2	14.2	35	30	2:35	26.9	36	5	10	56	30	4:55
	29	1	90	9.8	7.7	76	30	3:20	26.9	36	5	10	60	30	5:45
	30	1	90	8.2	7.2	68	30	3:10	26.9	36	5	10	56	30	5:30
	31	1	90	8.8	7.2	73	30	3:15	26.9	36	5	10	57	30	5:35
	32	1	90	3.4	8.4	24	30	2:25	26.9	36	5	10	44	30	4:30
	33	1	90	7.9	8.4	56	30	3:00	26.9	36	5	10	55	30	5:20
	34	1	90	8.0	8.4	57	30	3:00	26.9	36	5	10	55	30	5:20
	35	1	90	8.6	7.9	65	30	3:10	26.9	36	5	10	57	30	5:30
	36	1	90	6.5	20.6	19	30	2:20	26.8	36	5	10	52	30	4:35
	37	1	90	9.2	17.5	32	30	2:35	26.8	36	5	10	59	30	5:00
	38	1	90	6.5	17.5	22	30	2:25	26.8	36	5	10	52	30	4:40
	39	1	90	7.6	4.5	102	30	3:45	26.8	36	5	10	55	30	6:05
	40	1	90	6.6	19.0	21	30	2:25	26.8	36	5	10	53	30	4:40

		One-Wave								Two-Wave						
		Bus Number	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)
Route Number																
41	1	90	8.3	4.6	107	30	3:50	26.8	36	5	10	57	30	6:10		
42	1	90	8.7	5.0	105	30	3:45	26.8	36	5	10	58	30	6:05		
43	1	90	10.0	8.3	72	30	3:15	26.8	36	5	10	62	30	5:40		
44	1	90	9.9	20.1	29	30	2:30	26.8	36	5	10	61	30	4:55		
45	1	90	9.8	10.6	55	30	3:00	26.8	36	5	10	61	30	5:25		
46	1	90	9.2	20.1	27	30	2:30	26.8	36	5	10	59	30	4:55		
47	1	90	8.4	46.4	11	30	2:15	28.9	39	5	10	59	30	4:40		
48	1	90	8.6	46.4	11	30	2:15	28.9	39	5	10	60	30	4:40		
49	1	90	10.7	12.1	53	30	2:55	26.9	36	5	10	63	30	5:20		
50	1	90	10.0	12.0	50	30	2:50	26.9	36	5	10	60	30	5:15		
51	1	90	10.6	8.0	79	30	3:20	26.9	36	5	10	62	30	5:45		
52	1	90	9.6	8.3	69	30	3:10	26.9	36	5	10	60	30	5:35		
53	1	90	17.9	45.1	24	30	2:25	30.4	41	5	10	85	30	5:20		
54	1	90	4.1	44.9	5	30	2:10	28.9	39	5	10	49	30	4:25		
55	1	90	9.2	47.7	12	30	2:15	28.9	39	5	10	61	30	4:40		
56	1	90	9.2	47.7	12	30	2:15	28.9	39	5	10	61	30	4:40		
57	1	90	5.3	47.7	7	30	2:10	28.9	39	5	10	51	30	4:25		
58	1	90	8.5	39.0	13	30	2:15	26.9	36	5	10	58	30	4:35		
59	1	90	6.5	39.9	10	30	2:10	26.9	36	5	10	53	30	4:25		
60	1	90	7.0	39.0	11	30	2:15	26.9	36	5	10	54	30	4:35		

		One-Wave								Two-Wave							
		Bus Number		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)
Route Number	61			1	90	7.4	39.0	11	30	2:15	26.9	36	5	10	54	30	4:30
	62	1	90	6.7	39.0	10	30	2:15	26.9	36	5	10	53	30	4:30		
	63	1	90	5.2	46.3	7	30	2:10	26.8	36	5	10	49	30	4:20		
	64	1	90	5.2	45.8	7	30	2:10	26.8	36	5	10	49	30	4:20		
	65	1	90	7.6	40.3	11	30	2:15	26.8	36	5	10	55	30	4:35		
	66	1	90	4.4	40.3	7	30	2:10	26.8	36	5	10	47	30	4:20		
	67	1	90	4.6	40.3	7	30	2:10	26.8	36	5	10	47	30	4:20		
	68	1	90	6.1	40.3	9	30	2:10	26.8	36	5	10	51	30	4:25		
	69	1	90	5.6	46.3	7	30	2:10	26.8	36	5	10	50	30	4:25		
	70	1	90	9.7	4.9	119	30	4:00	26.8	36	5	10	61	30	6:25		
	71	1	90	8.4	5.0	100	30	3:45	26.8	36	5	10	57	30	6:05		
	72	1	90	5.8	3.0	117	30	4:00	37.7	50	5	10	65	30	6:45		
	73	1	90	3.9	6.7	35	30	2:35	37.7	50	5	10	60	30	5:15		
	74	1	90	4.2	6.3	40	30	2:40	37.7	50	5	10	61	30	5:20		
	75	1	90	11.1	8.0	83	30	3:25	26.9	36	5	10	63	30	5:50		
	76	1	90	4.7	48.4	6	30	2:10	35.4	47	5	10	59	30	4:45		
		Maximum ETE:							4:00	Maximum ETE:							6:45
		Average ETE:							2:45	Average ETE:							5:10

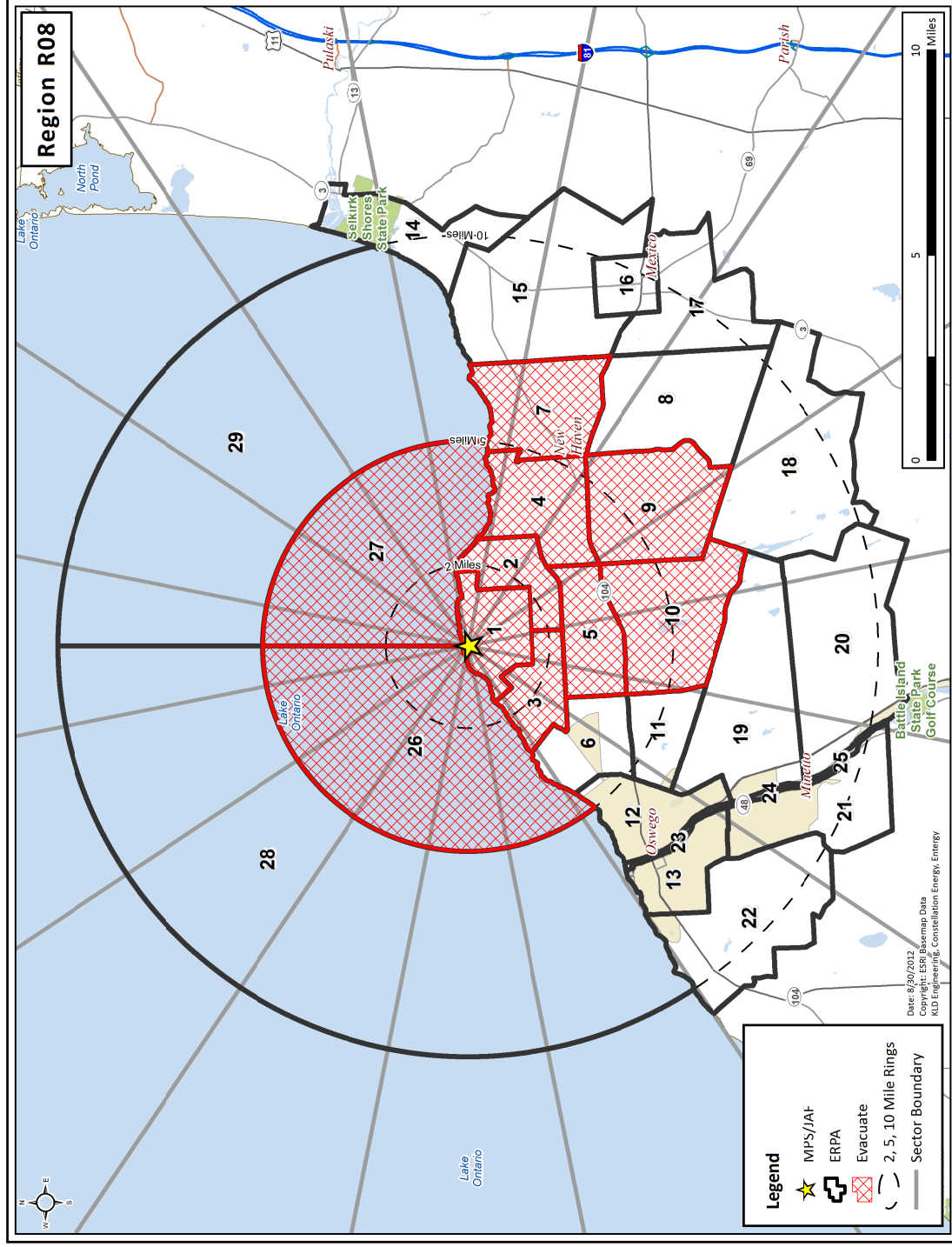


Figure H-8. Region R08

## 1 INTRODUCTION

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Nine Mile Point Nuclear Station and James A. FitzPatrick Nuclear Power Plant (NMP/JAF), located in Oswego County, NY. ETE provide state and local 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:

- Criteria for Development of Evacuation Time Estimate Studies, NUREG/CR-7002, November 2011.
- Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG 0654/FEMA REP 1, Rev. 1, November 1980.
- Analysis of Techniques for Estimating Evacuation Times for Emergency Planning Zones, NUREG/CR 1745, November 1980.
- Development of Evacuation Time Estimates for Nuclear Power Plants, NUREG/CR-6863, January 2005.

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.

**Table 1-1. Stakeholder Interaction**

Stakeholder	Nature of Stakeholder Interaction
Constellation Energy emergency planning personnel	Meetings to define data requirements and set up contacts with local government agencies
Entergy Emergency planning personnel	
Oswego County Emergency Management Office	Meetings to define data requirements and set up contacts with local government agencies. Obtain local emergency plans, special facility data, major employment data
New York State Office of Emergency Management	Obtain state emergency plan
Local and State Police Agencies	Obtain existing traffic management plans

### 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 Constellation

Energy/Entergy.

- b. Attended meetings with emergency planners from the New York State Office of Emergency Management and Oswego County Emergency Management and local law enforcement to identify issues to be addressed and resources available.
  - c. Conducted a detailed field survey of the highway system and of area traffic conditions within the Emergency Planning Zone (EPZ) and Shadow Region.
  - d. Obtained demographic data from the 2010 census, state and local agencies.
  - e. Conducted a random sample telephone survey of EPZ residents.
  - f. Conducted a data collection effort to identify and describe schools, 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 random sample telephone survey.
  3. Defined Evacuation Scenarios. These scenarios 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 to be implemented by local and state police in the event of an incident at NMP/JAF. Traffic control is applied at specified Traffic Control Points (TCP) located within the EPZ.
  5. Used existing ERPAs to define Evacuation Regions. The EPZ is partitioned into 29 ERPAs along jurisdictional and geographic boundaries. "Regions" are groups of contiguous ERPAs 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.
  6. Estimated demand for transit services for persons at "Special Facilities" and for transit-dependent persons 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 local and state agencies, Constellation Energy, Entergy and from the telephone survey.
    - b. Applied the procedures specified in the 2010 Highway Capacity Manual (HCM<sup>1</sup>) to the data acquired during the field survey, to estimate the capacity of all

---

<sup>1</sup> Highway Capacity Manual (HCM 2010), Transportation Research Board, National Research Council, 2010.

highway segments comprising the evacuation routes.

- c. Developed 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 NMP/JAF.
8. Executed the DYNEV II model 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.
  10. Calculated the ETE for all transit activities including those for special facilities (schools, medical facilities, etc.), for the transit-dependent population and for homebound special needs population.

## **1.2 The Locations of Nine Mile Point and James A. FitzPatrick**

Nine Mile point and James A. FitzPatrick are on adjacent parcels of land which border the southeast shore of Lake Ontario in the Town of Scriba in Oswego County, New York. The site is approximately 35 miles northwest of Syracuse, NY. The Emergency Planning Zone (EPZ) consists of parts of Oswego County and Lake Ontario. Figure 1-1 displays the area surrounding NMP/JAF. This map identifies the communities in the area and the major roads.

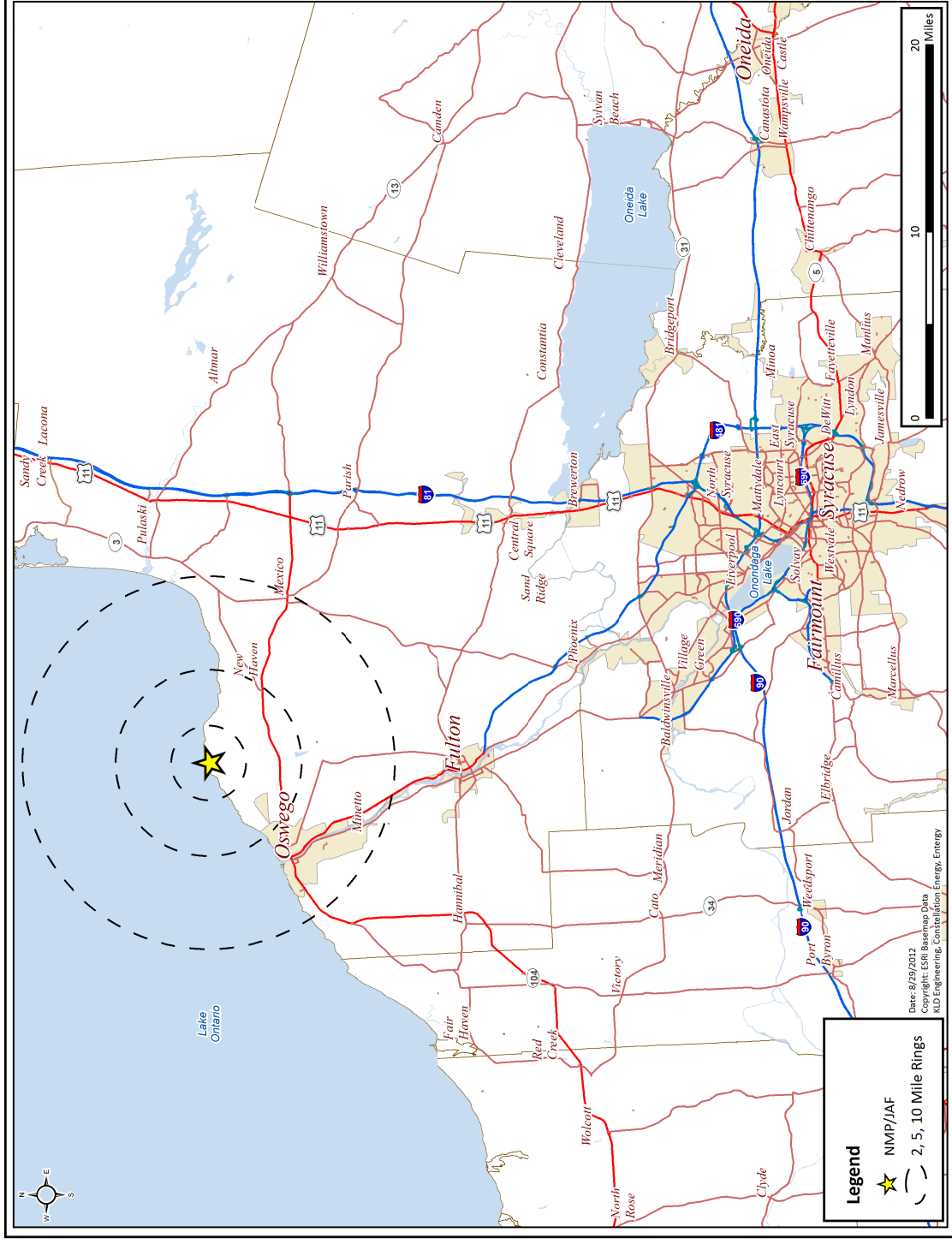


Figure 1-1. Location of Nine Mile Point Nuclear Station and James A. FitzPatrick Nuclear Power Plant

### 1.3 Preliminary Activities

These activities are described below.

#### Field Surveys of the Highway Network

KLD personnel drove the entire highway system within the EPZ and the Shadow Region which consists of the area between the EPZ boundary and approximately 15 miles radially from NMP/JAF. The characteristics of each section of highway were recorded. These characteristics are shown in Table 1-2:

**Table 1-2. Highway Characteristics**

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

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 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 15-30 in the HCM 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 geographical 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.

As documented on page 15-5 of the HCM 2010, the capacity of a two-lane highway is 1700 passenger cars per hour in one direction. For freeway sections, a value of 2250 vehicles per hour per lane is assigned, as per Exhibit 11-17 of the HCM 2010. 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 15-30. These links may be

identified by reviewing Appendix K. 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 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 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.

### Telephone Survey

A telephone survey was undertaken to gather information needed for the evacuation study. Appendix F presents the survey instrument, the procedures used and tabulations of data compiled from the survey returns.

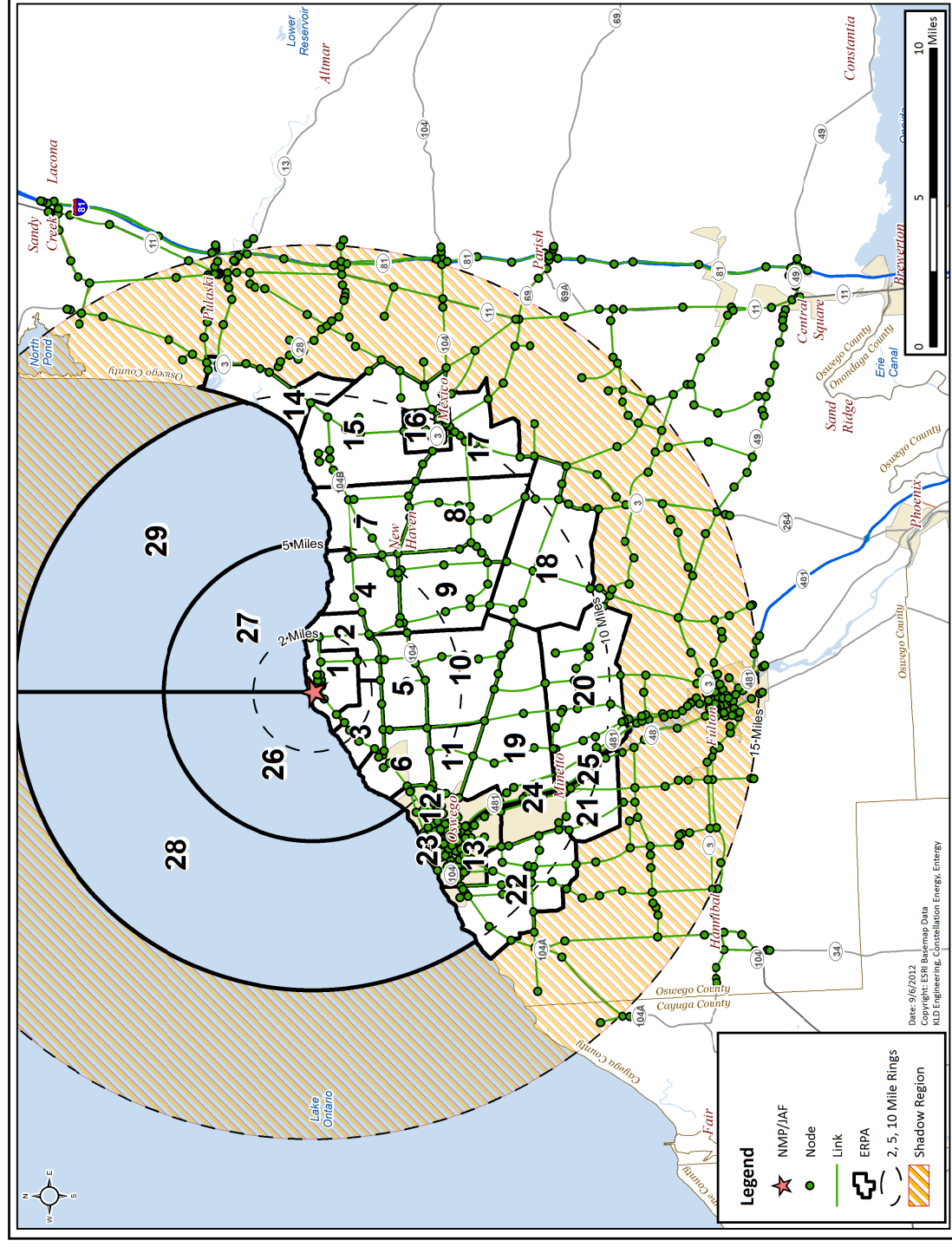
These data were utilized to develop estimates of vehicle occupancy to estimate the number of evacuating vehicles during an evacuation and to estimate elements of the mobilization process. This database was also referenced to estimate the number of transit-dependent residents.

### 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 NMP/JAF 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 NMP/JAF.

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 Prior ETE Study

Table 1-3 presents a comparison of the present ETE study with the 2003 study. The major factors contributing to the differences between the ETE values obtained in this study and those of the previous study can be summarized as follows:

- Vehicle occupancy and trip-generation rates are based on the results of an updated telephone survey of EPZ residents.
- A later generation evacuation model (DYVEV II) was employed which uses dynamic traffic assignment and distribution
- The findings of an updated road survey were incorporated
- Road capacities are based on 2010 HCM
- Different voluntary and shadow evacuation percentages are used
- The highway representation is more detailed.

**Table 1-3. ETE Study Comparisons**

Topic	Previous ETE Study	Current ETE Study
<b>Resident Population Basis</b>	2000 US Census Data, extrapolated to 2003; Population estimate = 41,903	ArcGIS Software using 2010 US Census blocks; area ratio method used. Population = 41,887
<b>Resident Population Vehicle Occupancy</b>	2.74 persons/household, 1.25 vehicles/household, yielding 2.19 persons per vehicle.	2.39 persons/household, 1.24 evacuating vehicles/household yielding: 1.93 persons/vehicle.
<b>Employee Population</b>	Employment journey to work data identified the proportion of employees who commute into the EPZ relative to the total number of employees. These proportions were applied on an ERPA by ERPA basis to total employment information for the year 2000 from NYS Dept. of Labor. One person per employee vehicle.	Employee estimates based on information provided by Oswego County about major employers in EPZ. 1.09 employees per vehicle based on telephone survey results. Employees = 1,714

Topic	Previous ETE Study	Current ETE Study
<b>Transit-Dependent Population</b>	Defined as households with 0 vehicles + households with 1 and 2 vehicles with commuters who do not return home. 3,801 total transit dependent people requiring 127 bus runs.	Estimates based upon U.S. Census data and the results of the telephone survey. A total of 1,881 people who do not have access to a vehicle, requiring at least 63 buses to evacuate. An additional 208 homebound special needs persons require transportation to evacuate (151 ambulatory and 57 wheelchair bound people, transported in 19 wheelchair vans).
<b>Transient Population</b>	Based on telephone calls to individual facilities. Transients = 11,920	Transient estimates based upon information provided about transient attractions in EPZ, supplemented by observations of the facilities during the road survey, internet searches and from phone calls to facilities. Transients = 8,315 (including 2,349 commuting SUNY students).
<b>Special Facilities Population</b>	Medical and correctional facility census approximately 1000.	Medical facility population based on information provided by Oswego County. Current census = 1,080 Wheelchair and regular buses Required = 223 Ambulances Required = 14 Correctional facility census = 160; 6 buses required.
<b>School Population</b>	School population based on information provided by the county. School enrollment = 8,710 SUNY Oswego enrollment 5,175 commuter students and 3,600 resident students.	School population based on information provided by Oswego County Emergency Management. School enrollment = 15,377 (including SUNY commuter students) Buses required = 160

Topic	Previous ETE Study	Current ETE Study
<b>Voluntary evacuation from within EPZ in areas outside region to be evacuated</b>	50% voluntary evacuation within the circle defined by the furthest radial extent of the Evacuation Region, 35% for EPZ population beyond this extent.	20 percent of the population within the EPZ, but not within the Evacuation Region (see Figure 2-1)
<b>Shadow Evacuation</b>	35% shadow evacuation.	20% of people outside of the EPZ within the Shadow Region (see Figure 7-2)
<b>Network Size</b>	964 links.	1,057 links; 716 nodes
<b>Roadway Geometric Data</b>	Field surveys conducted in 2002. Road capacities based on 2000 HCM.	Field surveys conducted in March 2012. Roads and intersections were video archived. Road capacities based on 2010 HCM.
<b>School Evacuation</b>	Direct evacuation to designated reception center/host school.	Direct evacuation to designated reception center.
<b>Ridesharing</b>	50 percent of transit-dependent persons will evacuate with a neighbor or friend.	50 percent of transit-dependent persons will evacuate with a neighbor or friend.
<b>Trip Generation for Evacuation</b>	Based on residential telephone survey of specific pre-trip mobilization activities:  Residents with commuters returning leave between 30 and 135 minutes  Residents without commuters returning leave between 15 and 120 minutes  Employees and transients leave between 15 and 90 minutes.  Times measured from the Order to Evacuate for all above.  Additional time to clear snow added to residential evacuation times for snow scenarios.	Based on residential telephone survey of specific pre-trip mobilization activities:  Residents with commuters returning leave between 15 and 210 minutes.  Residents without commuters returning leave between 5 and 165 minutes.  Employees and transients leave between 5 and 120 minutes.  All times measured from the Advisory to Evacuate.
<b>Weather</b>	Clear, 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.	Normal, 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.
<b>Modeling</b>	IDYNEV System: TRAD and PC DYNEV	DYNEV II System – Version 4.0.8.0

Topic	Previous ETE Study	Current ETE Study
<b>Special Events</b>	Classic Weekend and Harborfest	Harborfest Fireworks Special Event Population = 54,900 additional transients
<b>Evacuation Cases</b>	51 Regions and 14 Scenarios producing 714 unique cases.	54 Regions) and 14 Scenarios producing 756 unique cases.
<b>Evacuation Time Estimates Reporting</b>	ETE reported for 50 <sup>th</sup> , 90 <sup>th</sup> , 95 <sup>th</sup> and 100 <sup>th</sup> percentile for all regions. Results presented by Region and Scenario.	ETE reported for 90 <sup>th</sup> and 100 <sup>th</sup> percentile population. Results presented by Region and Scenario.
<b>Evacuation Time Estimates for the entire EPZ, 90<sup>th</sup> percentile</b>	Winter Weekday Midday, Good Weather: 3:10  Summer Weekend, Midday, Good Weather: 3:15	Winter Weekday Midday, Good Weather: 2:55  Summer Weekend, Midday, Good Weather: 2:35

## 2 STUDY ESTIMATES AND ASSUMPTIONS

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

### 2.1 Data Estimates

1. Population estimates are based upon Census 2010 data.
2. Estimates of employees who reside outside the EPZ and commute to work within the EPZ are based upon data obtained from Oswego County Emergency Management.
3. Population estimates at special facilities are based on available data from the county emergency management offices and from phone calls to specific facilities.
4. Roadway capacity estimates are based on field surveys and the application of the Highway Capacity Manual 2010.
5. Population mobilization times are based on a statistical analysis of data acquired from a random sample telephone survey of EPZ residents (see Section 5 and Appendix F).
6. The relationship between resident population and evacuating vehicles is developed from the telephone survey. Average values of 2.39 persons per household and 1.24 evacuating vehicles per household are used. The relationship between persons and vehicles for transients and employees is as follows:
  - a. Employees: 1.09 employees per vehicle (telephone survey results) for all major employers.
  - b. Parks and Marinas: Vehicle occupancy based on average household size from the telephone survey.
  - c. Special Events: Assumed transients attending the Harborfest firework show travel as families/households in a single vehicle, and used the average household size of 2.39 persons to estimate the number of vehicles.

## 2.2 Study Methodological Assumptions

1. ETE are presented for the evacuation of the 90<sup>th</sup> and 100<sup>th</sup> percentiles of population for each Region and for each Scenario. The percentile ETE is defined as the elapsed time from the Advisory to Evacuate issued to a specific Region of the EPZ, to the time that Region is clear of the indicated percentile of evacuees. A Region is defined as a group of ERPAs that is issued an Advisory to Evacuate. A scenario is a combination of circumstances, including time of day, day of week, season, and weather conditions.
2. The ETE are computed and presented in tabular format and graphically, in a format compliant with NUREG/CR-7002.
3. Evacuation movements (paths of travel) are generally outbound relative to NMP/JAF to the extent permitted by the highway network. All major evacuation routes are used in the analysis.
4. Regions are defined by the underlying “keyhole” or circular configurations as specified in Section 1.4 of NUREG/CR-7002 as well as those which result from the plant specific PARs which may be issued at either NMP or JAF. These Regions, as defined, display irregular boundaries reflecting the geography of the ERPAs included within these underlying configurations.
5. As indicated in Figure 2-2 of NUREG/CR-7002, 100% of people within the impacted region evacuate. 20% of those people within the EPZ, not within the impacted region, will voluntarily evacuate. 20% of those people within the Shadow Region will voluntarily evacuate. See Figure 2-1 for a graphical representation of these evacuation percentages. Sensitivity studies explore the effect on ETE of increasing the percentage of voluntary evacuees in the Shadow Region (see Appendix M).
6. A total of 14 “Scenarios” representing different temporal variations (season, time of day, day of week) and weather conditions are considered. These Scenarios are outlined in Table 2-1.
7. Scenario 14 considers the closure of a single lane southbound on SR 481, for the length of the two lane section of this roadway which is about 4/10<sup>ths</sup> of a mile south of Churchill Road to 1/4<sup>th</sup> mile north of Van Buren Dr.
8. 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<sup>1</sup>). The models have continuously been refined and extended since those hearings and were independently validated by a consultant retained by the NRC. The new DYNEV II model incorporates the latest technology in traffic simulation and in dynamic traffic assignment.

---

<sup>1</sup> Urbanik, T., et. al. Benchmark Study of the I-DYNEV Evacuation Time Estimate Computer Code, NUREG/CR-4873, Nuclear Regulatory Commission, June, 1988.

**Table 2-1. Evacuation Scenario Definitions**

Scenario	Season <sup>2</sup>	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	None
8	Winter	Midweek	Midday	Snow	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain	None
11	Winter	Weekend	Midday	Snow	None
12	Winter	Midweek, Weekend	Evening	Good	None
13	Summer	Weekend	Evening	Good	Special Event – Harborfest Fireworks
14	Summer	Midweek	Midday	Good	Roadway Impact – SB Lane Closure on SR 481

<sup>2</sup> Winter assumes that school is in session (also applies to spring and autumn). Summer assumes that school is not in session.

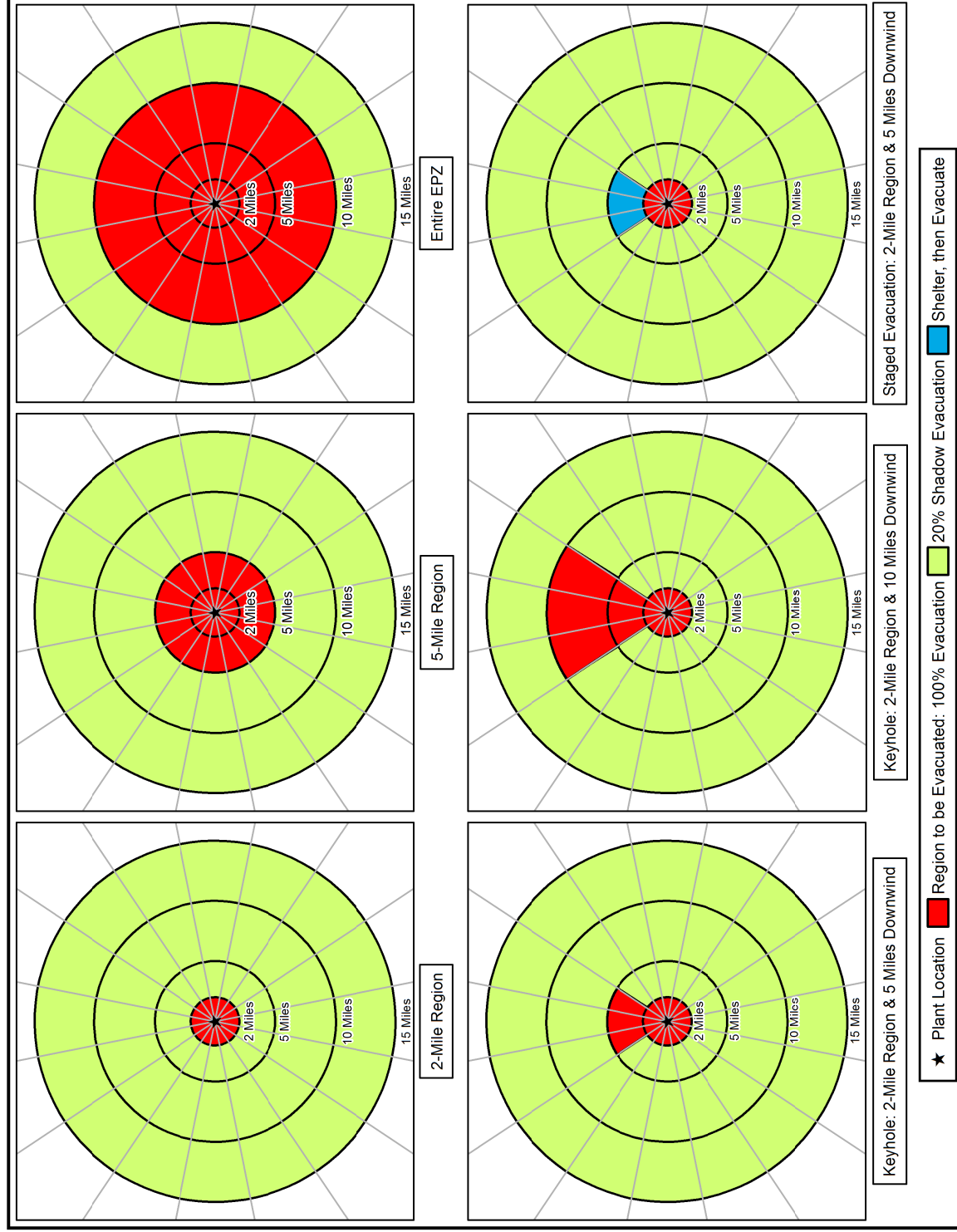


Figure 2-1. Voluntary Evacuation Methodology

## 2.3 Study Assumptions

1. The Planning Basis Assumption for the calculation of ETE is a rapidly escalating accident that requires evacuation, and includes the following:
  - a. Advisory to Evacuate is announced coincident with the siren notification.
  - b. Mobilization of the general population will commence within 15 minutes after siren notification.
  - c. ETE are measured relative to the Advisory to Evacuate.
2. It is assumed that everyone within the group of ERPA's forming a Region that is issued an Advisory to Evacuate will, in fact, respond and evacuate in general accord with the planned routes.
3. 56 percent of the households in the EPZ have at least 1 commuter; 45 percent of those households with commuters will await the return of a commuter before beginning their evacuation trip, based on the telephone survey results. Therefore 25 percent ( $56\% \times 45\% = 25\%$ ) of EPZ households will await the return of a commuter, prior to beginning their evacuation trip.
4. The ETE will also include consideration of "through" (External-External) trips during the time that such traffic is permitted to enter the evacuated Region. "Normal" traffic flow is assumed to be present within the EPZ at the start of the emergency.
5. Access Control Points (ACP) will be staffed within approximately 120 minutes following the siren notifications, to divert traffic attempting to enter the EPZ. Earlier activation of ACP locations could delay returning commuters. It is assumed that no through traffic will enter the EPZ after this 120 minute time period.
6. Traffic Control Points (TCP) within the EPZ will be staffed over time, beginning at the Advisory to Evacuate. Their number and location will depend on the Region to be evacuated and resources available. The objectives of these TCP are:
  - a. Facilitate the movements of all (mostly evacuating) vehicles at the location.
  - b. Discourage inadvertent vehicle movements towards NMP/JAF.
  - c. Provide assurance and guidance to any traveler who is unsure of the appropriate actions or routing.
  - d. Act as local surveillance and communications center.
  - e. Provide information to the emergency operations center (EOC) as needed, based on direct observation or on information provided by travelers.

In calculating ETE, it is assumed that evacuees will drive safely, travel in directions identified in the plan, and obey all control devices and traffic guides.

7. Buses will be used to transport those without access to private vehicles:
  - a. If schools are in session, transport (buses) will evacuate students directly to the designated reception center.
  - b. It is assumed parents will pick up children at day care centers prior to evacuation.
  - c. Buses, wheelchair vans and ambulances will evacuate patients at medical facilities and at any senior facilities within the EPZ, as needed.
  - d. Transit-dependent general population will be evacuated to reception centers.
  - e. Schoolchildren, if school is in session, are given priority in assigning transit vehicles.
  - f. Bus mobilization time is considered in ETE calculations.
  - g. Analysis of the number of required round-trips (“waves”) of evacuating transit vehicles is presented.
  - h. Transport of transit-dependent evacuees from reception centers to congregate care centers is not considered in this study.
8. Provisions are made for evacuating the transit-dependent portion of the general population to reception centers by bus, based on the assumption that some of these people will ride-share with family, neighbors, and friends, thus reducing the demand for buses. We assume that the percentage of people who rideshare is 50 percent. This assumption is based upon reported experience for other emergencies<sup>3</sup>, and on guidance in Section 2.2 of NUREG/CR-7002.
9. 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 earlier or at about the same time the evacuation advisory is issued. No weather-related reduction in the number of transients who may be present in the EPZ is assumed. It is assumed that roads are passable and that the appropriate agencies are plowing the roads as they would normally when snowing.

Adverse weather scenarios affect roadway capacity and the free flow highway speeds. The factors applied for the ETE study are based on recent research on the effects of weather on roadway operations<sup>4</sup>; the factors are shown in Table 2-2.

---

<sup>3</sup> Institute for Environmental Studies, University of Toronto, THE MISSISSAUGA EVACUATION FINAL REPORT, June 1981. The 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 76% (Page 5-10).

<sup>4</sup> Agarwal, M. et. Al. Impacts of Weather on Urban Freeway Traffic Flow Characteristics and Facility Capacity, Proceedings of the 2005 Mid-Continent Transportation Research Symposium, August, 2005. The results of this paper are included as Exhibit 10-15 in the HCM 2010.

10. School buses used to transport students are assumed to transport 70 students per bus for elementary schools and 50 students per bus for middle and high schools, based on information provided in the local emergency plans. Transit buses used to transport the transit-dependent general population are assumed to transport 30 people per bus. Wheelchair equipped buses are assumed to carry 34 ambulatory and 2 wheelchair bound individuals and wheelchair vans can accommodate 11 ambulatory and 3 wheelchair bound persons. The capacities of wheelchair-carrying vehicles are based on information provided in the local emergency plans. Ambulances are assumed to carry 2 bedridden occupants.

**Table 2-2. Model Adjustment for Adverse Weather**

Scenario	Highway Capacity*	Free Flow Speed*	Mobilization Time for General Population
Rain	90%	90%	No Effect
Snow	80%	80%	Clear driveway before leaving home (See Figure F-13)
*Adverse weather capacity and speed values are given as a percentage of good weather conditions. Roads are assumed to be passable.			

### 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 2010 Census, however, 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 shops within the EPZ could be counted as a resident, again as an employee and once again as a shopper.
- A visitor who stays at a hotel and spends time at a park, then goes shopping 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 NMP/JAF 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 (shopping, recreation) and then leave the area.
- Employees - people who reside outside of the EPZ and commute to businesses 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 ERPA and by polar coordinate representation (population rose). The NMP/JAF EPZ is subdivided into 29 ERPAs. The EPZ is shown in Figure 3-1.

### 3.1 Permanent Residents

The primary source for estimating permanent population is the latest U.S. Census data. The average household size (2.39 persons/household – See Figure F-1) and the number of evacuating vehicles per household (1.24 vehicles/household – See Figure F-8) were adapted from the telephone survey results.

Population estimates are based upon Census 2010 data. The estimates are created by cutting the census block polygons by the ERPA and EPZ boundaries. 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 what the population is within the EPZ. This methodology assumes that the population is evenly distributed across a census block. Table 3-1 provides the permanent resident population within the EPZ, by ERPA based on this methodology.

The year 2010 permanent resident population is divided by the average household size and then multiplied by the average number of evacuating vehicles per household in order to estimate number of vehicles. 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 NMP/JAF. This “rose” was constructed using GIS software.

It can be argued that this 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 percent of all households vacation for a two-week period over the summer.
- Assume these vacations, in aggregate, are uniformly dispersed over 10 weeks, i.e. 10 percent 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 percent 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.

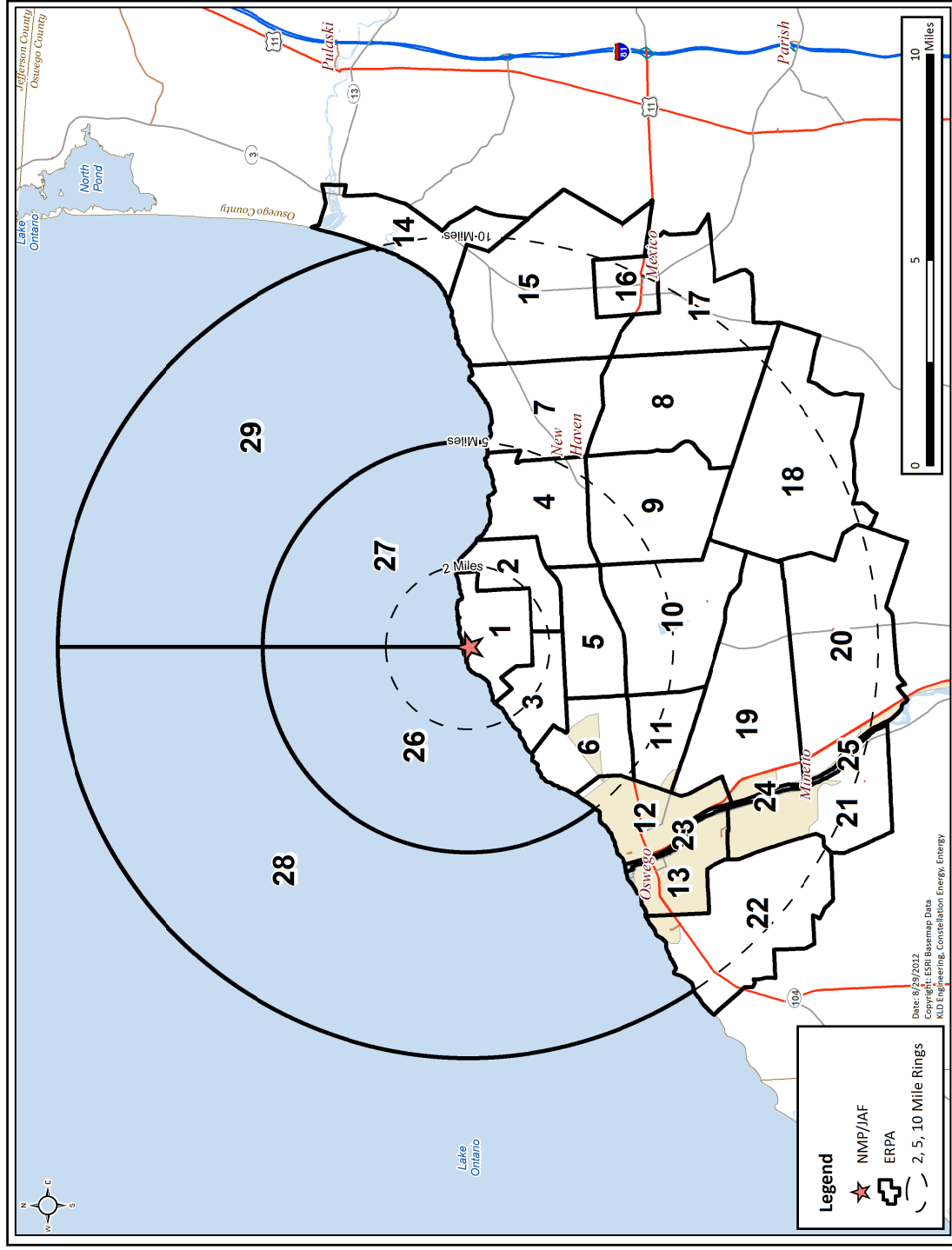


Figure 3-1. NMP/JAF EPZ

**Table 3-1. EPZ Permanent Resident Population**

<b>ERPA</b>	<b>2000 Population</b>	<b>2010 Population</b>
<b>1</b>	188	173
<b>2</b>	469	469
<b>3</b>	418	343
<b>4</b>	634	687
<b>5</b>	836	804
<b>6</b>	873	915
<b>7</b>	753	699
<b>8</b>	785	718
<b>9</b>	627	597
<b>10</b>	1,119	1,023
<b>11</b>	2,008	1,916
<b>12</b>	7,756	7,960
<b>13</b>	10,236	10,223
<b>14</b>	289	193
<b>15</b>	1,177	1,105
<b>16</b>	1,572	1,624
<b>17</b>	614	587
<b>18</b>	1,135	1,030
<b>19</b>	1,513	1,316
<b>20</b>	1,695	1,783
<b>21</b>	1,786	1,782
<b>22</b>	5,234	5,940
<b>TOTAL</b>	<b>41,717</b>	<b>41,887</b>
<b>EPZ Population Growth:</b>		<b>0.41%</b>

**Table 3-2. Permanent Resident Population and Vehicles by ERPA**

<b>ERPA</b>	<b>2010 Population</b>	<b>2010 Resident Vehicles</b>
<b>1</b>	173	92
<b>2</b>	469	244
<b>3</b>	343	178
<b>4</b>	687	358
<b>5</b>	804	418
<b>6</b>	915	473
<b>7</b>	699	364
<b>8</b>	718	373
<b>9</b>	597	310
<b>10</b>	1,023	533
<b>11</b>	1,916	994
<b>12</b>	7,960	4,130
<b>13</b>	10,223	5,382
<b>14</b>	193	104
<b>15</b>	1,105	571
<b>16</b>	1,624	844
<b>17</b>	587	307
<b>18</b>	1,030	535
<b>19</b>	1,316	686
<b>20</b>	1,783	929
<b>21</b>	1,782	927
<b>22</b>	5,940	4,168
<b>TOTAL</b>	<b>41,887</b>	<b>22,920</b>

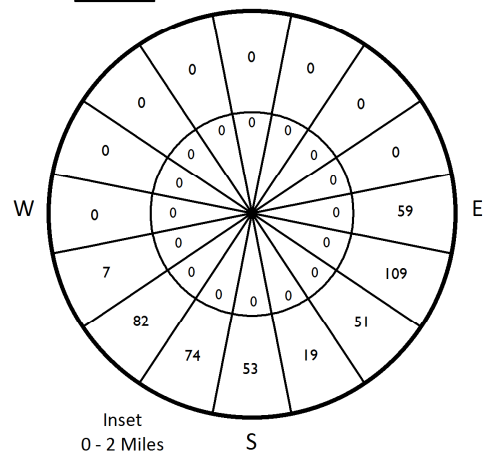
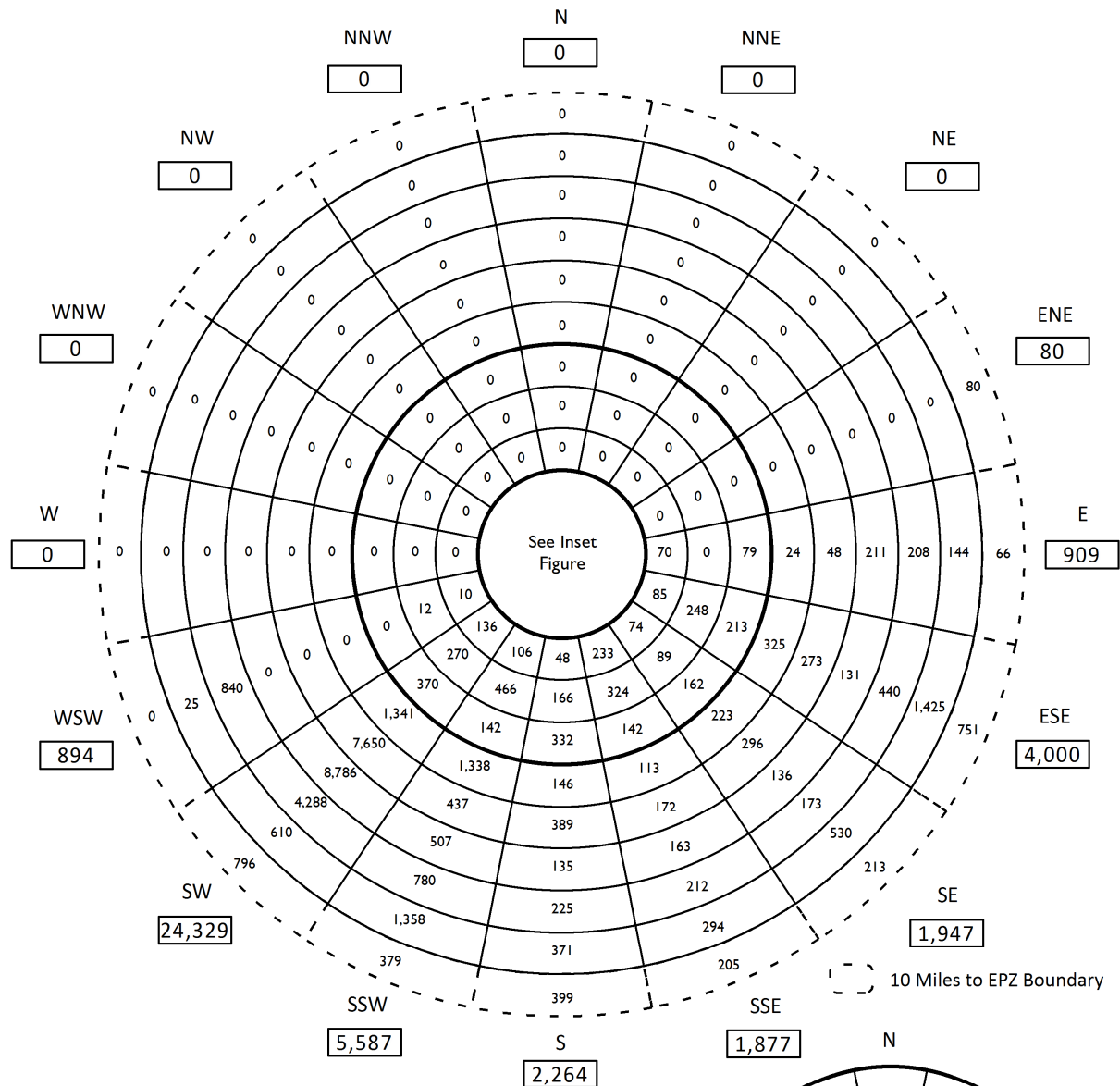
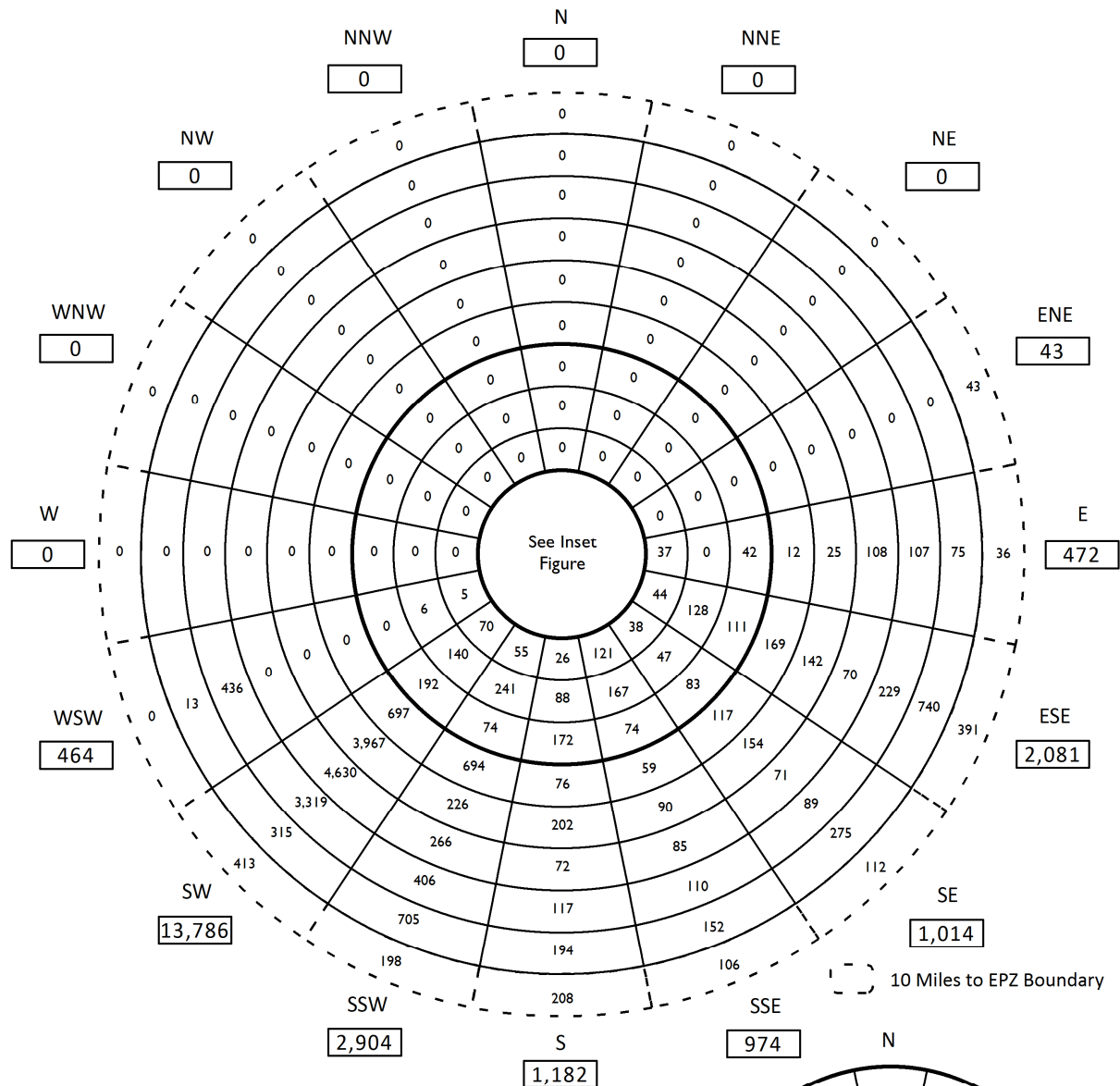


Figure 3-2. Permanent Resident Population by Sector



#### Resident Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	238	238
2 - 3	396	634
3 - 4	817	1,451
4 - 5	748	2,199
5 - 6	1,824	4,023
6 - 7	4,806	8,829
7 - 8	5,302	14,131
8 - 9	4,813	18,944
9 - 10	2,469	21,413
10 - EPZ	1,507	22,920
Total:		22,920

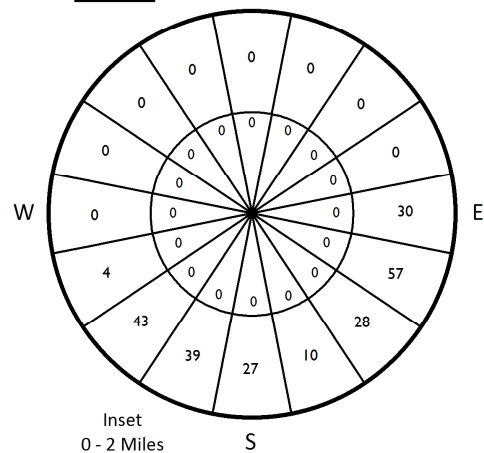


Figure 3-3. Permanent Resident Vehicles by Sector

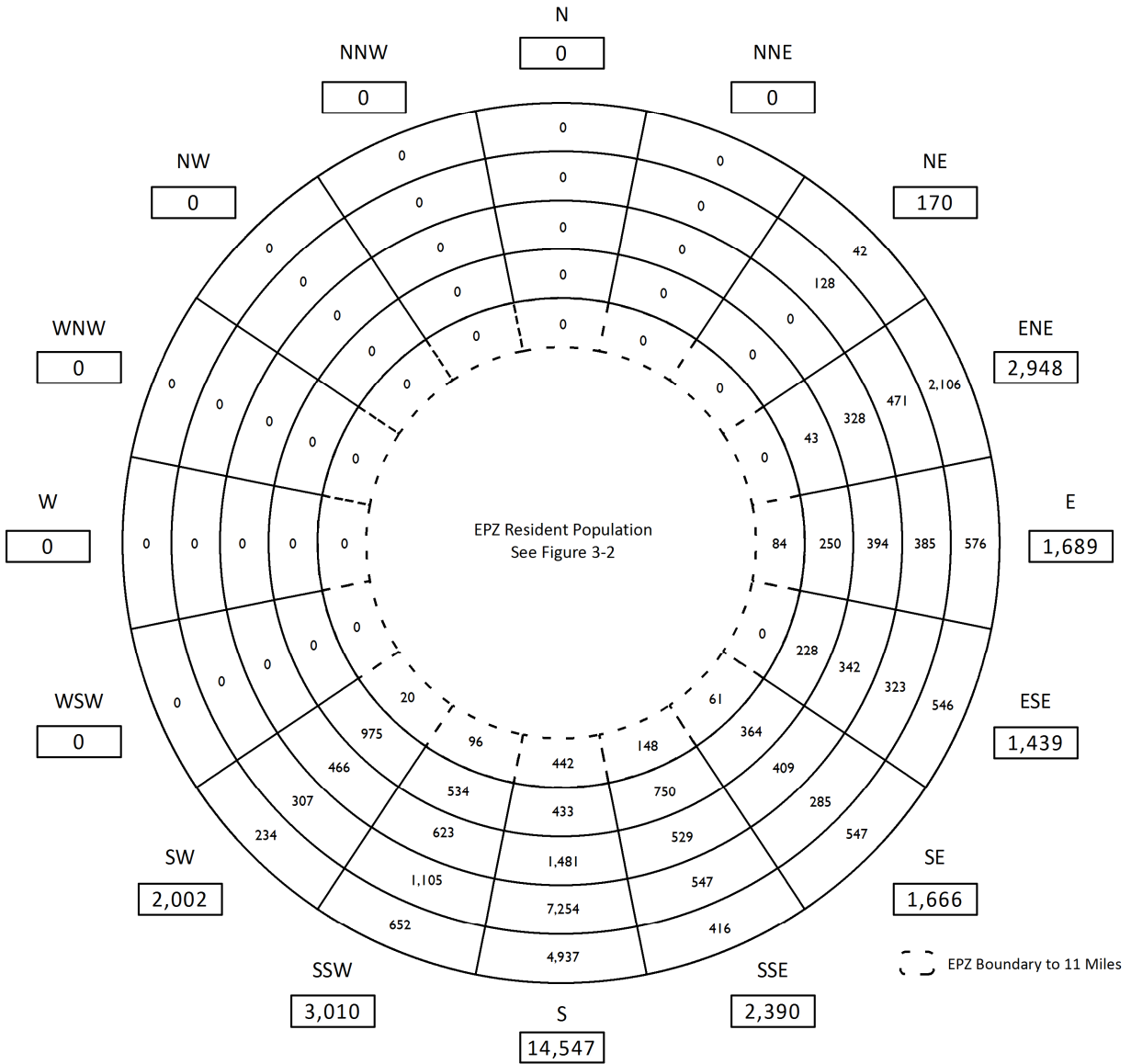
### 3.2 Shadow Population

A portion of the population living outside the evacuation area extending to 15 miles radially from the NMP/JAF (in the Shadow Region) may elect to evacuate without having been instructed to do so. Based upon NUREG/CR-7002 guidance, it is assumed that 20 percent of the permanent resident population, based on U.S. Census Bureau data, in this 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.

**Table 3-3. Shadow Population and Vehicles by Sector**

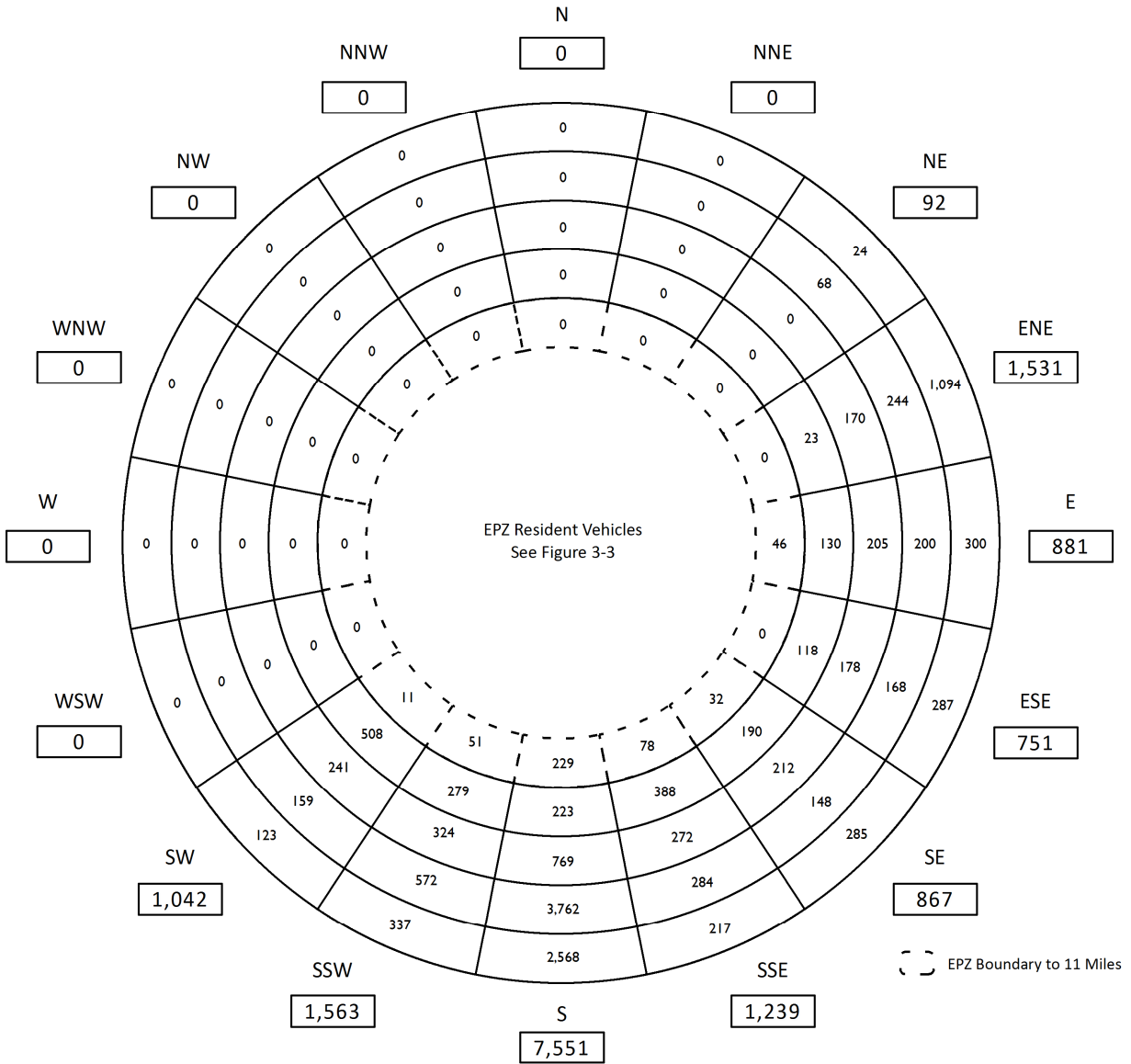
Sector	Population	Evacuating Vehicles
N	0	0
NNE	0	0
NE	170	92
ENE	2,948	1,531
E	1,689	881
ESE	1,439	751
SE	1,666	867
SSE	2,390	1,239
S	14,547	7,551
SSW	3,010	1,563
SW	2,002	1,042
WSW	0	0
W	0	0
WNW	0	0
NW	0	0
NNW	0	0
<b>TOTAL</b>	<b>29,861</b>	<b>15,517</b>



### Shadow Population

Miles	Subtotal by Ring	Cumulative Total
EPZ - 11	851	851
11 - 12	3,577	4,428
12 - 13	4,572	9,000
13 - 14	10,805	19,805
14 - 15	10,056	29,861
Total:		29,861

**Figure 3-4. Shadow Population by Sector**



### Shadow Vehicles

Miles	Subtotal by Ring	Cumulative Total
EPZ - 11	447	447
11 - 12	1,859	2,306
12 - 13	2,371	4,677
13 - 14	5,605	10,282
14 - 15	5,235	15,517
Total:		15,517

**Figure 3-5. Shadow Vehicles by Sector**

### 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 (shopping, recreation). Transients may spend less than one day or stay overnight at camping facilities, hotels and motels. The NMP/JAF EPZ has a number of areas and facilities that attract transients, including:

- Lodging Facilities
- Marinas
- Campgrounds
- Golf Courses
- Oswego Speedway
- SUNY Oswego (large commuter school)

Data was provided by Oswego County on the number of rooms, percentage of occupied rooms at peak times, and the number of people and vehicles per room for each lodging facility. These data were used to estimate the number of transients and evacuating vehicles at each of these facilities. A total of 924 transients in 453 vehicles are assigned to lodging facilities in the EPZ.

Data was provided by Oswego County on average daily attendance, number of slips and peak season of the marinas in the EPZ. These data were used to estimate the number of transients and evacuating vehicles at each of these facilities. A total of 770 transients and 643 vehicles are assigned to marinas in the EPZ.

Oswego County provided the number of campsites, peak occupancy, and the number of vehicles and people per campsite for each facility. These data were used to estimate the number of evacuating vehicles for transients at each of these facilities. A total of 1,773 transients and 653 vehicles are assigned to campgrounds in the EPZ.

There are two golf courses within the EPZ. Surveys of golf courses were conducted to determine the number of golfers and vehicles at each facility on a typical peak day, and the number of golfers that travels from outside the area. A total of 59 transients and 39 vehicles are assigned to golf courses within the EPZ.

Data provided by Oswego County, supplemented with internet based searches, supplied the peak seasons and attendance at Oswego Speedway used to determine the number of transients visiting the race track on a typical summer weekend. A total of 2,440 transients and 1,021 vehicles have been assigned to Oswego Speedway.

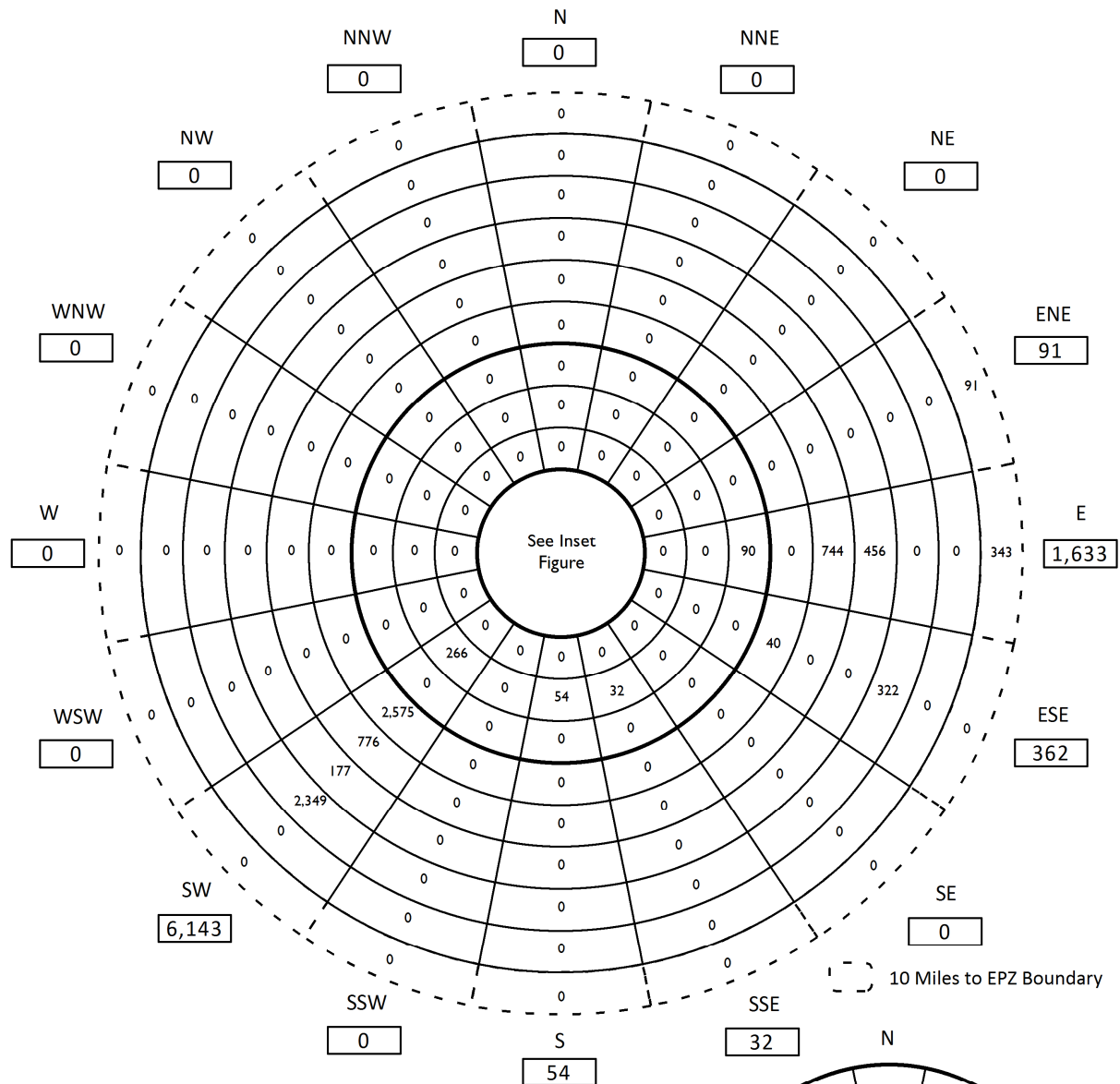
Data provided by Oswego County, supplemented with internet based searches, supplied the vehicle ownership rates, residency statistics, and enrollment information for SUNY Oswego used to determine the number of students commuting to the school from outside the EPZ. A total of 2349 transients and 2155 vehicles were assigned to SUNY Oswego.

Appendix E summarizes the transient data that was estimated for the EPZ. Table E-4 presents the number of transients visiting recreational areas, while Table E5 presents the number of transients at lodging facilities within the EPZ.

Table 3-4 presents transient population and transient vehicle estimates by ERPA. Figure 3-6 and Figure 3-7 present these data by sector and distance from NMP/JAF.

**Table 3-4. Summary of Transients and Transient Vehicles**

ERPA	Transients	Transient Vehicles
1	0	0
2	0	0
3	0	0
4	90	42
5	54	21
6	266	85
7	784	354
8	0	0
9	0	0
10	32	24
11	0	0
12	3,076	1,338
13	452	338
14	434	174
15	778	433
16	0	0
17	0	0
18	0	0
19	0	0
20	0	0
21	0	0
22	2,349	2,155
<b>TOTAL</b>	<b>8,315</b>	<b>4,964</b>



#### Transients

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	0	0
2 - 3	0	0
3 - 4	352	352
4 - 5	90	442
5 - 6	2,615	3,057
6 - 7	1,520	4,577
7 - 8	633	5,210
8 - 9	2,671	7,881
9 - 10	0	7,881
10 - EPZ	434	8,315
Total:		8,315

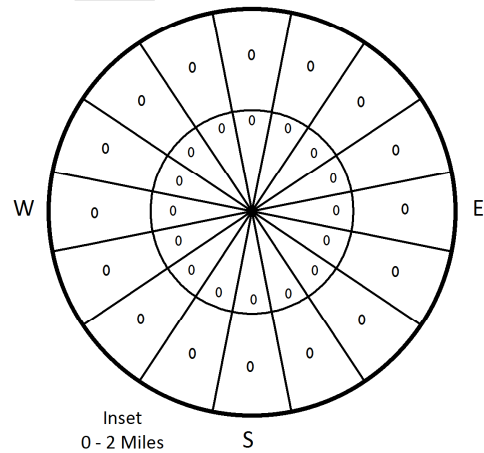
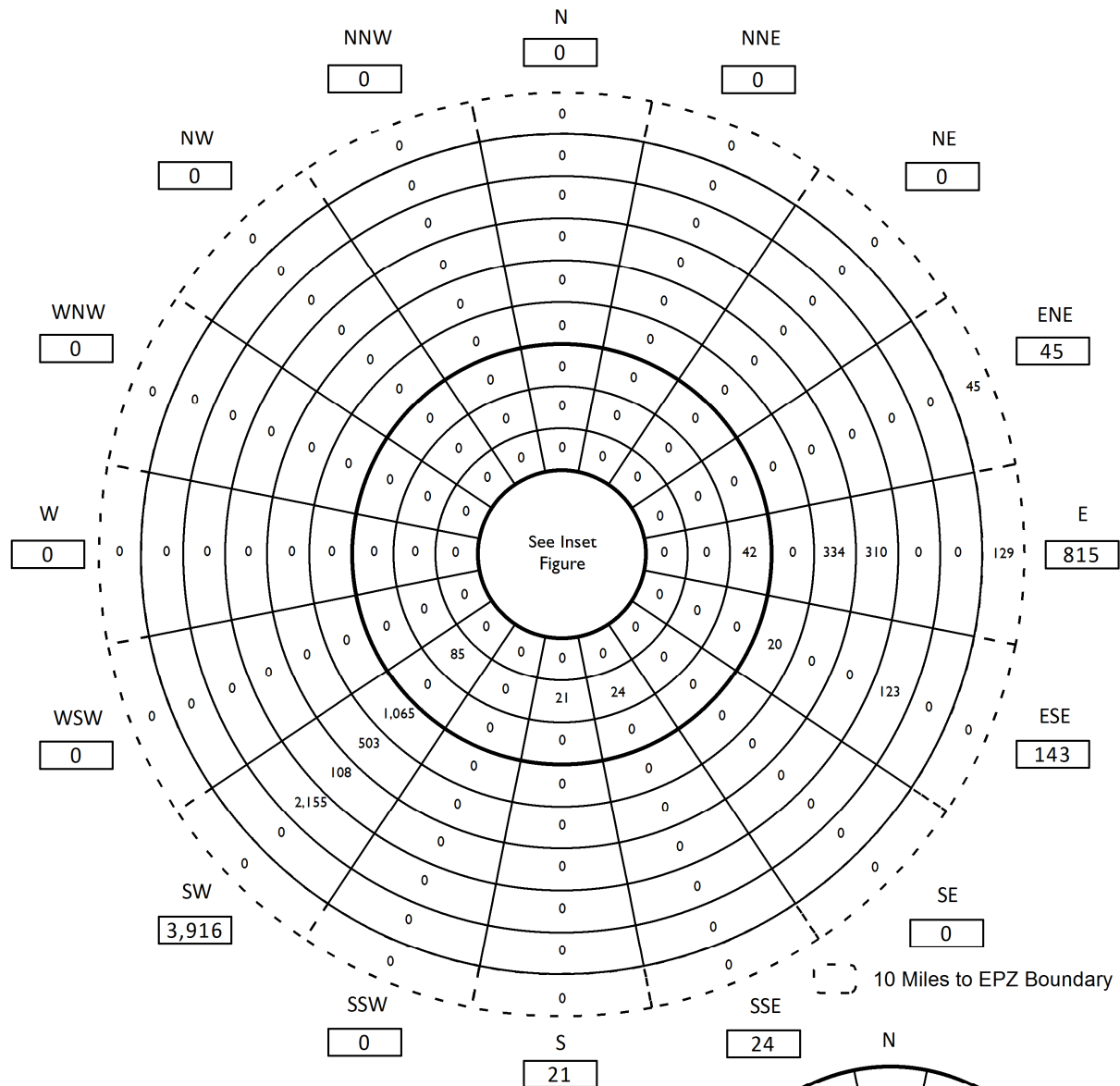


Figure 3-6. Transient Population by Sector



#### Transient Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	0	0
2 - 3	0	0
3 - 4	130	130
4 - 5	42	172
5 - 6	1,085	1,257
6 - 7	837	2,094
7 - 8	418	2,512
8 - 9	2,278	4,790
9 - 10	0	4,790
10 - EPZ	174	4,964
Total:		4,964

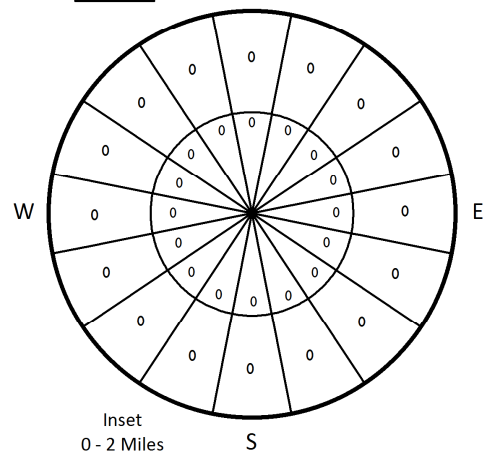


Figure 3-7. Transient Vehicles by Sector

### 3.4 Employees

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.

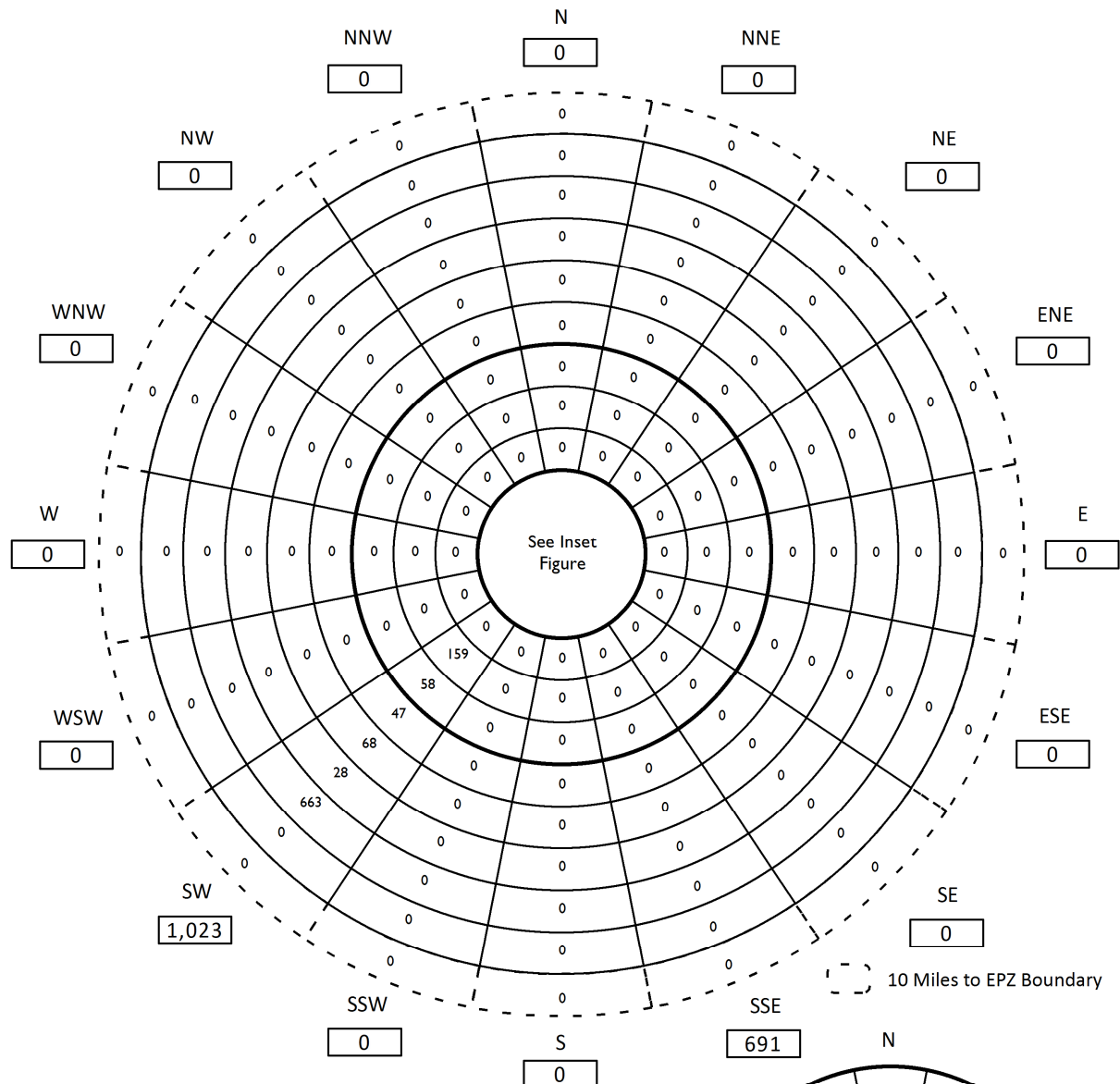
Data provided by Oswego County used to estimate the number of employees working at major employers as well as the percentage of staff commuting to work from outside of the EPZ.

In Table E-3, the Employees (Max Shift) is multiplied by the percent Non-EPZ factor to determine the number of employees who are not residents of the EPZ. A vehicle occupancy of 1.09 employees per vehicle obtained from the telephone survey (See Figure F-7) was used to determine the number of evacuating employee vehicles for all major employers.

Table 3-5 presents non-EPZ Resident employee and vehicle estimates by ERPA. Figure 3-8 and Figure 3-9 present these data by sector.

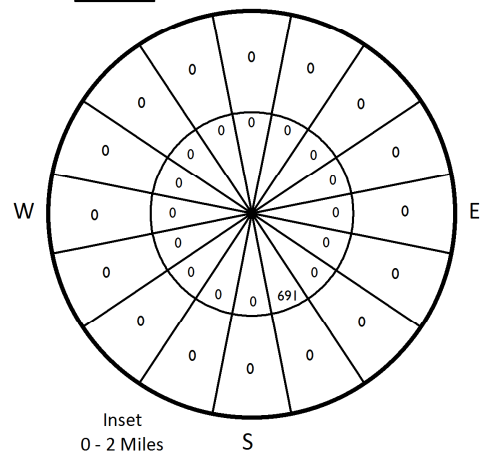
**Table 3-5. Summary of Non-EPZ Resident Employees and Employee Vehicles**

<b>ERPA</b>	<b>Employees</b>	<b>Employee Vehicles</b>
<b>1</b>	691	634
<b>2</b>	0	0
<b>3</b>	0	0
<b>4</b>	0	0
<b>5</b>	0	0
<b>6</b>	193	177
<b>7</b>	0	0
<b>8</b>	0	0
<b>9</b>	0	0
<b>10</b>	0	0
<b>11</b>	0	0
<b>12</b>	139	127
<b>13</b>	74	68
<b>14</b>	0	0
<b>15</b>	0	0
<b>16</b>	0	0
<b>17</b>	0	0
<b>18</b>	0	0
<b>19</b>	0	0
<b>20</b>	0	0
<b>21</b>	0	0
<b>22</b>	617	566
<b>TOTAL</b>	<b>1,714</b>	<b>1,572</b>

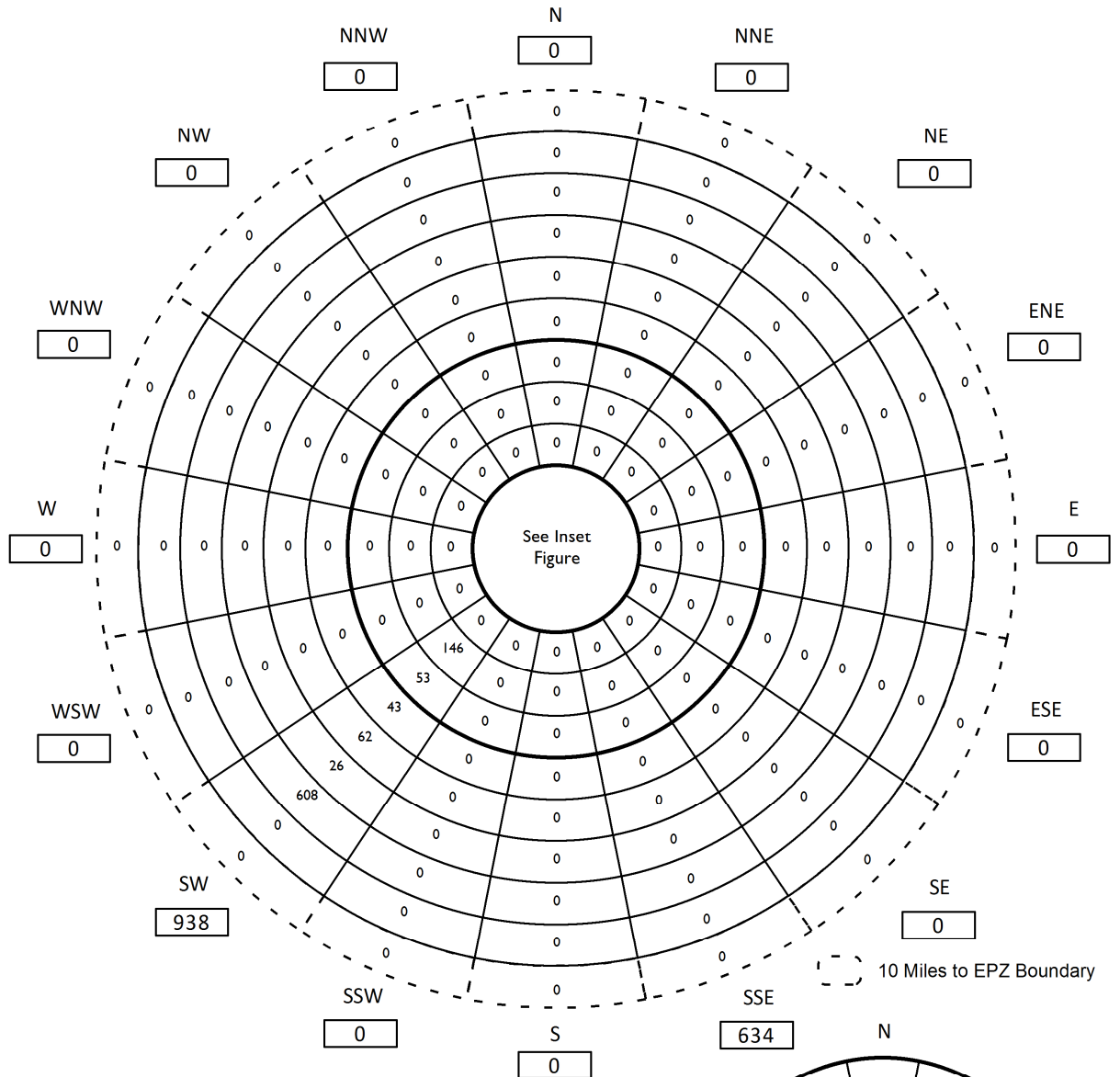


#### Employees

Miles	Subtotal by Ring	Cumulative Total
0 - 1	691	691
1 - 2	0	691
2 - 3	0	691
3 - 4	159	850
4 - 5	58	908
5 - 6	47	955
6 - 7	68	1,023
7 - 8	28	1,051
8 - 9	663	1,714
9 - 10	0	1,714
10 - EPZ	0	1,714
Total:		1,714

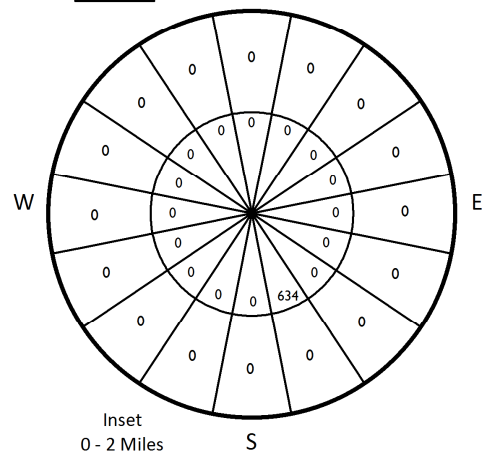


**Figure 3-8. Employee Population by Sector**



#### Employee Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	634	634
1 - 2	0	634
2 - 3	0	634
3 - 4	146	780
4 - 5	53	833
5 - 6	43	876
6 - 7	62	938
7 - 8	26	964
8 - 9	608	1,572
9 - 10	0	1,572
10 - EPZ	0	1,572
Total:		1,572



**Figure 3-9. Employee Vehicles by Sector**

### 3.5 Special Facilities

Data were provided by Oswego County for each of the medical facilities within the EPZ. Table E-2 in Appendix E summarizes the data gathered. Section 8 details the evacuation of medical facilities and their patients. The number and type of evacuating vehicles that need to be provided depend on the patients' state of health. It is estimated that buses can transport up to 30 ambulatory people; wheelchair buses up to 22 people (20 ambulatory, 2 wheelchair bound), wheelchair vans up to 10 people (7 ambulatory, 3 wheelchair bound); vans up to 8 ambulatory people; and ambulances, up to 2 bedridden people.

Data was provided by Oswego County for the one correctional facility (Oswego County Jail – Public Safety Center) within the EPZ. Table E-6 in Appendix E summarizes the data gathered. Section 8 discusses the evacuation of these prisoners. It is estimated that buses can transport up to 30 inmates. The capacity of these buses is reduced to account for the presence of correctional officers.

### 3.6 Total Demand in Addition to Permanent Population

Vehicles will be traveling through the EPZ (external-external trips) at the time of an accident. After the Advisory to Evacuate is announced, these through-travelers will also evacuate. These through vehicles are assumed to travel on the major route traversing the region – I 81. It is assumed that this traffic will continue to enter the EPZ during the first 120 minutes following the Advisory to Evacuate.

Average Annual Daily Traffic (AADT) data was obtained from Federal Highway Administration to estimate the number of vehicles per hour on the aforementioned routes. 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 30<sup>th</sup> 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 3-6 for each of the routes considered. The DDHV is then multiplied by 2 hours (access control points – ACP – are assumed to be activated at 120 minutes after the advisory to evacuate) to estimate the total number of external vehicles loaded on the analysis network. As indicated, there are 5,036 vehicles entering the EPZ 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, 12 and 13) as discussed in Section 6.

**Table 3-6. NMP/JAF EPZ External Traffic**

Up Node	Dn Node	Road Name	Direction	HPMS <sup>1</sup> AADT	K-Factor <sup>2</sup>	D-Factor <sup>2</sup>	Hourly Volume	External Traffic
8043	43	I 81	South	23,537	0.107	0.5	1,259	2,518
8298	298	I 81	North	23,537	0.107	0.5	1,259	2,518
<b>TOTAL:</b>								<b>5,036</b>

<sup>1</sup>Highway Performance Monitoring System (HPMS), Federal Highway Administration (FHWA), Washington, D.C., 2012

<sup>2</sup>HCM 2010

### 3.7 Special Event

One special event scenario (Scenario 13) is considered for the ETE study – Several special event candidates were considered for this scenario including the workforce influx induced by an outage at either NMP or JAF. Of the events considered, Harborfest fireworks draws in the greatest number of transients by far. Harborfest is a momentous occasion which attracts a considerable number of transients from the greater Central New York region. The capstone of the four-day festival is a Saturday night fireworks display. This event draws 90,000 people, 61% of whom are from outside of the EPZ. It was assumed that families travel to the event as a household unit in a single vehicle; therefore, the average household size of 2.39 was used for vehicle occupancy. A total of 22,971 vehicles were incorporated at various parking locations for this special event. The special event vehicle trips were generated utilizing the same mobilization distributions for transients. Public transportation is not provided for this event and was not considered in the special event analysis. (A shuttle bus is provided from the parking areas, however the total time allocated for transient mobilization is sufficient to include travel from the main event area to the parking areas, whether on the shuttle bus or by foot.)

### 3.8 Summary of Demand

A summary of population and vehicle demand is provided in Table 3-7 and Table 3-8, respectively. This summary includes all population groups described in this section. Additional population groups – transit-dependent, special facility and school population – are described in greater detail in Section 8. A total of 74,037 people and 38,539 vehicles are considered in this study.

**Table 3-7. Summary of Population Demand**

ERPA	Residents	Transit-Dependent	Transients	Employees	Special Facilities	Schools	Commuter Students	Shadow Population	External Traffic	Total
1	173	8	0	691	0	91	0	0	0	963
2	469	21	0	0	0	0	0	0	0	490
3	343	15	0	0	0	0	0	0	0	358
4	687	31	90	0	0	238	0	0	0	1,046
5	804	36	54	0	0	0	0	0	0	894
6	915	41	266	193	0	0	0	0	0	1,415
7	699	31	784	0	0	0	0	0	0	1,514
8	718	32	0	0	0	0	0	0	0	750
9	597	27	0	0	0	0	0	0	0	624
10	1,023	46	32	0	0	33	0	0	0	1,134
11	1,916	86	0	0	0	0	0	0	0	2,002
12	7,960	357	3,076	139	710	1,342	0	0	0	13,584
13	10,223	460	452	74	262	2,904	0	0	0	14,375
14	193	9	434	0	0	0	0	0	0	636
15	1,105	50	778	0	9	0	0	0	0	1,942
16	1,624	73	0	0	24	1,656	0	0	0	3,377
17	587	26	0	0	6	446	0	0	0	1,065
18	1,030	46	0	0	0	0	0	0	0	1,076
19	1,316	59	0	0	0	0	0	0	0	1,375
20	1,783	80	0	0	191	0	0	0	0	2,054
21	1,782	80	0	0	38	367	0	0	0	2,267
22	5,940	267	0	617	0	5,951	2,349	0	0	15,124
Shadow	0	0	0	0	0	0	0	5,972	0	5,972
<b>Total</b>	<b>41,887</b>	<b>1,881</b>	<b>5,966</b>	<b>1,714</b>	<b>1,240</b>	<b>13,028</b>	<b>2,349</b>	<b>5,972</b>	<b>0</b>	<b>74,037</b>

**NOTE:** Shadow Population has been reduced to 20%. Refer to Figure 2-1 for additional information.

**NOTE:** Special Facilities include both medical facilities and correctional facilities.

Table 3-8. Summary of Vehicle Demand

ERPA	Residents	Transit-Dependent	Transients	Employees	Special Facilities	Schools	Commuter Students	Shadow Vehicles	External Traffic	Total
1	92	2	0	634	0	4	0	0	0	732
2	244	2	0	0	0	0	0	0	0	246
3	178	2	0	0	0	0	0	0	0	180
4	358	2	42	0	0	8	0	0	0	410
5	418	2	21	0	0	0	0	0	0	441
6	473	4	85	177	0	0	0	0	0	739
7	364	2	354	0	0	0	0	0	0	720
8	373	2	0	0	0	0	0	0	0	375
9	310	2	0	0	0	0	0	0	0	312
10	533	4	24	0	0	2	0	0	0	563
11	994	6	0	0	0	0	0	0	0	1,000
12	4,130	28	1,338	127	222	46	0	0	0	5,891
13	5,382	38	338	68	116	108	0	0	0	6,050
14	104	2	174	0	0	0	0	0	0	280
15	571	4	433	0	2	0	0	0	0	1,010
16	844	6	0	0	4	66	0	0	0	920
17	307	2	0	0	2	18	0	0	0	329
18	535	4	0	0	0	0	0	0	0	539
19	686	4	0	0	0	0	0	0	0	690
20	929	6	0	0	122	0	0	0	0	1,057
21	927	6	0	0	4	16	0	0	0	953
22	4,168	22	0	566	0	52	2,155	0	0	6,963
Shadow	0	0	0	0	0	0	0	3,103	5,036	8,139
<b>Total</b>	<b>22,920</b>	<b>152</b>	<b>2,809</b>	<b>1,572</b>	<b>472</b>	<b>320</b>	<b>2,155</b>	<b>3,103</b>	<b>5,036</b>	<b>38,539</b>

NOTE: Buses represented as two passenger vehicles. Refer to Section 8 for additional information.

## 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 2010 Highway Capacity Manual (HCM 2010).

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" (SV). Service volume 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.

This distinction is illustrated in Exhibit 11-17 of the HCM 2010. 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 (BFFS<sup>1</sup>) according to Exhibit 15-7 of the HCM. Consequently, lane and shoulder widths at the narrowest points were observed during the road survey and these observations were recorded, but no detailed 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. Capacity is estimated from the procedures of

---

<sup>1</sup> A very rough estimate of BFFS might be taken as the posted speed limit plus 10 mph (HCM 2010 Page 15-15)

the 2010 HCM. For example, HCM Exhibit 7-1(b) shows the sensitivity of Service Volume at the upper bound of LOS D to grade (capacity is the Service Volume at the upper bound of LOS E).

As discussed in Section 2.3, it is necessary to adjust capacity figures to represent the prevailing conditions during inclement weather. Based on limited empirical data, weather conditions such as rain reduce the values of free speed and of highway capacity by approximately 10 percent. Over the last decade new studies have been made on the effects of rain on traffic capacity. These studies indicate a range of effects between 5 and 20 percent depending on wind speed and precipitation rates. As indicated in Section 2.3, we employ a reduction in free speed and in highway capacity of 10 percent and 20 percent for rain and snow, respectively.

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.

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 $h_{sat}$ , $F_1, F_2, \dots$

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 model<sup>2</sup>. The resulting values for  $h_m$  always satisfy the condition:

$$h_m \geq h_{sat}$$

---

<sup>2</sup>Lieberman, 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

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 2010.

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 18, 19 and 20 in the HCM 2010 address this topic. The factors,  $F_1, F_2, \dots$ , influencing saturation flow rate are identified in equation (18-5) of the HCM 2010.

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 service volume (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 service volume increases as demand volume and density increase, until the service volume 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 service volume) 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.

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 Levinson<sup>3</sup> 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 and indicated in Appendix K 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 15-30 in the Highway Capacity Manual 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.

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 2010 HCM. 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.

---

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

### 4.3 Application to the NMP/JAF 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:

2010 Highway Capacity Manual (HCM)  
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
- Multi-Lane Highways (at-grade)
- Freeways

Each of these classifications will be discussed.

#### 4.3.1 Two-Lane Roads

Ref: HCM Chapter 15

Two lane roads comprise the majority of highways within the EPZ. The per-lane capacity of a two-lane highway is estimated at 1700 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 3200 pc/h. The HCM procedures then estimate Level of Service (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 EPZ 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 Multi-Lane Highway

Ref: HCM Chapter 14

Exhibit 14-2 of the HCM 2010 presents a set of curves that indicate a per-lane capacity ranging from approximately 1900 to 2200 pc/h, for free-speeds of 45 to 60 mph, respectively. Based on observation, the multi-lane highways outside of urban areas within the EPZ service traffic with free-speeds in this range. The actual time-varying speeds computed by the simulation model reflect the demand: capacity relationship and the impact of control at intersections. A

conservative estimate of per-lane capacity of 1900 pc/h is adopted for this study for multi-lane highways outside of urban areas, as shown in Appendix K.

#### 4.3.3 Freeways

Ref: HCM Chapters 10, 11, 12, 13

Chapter 10 of the HCM 2010 describes a procedure for integrating the results obtained in Chapters 11, 12 and 13, 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 11 of the HCM 2010 presents procedures for estimating capacity and LOS for "Basic Freeway Segments". Exhibit 11-17 of the HCM 2010 presents capacity vs. free speed estimates, which are provided below.

Free Speed (mph):	55	60	65	70+
Per-Lane Capacity (pc/h):	2250	2300	2350	2400

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 2250 pc/h is adopted for this study for freeways, as shown in Appendix K.

Chapter 12 of the HCM 2010 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 12 depends on the "Type" and geometrics of the weaving segment and on the "Volume Ratio" (ratio of weaving volume to total volume).

Chapter 13 of the HCM 2010 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 13-8 of the HCM 2010, and depend on the number of freeway lanes and on the freeway free speed. Ramp capacity is presented in Exhibit 13-10 and is a function of the ramp free flow speed. The DYNEV II simulation model logic simulates the merging operations of the ramp and freeway traffic in accord with the procedures in Chapter 13 of the HCM 2010. 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 does not address LOS F explicitly).

#### 4.3.4 Intersections

Ref: HCM Chapters 18, 19, 20, 21

Procedures for estimating capacity and LOS for approaches to intersections are presented in Chapter 18 (signalized intersections), Chapters 19, 20 (un-signalized intersections) and Chapter 21 (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. Where applicable, the location and type of traffic control for nodes in the evacuation network are noted in Appendix K. The characteristics of the ten highest volume signalized intersections are detailed in Appendix J.

#### 4.4 Simulation and Capacity Estimation

Chapter 6 of the HCM 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 invoking several procedural chapters of the HCM. 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 an EPZ 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 – 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 2010 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) Free flow speed (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 2010, as described earlier. These parameters are listed in Appendix K, for each network link.

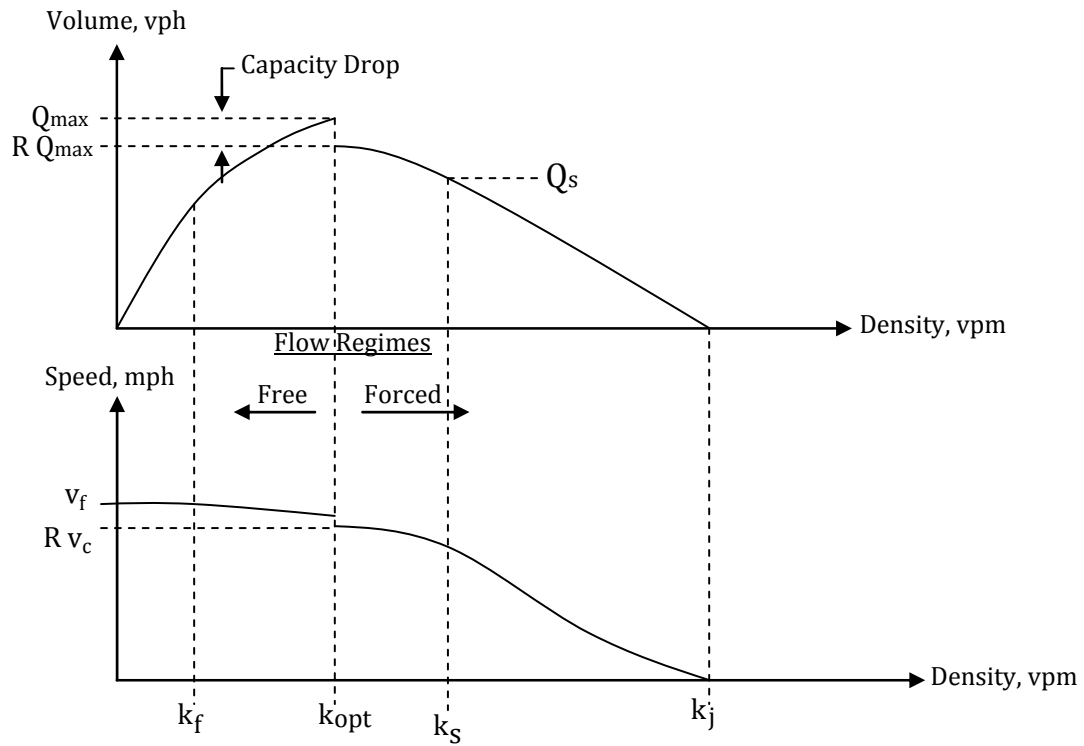


Figure 4-1. Fundamental Diagrams

## 5 ESTIMATION OF TRIP GENERATION TIME

Federal Government guidelines (see NUREG CR-7002) specify that the planner 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 telephone 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 Appendix 1 of NUREG 0654 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 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, that a rapidly escalating accident will be considered in calculating the Trip Generation Time. We will assume:

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

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 Advisory to Evacuate. 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 Advisory to Evacuate 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 broadcast. Thus, the time needed to complete the mobilization activities and the number of people

remaining to evacuate the EPZ after the Advisory to Evacuate, 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 notification systems available within the EPZ (e.g. sirens, tone alerts, EAS broadcasts, loud speakers).
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 accident.

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 4.1 of NUREG/CR-7002, the information required to compute trip generation times is typically obtained from a telephone survey of EPZ residents. Such a survey was conducted in support of this ETE study. Appendix F presents the survey sampling plan, survey instrument, and raw survey results. It is important to note that the shape and duration of the evacuation trip mobilization distribution is important for regions where traffic congestion is not expected to cause the evacuation time estimate to extend in time well beyond the trip generation period. The remaining discussion will focus on the application of the trip generation data obtained from the telephone 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 below:

**Table 5-1. Event Sequence for Evacuation Activities**

<b>Event Sequence</b>	<b>Activity</b>	<b>Distribution</b>
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

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)

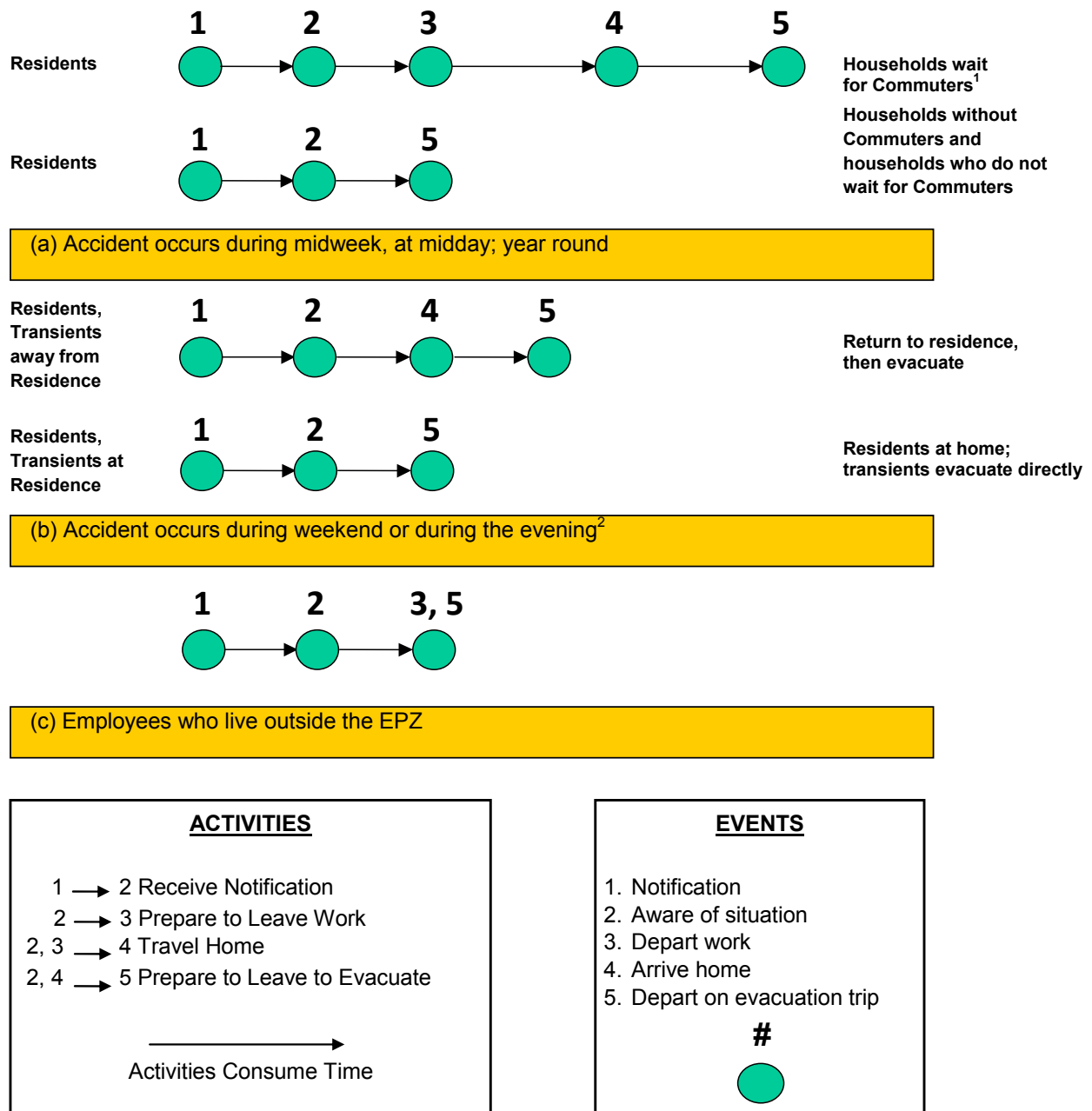
As such, a completed Activity changes the 'state' of an individual (e.g. the activity, 'travel home' changes the state from 'depart work' to 'arrive home'). Therefore, an Activity can be described as an 'Event Sequence'; the elapsed times to perform an event sequence vary from one person to the next 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 (i.e. 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, or removing snow only after the 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.



<sup>1</sup> Applies for evening and weekends also if commuters are at work.

<sup>2</sup> Applies throughout the year for transients.

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

### 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

In accordance with the 2012 Federal Emergency Management Agency (FEMA) Radiological Emergency Preparedness Program Manual, 100% of the population is notified within 45 minutes. It is assumed (based on the presence of sirens within the EPZ) that 87 percent of those within the EPZ will be aware of the accident within 30 minutes with the remainder notified within the following 15 minutes. The notification distribution is given below:

**Table 5-2. Time Distribution for Notifying the Public**

Elapsed Time (Minutes)	Percent of Population Notified
0	0%
5	7%
10	13%
15	27%
20	47%
25	66%
30	87%
35	92%
40	97%
45	100%

### 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 telephone survey. This distribution is plotted in Figure 5-2.

**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%	45	96.2%
5	51.1%	50	96.2%
10	70.6%	55	96.2%
15	80.7%	60	100.0%
20	85.9%	75	
25	86.4%	90	
30	94.0%	105	
35	94.5%	120	
40	95.9%	135	

**NOTE:** The survey data was normalized to distribute the "Don't know" 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 "Don't know" responders, if the event takes place, would be the same as those responders who provided estimates.

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

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

**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	40	89.6%
5	19.6%	45	94.3%
10	47.7%	50	95.1%
15	63.2%	55	95.1%
20	75.5%	60	98.3%
25	77.4%	75	99.4%
30	85.1%	90	100.0%
35	87.0%	105	

**NOTE:** The survey data was normalized to distribute the "Don't know" response

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

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

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

Elapsed Time (Minutes)	Cumulative Percent Ready to Evacuate
0	0%
15	18.2%
30	68.9%
45	75.5%
60	89.6%
75	93.9%
90	95.0%
105	95.0%
120	98.6%
135	100.0%

**NOTE:** The survey data was normalized to distribute the "Don't know" response

#### 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.

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. These data are provided by those households which responded to the telephone survey. This distribution is plotted in Figure 5-2 and listed in Table 5-6.

Note that those respondents (53.0%) 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.

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

Elapsed Time (Minutes)	Cumulative Percent Completing Snow Removal
0	53.0%
15	65.5%
30	88.1%
45	91.1%
60	94.2%
75	97.4%
90	97.9%
105	98.1%
120	98.9%
135	99.8%
150	100.0%

**NOTE:** The survey data was normalized to distribute the "Don't know" response

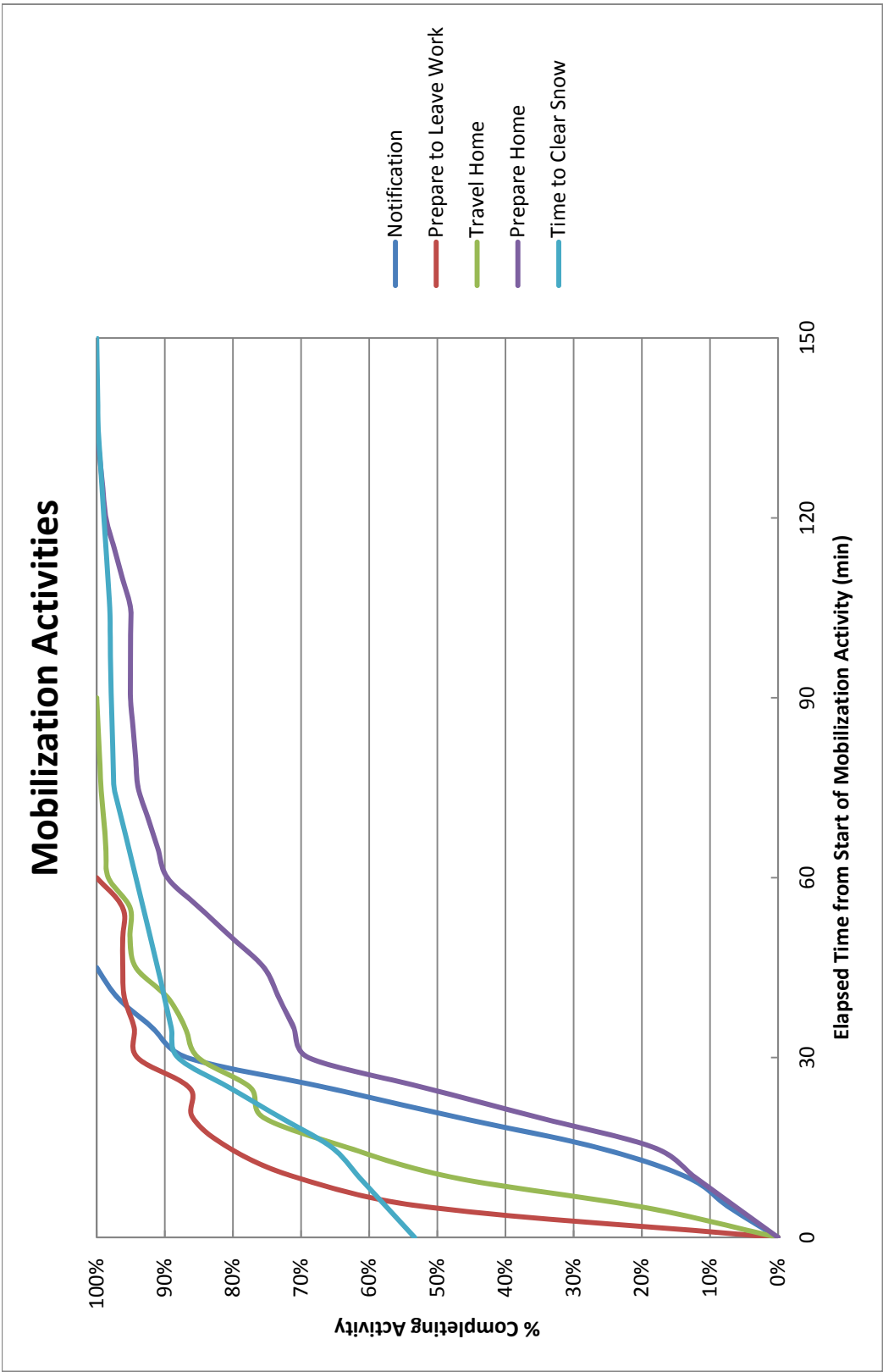


Figure 5-2. Evacuation Mobilization Activities

## 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 as shown 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 5-7. 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 presents a description of each of the final trip generation distributions achieved after the summing process is completed.

**Table 5-8. Description of the Distributions**

Distribution	Description
<b>A</b>	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>B</b>	Time distribution of commuters arriving home (Event 4).
<b>C</b>	Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip (Event 5).
<b>D</b>	Time distribution of residents without commuters returning home, leaving home to begin the evacuation trip (Event 5).
<b>E</b>	Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip, after snow clearance activities (Event 5).
<b>F</b>	Time distribution of residents with no commuters returning home, leaving to begin the evacuation trip, after snow clearance activities (Event 5).

#### 5.4.1 Statistical Outliers

As already mentioned, some portion of the survey respondents answer “don’t know” 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 alternates 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 special needs;
- 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.

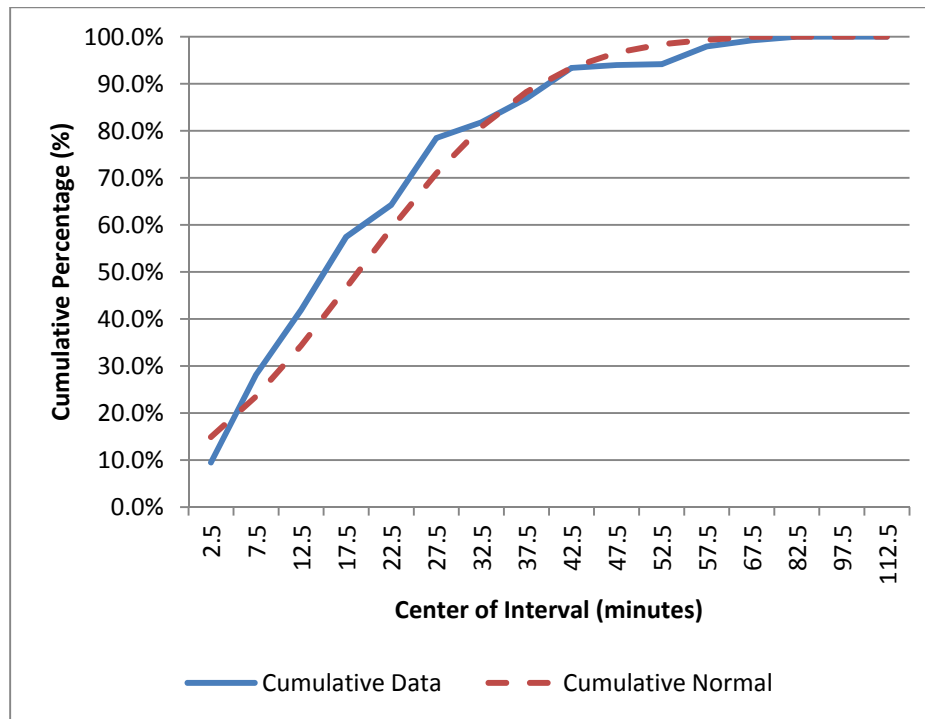
In establishing the overall mobilization time/trip generation distributions, the following principles are used:

- 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 snow) 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. special 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 4 standard deviations from the mean are allowed to be considered outliers, with gaps in the histogram expected.

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 below in Figure 5-3.



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

- 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:

- 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;
- 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, no snow or snow in each). 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 A, C, D, E and F. 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; snow clearance follows the preparation for departure, 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 that result 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, staged evacuation consists of the following:

1. ERPAs comprising the 2 mile region are advised to evacuate immediately
2. ERPAs comprising regions extending from 2 to 5 miles downwind are advised to shelter in-place while the two 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 ERPAs beyond 5 miles will react as does the population in the 2 to 5 mile region; that is they will first shelter, then evacuate after the 90<sup>th</sup> percentile ETE for the 2 mile region.
2. The population in the shadow region beyond the EPZ boundary, extending to approximately 15 miles radially from NMP/JAF, 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 telephone survey and analysis.
2. Trip generation for the population subject to staged evacuation will be formulated as follows:
  - a. Identify the 90<sup>th</sup> percentile evacuation time for the ERPAs comprising the two mile region. This value,  $T_{Scen}^*$ , is obtained from simulation results. 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 uses the statement “approximately 90<sup>th</sup> percentile” as the time to end staging and begin evacuating. The value of  $T_{Scen}^*$  is 1:30 for non-snow scenarios and 2:00 for snow scenarios.
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 and snow conditions
  - d. Residents without returning commuters and snow conditions

Figure 5-5 presents the staged trip generation distributions for both residents with and without returning commuters; the 90<sup>th</sup> percentile two-mile evacuation time is 90 minutes for good weather and between 110 and 120 minutes for snow scenarios. At the 90<sup>th</sup> percentile evacuation time, 20% of the 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 90<sup>th</sup> 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 15 minutes. After  $T_{Scen}^* + 15$ , the remainder of evacuation trips are generated in accordance with the unstaged trip generation distribution.

Table 5-10 provides the trip generation for staged evacuation.

#### 5.4.3 Trip Generation for Waterways and Recreational Areas

Procedure A Section 4.9 of the Oswego County Radiological Emergency Response Plan lists the clearing of water ERPAs as one component of Initial Precautionary Operations. In order to accomplish this, the County Director of Emergency Management (CDEM), in consultation with the Chairman of the Legislature, shall coordinate the activities of supporting County agencies.

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 2 hours. It is assumed that this 2 hour timeframe is sufficient time for boaters, campers and other transients to return to their vehicles and begin their evacuation trip.

**Table 5-9. Trip Generation Histograms for the EPZ Population for Unstaged Evacuation**

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 Snow (Distribution E)	Residents Without Snow (Distribution F)
1	15	8%	8%	0%	1%	0%	1%
2	30	74%	74%	6%	40%	3%	24%
3	15	12%	12%	15%	28%	10%	23%
4	15	3%	3%	22%	13%	16%	17%
5	15	2%	2%	19%	9%	17%	13%
6	30	1%	1%	23%	4%	27%	12%
7	30	0%	0%	9%	4%	14%	5%
8	15	0%	0%	3%	1%	4%	2%
9	15	0%	0%	1%	0%	3%	2%
10	15	0%	0%	1%	0%	3%	0%
11	15	0%	0%	1%	0%	1%	1%
12	15	0%	0%	0%	0%	1%	0%
13	15	0%	0%	0%	0%	0%	0%
14	15	0%	0%	0%	0%	1%	0%
15	600	0%	0%	0%	0%	0%	0%

**NOTE:**

- Shadow vehicles are loaded onto the analysis network (Figure 1-2) using Distributions C and E for good weather and snow, respectively.
- Special event vehicles are loaded using Distribution A.

## Mobilization Activities

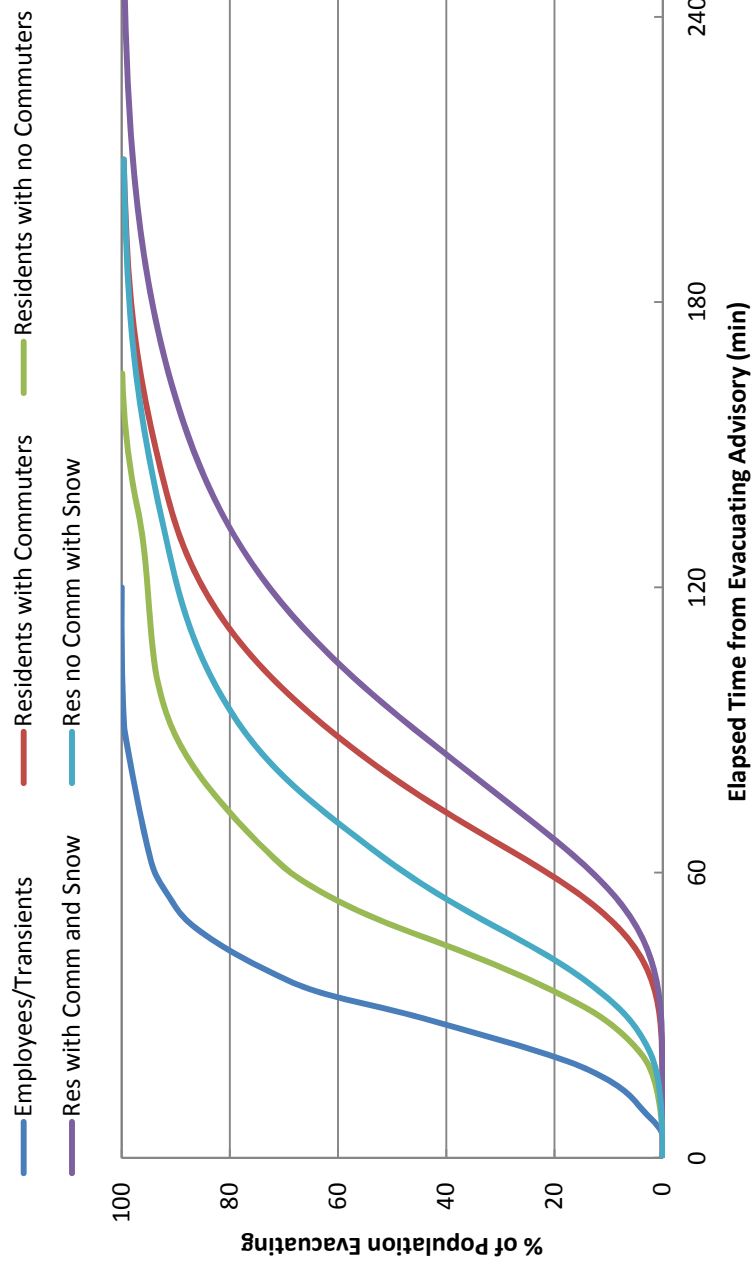


Figure 5-4. Comparison of Trip Generation Distributions

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*			
		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	30	1%	8%	1%	5%
3	15	3%	6%	2%	5%
4	15	5%	2%	3%	3%
5	15	3%	2%	3%	3%
6	30	73%	77%	6%	2%
7	30	9%	4%	72%	77%
8	15	3%	1%	4%	2%
9	15	1%	0%	3%	2%
10	15	1%	0%	3%	0%
11	15	1%	0%	1%	1%
12	15	0%	0%	1%	0%
13	15	0%	0%	0%	0%
14	15	0%	0%	1%	0%
15	600	0%	0%	0%	0%

\*Trip Generation for Employees and Transients (see Table 5-9) is the same for Unstaged and Staged Evacuation.

## Staged and Unstaged Evacuation Trip Generation

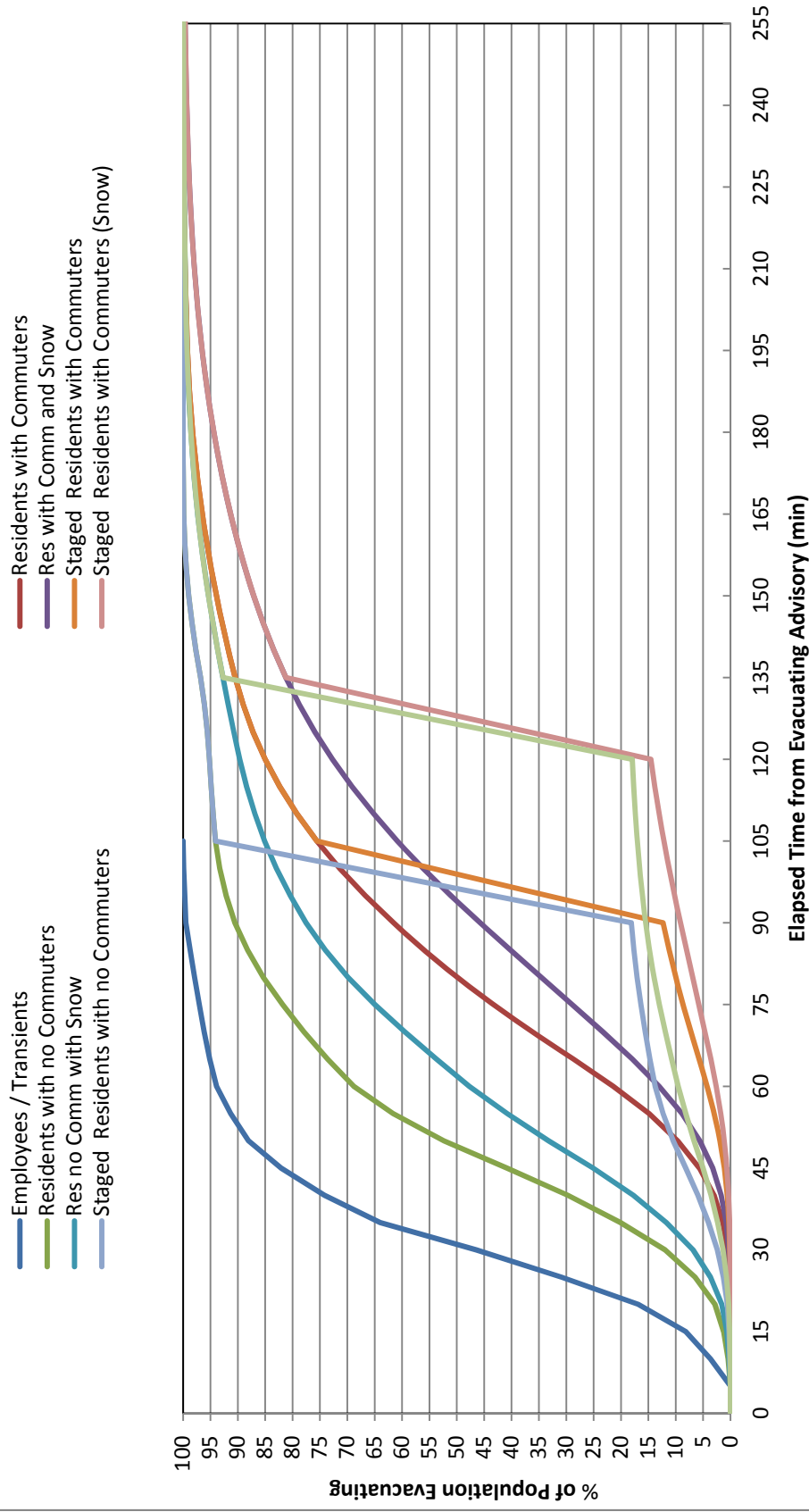


Figure 5-5. Comparison of Staged and Unstaged Trip Generation Distributions in the 2 to 5 Mile Region

## 6 DEMAND ESTIMATION FOR EVACUATION SCENARIOS

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

<b>Region</b>	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.
<b>Scenario</b>	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 54 Regions were defined which encompass all the groupings of ERPAs considered. These Regions are defined in Table 6-1. The ERPA configurations are identified in Figure 6-1. Each keyhole sector-based area consists of a central circle centered at NMP/JAF, as per NUREG/CR-7002 guidance. . These sectors extend to 5 miles from NMP/JAF (Regions R04 through R14) or to the EPZ boundary (Regions R15 through R36). Regions R01, R02 and R03 represent evacuations of circular areas with radii of 2, 5 and 10 miles, respectively. Regions R43 through R54 are identical to Regions R02, and R04 through R14, respectively; however, those ERPAs between 2 miles and 5 miles are staged until 90% of the 2-mile region (Region R01) has evacuated. In addition, both Nine Mile Point and James A. FitzPatrick can make site specific Protective Action Recommendations (PAR). The PAR logic employed by Nine Mile Point is given below in Table 6-2 and the PAR logic employed by James A FitzPatrick is given in Table 6-3.

All unique ERPA groupings which result from either of the two sets of site specific PARs are represented in regions R01 through R42.

A total of 14 Scenarios were evaluated for all Regions. Thus, there are a total of  $54 \times 14 = 756$  evacuation cases. Table 6-4 is a description of all Scenarios.

Each combination of region and scenario implies a specific population to be evacuated. Table 6-5 presents the percentage of each population group estimated to evacuate for each scenario. Table 6-6 presents the vehicle counts for each scenario for an evacuation of Region R03 – the entire EPZ.

The vehicle estimates presented in Section 3 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 average the scenario percentages are presented in Table 6-5, 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 workforce is at its peak) is equal to the product of 56% (the number of households with at least one commuter) and 45% (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.

Employment is assumed to be at its peak during the winter, midweek, midday scenarios. Employment is reduced slightly (96%) for summer, midweek, midday scenarios. This is based on the estimation that 50% of the employees commuting into the EPZ will be on vacation for a week during the approximate 12 weeks of summer. It is further estimated that those taking vacation will be uniformly dispersed throughout the summer with approximately 4% of employees vacationing each week. It is further 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 during summer weekends and less (36%) during the week. As shown in Appendix E, there is a significant amount of lodging and campgrounds offering overnight accommodations in the EPZ; thus, transient activity is estimated to be higher during evening hours – 39% for summer and 14% for winter. Transient activity on winter weekends is estimated to be 31%.

As noted in the shadow footnote to Table 6-5, the shadow percentages are computed using a base of 20% (see assumption 5 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 6-6 for Scenario 1, the shadow percentage is computed as follows:

$$20\% \times \left(1 + \frac{1,503}{5,784 + 17,136}\right) = 21\%$$

One special event – Harborfest Fireworks – was considered as Scenario 13. Thus, the special event traffic is 100% evacuated for Scenario 13, and 0% for all other scenarios.

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 for school children are needed under those circumstances. As discussed in Section 7, schools are in session during the winter season, midweek, midday and 100% of buses will be needed under those circumstances. Transit buses for the transit-dependent population are set to 100% for all scenarios as it is assumed that the transit-dependent population is present in the EPZ for all scenarios.

External traffic is estimated to be reduced by 60% during evening scenarios and is 100% for all other scenarios.

Table 6-1. Description of Evacuation Regions

Region	Description	ERPA																											
R01	2-Mile Radius	x	x	x																							x	x	
R02	5-Mile Radius	x	x	x	x	x	x		x	x	x																x	x	
R03	Full EPZ	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Evacuate 2-Mile Radius and Downwind to 5 Miles																													
Region	Wind Direction From°	ERPA																											
N/A	96 to 233	See Region R01																											
R04	234 to 240	x	x	x			x																			x	x		
R05	241 to 262	x	x	x	x		x																			x	x		
R06	263 to 278	x	x	x	x		x																			x	x		
R07	279 to 292	x	x	x	x		x																			x	x		
R08	293 to 332	x	x	x	x	x		x																		x	x		
R09	333 to 349	x	x	x	x	x		x																		x	x		
R10	350 to 12	x	x	x			x																			x	x		
R11	13 to 51	x	x	x			x																			x	x		
R12	52 to 61	x	x	x	x		x																			x	x		
R13	62 to 70	x	x	x			x																			x	x		
R14	71 to 95	x	x	x			x																			x	x		
Shelter-in-Place until 90% ETE for R01, then Evacuate		Area(s) Shelter-in-Place														Area(s) Evacuate													

Regions Specific to James A. FitzPatrick																																		
Evacuate 2-Mile Radius and Downwind to 10 Miles																																		
Region	Wind Direction From°	ERPA																																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29				
R15	214 to 233	x	x	x										x													x	x				x		
R16	234 to 240	x	x	x			x							x													x	x				x		
R17	241 to 254	x	x	x	x		x							x													x	x				x		
R18	255 to 262	x	x	x	x		x							x			x										x	x				x		
R19	263 to 278	x	x	x	x		x	x						x			x										x	x				x		
R20	279 to 292	x	x	x	x	x	x	x						x			x		x								x	x				x		
R21	293 to 305	x	x	x	x	x	x	x	x					x			x		x								x	x				x		
R22	306 to 311	x	x	x	x	x	x	x	x	x				x			x		x								x	x				x		
R23	312 to 332	x	x	x	x	x	x	x	x	x				x			x		x								x	x				x		
R24	333 to 340	x	x	x	x	x					x						x		x								x	x						
R25	341 to 349	x	x	x	x	x					x								x								x	x						
R26	350 to 356	x	x	x		x					x			x					x								x	x						
R27	357 to 12	x	x	x		x					x			x					x								x	x						
R28	13 to 20	x	x	x		x					x			x					x								x	x						
R29	21 to 51	x	x	x		x					x			x													x	x						
R30	52 to 56	x	x	x		x								x													x	x						
R31	57 to 61	x	x	x		x								x													x	x						
R32	62 to 70	x	x	x										x													x	x						
R33	71 to 89	x	x	x										x													x	x						
R34	90 to 95	x	x	x										x													x	x						
R35	96 to 146	x	x	x																							x	x						
R36	147 to 213	x	x	x																							x	x						
Shelter-in-Place until 90% ETE for R01, then Evacuate		Area(s) Shelter-in-Place														Area(s) Evacuate																		

Regions Specific to Nine Mile Point																																									
Evacuate 2-Mile Radius and Downwind to 5 Miles - Lake Breeze Adjusted (5 Mile Radius)																																									
Region	Wind Direction From°	ERPA																																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29											
N/A	115 to 222																																								
N/A	223 to 240																																								
N/A	241 to 262																																								
N/A	263 to 278																																								
N/A	279 to 311																																								
R37	312 to 332	X	X	X	X	X	X	X	X	X	X	X															X	X													
R38	333 to 349	X	X	X	X	X	X	X	X	X	X	X															X	X													
N/A	350 to 356																																								
R39	357 to 20	X	X	X	X	X	X	X	X	X	X	X															X	X													
N/A	21 to 51																																								
N/A	52 to 61																																								
R40	62 to 70	X	X	X			X				X	X															X	X													
N/A	71 to 89																																								
R41	90 to 95	X	X	X		X	X				X	X															X	X													
R42	96 to 114	X	X	X			X					X															X	X													
Shelter-in-Place until 90% ETE for R01, then Evacuate														Area(s) Shelter-in-Place																Area(s) Evacuate											
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 5 Miles																																									
Region	Wind Direction From°	ERPA																																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29											
N/A	96 to 233																																								
R43	234 to 240	X	X	X			X																				X	X													
R44	241 to 262	X	X	X	X		X																				X	X													
R45	263 to 278	X	X	X	X		X		X																		X	X													
R46	279 to 292	X	X	X	X	X	X		X																		X	X													
R47	293 to 332	X	X	X	X	X	X		X		X																X	X													
R48	333 to 349	X	X	X	X	X			X		X	X															X	X													
R49	350 to 12	X	X	X		X			X		X	X															X	X													
R50	13 to 51	X	X	X	X	X	X			X		X	X														X	X													
R51	52 to 61	X	X	X	X	X	X				X	X															X	X													
R52	62 to 70	X	X	X		X						X															X	X													
R53	71 to 95	X	X	X																							X	X													
R54	5-Mile Region	X	X	X	X	X	X	X	X	X	X	X															X	X													
Shelter-in-Place until 90% ETE for R01, then Evacuate														Area(s) Shelter-in-Place																Area(s) Evacuate											

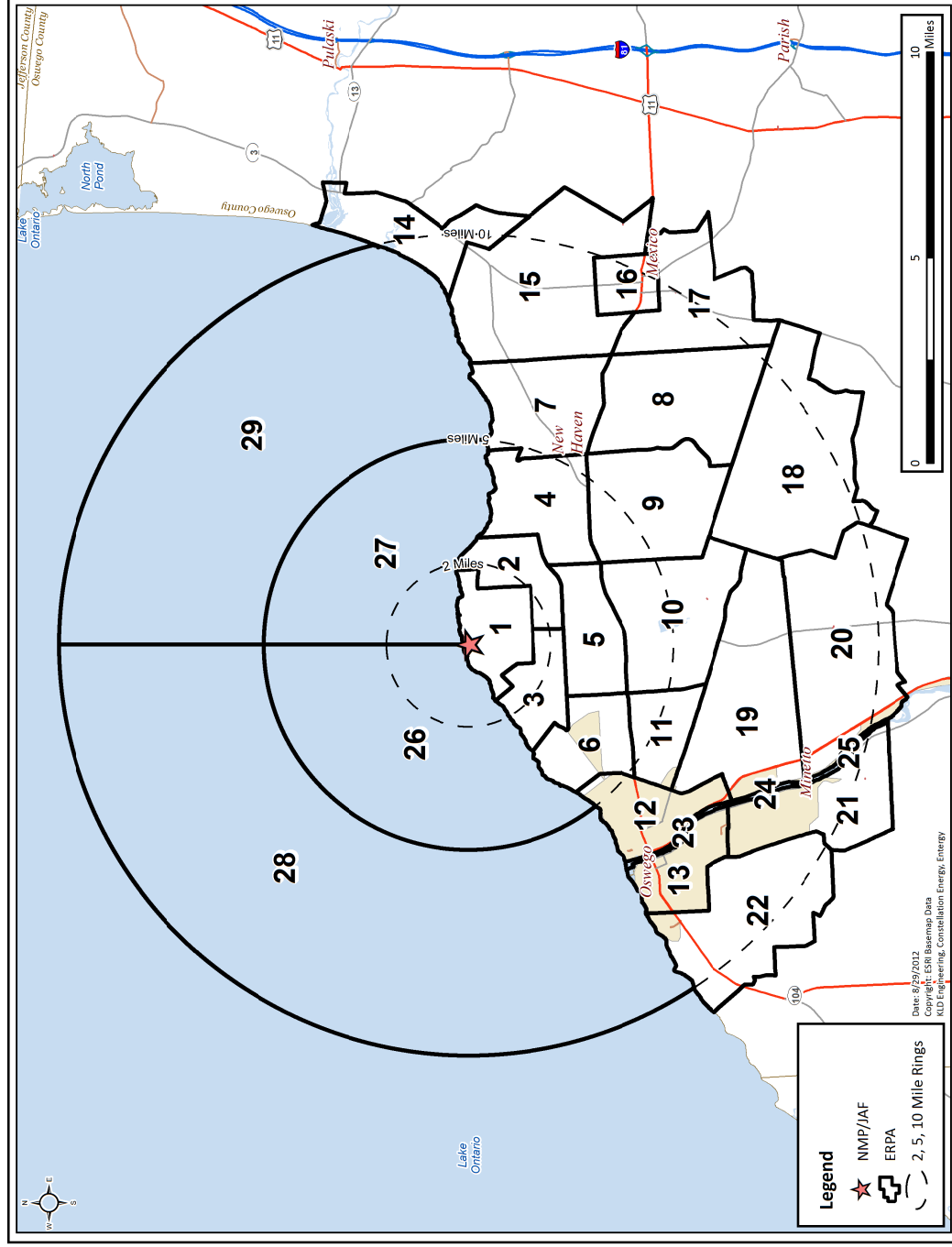


Figure 6-1. NMP/JAF EPZ ERPAs

Table 6-2. Nine Mile Point PAR Logic

Wind Direction From °	2 Miles Around and 5 Downwind	Lake Breeze Adjustment (5 Mile Radius)
214 to 222	1,2,3,26,27	
223 to 233	1,2,3,26,27	4,7
234 to 240	1,2,3,7,26,27	4
241 to 254	1,2,3,4,7,26,27	9
255 to 262	1,2,3,4,7,26,27	9
263 to 278	1,2,3,4,7,9,26,27	5
279 to 292	1,2,3,4,5,7,9,26,27	10
293 to 305	1,2,3,4,5,7,9,10,26,27	
306 to 311	1,2,3,4,5,7,9,10,26,27	
312 to 332	1,2,3,4,5,7,9,10,26,27	6,11
333 to 340	1,2,3,4,5,9,10,11,26,27	6,7,12
341 to 349	1,2,3,4,5,9,10,11,26,27	6,7,12
350 to 356	1,2,3,5,6,9,10,11,26,27	4,7
357 to 12	1,2,3,5,6,9,10,11,26,27	4
13 to 20	1,2,3,5,6,10,11,26,27	4,9
21 to 51	1,2,3,5,6,10,11,26,27	9
52 to 56	1,2,3,5,6,11,26,27	10
57 to 61	1,2,3,5,6,11,26,27	10
62 to 70	1,2,3,6,11,26,27	10
71 to 89	1,2,3,6,26,27	11
90 to 95	1,2,3,6,26,27	5,11,12
96 to 114	1,2,3,26,27	6,12
115 to 146	1,2,3,26,27	
147 to 213	1,2,3,26,27	

Table 6-3. James A. FitzPatrick PAR Logic

Wind Direction From °	2 Miles Around and 5 Downwind	5 to 10 Miles Downwind
214 to 222	1,2,3,26,27	1,2,3,14,26,27,29
223 to 233	1,2,3,26,27	1,2,3,14,26,27,29
234 to 240	1,2,3,7,26,27	1,2,3,7,14,15,26,27,29
241 to 254	1,2,3,4,7,26,27	1,2,3,4,7,14,15,26,27,29
255 to 262	1,2,3,4,7,26,27	1,2,3,4,7,14,15,16,17,26,27,29
263 to 278	1,2,3,4,7,9,26,27	1,2,3,4,7,8,9,14,15,16,17,26,27,29
279 to 292	1,2,3,4,5,7,9,26,27	1,2,3,4,5,7,8,9,14,15,16,17,18,26,27,29
293 to 305	1,2,3,4,5,7,9,10,26,27	1,2,3,4,5,7,8,9,10,14,15,16,17,18,26,27,29
306 to 311	1,2,3,4,5,7,9,10,26,27	1,2,3,4,5,7,8,9,10,14,15,16,17,18,19,20,26,27,29
312 to 332	1,2,3,4,5,7,9,10,26,27	1,2,3,4,5,7,8,9,10,14,15,16,17,18,19,20,26,27
333 to 340	1,2,3,4,5,9,10,11,26,27	1,2,3,4,5,8,9,10,11,15,16,17,18,19,20,21,25,26,27
341 to 349	1,2,3,4,5,9,10,11,26,27	1,2,3,4,5,8,9,10,11,17,18,19,20,21,24,25,26,27
350 to 356	1,2,3,5,6,9,10,11,26,27	1,2,3,5,6,8,9,10,11,12,13,18,19,20,21,22,24,25,26,27
357 to 12	1,2,3,5,6,9,10,11,26,27	1,2,3,5,6,9,10,11,12,13,18,19,20,21,22,23,24,25,26,27
13 to 20	1,2,3,5,6,10,11,26,27	1,2,3,5,6,10,11,12,13,18,19,20,21,22,23,24,25,26,27
21 to 51	1,2,3,5,6,10,11,26,27	1,2,3,5,6,10,11,12,13,19,20,21,22,23,24,25,26,27,28
52 to 56	1,2,3,5,6,11,26,27	1,2,3,5,6,11,12,13,19,20,21,22,23,24,26,27,28
57 to 61	1,2,3,5,6,11,26,27	1,2,3,5,6,11,12,13,19,21,22,23,24,26,27,28
62 to 70	1,2,3,6,11,26,27	1,2,3,6,11,12,13,19,21,22,23,24,26,27,28
71 to 89	1,2,3,6,26,27	1,2,3,6,12,13,21,22,23,24,26,27,28
90 to 95	1,2,3,6,26,27	1,2,3,6,26,27,28
96 to 114	1,2,3,26,27	1,2,3,26,27,28
115 to 146	1,2,3,26,27	1,2,3,26,27,28
147 to 213	1,2,3,26,27	1,2,3,26,27,28,29

**Table 6-4. Evacuation Scenario Definitions**

Scenario	Season <sup>1</sup>	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	None
8	Winter	Midweek	Midday	Snow	None
9	Winter	Weekend	Midday	Good	None
10	Winter	Weekend	Midday	Rain	None
11	Winter	Weekend	Midday	Snow	None
12	Winter	Midweek, Weekend	Evening	Good	None
13	Summer	Weekend	Evening	Good	Harborfest Fireworks
14	Summer	Midweek	Midday	Good	Roadway Impact – Lane Closure on SR 481 SB

<sup>1</sup> Winter means that school is in session (also applies to spring and autumn). Summer means that school is not in session.

Table 6-5. Percent of Population Groups Evacuating for Various Scenarios

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Transients	Shadow	Special Events	SUNY Oswego Commuters	School Buses	Transit Buses	External Through Traffic
1	25%	75%	96%	36%	21%	0%	10%	10%	100%	100%
2	25%	75%	96%	36%	21%	0%	10%	10%	100%	100%
3	3%	97%	10%	100%	20%	0%	0%	0%	100%	100%
4	3%	97%	10%	100%	20%	0%	0%	0%	100%	100%
5	3%	97%	10%	39%	20%	0%	0%	0%	100%	40%
6	25%	75%	100%	13%	21%	0%	100%	100%	100%	100%
7	25%	75%	100%	13%	21%	0%	100%	100%	100%	100%
8	25%	75%	100%	13%	21%	0%	100%	100%	100%	100%
9	3%	97%	10%	31%	20%	0%	0%	0%	100%	100%
10	3%	97%	10%	31%	20%	0%	0%	0%	100%	100%
11	3%	97%	10%	31%	20%	0%	0%	0%	100%	100%
12	3%	97%	10%	14%	20%	0%	0%	0%	100%	40%
13	3%	97%	10%	39%	20%	100%	0%	0%	100%	40%
14	25%	75%	96%	36%	21%	0%	10%	10%	100%	100%

Resident Households with Commuters..... Households of EPZ residents who await the return of commuters prior to beginning the evacuation trip.  
Resident Households with No 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.  
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 Events..... Additional vehicles in the EPZ due to the identified special event.  
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).  
External Through Traffic..... Traffic on interstates/freeways and major arterial roads at the start of the evacuation. This traffic is stopped by access control approximately 2 hours after the evacuation begins.

Table 6-6. Vehicle Estimates by Scenario

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Transients	Shadow	Special Events	SUNY Oswego Commuters	School Buses	Transit Buses	External Through Traffic	Total Scenario Vehicles
1	5,784	17,136	1,509	1,011	3,307	0	216	32	152	5,036	34,177
2	5,784	17,136	1,509	1,011	3,307	0	216	32	152	5,036	34,177
3	578	22,342	157	2,809	3,125	0	0	0	152	5,036	34,199
4	578	22,342	157	2,809	3,125	0	0	0	152	5,036	34,199
5	578	22,342	157	1,096	3,125	0	0	0	152	2,014	29,464
6	5,784	17,136	1,572	365	3,315	0	2,155	320	152	5,036	35,829
7	5,784	17,136	1,572	365	3,315	0	2,155	320	152	5,036	35,829
8	5,784	17,136	1,572	365	3,315	0	2,155	320	152	5,036	35,829
9	578	22,342	157	871	3,125	0	0	0	152	5,036	32,261
10	578	22,342	157	871	3,125	0	0	0	152	5,036	32,261
11	578	22,342	157	871	3,125	0	0	0	152	5,036	32,261
12	578	22,342	157	393	3,125	0	0	0	152	2,014	28,761
13	578	22,342	157	1,096	3,125	22,971	0	0	152	2,014	52,435
14	5,784	17,136	1,509	1,011	3,307	0	216	32	152	5,036	34,177

**Note:** Vehicle estimates are for an evacuation of the entire EPZ (Region R03)

## 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 54 regions within the NMP/JAF 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 of the 2-mile region in both staged and un-staged regions are presented in Table 7-3 and Table 7-4. Table 7-5 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 people within the EPZ in ERPA for which an Advisory to Evacuate has not been issued, yet who elect to evacuate. “Shadow evacuation” is the voluntary outward movement of some people 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 NMP/JAF EPZ addresses the issue of voluntary evacuees in the manner shown in Figure 7-1. Within the EPZ, 20 percent of people located in ERPA outside of the evacuation region who are not advised to evacuate, are assumed to elect to evacuate. Similarly, it is assumed that 20 percent of those people 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 NMP/JAF to cover a region between the EPZ boundary and approximately 15 miles. 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, it is estimated that a total of 29,861 people reside in the Shadow Region; 20 percent of them would evacuate. See Table 6-6 for the number of evacuating vehicles from the Shadow Region.

Traffic generated within this Shadow Region, traveling away from the NMP/JAF location, 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, staged evacuation consists of the following:

1. ERPAs comprising the 2 mile region are advised to evacuate immediately.
2. ERPAs comprising regions extending from 2 to 5 miles downwind are advised to shelter in-place while the two 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 population sheltering in the 2 to 5 mile region is advised to evacuate when approximately 90% of the 2 mile region evacuating traffic crosses the 2 mile region boundary.
5. 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 7-7 illustrate the patterns of traffic congestion that arise for the case when the entire EPZ (Region R03) is advised to evacuate during the winter, midweek, midday period under good weather conditions (Scenario 6).

Traffic congestion, as the term is used here, is defined as Level of Service (LOS) F. LOS F is defined as follows (HCM 2010, page 5-5):

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

- *Demand-to-capacity ratios* describe the extent to which capacity is exceeded during the analysis period (e.g., by 1%, 15%, etc.);
- *Duration of LOS F* describes how long the condition persists (e.g., 15 min, 1 h, 3 h); and
- *Spatial extent measures* describe the areas affected by LOS F conditions. These 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 concentrations of population and traffic bottlenecks. Figure 7-3 displays the developing congestion within the City of Oswego to the southwest of NMP/JAF, just 30 minutes after the Advisory to Evacuate (ATE). Note that SR 481 southbound and SR 104 WB, which are servicing the City of Oswego, are displaying congested traffic conditions (LOS F) on roadway sections exiting the City of Oswego.

At 1 hour, 30 minutes after the ATE, Figure 7-4 displays fully-developed congestion within the City of Oswego, the City of Fulton within the shadow region, and along the sections of SR 104, SR 481, and SR 48 exiting the City of Oswego. The congestion in the south is now involving

shadow evacuees from the Shadow Region in the City of Fulton.

At 2 hours, 30 minutes as shown in Figure 7-5, congestion has cleared within the 5-mile area. Congestion in the core of the City of Oswego has begun to clear as evacuees vacate the area. The main exit paths of SR 481, SR 104 and SR 48 remain fully congested along the paths exiting the city center. Congestion persists in the City of Fulton as the evacuees from portions of the EPZ to its north converge upon it. Also of note, egress from the SUNY Oswego campus is constrained by the presence of heavy congestion on SR 104.

Congested conditions remain in the Fulton area as well as on SR 104 at 3 hours 30 minutes after the ATE (Figure 7-6). However, the extent of the congestion has been reduced as seen by comparing Figure 7-6 with Figure 7-5. The main exit from the SUNY Oswego Campus is now clear and egress is unrestricted as congestion on SR 104 migrates further west.

Over the next 15 minutes, at time 3:45, the EPZ is cleared of congestion as shown in Figure 7-7. LOS F conditions remain in the Shadow Region along small portions of SR 104 and SR 481. Light traffic remains elsewhere in the shadow but is limited to areas near those mentioned. All other areas are free of congested conditions. All congestion inside the shadow region is cleared within the next 15 minutes, by 4 hours after the ATE.

## 7.4 Evacuation Rates

Evacuation is a continuous process, as implied by

Figure 7-8 through Figure 7-21. These figures indicate 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 7-8, 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 – 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 and Table 7-2 present the ETE values for all 54 Evacuation Regions and all 14 Evacuation Scenarios. Table 7-3 and Table 7-4 present the ETE values for the 2-Mile region for both staged and un-staged keyhole regions downwind to 5 miles. The tables are organized as follows:

Table	Contents
7-1	ETE represents the elapsed time required for 90 percent 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 percent 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 percent of the population within the 2-mile Region, to evacuate from that Region with both Concurrent and Staged Evacuations.
7-4	ETE represents the elapsed time required for 100 percent of the population within the 2-mile Region, to evacuate from that Region with both Concurrent and Staged Evacuations.

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 7-7. Most of the congestion is located in ERPAs 12 and 13 which are comprised of the western and eastern halves of the city of Oswego and lie beyond the 5-mile area. This fact is reflected in the ETE statistics:

- The 90<sup>th</sup> percentile ETE for Region R01 (2-mile area) is 1:30 for good weather and rain and up to 30 minutes higher for snow cases.
- The 90<sup>th</sup> percentile ETE for Region R02 (5-mile area) is between 1:40 and 1:50 for good and rain weather (non-special event) scenarios. Snow conditions increase the ETE by as much as 25 minutes.
- The 90<sup>th</sup> percentile ETE for Region R03 (full EPZ) is between 2:25 and 2:55 for good weather (non-special event) scenarios. Rain increases the ETE by up to 15 minutes. Snow has a larger impact and increases ETE by as much as 40 minutes.
- Generally, populous regions which contain ERPA 12 and ERPA 13 resemble the pattern exhibited by R03. Rural regions which do not include either ERPA 12 or ERPA 13 more closely resemble R01.
- The 100<sup>th</sup> percentile ETE for all rural regions are governed by the mobilization times. This fact implies that the congestion within the EPZ dissipates prior to the end of mobilization.
- The 100<sup>th</sup> percentile ETE for populous regions can exceed the mobilization times by as

much as 35 minutes for non-special event scenarios.

Comparison of Scenarios 5 and 13 in Table 7-1 indicates that the Special Event –Harborfest Fireworks– has a substantial impact on the ETE for the 90<sup>th</sup> and 100<sup>th</sup> percentiles.

Harborfest attracts a considerable number of transients from the greater Central New York region. The capstone of the Harborfest weekend celebration is a Saturday night fireworks display. This event is expected to draw 90,000 people, 61% of whom are from outside of the EPZ. The additional 22,970 vehicles significantly increase congestion on all major evacuation routes exiting the city of Oswego. The 90<sup>th</sup> percentile ETE for R03 (full EPZ) is 2:45 higher, representing a more than two fold increase. The impact on the 2-Mile and 5-Mile Region ETE is far less severe because the event is situated in the shadow. The special event does not impact these regions, as they are spatially removed from the event to the extent that no peripheral effects are experienced.

Comparison of Scenarios 1 and 14 in Table 7-1 indicates that the roadway closure – one southbound lane closed on SR 481 – does not have a material impact on 90<sup>th</sup> percentile ETE due to the fact that the 1 lane section of SR 481 to the north of the lane closure forms a bottleneck upstream of the lane closure.

Table 7-3 and Table 7-4 present a comparison of the ETE compiled for the concurrent (unstaged) and staged evacuation studies. Note that Regions R43 through R53 are the same geographic areas as Regions R04 through R14 and R54 is the same as R02.

To determine whether the staged evacuation strategy is worthy of consideration, one must show that the ETE for the 2 Mile region can be reduced without significantly affecting the region between 2 miles and 5 miles. In all cases, as shown in these tables, the ETE for the 2 mile region is unchanged when a staged evacuation is implemented. The reason for this is that the congestion within the 5-mile area does not extend upstream to the extent that it penetrates to within 2 miles of the NMP/JAF. Consequently, the impedance, due to this congestion within the 5-mile area, to evacuees from within the 2-mile area is not sufficient to materially influence the 90<sup>th</sup> percentile ETE for the 2-mile area. Therefore, staging the evacuation to sharply reduce congestion within the 5-mile area provides no benefits to evacuees from within the 2 mile region and unnecessarily delays the evacuation of those beyond 2 miles.

While failing to provide assistance to evacuees from within 2 miles of the NMP/JAF, staging produces a negative impact on the ETE for those evacuating from within the 5-mile area. A comparison of ETE between regions, R43 through R53 with R04 through R14 and R54 with R02 ; reveals that staging retards the 90<sup>th</sup> percentile ETE for those in the 2 to 5-mile area by up to 40 minutes (see Table 7-1) and does not appreciably impact the 100<sup>th</sup> percentile ETE (see Table 7-2). This extending of ETE is due to the delay in beginning the evacuation trip, experienced by those who shelter, plus the effect of the trip-generation “spike” (significant volume of traffic beginning the evacuation trip at the same time) that follows their eventual ATE, in creating congestion within the EPZ area beyond 2 miles.

In summary, the staged evacuation protective action strategy provides no benefits and

adversely impacts many evacuees located beyond 2 miles from the NMP/JAF.

## 7.6 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 90<sup>th</sup> 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
  - Snow
- Special Event
  - Harborfest Fireworks
  - Road Closure (1 southbound lane on SR 481)
- 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 are not explicitly identified in the Tables. For these conditions, Scenarios (7) and (10) for rain apply.
- The conditions of a winter evening (either midweek or weekend) and snow are not explicitly identified in the Tables. For these conditions, Scenarios (8) and (11) for snow apply.
- The seasons are defined as follows:
  - Summer assumes that public schools are not in session.
  - Winter (includes Spring and Autumn) considers that public schools are in session.
- 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 degrees.
  - Determine the distance that the Evacuation Region will extend from the nuclear power plants. The applicable distances and their associated candidate Regions are given below:
    - 2 Miles (Region R01)
    - To 5 Miles (Region R02, R04 through R14)
    - To EPZ Boundary (Regions R03, R15 through R36)
  - Enter Table 7-5 and identify the applicable group of candidate Regions based on the distance that the selected Region extends from the NMP/JAF. 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 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 4:00 AM.
- It is raining.
- Wind direction is from 60°.
- Wind speed is such that the distance to be evacuated is judged to be a 2-mile radius and downwind to 5 miles.
- The desired ETE is that value needed to evacuate 90 percent of the population from within the impacted Region.
- A staged evacuation is not desired.

Table 7-1 is applicable because the 90<sup>th</sup> 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 7-5 and locate the Region described as “Evacuate 2-Mile Radius and Downwind to the 5 Miles” for wind direction from° 52-61 and read Region R12 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 R12. This data cell is in column (4) and in the row for Region R12; it contains the

ETE value of 1:35.

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

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

Scenario:	Summer			Summer			Summer			Winter			Winter			Winter			Summer		
	Midweek			Weekend			Midweek Weekend			Midweek			Weekend			Midweek Weekend			Weekend		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)							
Region	Midweek			Midweek			Midweek			Midweek			Midweek			Midweek			Midweek		
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather	Good Weather
2-Mile Region and Keyhole to EPZ Boundary (James A. FitzPatrick)																					
R15	1:40	1:40	1:30	1:30	1:35	1:40	1:40	2:00	1:35	1:35	2:05	1:35	1:35	1:40	1:35	1:35	1:35	1:35	1:35	1:35	1:40
R16	1:40	1:45	1:35	1:40	1:35	1:45	1:45	2:05	1:35	1:35	2:05	1:35	1:35	1:40	1:35	1:35	1:35	1:35	1:35	1:35	1:40
R17	1:45	1:45	1:40	1:50	1:35	1:50	1:50	2:10	1:35	1:35	2:10	1:40	1:40	1:35	1:40	1:40	1:35	1:35	1:35	1:35	1:45
R18	1:45	1:50	1:50	1:50	1:35	1:50	1:50	2:10	1:35	1:35	2:10	1:40	1:40	1:35	1:40	1:40	1:40	1:35	1:35	1:35	1:45
R19	1:50	1:50	1:45	1:55	1:35	1:50	1:55	2:15	1:35	1:35	2:15	1:40	1:40	1:35	1:40	1:40	1:40	1:35	1:35	1:35	1:50
R20	1:50	1:50	1:45	1:50	1:40	1:50	1:55	2:15	1:40	1:40	2:15	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:50
R21	1:50	1:50	1:45	1:50	1:40	1:50	1:55	2:15	1:40	1:40	2:15	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:50
R22	1:50	1:55	1:45	1:50	1:40	1:55	1:55	2:15	1:40	1:40	2:15	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:45	1:45	1:50
R23	1:50	1:55	1:45	1:50	1:40	1:55	1:55	2:15	1:40	1:40	2:15	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:45	1:45	1:50
R24	1:50	1:55	1:40	1:45	1:40	1:55	1:55	2:15	1:40	1:40	2:15	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:45	1:45	1:50
R25	1:50	1:55	1:40	1:45	1:40	1:55	1:55	2:15	1:40	1:40	2:15	1:40	1:40	1:40	1:40	1:40	1:40	1:40	1:50	1:50	1:50
R26	2:45	2:55	2:45	2:50	2:30	3:00	3:15	3:40	2:35	2:45	3:05	2:45	2:45	2:35	3:05	2:30	2:30	5:10	2:45	2:45	2:45
R27	2:40	2:55	2:40	2:50	2:35	3:05	3:15	3:35	2:30	2:45	3:35	2:45	2:45	2:30	3:05	2:30	2:30	5:15	2:40	2:40	2:40
R28	2:45	2:55	2:40	2:50	2:35	3:00	3:10	3:40	2:35	2:45	3:40	2:45	2:45	2:35	3:05	2:30	2:30	5:10	2:45	2:45	2:45
R29	2:40	2:55	2:45	2:50	2:30	3:00	3:20	3:40	2:30	2:40	3:40	2:40	2:40	2:30	3:00	2:30	2:30	5:10	2:45	2:45	2:45
R30	2:40	2:55	2:40	2:50	2:30	3:00	3:15	3:40	2:30	2:40	3:40	2:40	2:40	2:35	3:05	2:30	2:30	5:10	2:40	2:40	2:40
R31	2:35	2:45	2:30	2:45	2:25	2:55	3:15	3:35	2:25	2:35	3:35	2:35	2:35	2:25	2:50	2:20	2:20	5:05	2:35	2:35	2:35
R32	2:35	2:45	2:30	2:45	2:25	2:55	3:05	3:30	2:25	2:35	3:30	2:35	2:35	2:25	2:55	2:20	2:20	5:05	2:35	2:35	2:35
R33	2:35	2:50	2:30	2:40	2:20	2:55	3:10	3:25	2:20	2:30	3:25	2:30	2:30	2:20	2:55	2:20	2:20	5:00	2:35	2:35	2:35
R34	1:35	1:35	1:30	1:30	1:35	1:35	1:35	2:00	1:35	1:35	2:00	1:35	1:35	1:35	2:05	1:35	1:35	1:35	1:35	1:35	1:35
R35	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	1:50	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30	1:30
R36	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	1:50	1:30	1:30	1:30	2:00	1:30	1:30	1:30	1:30	1:30	1:30

Scenario:	Summer			Summer			Summer			Winter			Winter			Winter			Summer		
	Midweek			Weekend			Midweek			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	Good Weather	Snow	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Good Weather	Evening	Evening	Special Event	Midweek	Midweek
2-Mile Region and Downwind to 5 Miles - Lake Breeze Adjusted (Nine Mile Point)																					
R37	1:50	1:50	1:40	1:40	1:40	1:50	1:50	2:15	1:40	1:40	2:05	1:40	1:40	2:05	1:40	1:40	1:40	1:40	1:40	1:50	1:50
R38	1:55	2:00	1:55	1:55	1:50	1:55	2:00	2:20	1:50	1:50	2:15	1:45	1:50	2:15	1:45	1:45	1:45	1:40	3:40	1:55	1:55
R39	1:50	1:50	1:40	1:40	1:40	1:50	1:50	2:15	1:40	1:40	2:10	1:40	1:45	2:10	1:40	1:40	1:40	1:40	1:40	1:50	1:50
R40	1:50	1:50	1:40	1:40	1:40	1:50	1:50	2:10	1:40	1:40	2:10	1:40	1:40	2:10	1:40	1:40	1:40	1:40	1:40	1:50	1:50
R41	2:00	2:00	1:55	1:55	1:45	1:55	2:00	2:20	1:50	1:50	2:15	1:50	1:50	2:15	1:50	1:50	1:50	3:45	2:00	2:00	2:00
R42	1:55	1:55	1:50	1:50	1:40	1:55	2:00	2:20	1:45	1:50	2:10	1:45	1:50	2:10	1:50	1:45	1:45	3:40	1:55	1:55	1:55
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																					
R43	1:55	1:55	1:55	1:55	1:55	1:55	1:55	2:25	1:55	2:00	2:30	1:55	2:00	2:30	2:00	2:00	2:00	1:55	1:55	1:55	1:55
R44	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:00	2:00	2:00	2:00	2:00
R45	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:00	2:00	2:00	2:00	2:00
R46	2:00	2:00	2:00	2:00	2:00	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:30	2:00	2:00	2:00	2:00	2:00	2:00	2:00
R47	2:05	2:05	2:05	2:05	2:05	2:05	2:05	2:35	2:05	2:05	2:35	2:05	2:05	2:35	2:05	2:05	2:05	2:05	2:05	2:05	2:05
R48	2:10	2:15	2:10	2:15	2:10	2:10	2:15	2:45	2:10	2:15	2:45	2:10	2:15	2:45	2:10	2:10	2:10	2:10	2:10	2:10	2:10
R49	2:15	2:15	2:15	2:15	2:15	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:15	2:15	2:15	2:15	2:15
R50	2:15	2:15	2:15	2:15	2:15	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:15	2:15	2:15	2:15	2:15
R51	2:15	2:15	2:15	2:15	2:15	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:15	2:15	2:15	2:15	2:15
R52	2:05	2:05	2:05	2:10	2:10	2:05	2:10	2:40	2:05	2:10	2:40	2:10	2:10	2:40	2:10	2:10	2:10	2:10	2:10	2:05	2:05
R53	1:55	1:55	1:55	1:55	1:55	1:55	1:55	2:25	1:55	1:55	2:30	1:55	1:55	2:30	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R54	2:15	2:15	2:15	2:15	2:15	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:45	2:15	2:15	2:15	2:15	2:15	2:15	2:15

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

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

	Summer		Summer		Summer		Winter		Winter		Winter		Summer	
	Midweek		Weekend		Midweek Weekend		Midweek		Midweek		Weekend		Midweek Weekend	
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening		Midday		Midday		Midday		Evening	
	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Snow	Good Weather	Special Event
2-Mile Region and Keyhole to EPZ Boundary (James A. FitzPatrick)														
R15	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R16	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R17	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R18	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R19	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R20	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R21	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R22	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R23	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R24	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R25	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R26	3:40	3:50	3:40	3:40	3:40	4:00	4:05	4:50	3:40	3:40	4:25	3:40	7:15	3:40
R27	3:40	3:45	3:40	3:40	3:40	4:00	4:10	4:50	3:40	3:40	4:25	3:40	7:00	3:40
R28	3:40	3:45	3:40	3:40	3:40	4:00	4:10	4:50	3:40	3:40	4:25	3:40	7:20	3:40
R29	3:40	3:45	3:40	3:40	3:40	4:00	4:15	4:50	3:40	3:40	4:25	3:40	7:05	3:40
R30	3:40	3:45	3:40	3:40	3:40	4:00	4:10	4:45	3:40	3:40	4:25	3:40	7:05	3:40
R31	3:40	3:45	3:40	3:40	3:40	4:00	4:10	4:45	3:40	3:40	4:25	3:40	7:10	3:40
R32	3:40	3:45	3:40	3:40	3:40	4:00	4:05	4:35	3:40	3:40	4:25	3:40	7:10	3:40
R33	3:40	3:45	3:40	3:40	3:40	4:00	4:05	4:35	3:40	3:40	4:25	3:40	6:55	3:40
R34	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R35	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40
R36	3:40	3:40	3:40	3:40	3:40	3:40	3:40	4:25	3:40	3:40	4:25	3:40	3:40	3:40

	Summer			Summer			Winter			Winter			Summer		
	Midweek			Weekend			Midweek			Weekend			Midweek		
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Region	Midday			Midday			Midday			Midday			Evening		
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact	
2-Mile Region and Downwind to 5 Miles - Lake Breeze Adjusted (Nine Mile Point)															
R37	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R38	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	5:50	3:35	
R39	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R40	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R41	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	5:50	3:35	
R42	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	5:45	3:35	
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles															
R43	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R44	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R45	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R46	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R47	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R48	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R49	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R50	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R51	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R52	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R53	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	
R54	3:35	3:35	3:35	3:35	3:35	3:35	3:35	4:20	3:35	3:35	4:20	3:35	3:35	3:35	

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

	Summer			Summer			Winter			Winter			Summer		
	Midweek			Weekend			Midweek			Weekend			Midweek Weekend		
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
Region	Midday			Midday			Midday			Midday			Evening		
	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
Entire 2-Mile Region, 5-Mile Region															
R01	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R02	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
2-Mile Region and Keyhole to 5 Miles															
R04	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R05	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R06	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R07	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R08	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R09	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R10	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R11	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R12	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R13	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
R14	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:30	1:50	1:30	1:30	2:00	1:30	1:30	1:30
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles															
R43	1:30	1:30	1:35	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:30
R44	1:35	1:35	1:45	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:35
R45	1:35	1:35	1:45	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:35
R46	1:35	1:35	1:45	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:35
R47	1:35	1:35	1:45	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:35
R48	1:35	1:35	1:45	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:35
R49	1:30	1:30	1:35	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:30
R50	1:30	1:30	1:35	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:30
R51	1:30	1:30	1:35	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:30
R52	1:30	1:30	1:35	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:30
R53	1:30	1:30	1:35	1:35	1:35	1:35	1:30	1:30	1:50	1:35	1:35	2:05	1:35	1:35	1:30
R54	1:35	1:35	1:45	1:45	1:45	1:45	1:35	1:35	1:55	1:45	1:45	2:15	1:45	1:45	1:35

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

Region	Summer		Summer		Summer		Winter			Winter			Winter		Summer		Summer	
	Midweek		Weekend		Midweek		Midweek			Midweek			Weekend		Weekend		Weekend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)		
Entire 2-Mile Region, 5-Mile Region																		
R01	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R02	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
2-Mile Region and Keyhole to 5 Miles																		
R04	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R05	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R06	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R07	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R08	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R09	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R10	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R11	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R12	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R13	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R14	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
Staged Evacuation - 2-Mile Region and Keyhole to 5 Miles																		
R43	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R44	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R45	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R46	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R47	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R48	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R49	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R50	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R51	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R52	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R53	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	
R54	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	3:30	

Table 7-5. Description of Evacuation Regions

Region	Description	ERPA																													
R01	2-Mile Radius	x	x	x																							x	x			
R02	5-Mile Radius	x	x	x	x	x	x			x	x	x																x	x		
R03	Full EPZ	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Evacuate 2-Mile Radius and Downwind to 5 Miles																															
Region		ERPA																													
Wind Direction From°		See Region R01																													
N/A	96 to 233	x	x	x																											
R04	234 to 240	x	x	x																							x	x			
R05	241 to 262	x	x	x	x																						x	x			
R06	263 to 278	x	x	x	x					x																	x	x			
R07	279 to 292	x	x	x	x	x				x																	x	x			
R08	293 to 332	x	x	x	x	x				x																	x	x			
R09	333 to 349	x	x	x	x					x	x	x															x	x			
R10	350 to 12	x	x	x						x	x	x															x	x			
R11	13 to 51	x	x	x							x																x	x			
R12	52 to 61	x	x	x	x						x																x	x			
R13	62 to 70	x	x	x																							x	x			
R14	71 to 95	x	x	x																							x	x			
Shelter-in-Place until 90% ETE for R01, then Evacuate		Area(s) Shelter-in-Place														Area(s) Evacuate															

Regions Specific to James A. FitzPatrick																															
Evacuate 2-Mile Radius and Downwind to 10 Miles																															
Region	Wind Direction From°	ERPA																													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
R15	214 to 233	x	x	x										x														x	x		x
R16	234 to 240	x	x	x										x	x													x	x		x
R17	241 to 254	x	x	x	x									x	x													x	x		x
R18	255 to 262	x	x	x	x									x	x	x												x	x		x
R19	263 to 278	x	x	x	x									x	x	x	x											x	x		x
R20	279 to 292	x	x	x	x	x								x	x	x	x			x								x	x		x
R21	293 to 305	x	x	x	x	x								x	x	x	x			x								x	x		x
R22	306 to 311	x	x	x	x	x								x	x	x	x			x								x	x		x
R23	312 to 332	x	x	x	x	x								x	x	x	x			x								x	x		
R24	333 to 340	x	x	x	x	x														x								x	x		
R25	341 to 349	x	x	x	x	x														x								x	x		
R26	350 to 356	x	x	x										x	x					x								x	x		
R27	357 to 12	x	x	x										x	x	x				x								x	x		
R28	13 to 20	x	x	x										x	x	x				x								x	x		
R29	21 to 51	x	x	x										x	x	x				x								x	x		
R30	52 to 56	x	x	x										x	x	x				x								x	x		
R31	57 to 61	x	x	x										x	x	x				x								x	x		
R32	62 to 70	x	x	x										x	x	x				x								x	x		
R33	71 to 89	x	x	x										x	x	x				x								x	x		
R34	90 to 95	x	x	x																								x	x		
R35	96 to 146	x	x	x																								x	x		
R36	147 to 213	x	x	x																								x	x		x
Shelter-in-Place until 90% ETE for R01, then Evacuate		Area(s) Shelter-in-Place														Area(s) Evacuate															



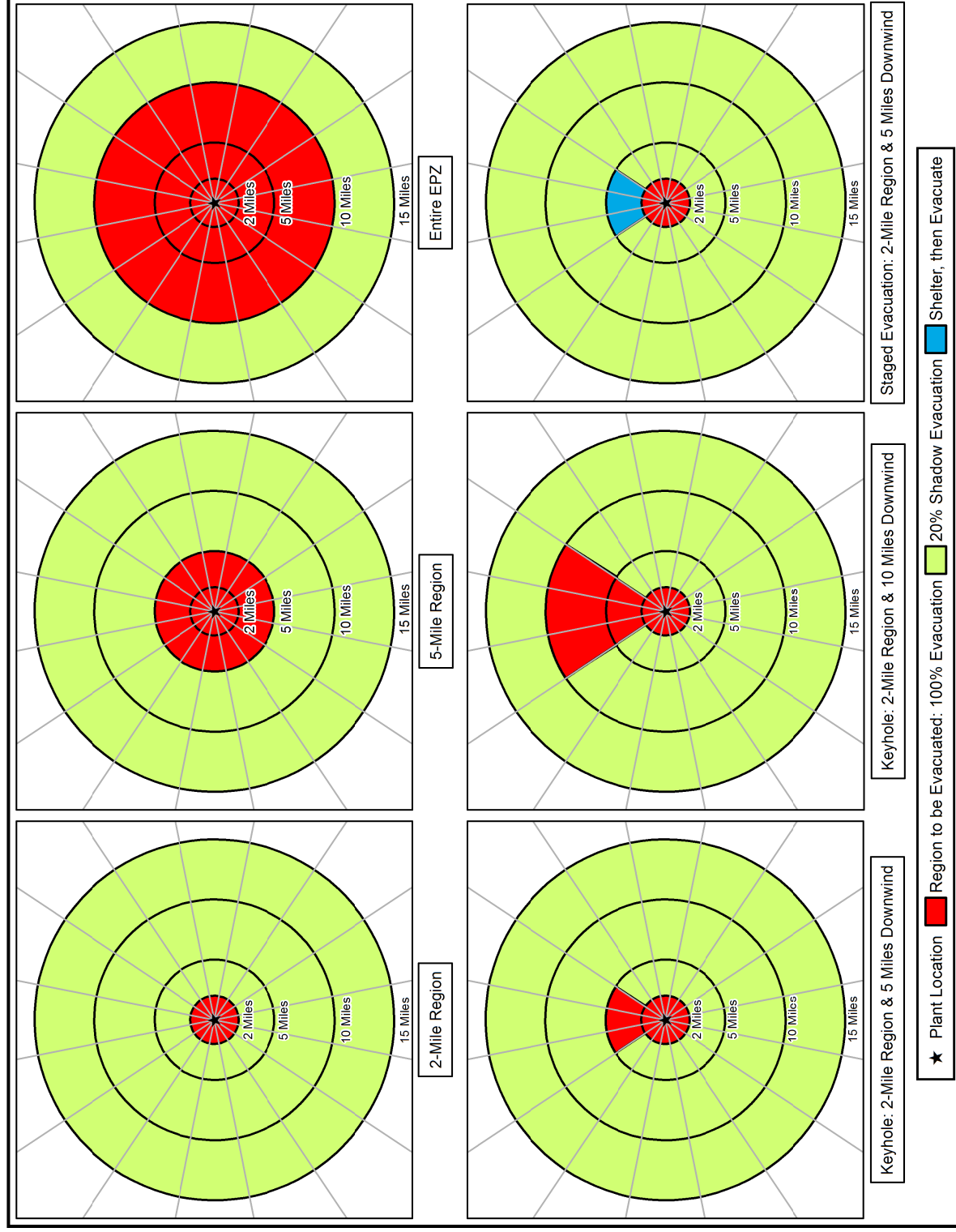


Figure 7-1. Voluntary Evacuation Methodology

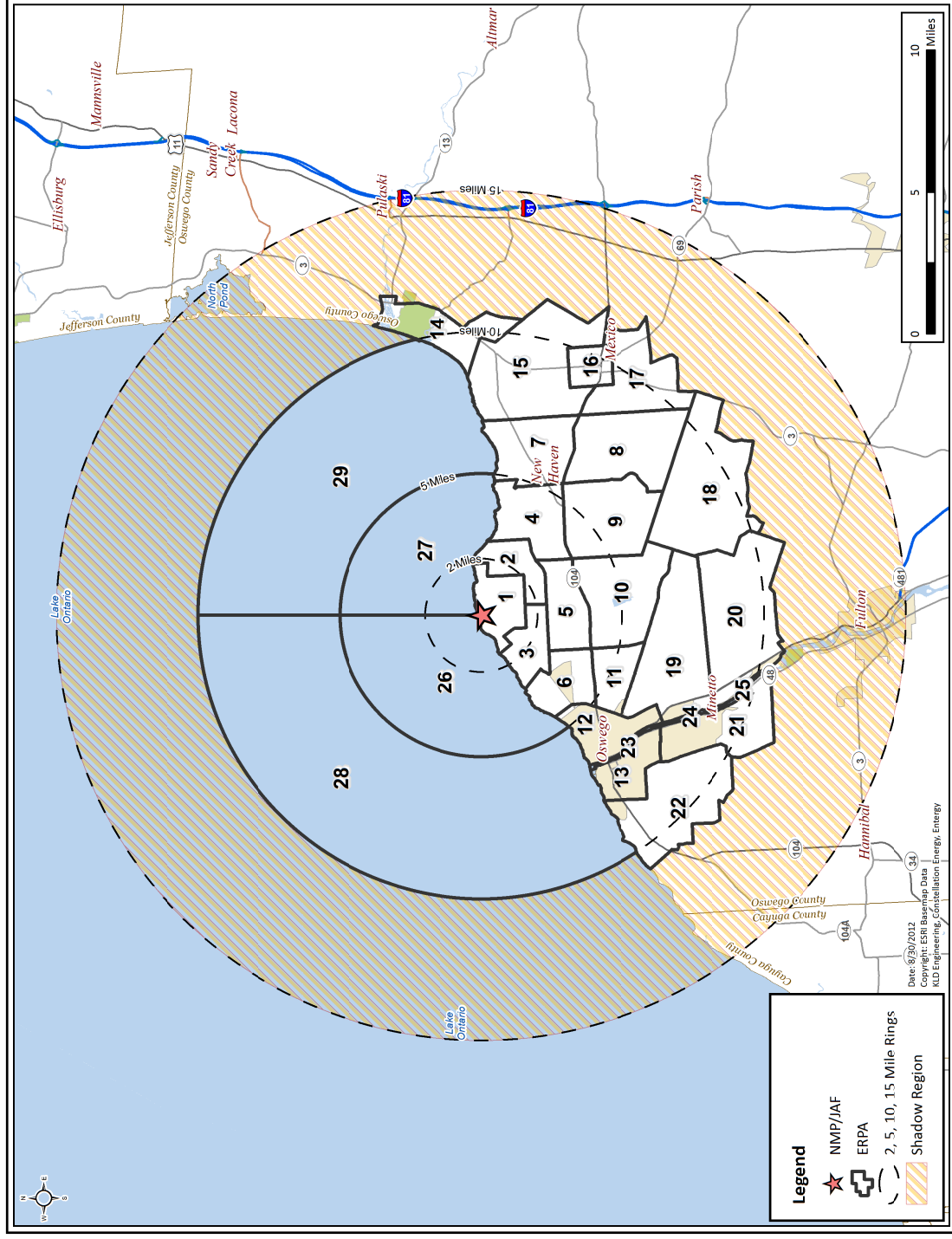
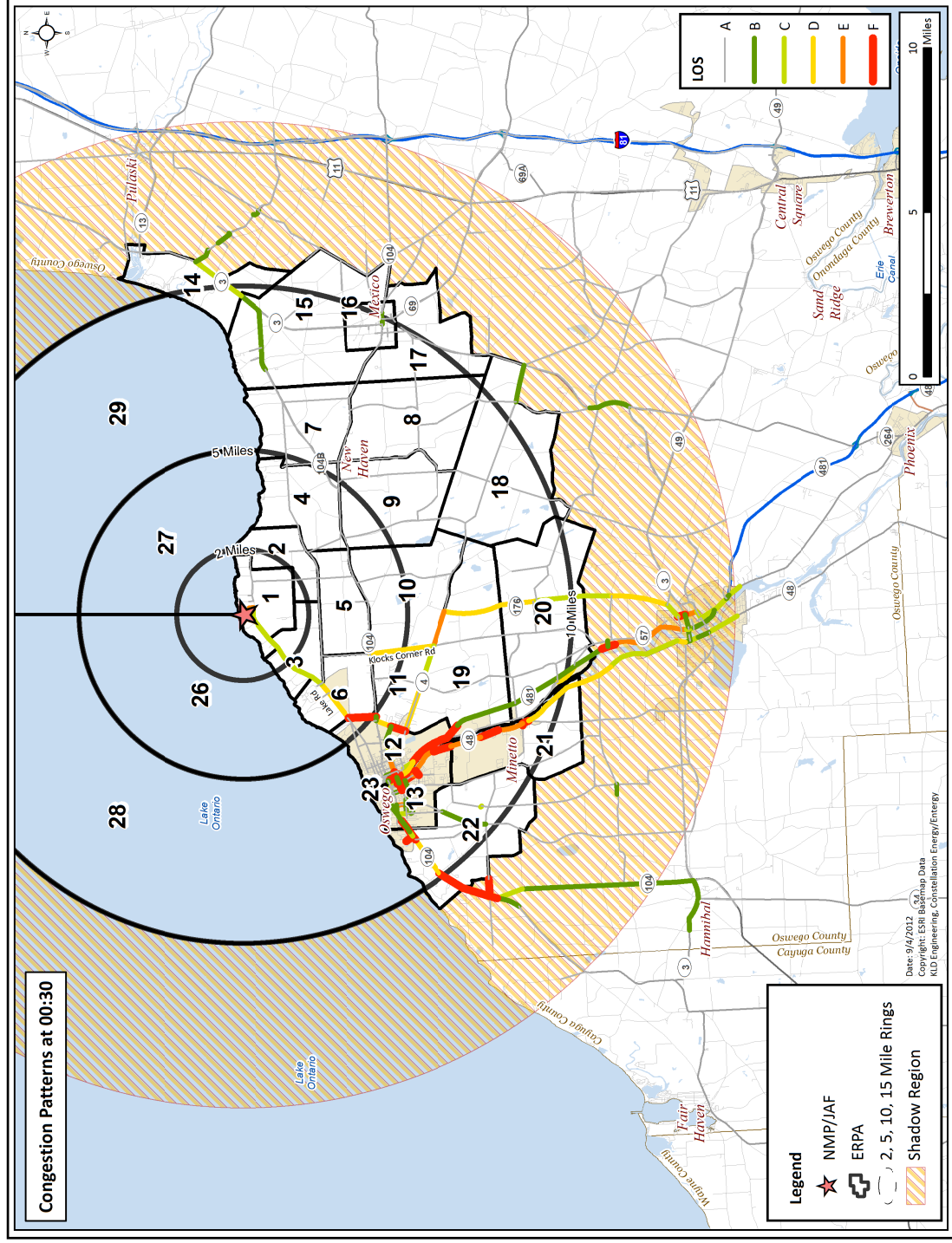


Figure 7-2. NMP/JAF Shadow Region



**Figure 7-3. Congestion Patterns at 30 Minutes after the Advisory to Evacuate**

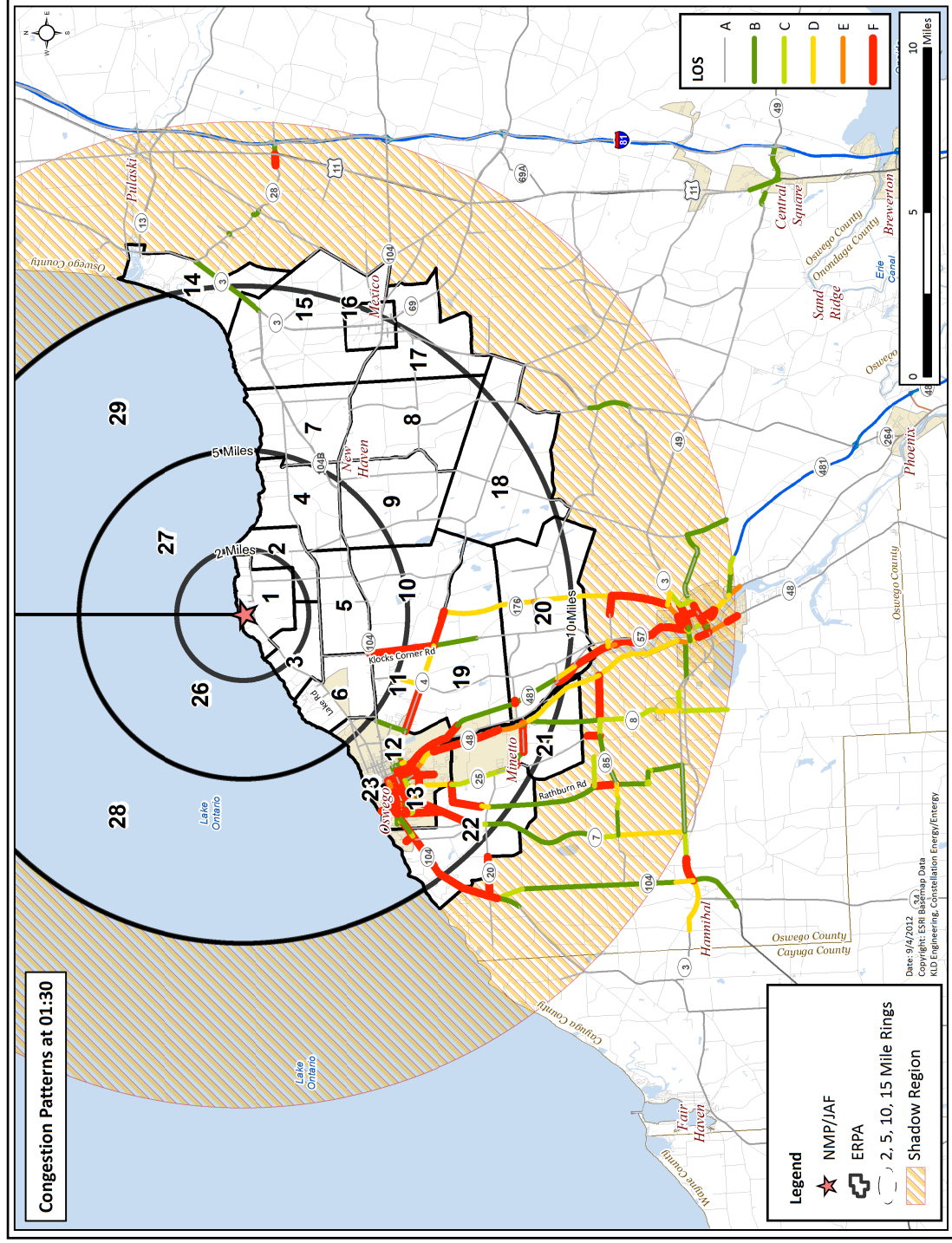


Figure 7-4. Congestion Patterns at 1 Hour, 30 minutes after the Advisory to Evacuate

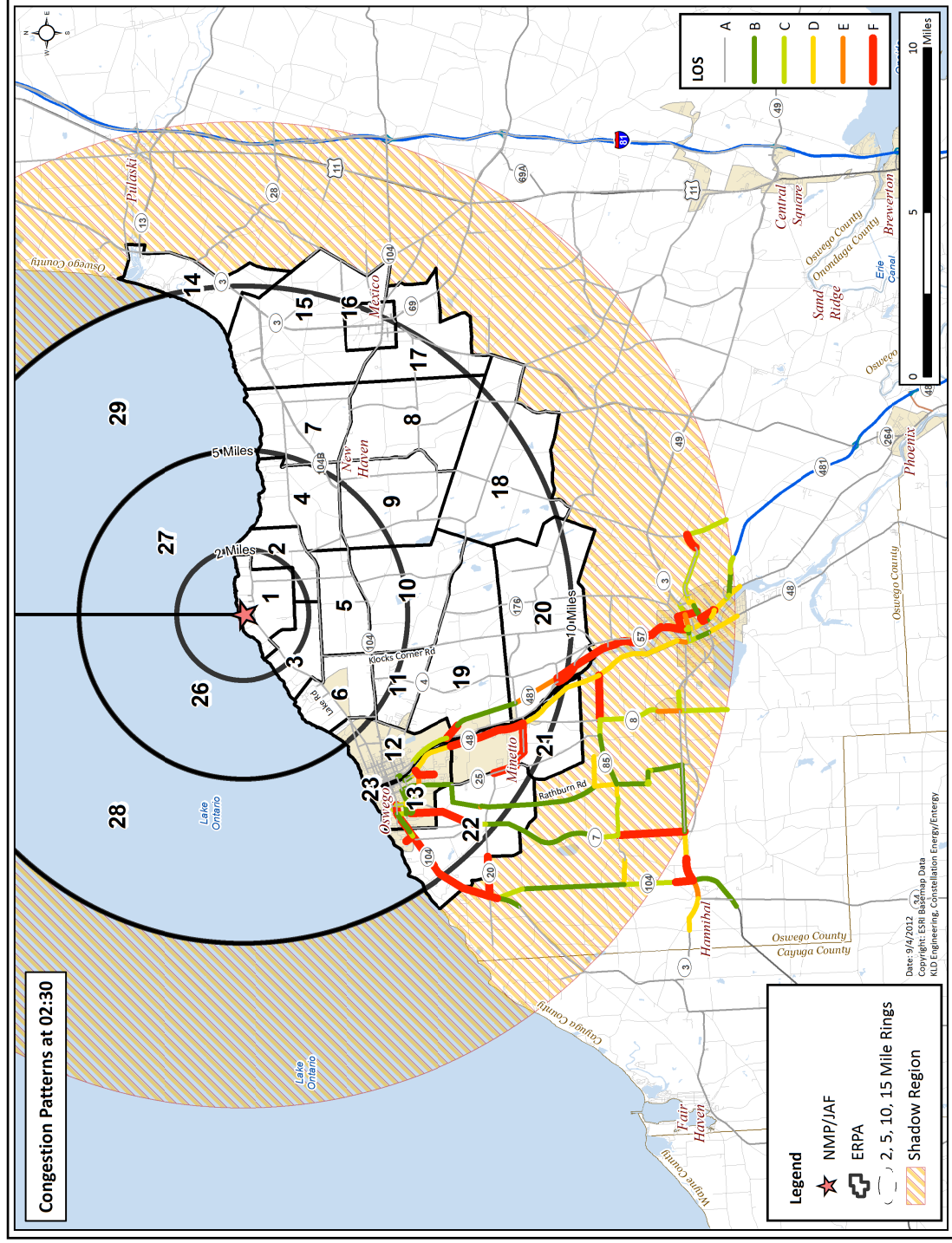


Figure 7-5. Congestion Patterns at 2 Hours, 30 Minutes after the Advisory to Evacuate

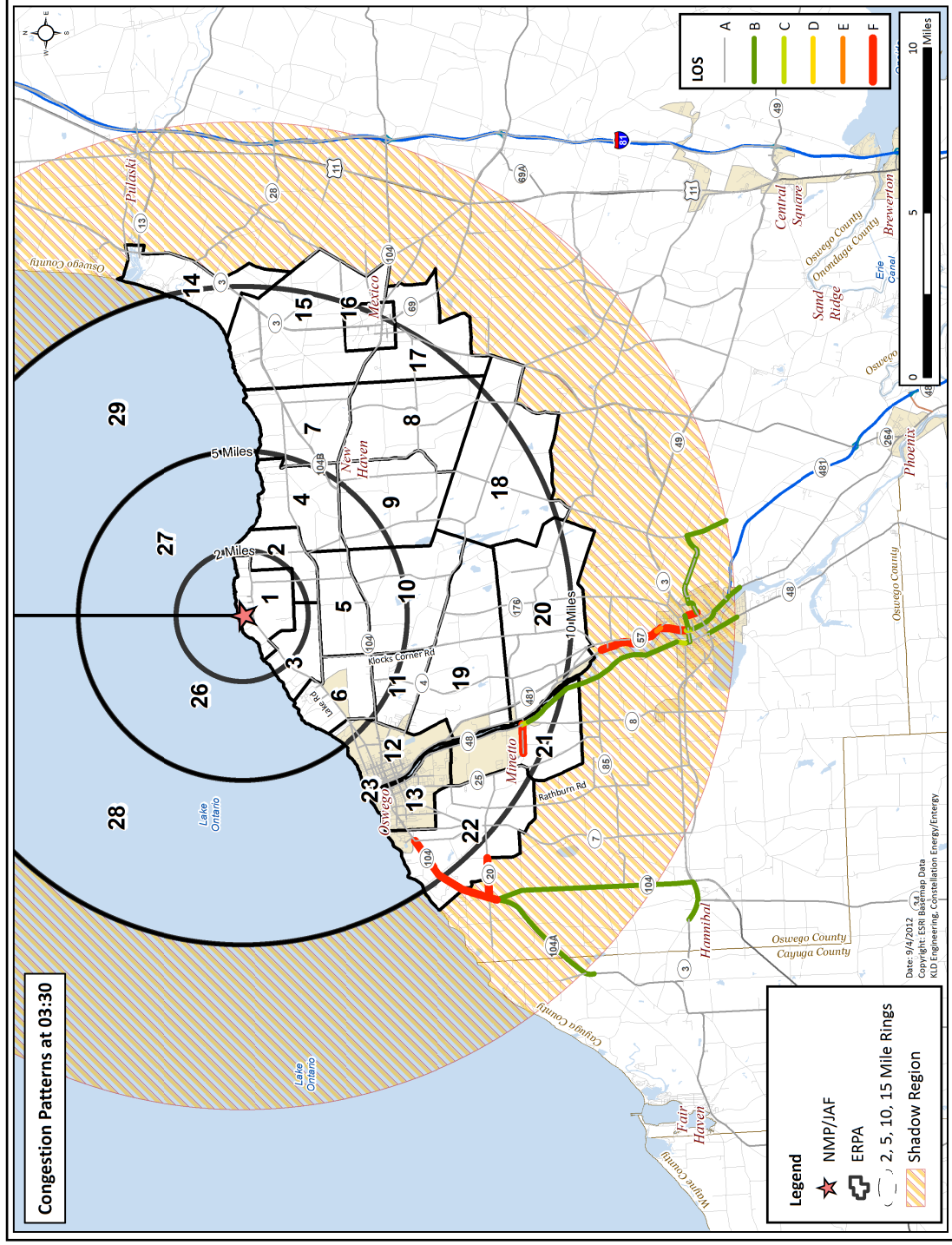


Figure 7-6. Congestion Patterns at 3 Hours, 30 Minutes after the Advisory to Evacuate

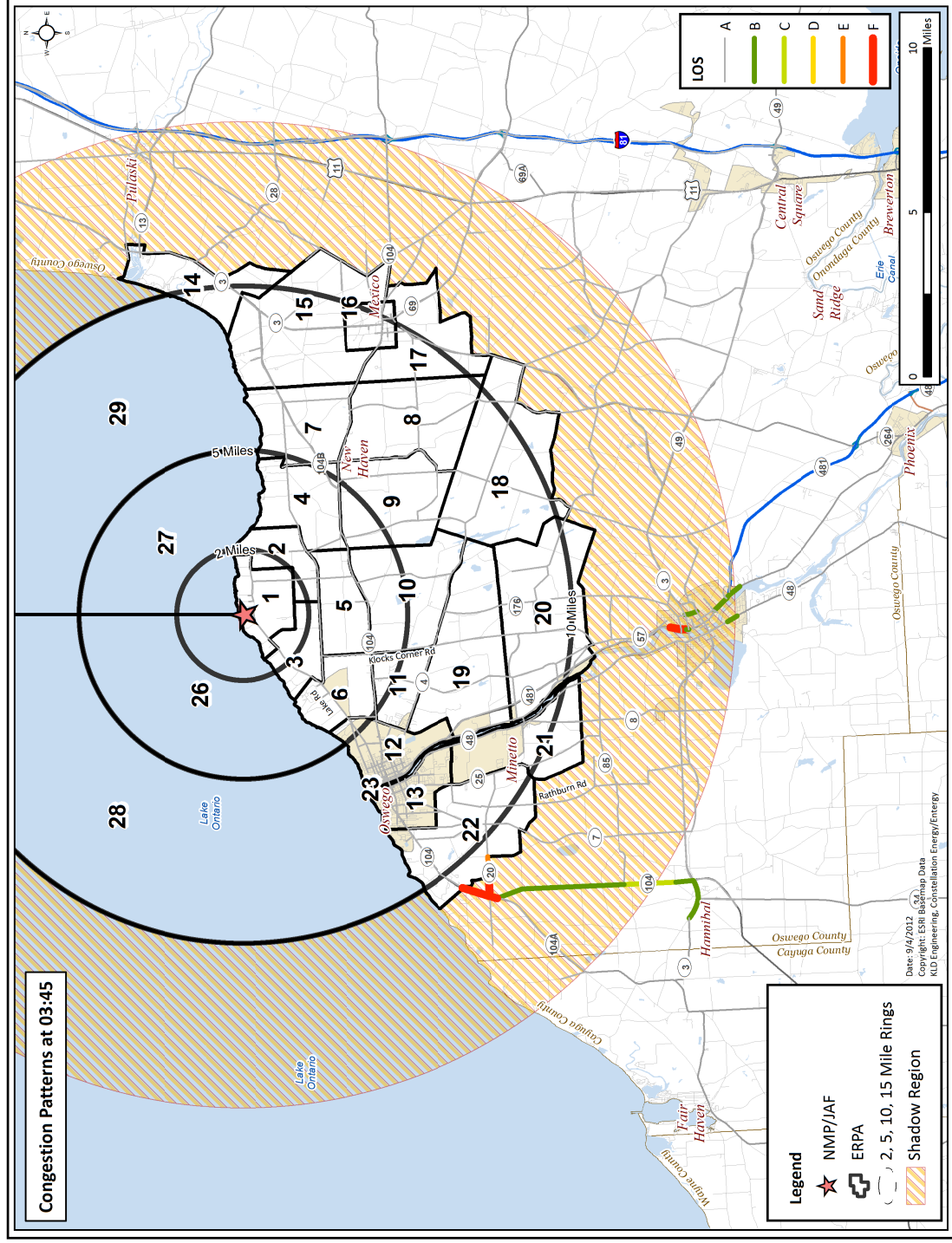


Figure 7-7. Congestion Patterns at 3 Hours, 45 Minutes after the Advisory to Evacuate

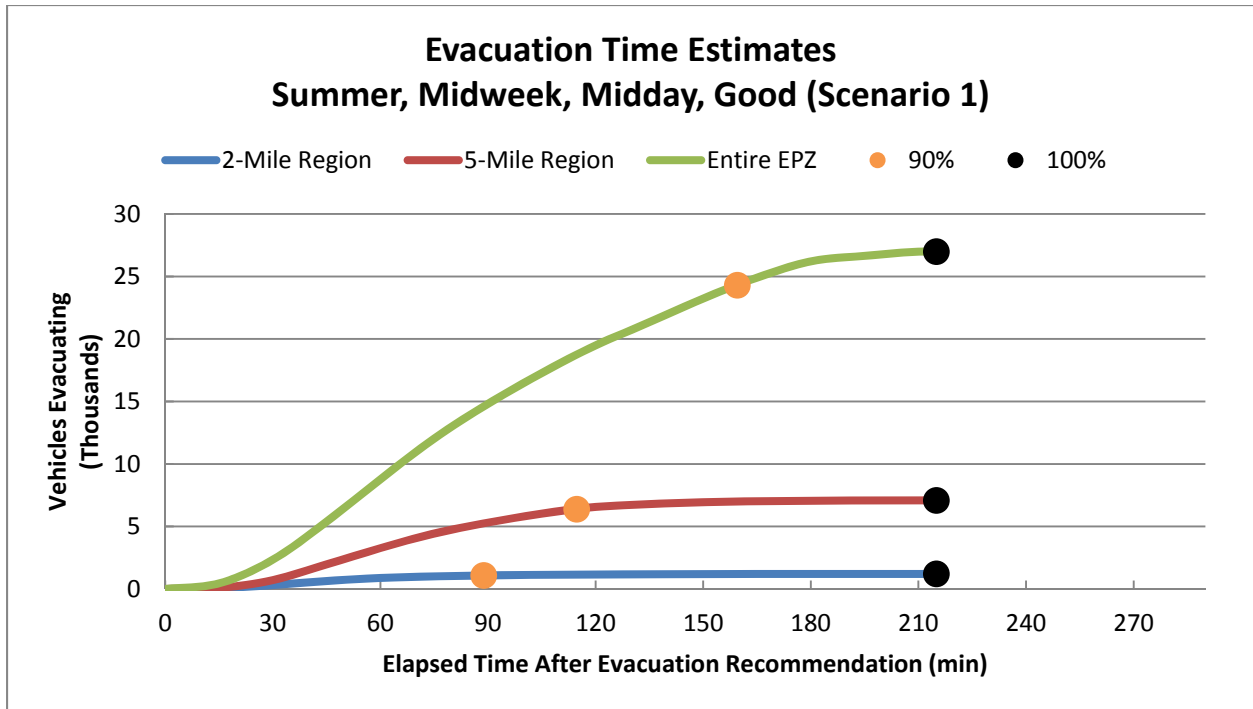


Figure 7-8. Evacuation Time Estimates - Scenario 1 for Region R03

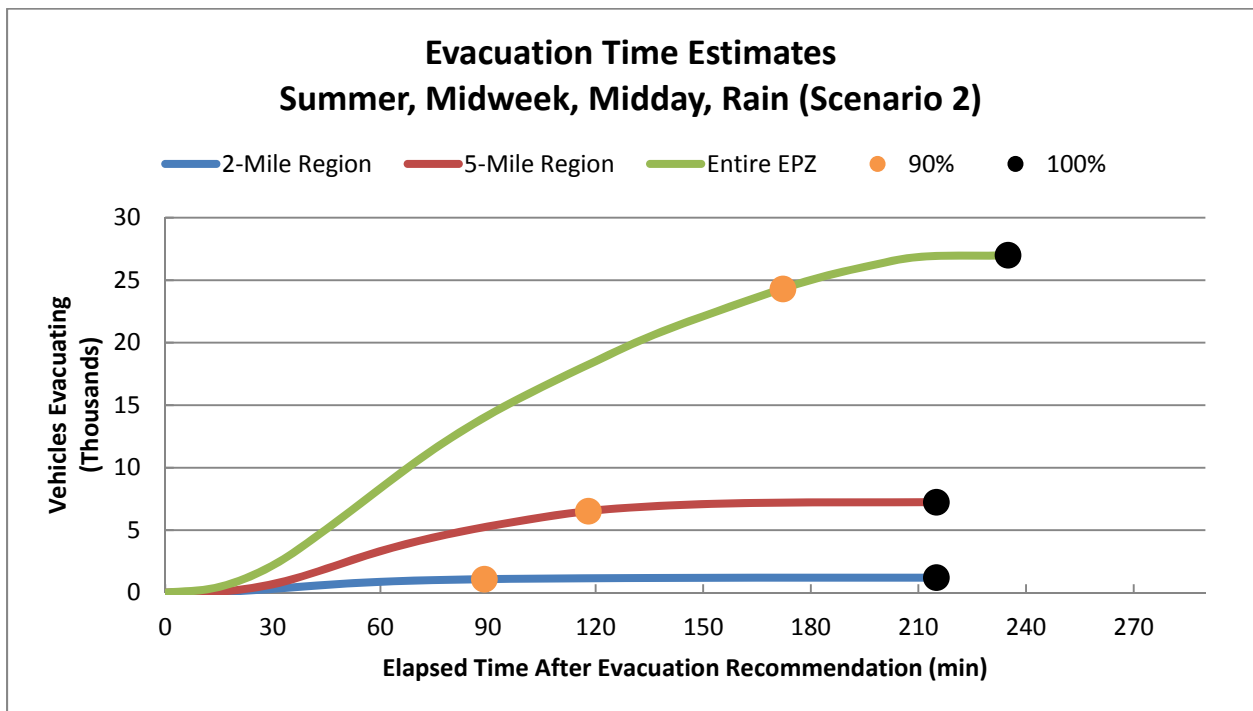


Figure 7-9. Evacuation Time Estimates - Scenario 2 for Region R03

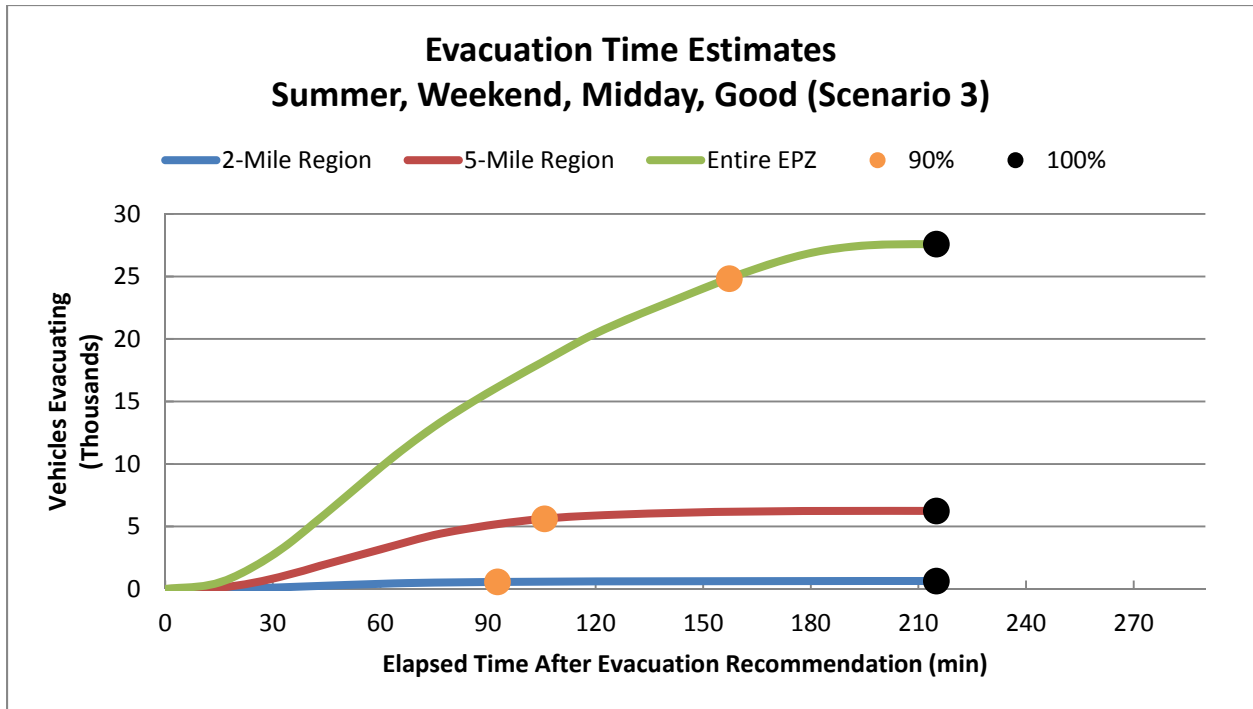


Figure 7-10. Evacuation Time Estimates - Scenario 3 for Region R03

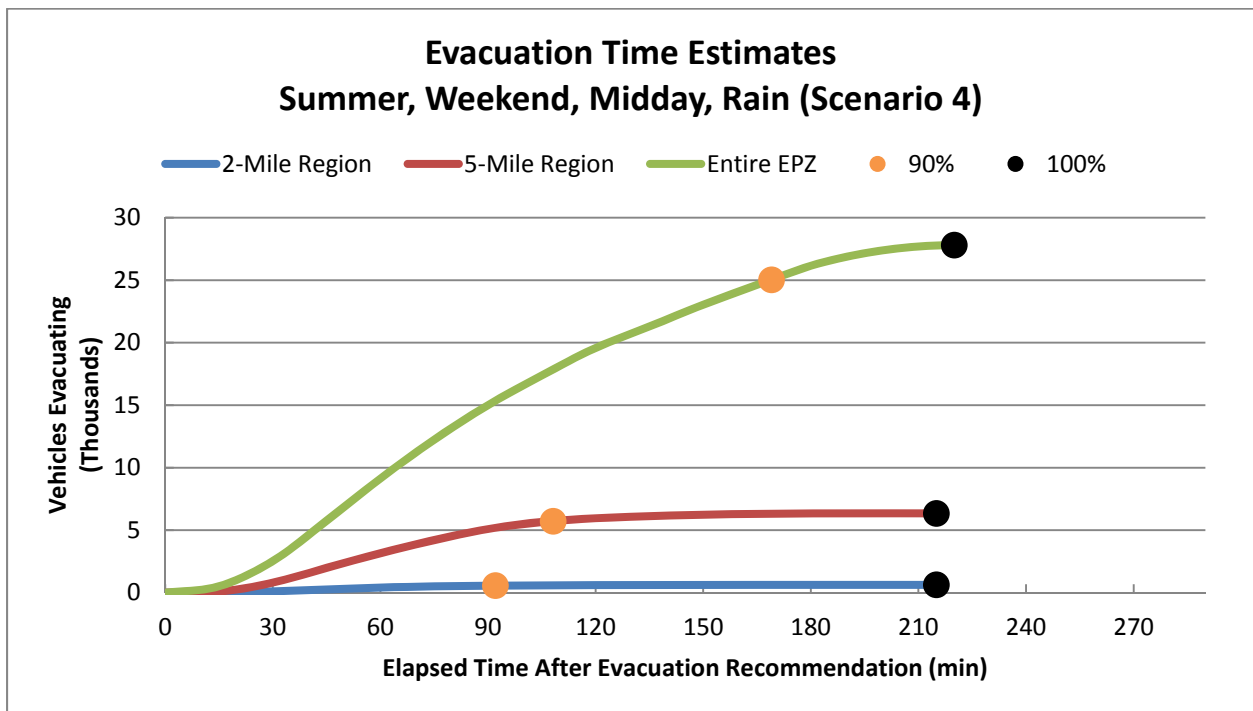


Figure 7-11. Evacuation Time Estimates - Scenario 4 for Region R03

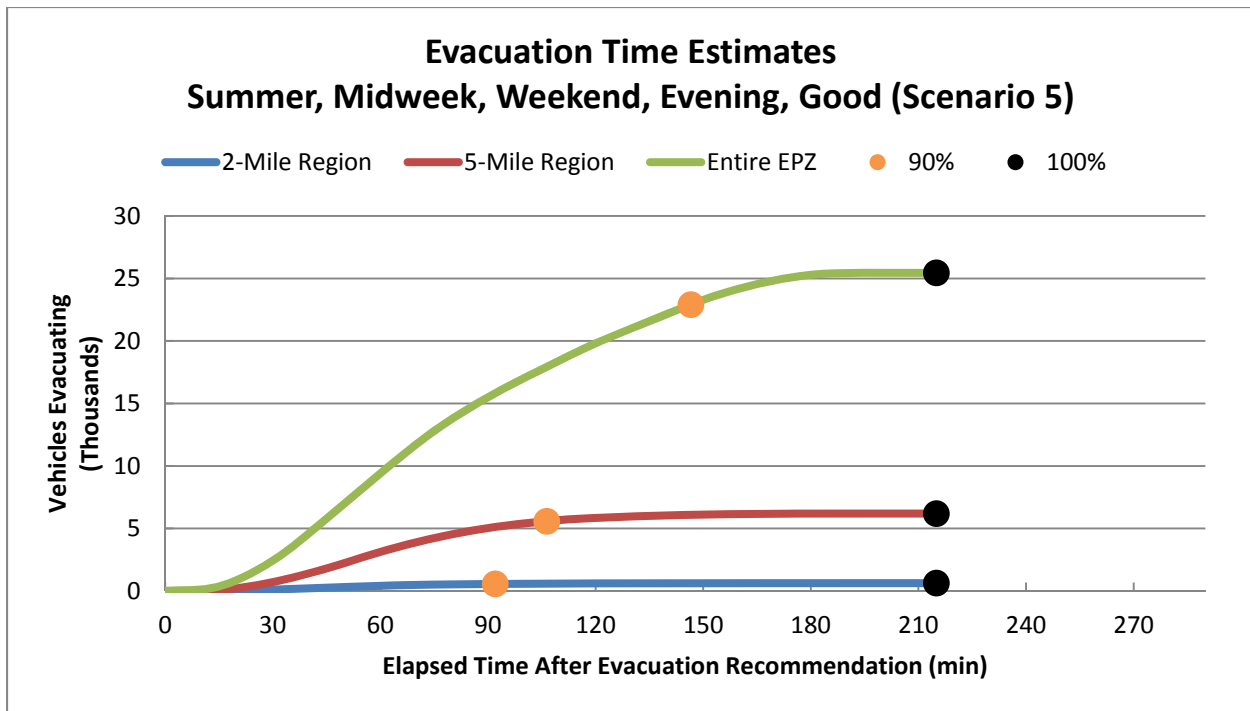


Figure 7-12. Evacuation Time Estimates - Scenario 5 for Region R03

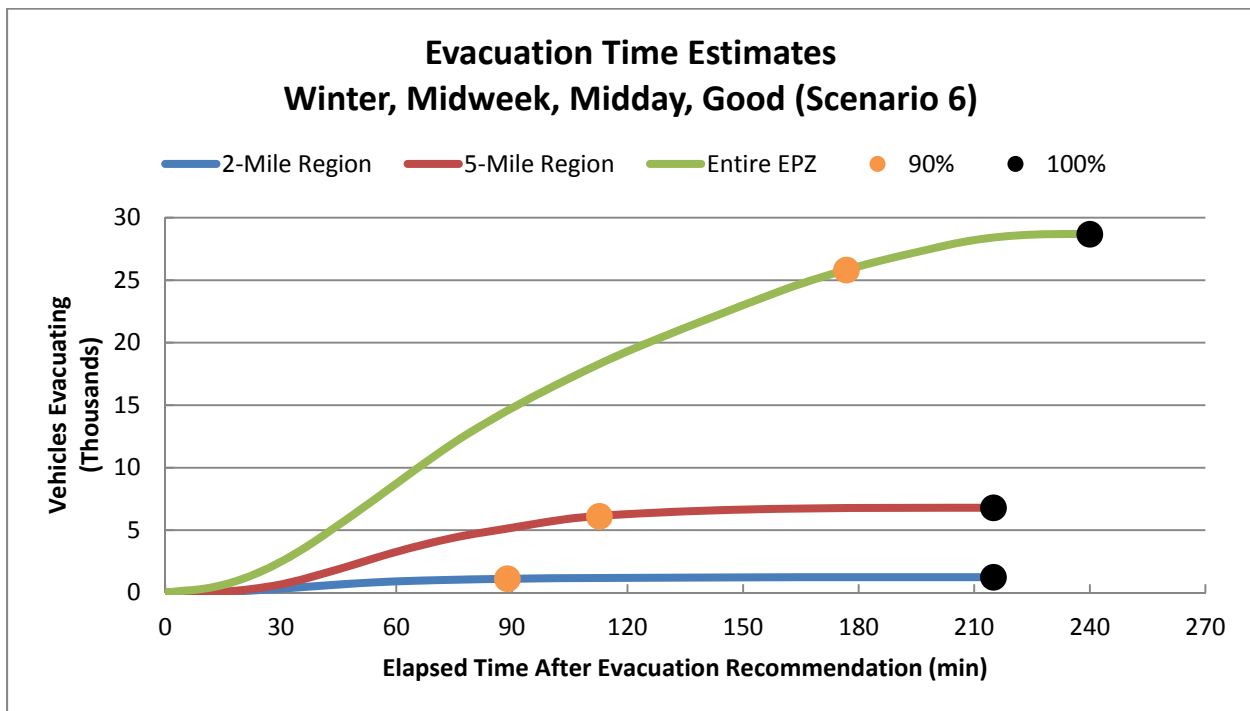


Figure 7-13. Evacuation Time Estimates - Scenario 6 for Region R03

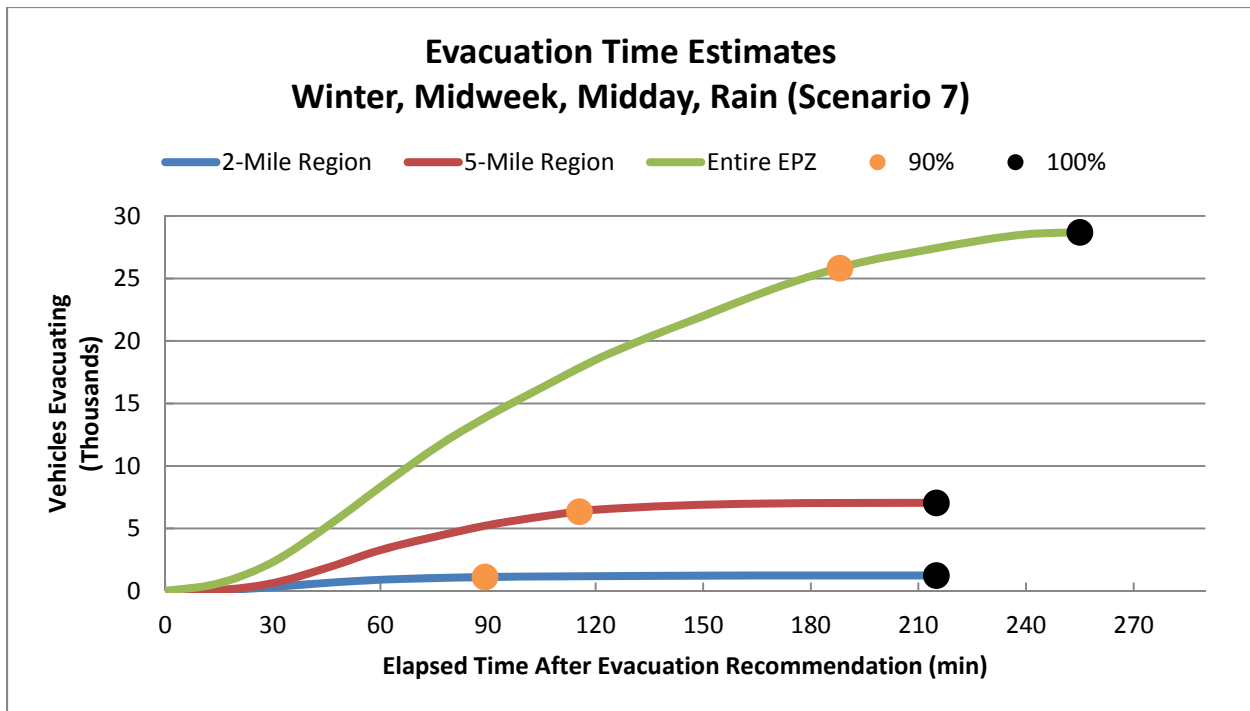


Figure 7-14. Evacuation Time Estimates - Scenario 7 for Region R03

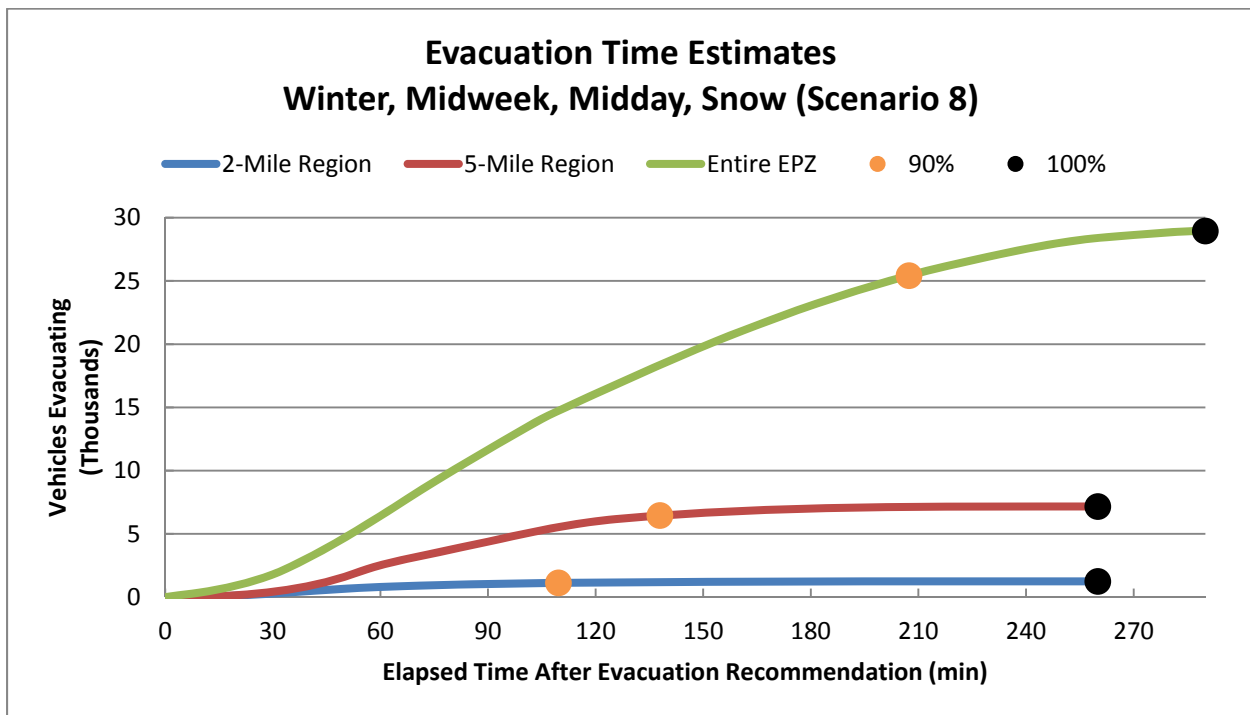


Figure 7-15. Evacuation Time Estimates - Scenario 8 for Region R03

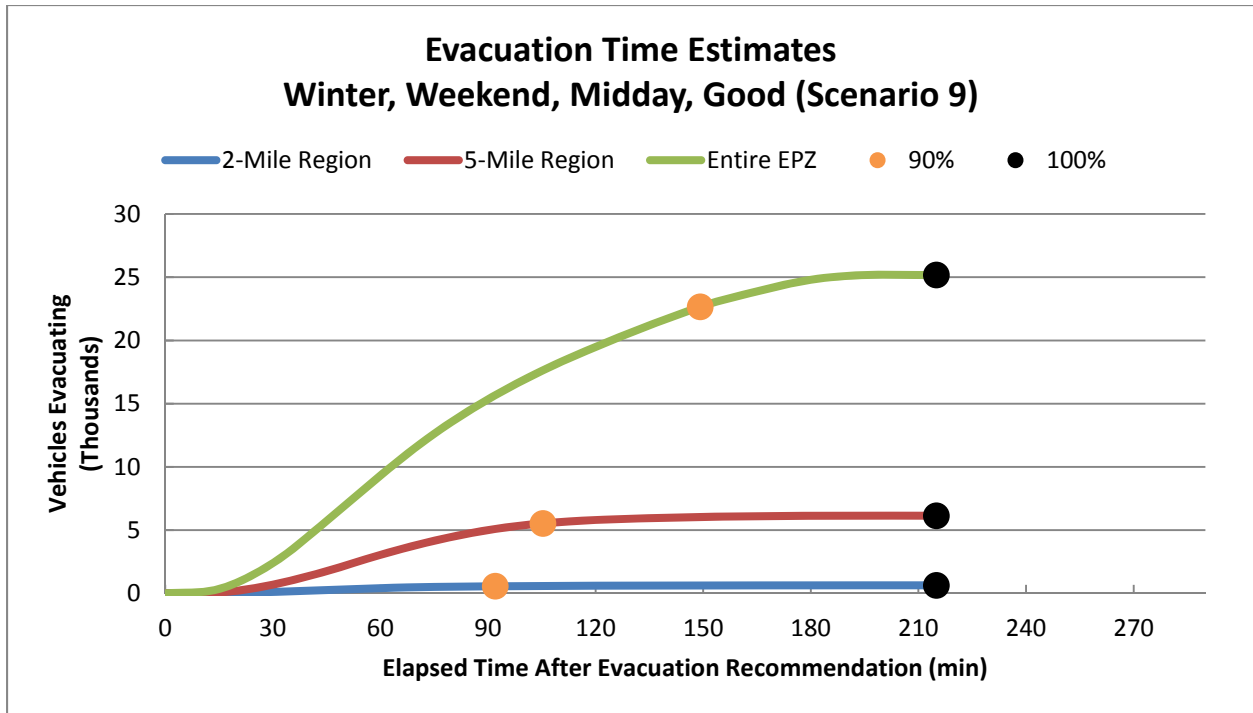


Figure 7-16. Evacuation Time Estimates - Scenario 9 for Region R03

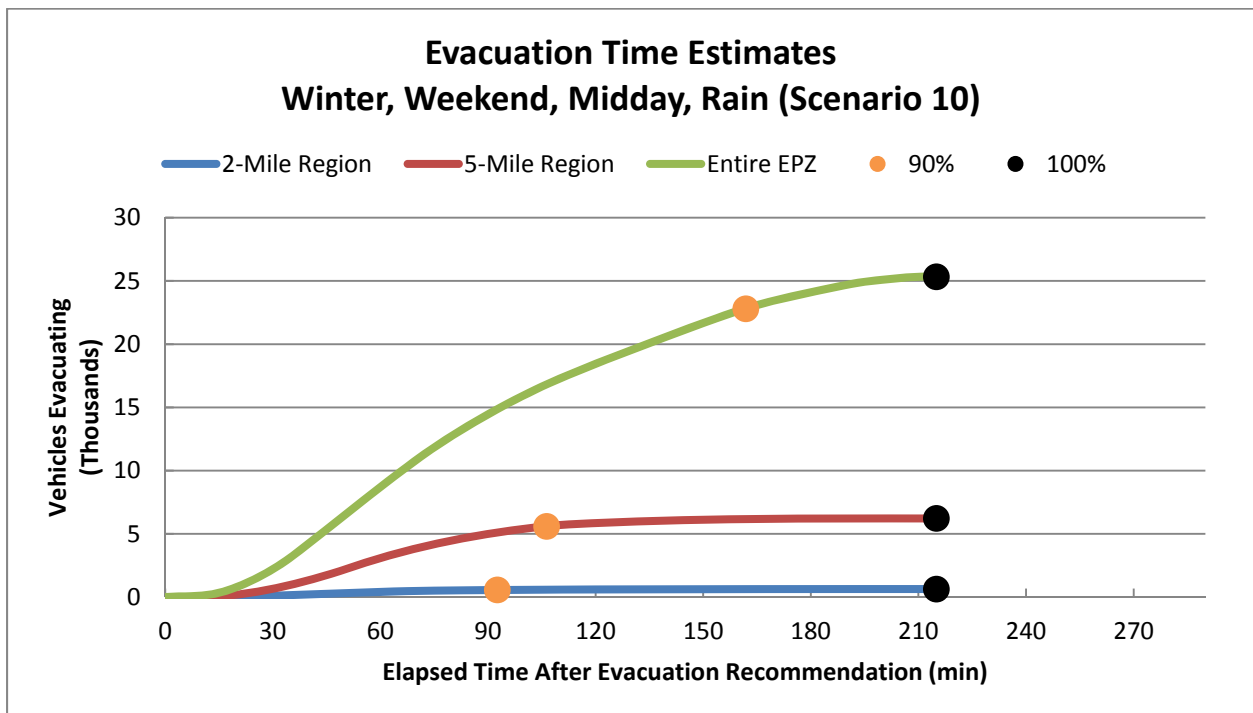


Figure 7-17. Evacuation Time Estimates - Scenario 10 for Region R03

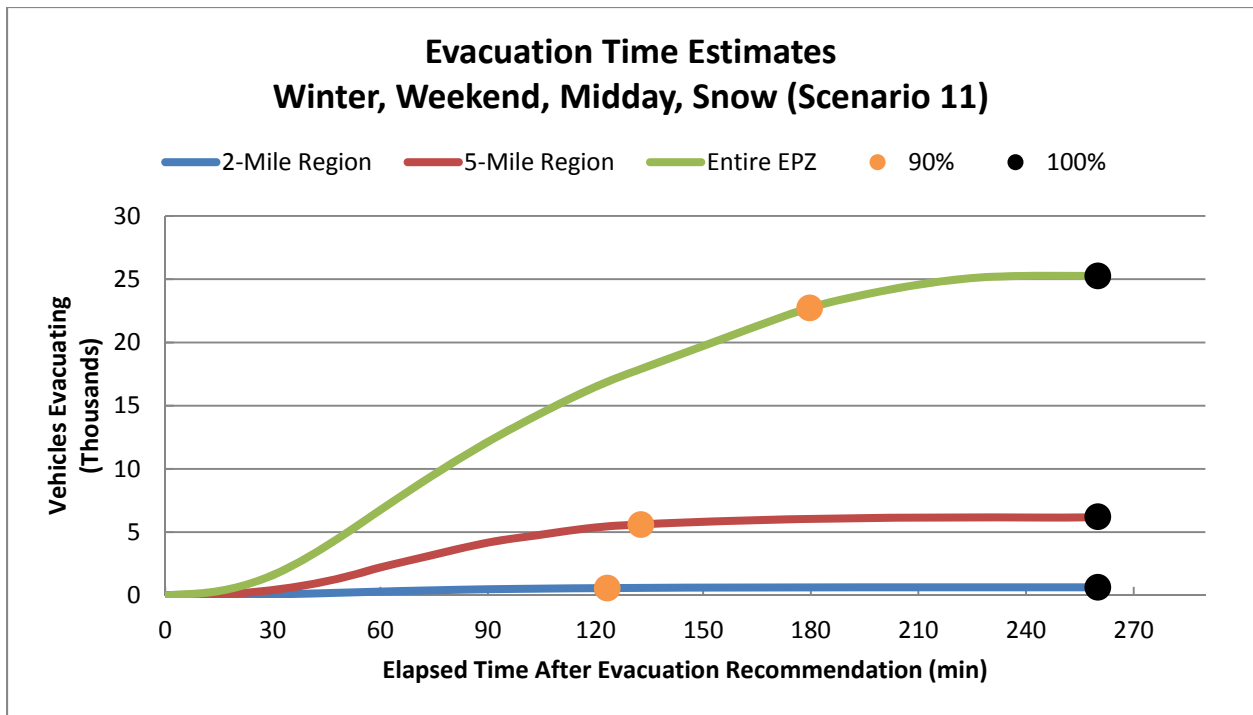


Figure 7-18. Evacuation Time Estimates - Scenario 11 for Region R03

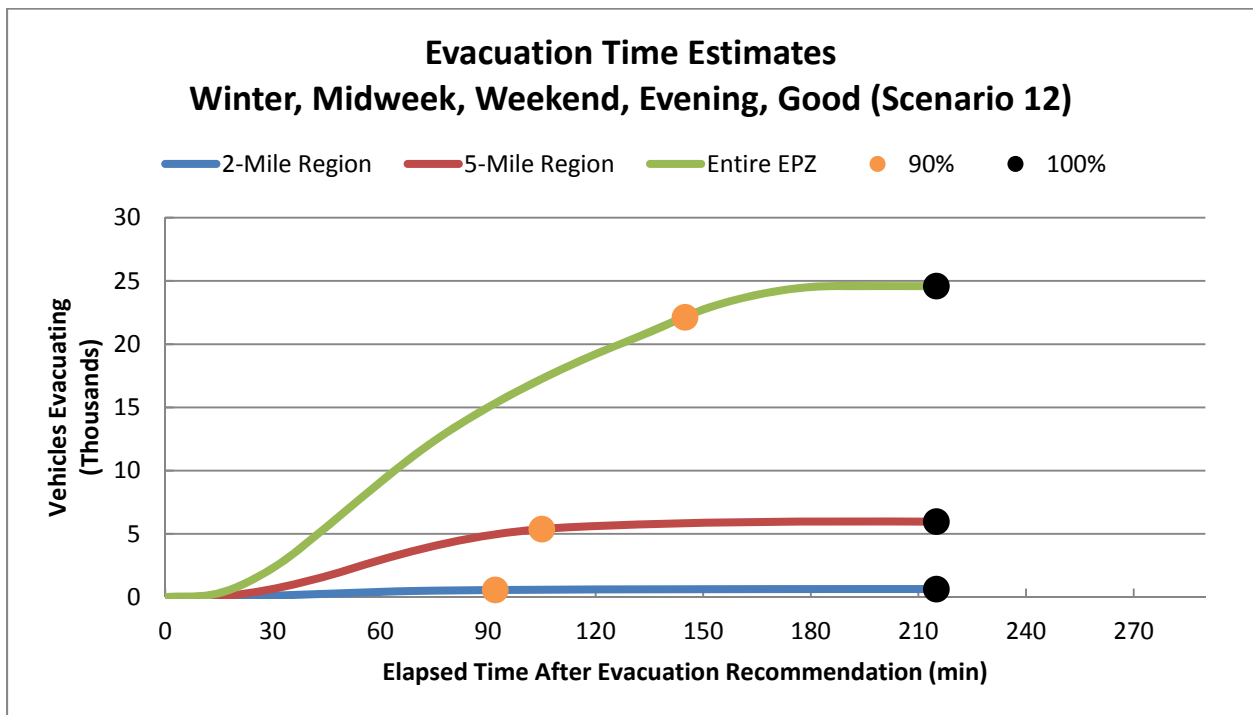


Figure 7-19. Evacuation Time Estimates - Scenario 12 for Region R03

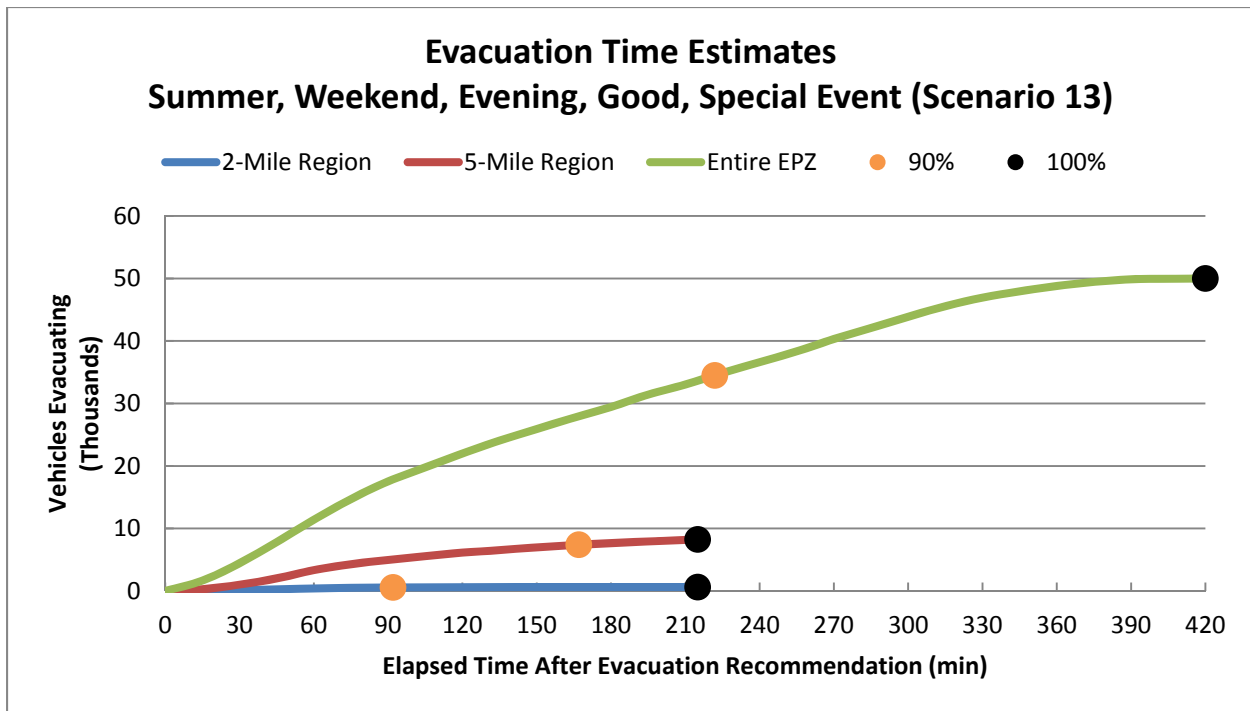


Figure 7-20. Evacuation Time Estimates - Scenario 13 for Region R03

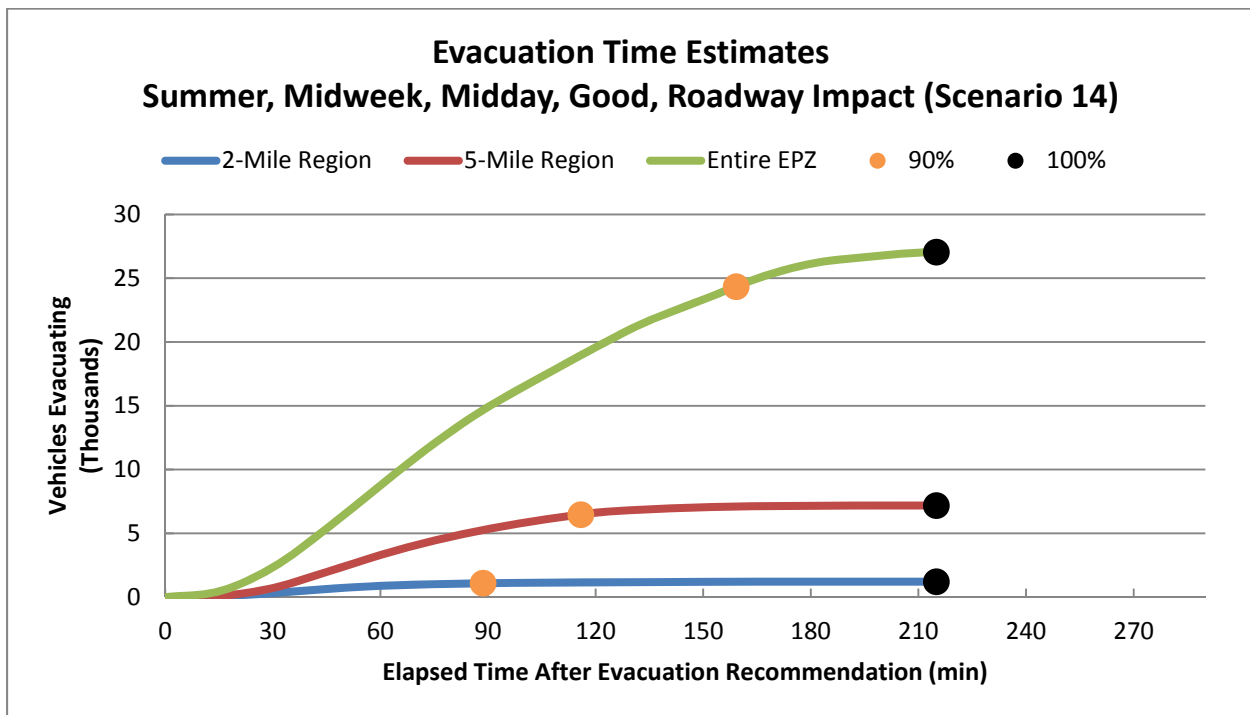


Figure 7-21. Evacuation Time Estimates - Scenario 14 for Region R03

## 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. 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, medical facilities, and correctional facilities; and (3) homebound special 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 longer 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. Based on discussion with the offsite agencies, it is estimated that bus mobilization time will average approximately 90 minutes extending from the Advisory to Evacuate, to the time when buses first arrive at the facility to be evacuated.

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 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 NMP/JAF EPZ indicates that schoolchildren and children at daycares with an enrollment of 30 or larger may be evacuated to the reception center at the New York State Fairgrounds in Syracuse at emergency action levels of Alert or higher. As discussed in Section 2, this study assumes a fast breaking general emergency. Therefore, children are evacuated to the reception center. 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 children will be picked up by their parents (in accordance with NUREG/CR-7002), to present an upper bound estimate of buses required. It is assumed that children at day-care centers are picked up by parents or guardians and that the time to perform this activity is included in the trip generation times discussed in Section 5.

The procedure for computing transit-dependent ETE is to:

- Estimate demand for transit service

- Estimate time to perform all transit functions
- Estimate route travel times to the EPZ boundary and to the reception center

### 8.1 Transit Dependent People Demand Estimate

The telephone 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 8-1 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 ride-sharing with neighbors, friends or family. For example, nearly 80 percent of those who evacuated from Mississauga, Ontario who did not use their own cars, shared a ride with neighbors or friends. Other documents report that approximately 70 percent of transit dependent persons were evacuated via ride sharing. **We will adopt a conservative estimate that 50 percent of transit dependent persons will ride share, in accordance with NUREG/CR-7002.**

The estimated number of bus trips needed to service transit-dependent persons is based on an estimate of average bus occupancy of 30 persons at the conclusion of the bus run. Transit vehicle seating capacities typically equal or exceed 60 children on average (roughly equivalent to 40 adults). If transit vehicle evacuees are two thirds adults and one third children, then the number of “adult seats” taken by 30 persons is  $20 + (2/3 \times 10) = 27$ . On this basis, the average load factor anticipated is  $(27/40) \times 100 = 68$  percent. Thus, if the actual demand for service exceeds the estimates of Table 8-1 by 50 percent, the demand for service can still be accommodated by the available bus seating capacity.

$$\left[ 20 + \left( \frac{2}{3} \times 10 \right) \right] \div 40 \times 1.5 = 1.00$$

Table 8-1 indicates that transportation must be provided for 1,881 people. Therefore, a total of **63 bus runs** are required to transport this population to the reception center. Although this study considers 76 buses to provide a minimum of one bus for each route specified in the

county emergency plans, see section 8.4 for additional details.

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 NMP/JAF EPZ:

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

Where,

A = Percent of households with commuters

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

$$P = 17,526 \times [0.0646 \times 1.75 + 0.297 \times (1.83 - 1) \times 0.56 \times 0.55 + 0.4747 \times (2.57 - 2) \times (0.56 \times 0.55)^2] = 17,526 \times 0.21464 = 3,762$$

$$B = (0.5 \times P) \div 30 = 63$$

These calculations are explained as follows:

- All members (1.75 avg.) of households (HH) with no vehicles (6.46%) will evacuate by public transit or ride-share. The term 17,526 (number of households) x 0.0646 x 1.75, accounts for these people.
- The members of HH with 1 vehicle away (29.7%), who are at home, equal (1.83-1). The number of HH where the commuter will not return home is equal to (17,526 x 0.297 x 0.56 x 0.55), as 56% of EPZ households have a commuter, 55% of which would not return home in the event of an emergency. 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 (47.47%), who are at home, equal (2.57 - 2). The number of HH where neither commuter will return home is equal to 17,526 x 0.4747 x (0.56 x 0.55)<sup>2</sup>. 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 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.

The estimate of transit-dependent population in Table 8-1 far exceeds the number of registered transit-dependent persons in the EPZ as provided by the county (discussed below in Section 8.5). This is consistent with the findings of NUREG/CR-6953, Volume 2, in that a large majority of the transit-dependent population within the EPZs of U.S. nuclear plants does not register with their local emergency response agency.

## 8.2 School Population – Transit Demand

Table 8-2 presents the school population and transportation requirements for the direct evacuation of all schools within the EPZ for the 2011-2012 school year. This information was provided by Oswego County Emergency Management. The column in Table 8-2 entitled “Buses Required” specifies the number of buses required for each school under the following set of assumptions and estimates:

- No students will be picked up by their parents prior to the arrival of the buses.
- While many high school students commute to school using private automobiles (as discussed in Section 2.4 of NUREG/CR-7002), the estimate of buses required for school evacuation do not consider the use of these private vehicles.
- Bus capacity, expressed in students per bus, is set to 70 for primary schools and 50 for middle and high schools.
- Those staff members who do not accompany the students will evacuate in their private vehicles.
- No allowance is made for student absenteeism, typically 3 percent daily.

It is recommended that Oswego County introduces procedures whereby the schools are contacted prior to the dispatch of buses from the depot, to ascertain the current estimate of students to be evacuated. 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.

Students will be transported to the reception center located at the New York State Fairgrounds in Syracuse where they will be subsequently retrieved by their respective families (Table 8-3).

## 8.3 Medical Facility Demand

Table 8-4 presents the census of medical facilities in the EPZ. 1080 people have been identified as living in, or being treated in, these facilities. The capacity and current census for each facility were provided by the county emergency management agencies. This data is presented in Table 8-4.

The transportation requirements for the medical facility population are also presented in Table 8-4. The number of ambulance runs is determined by assuming that 2 patients can be accommodated per ambulance trip. The capacities of other vehicle classes were reduced to allow for medical staff, equipment and for other contingencies. It was assumed a bus can accommodate 30 persons, a wheelchair buses may transport 20 ambulatory and 2 wheelchair bound individuals and wheelchair vans can accommodate 7 ambulatory and 3 wheelchair bound persons.

## 8.4 Evacuation Time Estimates for Transit Dependent People

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 center 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.

When school evacuation needs are satisfied, subsequent assignments of buses to service the transit-dependent should be sensitive to their mobilization time. Clearly, the buses should be dispatched after people have completed their mobilization activities and are in a position to board the buses when they arrive at the pick-up points.

Evacuation Time Estimates 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.

### Activity: Mobilize Drivers (A→B→C)

Mobilization is the elapsed time from the Advisory to Evacuate until the time the buses arrive at the facility to be evacuated. It is assumed that for a rapidly escalating radiological emergency with no observable indication before the fact, school bus drivers would likely require 90 minutes to be contacted, to travel to the depot, be briefed, and to travel to the transit-dependent facilities. Mobilization time is slightly longer in adverse weather – 100 minutes when raining, 110 minutes when snowing.

### Activity: Board Passengers (C→D)

Based on discussions with offsite agencies, a loading time of 15 minutes (20 minutes for rain and 25 minutes for snow) for school buses is used.

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
- $v = 25 \text{ mph} = 37 \text{ ft/sec}$
- $a = 4 \text{ ft/sec/sec}$ , 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; total loading time is 40 minutes per bus in rain, 50 minutes in snow.

Activity: Travel to EPZ Boundary (D→E)

### School Evacuation

Transportation resources available were provided by the EPZ county emergency management agencies and are summarized in Table 8-5. Also included in the table are the number of buses needed to evacuate schools, medical facilities, transit-dependent population, homebound special needs (discussed below in Section 8.5) and correctional facilities (discussed below in Section 8.6). These numbers indicate there are just sufficient resources available to evacuate everyone in a single wave. However, given the safety factors employed, it is likely that only a single wave is required so long as resources are deployed systematically. Should the need arise, mutual aid agreements would supply the necessary resources to address any shortfalls.

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 school reception center. 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 8-6 (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 8-7 through Table 8-9 for school evacuation, and in Table 8-11 through Table 8-13 for the transit vehicles evacuating transit-dependent persons, which are discussed later. 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. Speeds were reduced in Table 8-7 through Table 8-9 and in Table 8-11 through Table 8-13 to 45 mph (40 mph for rain – 10% decrease, rounded to the nearest 5 mph – and 35 mph for snow – 20% decrease, rounded to the nearest 5mph) for those calculated bus speeds which exceed 55 mph, as the school bus speed limit for state routes in New York is 55 mph. The travel time from the EPZ boundary to the reception center was computed assuming an average speed of 45 mph, 40 mph, and 35 mph for good weather, rain and snow, respectively.

Table 8-7 (good weather), Table 8-8 (rain) and Table 8-9 (snow) present the following evacuation time estimates (rounded up to the nearest 5 minutes) for schools in the EPZ: (1) The elapsed time from the Advisory to Evacuate until the bus exits the EPZ; and (2) The elapsed time until the bus reaches the reception center. 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 + 59 = 2:45 for Oswego High School, with good weather). The evacuation time to the school reception center is determined by adding the time associated with Activity E→F (discussed below), to this EPZ evacuation time.

#### Evacuation of Transit-Dependent Population

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 percent of the evacuees will complete their mobilization when the buses will begin their routes, approximately 90 minutes after the Advisory to Evacuate.

Those buses servicing the transit-dependent evacuees will first travel along their pick-up routes, then proceed out of the EPZ. Transit-dependent pick-up locations are provided annually to EPZ residents in the emergency preparedness brochure. The county emergency plans define bus routes to service these pick-up locations.

Table 8-10 outlines the 76 General population bus routes outlined in the Oswego County Emergency Plans. It is assumed that residents will walk to and congregate at pre-designated

pick-up locations, and that they can arrive at the stops within the 90 minute bus mobilization time (good weather). Detailed descriptions of each bus route are available in Procedure E of the Oswego County radiological Emergency Preparedness Plan, Table 2; maps of the pick-up points in each ERPA are contained in the EMO calendar.

As previously discussed, a pickup time of 30 minutes (good weather) is estimated for 30 individual stops to pick up passengers, with an average of one minute of delay associated with each stop. A longer pickup time of 40 minutes and 50 minutes are used for rain and snow, respectively.

The travel distance along the respective pick-up routes within the EPZ is estimated using the UNITES software as well as the route lengths given in the County Emergency Plans. 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 8-11 through Table 8-13 present the transit-dependent population evacuation time estimates for each bus route calculated using the above procedures for good weather, rain and snow, respectively.

For example, the ETE for the bus route servicing Route 1 is computed as  $90 + 80 + 30 = 3:20$  for good weather (rounded up to nearest 5 minutes). Here, 80 minutes is the time to travel 18.5 miles at 13.9 mph, the average speed output by the model for this route starting at 90 minutes. The ETE for a second wave (discussed below) is presented in the event there is a shortfall of available buses or bus drivers, as previously discussed.

#### 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 reception center. The reception centers are mapped in Figure 10-1. 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. Assumed bus speeds of 45 mph, 40 mph, and 35 mph for good weather, rain, and 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. The travel time back to the EPZ is equal to the travel time to the reception center.

The second-wave ETE for Route 1 is computed as follows for good weather:

- Bus arrives at reception center at 3:56 in good weather (3:20 to exit EPZ + 36 minute travel time to reception center).
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Bus returns to EPZ and completes second route: 60.6 minutes (equal to travel time to reception center + travel time to return to the beginning of the route) + 21.6 minutes (18.5 miles @ 51.5 mph) = 82 minutes
- Bus completes pick-ups along route: 30 minutes.
- Bus exits EPZ at time  $3:20 + 0:36 + 0:15 + 0:82 + 0:30 = 6:05$  (rounded to nearest 5 minutes) after the Advisory to Evacuate.

The ETE for the completion of the second wave for all transit-dependent bus routes are provided in Table 8-11 through Table 8-13. The average ETE for a two-wave evacuation of transit-dependent people exceeds the ETE for the general population at the 90<sup>th</sup> percentile.

The relocation of transit-dependent evacuees from the reception centers to congregate care centers, if the county decides to do so, is not considered in this study.

#### Evacuation of Medical Facilities

The transit operations for these facilities are similar to those for school evacuation except:

- Buses are assigned on the basis of 30 patients to allow for staff to accompany the patients.
- Wheelchair Buses are assigned on the basis of 20 ambulatory patients and 3 wheelchair bound patients. Again, this number is reduced from the average fleet capacity to allow for staff accompaniment.
- The passenger loading time will be longer at approximately one minute per patient to account for the time to move patients from inside the facility to the vehicles.

Table 8-4 indicates that 7 bus runs, 216 wheelchair bus runs and 14 ambulance runs are needed to service all of the medical facilities in the EPZ. According to Table 8-5, the county can provide 249 buses, 8 vans, 220 wheel-chair accessible buses, 21 wheelchair accessible vans and 30 ambulances. Thus, there are sufficient resources to evacuate the ambulatory, wheelchair bound and bedridden persons from the medical facilities in a single wave.

As is done for the schools, it is estimated that mobilization time averages 90 minutes. 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.

Table 8-14 through Table 8-16 summarize the ETE for medical facilities within the EPZ for good weather, rain, and snow. Loading times of 1 minute, 5 minutes, and 15 minutes are assumed for ambulatory patients, wheelchair bound patients, and bedridden patients, respectively. Average speeds output by the model for Scenario 6 (Scenario 7 for rain and Scenario 8 for snow) Region 3, capped at 55 mph (50 mph for rain and 45 mph for snow), are used to compute travel time to 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, wheelchair buses/vans, and ambulances at capacity is assumed. All ETE are rounded to the nearest 5 minutes. For example, the calculation of ETE for Bishop Commons at St. Luke's with 66 ambulatory residents during good weather is:

$$\text{ETE: } 90 + 20 + 50 = 2:40$$

It is assumed that medical facility population is directly evacuated to appropriate host medical facilities. Relocation of this population to permanent facilities and/or passing through the reception center before arriving at the host facility are not considered in this analysis.

## 8.5 Special Needs Population

Oswego County Emergency Management has a combined registration for transit-dependent and homebound special needs persons. Based on data provided by the county, there are an estimated 208 homebound special needs people within the EPZ who require transportation assistance to evacuate. There are 151 ambulatory, 57 wheelchair bound and no bedridden people which constitute this group.

### ETE for Homebound Special Needs Persons

Table 8-17 summarizes the ETE for homebound special needs people. 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 to reduce the number of stops per vehicle. It is conservatively assumed that ambulatory and wheelchair bound special needs households are spaced 3 miles apart and bedridden households are spaced 5 miles apart. Van and bus speeds approximate 20 mph between households and ambulance speeds approximate 30 mph in good weather (10% slower in rain, 20% slower in snow). Mobilization times of 90 minutes were used (100 minutes for rain, and 110 minutes for snow). The last HH is assumed to be 5 miles from the EPZ boundary, and the network-wide average speed, capped at 55 mph (50 mph for rain and 45 mph for snow), after the last pickup is used to compute travel time. ETE is computed by summing mobilization time, loading time at first household, travel to subsequent households, loading time at subsequent households, and travel time to EPZ boundary. All ETE are rounded to the nearest 5 minutes. Loading time is conservatively estimated as 5 minutes per stop.

For example, assuming no more than one special needs person per HH implies that 208 households need to be serviced. If 19 wheelchair equipped vans are deployed to service these special needs HH, then each would require about 11 stops. The following outlines the ETE calculations:

1. Assume 19 wheelchair vans are deployed, each with about 11 stops, to service a total of 208 HH.
2. The ETE is calculated as follows:
  - a. Buses arrive at the first pickup location: 90 minutes
  - b. Load HH members at first pickup: 5 minutes
  - c. Travel to subsequent pickup locations: 10 @ 9 minutes = 90 minutes

- d. Load HH members at subsequent pickup locations: 10 @ 5 minutes = 50 minutes
- e. Travel to EPZ boundary: 13 minutes (5 miles @ 22.6 mph).

ETE:  $90 + 5 + 90 + 50 + 13 = 4:10$  rounded to the nearest 5 minutes

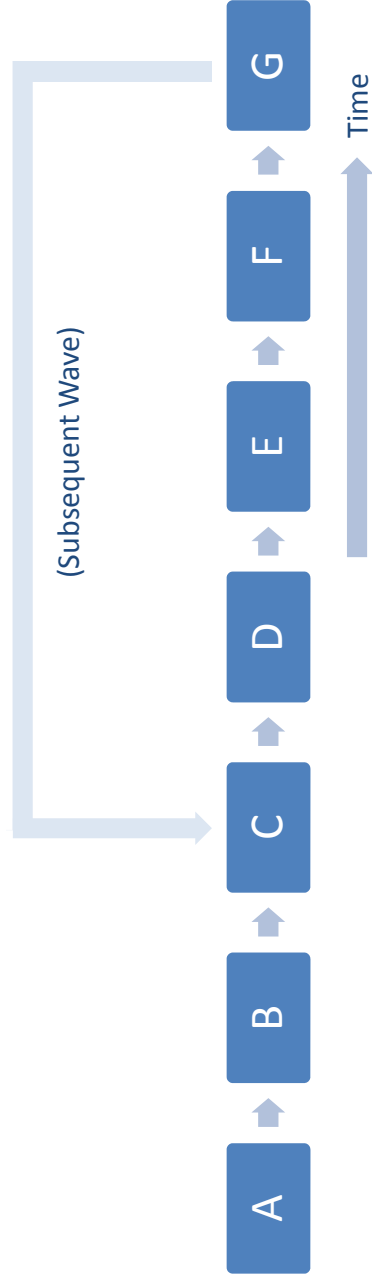
## 8.6 Correctional Facilities

As detailed in Table E-6, there is one correctional facility within the EPZ – Oswego County Jail. The total inmate population at these facilities is 160 persons. A total of 6 buses are needed to evacuate this facility, based on a capacity of 30 inmates per bus. Mobilization time is assumed to be 90 minutes (100 minutes in rain). It is estimated that it takes 60 minutes to load the inmates onto a bus, and that 6 buses can be loaded in parallel. Thus, total loading time is estimated at approximately 60 minutes. The detailed evacuation plans for these facilities are confidential. Using GIS software, the shortest route from the facility to the EPZ boundary, traveling away from NMP/JAF, is 5.5 miles. The travel time to traverse 5.5 miles is 38 minutes (8.7 mph at 2:30) in good weather, 39 minutes (8.5 mph at 2:40) in rain and 61 minutes (5.4 mph at 2:50) in snow. All ETE are rounded to the nearest 5 minutes.

ETE:  $90 + 60 + 38 = 3:10$

Rain ETE:  $100 + 60 + 39 = 3:20$

Snow ETE:  $110 + 60 + 61 = 3:55$



Event	
A	Advisory to Evacuate
B	Bus Dispatched from Depot
C	Bus Arrives at Facility/Pick-up Route
D	Bus Departs for Reception Center
E	Bus Exits Region
F	Bus Arrives at Reception Center/Host Facility
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 Center Outside the EPZ
F→G	Passengers Leave Bus; Driver Takes a Break

**Figure 8-1. Chronology of Transit Evacuation Operations**

Table 8-1. Transit-Dependent Population Estimates

2010 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						
41,887	1.75	1.83	2.57	17,526	6.46%	29.70%	47.47%	56%	55%	3,762	50%	1,881	4.5%

**Table 8-2. School Population Demand Estimates**

<b>ERPA</b>	<b>School Name</b>	<b>Enrollment</b>	<b>Bus Runs Required</b>
1	Ontario Bible Conference	91	2
4	New Haven Elementary School	238	4
10	School Age Children Care Program	33	1
12	Charles E. Riley Elementary	497	8
12	Fitzhugh Park Elementary School	416	6
12	Headstart of Oswego	80	2
12	Little Luke's Childcare Center	100	2
12	Oswego Community Christian School	76	2
12	Trinity Catholic School	173	3
13	Children's Center of SUNY Oswego	100	2
13	Frederick Leighton Elementary School	485	7
13	Kingsford Park Elementary	381	6
13	Oswego High School	1,281	26
13	Oswego Middle School	597	12
13	Oswego YMCA School's Out Program	60	1
16	Mexico Elementary School	255	4
16	Mexico High School	700	14
16	Mexico Middle School	701	15
17	Oswego County BOCES	446	9
21	Minetto Elementary School	367	8
22	SUNY Oswego	8,300	26
<b>TOTAL:</b>		<b>15,377</b>	<b>160</b>

**Table 8-3. School Reception Centers**

School	Reception Center
Ontario Bible Conference	New York State Fairgrounds, Syracuse, NY
New Haven Elementary School	
School Age Children Care Program	
Charles E. Riley Elementary	
Fitzhugh Park Elementary School	
Headstart of Oswego	
Little Luke's Childcare Center	
Oswego Community Christian School	
Trinity Catholic School	
Children's Center of SUNY Oswego	
Frederick Leighton Elementary School	
Kingsford Park Elementary	
Oswego High School	
Oswego Middle School	
Oswego YMCA School's Out Program	
Mexico Elementary School	
Mexico High School	
Mexico Middle School	
Oswego County BOCES	
Minetto Elementary School	
SUNY Oswego	

Table 8-4. Medical Facility Transit Demand

ERPA	Facility Name	Municipality	Capacity	Current Census	Ambulatory	Wheel-chair Bound	Bed-ridden	WC Bus Runs	Bus Runs	Ambulance Runs
12	Bishop Commons at St Luke's	Oswego	68	68	66	2	0	1	2	0
12	Ladies Home of Oswego	Oswego	21	15	15	0	0	1	0	0
12	Oswego Health Behavioral Health Services	Oswego	28	17	15	2	0	1	0	0
12	Pontiac Nursing Home	Oswego	80	80	25	55	0	28	0	0
12	Simeon-Dewitt Apts.	Oswego	150	150	150	0	0	8	0	0
12	St Luke Health Services	Oswego	200	192	57	115	20	58	0	10
12	Valehaven Home for Adults	Oswego	35	28	28	0	0	0	1	0
13	Morning Star Nursing Home	Oswego	120	117	17	96	4	48	0	2
13	Oswego Hospital	Oswego	100	65	55	7	3	4	0	2
13	Pontiac Terrace Apts	Oswego	80	80	72	8	0	4	0	0
15	Fravor Rd IRA	Mexico	10	9	7	2	0	1	0	0
16	Parkview Manor Apts	Mexico	24	24	23	1	0	1	1	0
17	Sabill Drive IRA	Mexico	6	6	5	1	0	1	0	0
20	Springside at Seneca Hill	Oswego	75	75	74	1	0	1	2	0
20	The Manor at Seneca Hill	Oswego	120	116	0	116	0	58	0	0
21	Minetto Senior Housing	Oswego	38	38	37	1	0	1	1	0
		<b>Totals</b>	<b>1155</b>	<b>1080</b>	<b>646</b>	<b>407</b>	<b>27</b>	<b>216</b>	<b>7</b>	<b>14</b>

Table 8-5. Summary of Transportation Resources

Transportation Resource	Vans	Buses	WC Buses	WC Van	Ambulances
Resources Available					
A&E Transport, Inc.	0	13	3	0	0
Central Square Central School District	4	80	2	0	0
Central Square School District	0	48	2	0	0
City School District of Oswego	0	56	4	3	0
CNY CENTRO, Inc.	0	10	158	18	0
Oswego County BOCES	0	2	15	0	0
Oswego County Opportunities	0	11	33	0	0
Phoenix Central School District	4	29	3	0	0
Oswego County Fire & Rescue	0	0	0	0	4
Oswego County EMS	0	0	0	0	26
<b>TOTAL:</b>	<b>8</b>	<b>249</b>	<b>220</b>	<b>21</b>	<b>30</b>
Resources Needed					
Population Group/Mobility Level	Buses	WC Buses	WC Van	Ambulances	
Schools (Table 8-2):	160	0	0	0	
Medical Facilities (Table 8-4):	7	216	0	14	
Transit-Dependent Population (Table 8-10):	76	0	0	0	
Correctional Facilities (Table 8-19)	6	0	0	0	
Homebound Special Needs (Section 8.5):	0	0	19	0	
<b>TOTAL TRANSPORTATION NEEDS:</b>	<b>249</b>	<b>216</b>	<b>19</b>	<b>14</b>	

**Table 8-6. Bus Route Descriptions**

<b>Bus Route Number</b>	<b>Description</b>	<b>Nodes Traversed to EPZ Boundary</b>
1	Transit Dependent Bus Route 1	181, 203, 202, 191, 604, 188, 189, 306, 305, 308, 310, 309, 311, 312, 212, 211, 637, 214, 243, 219, 635
2	Transit Dependent Bus Route 2	205, 181, 203, 202, 191, 604, 188, 189, 306, 305, 308, 310, 309, 311, 312, 212, 211, 637, 214, 243, 219, 635
3	Transit Dependent Bus Route 3	178, 172, 154, 149, 148, 199, 147, 146, 145, 183, 143, 628, 238, 236
4	Transit Dependent Bus Route 4	154, 149, 148, 199, 147, 146, 145, 183, 143, 628, 238, 236
5	Transit Dependent Bus Route 5	190, 145, 183, 143, 628, 238, 236
6	Transit Dependent Bus Route 6	149, 148, 199, 147, 146, 145, 183, 143, 628, 238, 236
7	Transit Dependent Bus Route 7	152, 153, 89, 78, 79, 80, 200, 81, 82, 83
8	Transit Dependent Bus Route 8	151, 152, 153, 89, 78, 79, 80, 200, 81, 82, 83
9	Transit Dependent Bus Route 9	355, 627, 144, 698, 83
10	Transit Dependent Bus Route 10	82, 83, 129
11	Transit Dependent Bus Route 11	144, 698, 83
12	Transit Dependent Bus Route 12	138, 632, 215, 221, 213, 212, 211, 637, 214, 243, 219, 635
13	Transit Dependent Bus Route 13	333, 334, 304, 687, 347, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
14	Transit Dependent Bus Route 14	305, 308, 334, 304, 687, 347, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
15	Transit Dependent Bus Route 15	325, 307, 705, 305, 308, 334, 304, 687, 347, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
16	Transit Dependent Bus Route 16	202, 191, 604, 188, 189, 306, 305, 308, 334, 304, 687, 347, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
17	Transit Dependent Bus Route 17	145, 183, 143, 628, 238, 236
18	Transit Dependent Bus Route 18	145, 183, 143, 628, 238, 236
19	Transit Dependent Bus Route 19	101, 12, 13
20	Transit Dependent Bus Route 20	607, 85, 86
21	Transit Dependent Bus Route 21	605, 157, 86
22	Transit Dependent Bus Route 22	89, 78, 79, 80, 200, 81, 82, 83
23	Transit Dependent Bus Route 23	89, 78, 79, 80, 200, 81, 82, 83

Bus Route Number	Description	Nodes Traversed to EPZ Boundary
24	Transit Dependent Bus Route 24	607, 85, 86
25	Transit Dependent Bus Route 25	336, 337, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
26	Transit Dependent Bus Route 26	304, 687, 347, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
27	Transit Dependent Bus Route 27	550, 303, 553, 313, 554, 547, 664, 480, 479, 481, 482, 214, 243, 219, 635
28	Transit Dependent Bus Route 28	314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219
29	Transit Dependent Bus Route 29	303, 553, 313, 554, 547, 664, 480, 479, 481, 482, 214, 243, 219, 635
30	Transit Dependent Bus Route 30	313, 554, 547, 664, 480, 479, 481, 482, 214, 243, 219, 635
31	Transit Dependent Bus Route 31	313, 554, 547, 664, 480, 479, 481, 482, 214, 243, 219, 635
32	Transit Dependent Bus Route 32	219, 635, 699
33	Transit Dependent Bus Route 33	547, 664, 480, 479, 481, 482, 214, 243, 219, 635
34	Transit Dependent Bus Route 34	547, 664, 480, 479, 481, 482, 214, 243, 219, 635
35	Transit Dependent Bus Route 35	525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
36	Transit Dependent Bus Route 36	692, 516, 515, 484, 485, 474, 473, 701
37	Transit Dependent Bus Route 37	518, 692, 516, 515, 484, 485, 474, 473, 701
38	Transit Dependent Bus Route 38	518, 692, 516, 515, 484, 485, 474, 473, 701
39	Transit Dependent Bus Route 39	519, 502, 468, 469, 470, 471, 483, 484, 485, 474, 473, 701
40	Transit Dependent Bus Route 40	513, 517, 518, 692, 516, 515, 484, 485, 474, 473, 701
41	Transit Dependent Bus Route 41	541, 543, 504, 512, 505, 710, 436, 466, 498, 467, 468, 469, 470, 471, 483, 484, 485, 474, 473
42	Transit Dependent Bus Route 42	512, 505, 710, 436, 466, 498, 467, 468, 469, 470, 471, 483, 484, 485, 474, 473, 701
43	Transit Dependent Bus Route 43	532, 529, 521, 511, 533, 544, 512, 505, 710, 436, 466, 498, 467, 468, 469, 470, 471, 483, 484, 485, 474, 473, 701
44	Transit Dependent Bus Route 44	507, 506, 505, 710, 436, 466, 498, 467, 468, 469, 470, 471, 483, 484, 485, 474, 473, 701
45	Transit Dependent Bus Route 45	530, 511, 533, 544, 512, 505, 710, 436, 466, 498, 467, 468, 469, 470, 471, 483, 484, 485, 474, 473, 701

Bus Route Number	Description	Nodes Traversed to EPZ Boundary
46	Transit Dependent Bus Route 46	507, 506, 505, 710, 436, 466, 498, 467, 468, 469, 470, 471, 483, 484, 485, 474, 473, 701
47	Transit Dependent Bus Route 47	190, 145, 183, 143, 628, 238, 236
48	Transit Dependent Bus Route 48	141, 194, 142, 143, 628, 238, 236
49	Transit Dependent Bus Route 49	138, 632, 215, 221, 213, 212, 211, 637, 214, 243, 219, 635
50	Transit Dependent Bus Route 50	138, 309, 311, 312, 212, 211, 637, 214, 243, 219, 635
51	Transit Dependent Bus Route 51	309, 311, 312, 212, 211, 637, 214, 243, 219, 635
52	Transit Dependent Bus Route 52	303, 553, 313, 554, 547, 664, 480, 479, 481, 482, 214, 243, 219, 635
53	Transit Dependent Bus Route 53	299, 82, 83, 129, 259, 359, 130, 131, 250, 252
54	Transit Dependent Bus Route 54	628, 238, 236
55	Transit Dependent Bus Route 55	631, 235, 236
56	Transit Dependent Bus Route 56	631, 235, 236
57	Transit Dependent Bus Route 57	631, 235, 236
58	Transit Dependent Bus Route 58	217, 218, 700
59	Transit Dependent Bus Route 59	216, 217, 218
60	Transit Dependent Bus Route 60	217, 218, 700
61	Transit Dependent Bus Route 61	219, 635, 699
62	Transit Dependent Bus Route 62	217, 218, 700
63	Transit Dependent Bus Route 63	484, 485, 474, 473, 701
64	Transit Dependent Bus Route 64	473, 701, 425
65	Transit Dependent Bus Route 65	485, 426, 425
66	Transit Dependent Bus Route 66	469, 499, 500
67	Transit Dependent Bus Route 67	469, 499, 500
68	Transit Dependent Bus Route 68	469, 499, 500
69	Transit Dependent Bus Route 69	484, 485, 474, 473, 701
70	Transit Dependent Bus Route 70	436, 466, 498, 467, 468, 469, 470, 471, 483, 484, 485, 474, 473, 701
71	Transit Dependent Bus Route 71	505, 710, 436, 466, 498, 467, 468, 469, 470, 471, 483, 484, 485, 474, 473, 701
72	Transit Dependent Bus Route 72	505, 710, 436, 465, 464
73	Transit Dependent Bus Route 73	508, 679, 463
74	Transit Dependent Bus Route 74	509, 708, 508, 679
75	Transit Dependent Bus Route 75	309, 311, 312, 212, 211, 637, 214, 243, 219, 635
76	Transit Dependent Bus Route 76	607, 85, 86

Bus Route Number	Description	Nodes Traversed to EPZ Boundary
77	Ontario Bible Conference	705, 305, 308, 334, 304, 687, 347, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
78	New Haven Elementary School	609, 198, 190, 145, 183, 143, 628, 238, 236
79	School Age Children Care Program	305, 308, 334, 304, 687, 347, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
80	Charles E. Riley Elementary	664, 480, 479, 481, 482, 214, 243, 219, 635
81	Fitzhugh Park Elementary School	567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
82	Headstart of Oswego	566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
83	Little Luke's Childcare Center	554, 547, 664, 480, 479, 481, 482, 214, 243, 219, 635
84	Oswego Community Christian School	687, 347, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
85	Trinity Catholic School	566, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
86	Children's Center of SUNY Oswego	509, 678, 507, 680, 511, 530, 520, 527, 526, 523, 707, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
87	Frederick Leighton Elementary School	533, 511, 530, 520, 527, 526, 523, 707, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
88	Kingsford Park Elementary	540, 539, 670, 513, 517, 518, 692, 516, 515, 484, 485, 474, 473, 701
89	Oswego High School	530, 520, 527, 526, 523, 707, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
90	Oswego Middle School	518, 692, 516, 515, 484, 485, 474, 473, 701
91	Oswego YMCA School's Out Program	669, 524, 539, 670, 513, 517, 518, 692, 516, 515, 484, 485, 474, 473, 701
92	Mexico Elementary School	78, 79, 80, 200, 81, 82, 83
93	Mexico High School	77, 78, 79, 80, 200, 81, 82, 83
94	Mexico Middle School	89, 78, 79, 80, 200, 81, 82, 83
95	Oswego County BOCES	89, 78, 79, 80, 200, 81, 82, 83
96	Minetto Elementary School	485, 474, 473, 701
97	SUNY Oswego	510, 509, 678, 507, 680, 511, 530, 520, 527, 526, 523, 707, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
98	Bishop Commons at St Luke's	480, 479, 481, 482, 214, 243, 219, 635

Bus Route Number	Description	Nodes Traversed to EPZ Boundary
99	Ladies Home of Oswego	548, 566, 525, 707, 523, 526, 527, 520, 530, 511, 680, 507, 678, 509, 708, 508, 679
100	Oswego Behavioral Health Services	313, 554, 547, 664, 480, 479, 481, 482, 214, 243, 219, 635
101	Pontiac Nursing Home	480, 479, 481, 482, 214, 243, 219, 635
102	Simeon-Dewitt Apts.	661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
103	St Luke Health Services	480, 479, 481, 482, 214, 243, 219, 635
104	Valehaven Home for Adults	525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
105	Morning Star Nursing Home	511, 530, 520, 527, 526, 523, 707, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
106	Oswego Hospital	527, 520, 530, 511, 680, 507, 678, 509, 708, 508, 679
107	Pontiac Terrace Apts	669, 523, 707, 525, 661, 346, 662, 549, 480, 479, 481, 482, 214, 243, 219, 635
108	Fravor Rd IRA	89, 78, 77, 76, 84, 607, 85, 86
109	Parkview Manor Apts	78, 77, 76, 610, 75, 74
110	Sabill Drive IRA	153, 89, 78, 77, 76, 610, 75, 74
111	Springside at Seneca Hill	479, 481, 482, 214, 243, 219, 635
112	The Manor at Seneca Hill	214, 243, 219, 635
113	Minetto Senior Housing	692, 516, 515, 484, 485, 474, 473, 701
114	Oswego County Jail	479, 481, 482, 214, 243, 219, 635
115	SR 481 - Major Evacuation Route	549, 480, 479, 481, 482, 214, 243, 219, 635
116	SR 104 Westbound - Major Evacuation Route	306, 305, 308, 334, 304, 687, 347, 338, 342, 656, 314, 657, 560, 568, 567, 566, 525, 707, 523, 526, 527, 520, 530, 511, 680, 507, 678, 509, 708, 508, 679
117	SR 48 - Major Evacuation Route	513, 517, 518, 692, 516, 515, 484, 485, 474, 473, 701
118	104E - Major Evacuation Route	189, 188, 604, 191, 202, 155, 609, 149, 150, 363, 151, 152, 153, 89, 78, 77, 76, 84, 607, 85, 86
119	SR 3 - Major Evacuation Route	77, 88, 96, 120, 121, 97, 98

Table 8-7. School 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 R.C. (mi.)	Travel Time from EPZ Bdry to H.S. (min)	ETE to H.S. (hr:min)	
Ontario Bible Conference	90	15	13.0	12.8	62	2:50	26.9	36	3:25	
New Haven Elementary School	90	15	7.4	46.1	10	1:55	28.9	39	2:35	
School Age Children Care Program	90	15	11.7	11.9	60	2:45	26.9	36	3:25	
Charles E. Riley Elementary	90	15	6.8	7.8	53	2:40	26.9	36	3:15	
Fitzhugh Park Elementary School	90	15	7.9	8.4	57	2:45	26.9	36	3:20	
Headstart of Oswego	90	15	7.8	8.4	57	2:45	26.9	36	3:20	
Little Luke's Childcare Center	90	15	7.3	8.1	55	2:40	26.9	36	3:20	
Oswego Community Christian School	90	15	9.2	9.4	59	2:45	26.9	36	3:20	
Trinity Catholic School	90	15	7.8	8.4	57	2:45	26.9	36	3:20	
Children's Center of SUNY Oswego	90	15	9.7	10.0	59	2:45	26.9	36	3:20	
Frederick Leighton Elementary School	90	15	9.1	8.9	62	2:50	26.9	36	3:25	
Kingsford Park Elementary	90	15	6.7	20.9	20	2:05	26.8	36	2:45	
Oswego High School	90	15	8.6	8.8	59	2:45	26.9	36	3:20	
Oswego Middle School	90	15	5.2	18.7	17	2:05	26.8	36	2:40	
Oswego YMCA School's Out Program	90	15	6.7	19.6	21	2:10	26.8	36	2:45	
Mexico Elementary School	90	15	4.5	48.8	6	1:55	30.4	41	2:35	
Mexico High School	90	15	4.8	47.2	7	1:55	30.4	41	2:35	
Mexico Middle School	90	15	5.0	46.6	7	1:55	30.4	41	2:35	
Oswego County BOCES	90	15	5.0	46.6	7	1:55	31.4	42	2:35	
Minetto Elementary School	90	15	2.2	48.2	3	1:50	26.8	36	2:25	
SUNY Oswego	90	15	9.9	9.8	62	2:50	26.9	36	3:25	
Maximum for EPZ:						2:50	Maximum:			3:25
Average for EPZ:						2:25	Average:			3:05

Table 8-8. School Evacuation Time Estimates – Rain

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 R.C. (mi.)	Travel Time from EPZ Bdry to H.S. (min)	ETE to H.S. (hr:min)
A COUNTY SCHOOLS									
Ontario Bible Conference	100	20	13.0	11.0	71	3:15	26.9	41	3:55
New Haven Elementary School	100	20	7.4	41.4	11	2:15	28.9	44	2:55
School Age Children Care Program	100	20	11.7	9.5	74	3:15	26.9	41	3:55
Charles E. Riley Elementary	100	20	6.8	5.9	70	3:10	26.9	41	3:55
Fitzhugh Park Elementary School	100	20	7.9	7.1	68	3:10	26.9	41	3:50
Headstart of Oswego	100	20	7.8	7.0	67	3:10	26.9	41	3:50
Little Luke's Childcare Center	100	20	7.3	6.7	66	3:10	26.9	41	3:50
Oswego Community Christian School	100	20	9.2	7.9	70	3:10	26.9	41	3:55
Trinity Catholic School	100	20	7.8	7.0	67	3:10	26.9	41	3:50
Children's Center of SUNY Oswego	100	20	9.7	7.8	75	3:15	26.9	41	4:00
Frederick Leighton Elementary School	100	20	9.1	8.0	69	3:10	26.9	41	3:50
Kingsford Park Elementary	100	20	6.7	19.8	21	2:25	26.8	41	3:05
Oswego High School	100	20	8.6	7.2	72	3:15	26.9	41	3:55
Oswego Middle School	100	20	5.2	18.6	17	2:20	26.8	41	3:00
Oswego YMCA School's Out Program	100	20	6.7	18.9	22	2:25	26.8	41	3:05
Mexico Elementary School	100	20	4.5	41.5	7	2:10	30.4	46	2:55
Mexico High School	100	20	4.8	40.3	8	2:10	30.4	46	2:55
Mexico Middle School	100	20	5.0	40.1	8	2:10	30.4	46	2:55
Oswego County BOCES	100	20	5.0	40.1	8	2:10	31.4	48	3:00
Minetto Elementary School	100	20	5.0	41.1	8	2:10	31.4	48	3:00
SUNY Oswego	100	20	2.2	6.4	21	2:25	26.8	41	3:05
Maximum for EPZ:						3:15	Maximum:		
Average for EPZ:						2:45	Average:		

Table 8-9. School Evacuation Time Estimates – 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 R.C. (mi.)	Travel Time from EPZ Bdry to H.S. (min)	ETE to H.S. (hr:min)
A COUNTY SCHOOLS									
Ontario Bible Conference	110	25	13.0	8.7	90	3:45	26.9	47	4:35
New Haven Elementary School	110	25	7.4	37.7	12	2:30	28.9	50	3:20
School Age Children Care Program	110	25	11.7	7.5	95	3:50	26.9	47	4:40
Charles E. Riley Elementary	110	25	6.8	5.0	82	3:40	26.9	47	4:25
Fitzhugh Park Elementary School	110	25	7.9	5.5	87	3:45	26.9	47	4:30
Headstart of Oswego	110	25	7.8	5.5	87	3:45	26.9	47	4:30
Little Luke's Childcare Center	110	25	7.3	5.2	84	3:40	26.9	47	4:30
Oswego Community Christian School	110	25	9.2	6.1	90	3:45	26.9	47	4:35
Trinity Catholic School	110	25	7.8	5.5	87	3:45	26.9	47	4:30
Children's Center of SUNY Oswego	110	25	9.7	6.4	92	3:50	26.9	47	4:35
Frederick Leighton Elementary School	110	25	9.1	6.0	92	3:50	26.9	47	4:35
Kingsford Park Elementary	110	25	6.7	14.7	28	2:45	26.8	46	3:30
Oswego High School	110	25	8.6	5.9	89	3:45	26.9	47	4:35
Oswego Middle School	110	25	5.2	15.9	20	2:35	26.8	46	3:25
Oswego YMCA School's Out Program	110	25	6.7	14.4	29	2:45	26.8	46	3:30
Mexico Elementary School	110	25	4.5	39.6	7	2:25	30.4	53	3:15
Mexico High School	110	25	4.8	38.2	8	2:25	30.4	53	3:20
Mexico Middle School	110	25	5.0	38.0	8	2:25	30.4	53	3:20
Oswego County BOCES	110	25	5.0	38.0	8	2:25	31.4	54	3:20
Minetto Elementary School	110	25	2.2	36.9	4	2:20	26.8	46	3:05
SUNY Oswego	110	25	9.9	6.8	89	3:45	26.9	47	4:35
Maximum for EPZ:						3:50	Maximum:		
Average for EPZ:						3:15	Average:		

**Table 8-10. Summary of Transit-Dependent Bus Routes**

Route	No. of Buses	ERPAs Served	Number of Stops Made	Length (mi.)
1	1	1,2,5	9	4.2
2	1	2,4,5	5	2.2
3	1	2,4,7	12	6.75
4	1	4	4	1.4
5	1	4,7,8,9	7	2.9
6	1	4,9	6	2.1
7	1	7,8	8	4
8	1	7	6	2.4
9	1	7,8,9	17	8.1
10	1	8,18	13	6.1
11	1	8,18	17	9.2
12	1	5,6,10,11	7	3
13	1	6	4	1.9
14	1	3,5,6,10,11	12	5.4
15	1	1,3,6	10	3.7
16	1	4,5,9,10	10	3.4
17	1	9	7	2.8
18	1	4,9	11	6.1
19	1	14	13	7.5
20	1	14,15	16	7.5
21	1	14,15,16	28	14.4
22	1	7,15,16	15	7.1
23	1	7,8,15,16,17	8	3.3
24	1	15,16,17	14	5.5
25	1	12	6	0.8
26	1	12	10	1.5
27	1	12	13	1.1
28	1	12	11	0.8
29	1	12	15	1.5
30	1	12	8	0.6
31	1	12	13	1.2
32	1	12	11	2.2
33	1	12	10	0.8
34	1	12	13	0.9
35	1	12	12	0.8
36	1	13	13	1.8
37	1	13	22	4
38	1	13	16	1.25

Route	No. of Buses	ERPAs Serviced	Number of Stops Made	Length (mi.)
39	1	13	16	1.75
40	1	13	7	0.6
41	1	13	15	0.4
42	1	13,22	9	1.3
43	1	13	9	0.5
44	1	13	22	1.35
45	1	13	13	0.7
46	1	22	3	0.7
47	1	9,10	7	2.6
48	1	10	8	3.9
49	1	10	6	2.6
50	1	10,11	4	1.9
51	1	6,11	11	3.8
52	1	11,12	11	1.3
53	1	8,16,17	23	9.8
54	1	18	8	3.4
55	1	18,20	15	7.3
56	1	10,19,20	15	7.3
57	1	20	8	3.4
58	1	10,11,19,20	15	7.2
59	1	19,20	10	4.6
60	1	19,20	12	5.7
61	1	12,19,20	11	6.2
62	1	12,19,20	14	5.4
63	1	13,21	8	2.8
64	1	21	10	4.2
65	1	21	9	4.1
66	1	21	5	2
67	1	21,22	10	2.2
68	1	13,22	8	3.7
69	1	21,22	9	3.2
70	1	13,22	8	3.6
71	1	22	5	1.9
72	1	22	9	3.7
73	1	22	7	2.2
74	1	22	5	2
75	1	11,15,19	13	4.25
76	1	15,16,17	11	3.3
Total:	76			

Table 8-11. Transit-Dependent Evacuation Time Estimates - Good Weather

Route Number	Bus Number	One-Wave						Distance to R. C. (miles)	Two-Wave				
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)		Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)
1	1	90	18.5	13.9	80	30	3:20	26.9	5	10	82	30	6:05
2	1	90	16.6	14.0	71	30	3:15	26.9	5	10	77	30	5:55
3	1	90	16.2	45.9	21	30	2:25	28.9	5	10	79	30	5:10
4	1	90	9.7	46.4	13	30	2:15	28.9	5	10	63	30	4:45
5	1	90	8.7	44.6	12	30	2:15	28.9	5	10	60	30	4:40
6	1	90	9.9	47.3	13	30	2:15	28.9	5	10	63	30	4:45
7	1	90	10.2	46.7	13	30	2:15	30.4	5	10	66	30	4:50
8	1	90	9.2	47.3	12	30	2:15	30.4	5	10	63	30	4:45
9	1	90	10.4	43.2	14	30	2:15	30.4	5	10	67	30	4:50
10	1	90	8.3	45.6	11	30	2:15	30.4	5	10	61	30	4:45
11	1	90	10.3	52.2	12	30	2:15	30.4	5	10	66	30	4:50
12	1	90	11.1	9.0	74	30	3:15	26.9	5	10	64	30	5:40
13	1	90	12.5	10.1	75	30	3:15	26.9	5	10	67	30	5:45
14	1	90	17.1	10.8	95	30	3:35	26.9	5	10	79	30	6:15
15	1	90	17.7	12.2	87	30	3:30	26.9	5	10	81	30	6:15
16	1	90	19.0	13.4	85	30	3:30	26.9	5	10	83	30	6:15
17	1	90	7.1	47.4	9	30	2:10	28.9	5	10	56	30	4:30
18	1	90	10.4	47.4	13	30	2:15	28.9	5	10	64	30	4:45
19	1	90	9.8	46.6	13	30	2:15	35.4	5	10	73	30	5:00
20	1	90	8.9	48.4	11	30	2:15	35.4	5	10	69	30	5:00

Route Number	Bus Number	One-Wave						Distance to R. C. (miles)	Two-Wave				
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)		Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)
21	1	90	16.3	36.6	27	30	2:30	35.4	5	10	92	30	5:35
22	1	90	12.1	45.0	16	30	2:20	30.4	5	10	71	30	5:00
23	1	90	8.3	45.0	11	30	2:15	30.4	5	10	61	30	4:45
24	1	90	6.9	48.4	9	30	2:10	35.4	5	10	64	30	4:50
25	1	90	10.5	11.1	57	30	3:00	26.9	5	10	62	30	5:25
26	1	90	11.2	11.2	60	30	3:00	26.9	5	10	64	30	5:25
27	1	90	9.9	8.0	74	30	3:15	26.9	5	10	61	30	5:40
28	1	90	8.2	14.2	35	30	2:35	26.9	5	10	56	30	4:55
29	1	90	9.8	7.7	76	30	3:20	26.9	5	10	60	30	5:45
30	1	90	8.2	7.2	68	30	3:10	26.9	5	10	56	30	5:30
31	1	90	8.8	7.2	73	30	3:15	26.9	5	10	57	30	5:35
32	1	90	3.4	8.4	24	30	2:25	26.9	5	10	44	30	4:30
33	1	90	7.9	8.4	56	30	3:00	26.9	5	10	55	30	5:20
34	1	90	8.0	8.4	57	30	3:00	26.9	5	10	55	30	5:20
35	1	90	8.6	7.9	65	30	3:10	26.9	5	10	57	30	5:30
36	1	90	6.5	20.6	19	30	2:20	26.8	5	10	52	30	4:35
37	1	90	9.2	17.5	32	30	2:35	26.8	5	10	59	30	5:00
38	1	90	6.5	17.5	22	30	2:25	26.8	5	10	52	30	4:40
39	1	90	7.6	4.5	102	30	3:45	26.8	5	10	55	30	6:05
40	1	90	6.6	19.0	21	30	2:25	26.8	5	10	53	30	4:40

Route Number	Bus Number	One-Wave						Distance to R. C. (miles)	Two-Wave					
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)		Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
41	1	90	8.3	4.6	107	30	3:50	26.8	36	5	10	57	30	6:10
42	1	90	8.7	5.0	105	30	3:45	26.8	36	5	10	58	30	6:05
43	1	90	10.0	8.3	72	30	3:15	26.8	36	5	10	62	30	5:40
44	1	90	9.9	20.1	29	30	2:30	26.8	36	5	10	61	30	4:55
45	1	90	9.8	10.6	55	30	3:00	26.8	36	5	10	61	30	5:25
46	1	90	9.2	20.1	27	30	2:30	26.8	36	5	10	59	30	4:55
47	1	90	8.4	46.4	11	30	2:15	28.9	39	5	10	59	30	4:40
48	1	90	8.6	46.4	11	30	2:15	28.9	39	5	10	60	30	4:40
49	1	90	10.7	12.1	53	30	2:55	26.9	36	5	10	63	30	5:20
50	1	90	10.0	12.0	50	30	2:50	26.9	36	5	10	60	30	5:15
51	1	90	10.6	8.0	79	30	3:20	26.9	36	5	10	62	30	5:45
52	1	90	9.6	8.3	69	30	3:10	26.9	36	5	10	60	30	5:35
53	1	90	17.9	45.1	24	30	2:25	30.4	41	5	10	85	30	5:20
54	1	90	4.1	44.9	5	30	2:10	28.9	39	5	10	49	30	4:25
55	1	90	9.2	47.7	12	30	2:15	28.9	39	5	10	61	30	4:40
56	1	90	9.2	47.7	12	30	2:15	28.9	39	5	10	61	30	4:40
57	1	90	5.3	47.7	7	30	2:10	28.9	39	5	10	51	30	4:25
58	1	90	8.5	39.0	13	30	2:15	26.9	36	5	10	58	30	4:35
59	1	90	6.5	39.9	10	30	2:10	26.9	36	5	10	53	30	4:25
60	1	90	7.0	39.0	11	30	2:15	26.9	36	5	10	54	30	4:35

		One-Wave							Two-Wave						
		Bus Number	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)
61	1	90	7.4	39.0	11	30	2:15	26.9	36	5	10	54	30	4:30	
62	1	90	6.7	39.0	10	30	2:15	26.9	36	5	10	53	30	4:30	
63	1	90	5.2	46.3	7	30	2:10	26.8	36	5	10	49	30	4:20	
64	1	90	5.2	45.8	7	30	2:10	26.8	36	5	10	49	30	4:20	
65	1	90	7.6	40.3	11	30	2:15	26.8	36	5	10	55	30	4:35	
66	1	90	4.4	40.3	7	30	2:10	26.8	36	5	10	47	30	4:20	
67	1	90	4.6	40.3	7	30	2:10	26.8	36	5	10	47	30	4:20	
68	1	90	6.1	40.3	9	30	2:10	26.8	36	5	10	51	30	4:25	
69	1	90	5.6	46.3	7	30	2:10	26.8	36	5	10	50	30	4:25	
70	1	90	9.7	4.9	119	30	4:00	26.8	36	5	10	61	30	6:25	
71	1	90	8.4	5.0	100	30	3:45	26.8	36	5	10	57	30	6:05	
72	1	90	5.8	3.0	117	30	4:00	37.7	50	5	10	65	30	6:45	
73	1	90	3.9	6.7	35	30	2:35	37.7	50	5	10	60	30	5:15	
74	1	90	4.2	6.3	40	30	2:40	37.7	50	5	10	61	30	5:20	
75	1	90	11.1	8.0	83	30	3:25	26.9	36	5	10	63	30	5:50	
76	1	90	4.7	48.4	6	30	2:10	35.4	47	5	10	59	30	4:45	
Maximum ETE: 4:00								Maximum ETE: 6:45							
Average ETE: 2:45								Average ETE: 5:10							

Table 8-12. Transit-Dependent Evacuation Time Estimates - Rain

		One-Wave							Two-Wave						
		Bus Number	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)
Route Number															
1		1	100	18.5	10.3	108	40	4:10	26.9	40	5	10	92	40	7:20
2		1	100	16.6	10.4	96	40	4:00	26.9	40	5	10	87	40	7:05
3		1	100	16.2	42.4	23	40	2:45	28.9	43	5	10	89	40	5:55
4		1	100	9.7	42.9	14	40	2:35	28.9	43	5	10	70	40	5:25
5		1	100	8.7	42.1	12	40	2:35	28.9	43	5	10	67	40	5:25
6		1	100	9.9	43.1	14	40	2:35	28.9	43	5	10	71	40	5:25
7		1	100	10.2	43.1	14	40	2:35	28.9	43	5	10	72	40	5:30
8		1	100	9.2	43.5	13	40	2:35	28.9	43	5	10	69	40	5:25
9		1	100	10.4	38.9	16	40	2:40	28.9	43	5	10	73	40	5:35
10		1	100	8.3	42.4	12	40	2:35	28.9	43	5	10	66	40	5:20
11		1	100	10.3	46.9	13	40	2:35	28.9	43	5	10	71	40	5:25
12		1	100	11.1	6.7	100	40	4:00	28.9	43	5	10	75	40	6:55
13		1	100	12.5	7.5	100	40	4:00	28.9	43	5	10	78	40	7:00
14		1	100	17.1	8.7	118	40	4:20	28.9	43	5	10	91	40	7:30
15		1	100	17.7	10.0	107	40	4:10	28.9	43	5	10	93	40	7:25
16		1	100	19.0	10.8	105	40	4:10	28.9	43	5	10	96	40	7:25
17		1	100	7.1	42.8	10	40	2:30	28.9	43	5	10	63	40	5:15
18		1	100	10.4	42.8	15	40	2:35	28.9	43	5	10	72	40	5:30
19		1	100	9.8	39.9	15	40	2:35	28.9	43	5	10	72	40	5:25
20		1	100	8.9	43.9	12	40	2:35	28.9	43	5	10	68	40	5:25



		One-Wave										Two-Wave									
		Bus Number	Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to R. C. (miles)	Travel		Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)						
Time to R. C. (min)	Unload (min)																				
Route Number																					
41		1	100	8.3	3.7	135	40	4:35	28.9	43	5	10	67	40	7:25						
42		1	100	8.7	4.1	127	40	4:30	28.9	43	5	10	69	40	7:20						
43		1	100	10.0	4.1	146	40	4:50	28.9	43	5	10	73	40	7:45						
44		1	100	9.9	5.3	112	40	4:15	28.9	43	5	10	71	40	7:05						
45		1	100	9.8	4.5	131	40	4:35	28.9	43	5	10	71	40	7:25						
46		1	100	9.2	5.3	104	40	4:05	28.9	43	5	10	70	40	6:55						
47		1	100	8.4	40.7	12	40	2:35	28.9	43	5	10	67	40	5:20						
48		1	100	8.6	40.2	13	40	2:35	28.9	43	5	10	67	40	5:25						
49		1	100	10.7	5.5	117	40	4:20	28.9	43	5	10	73	40	7:15						
50		1	100	10.0	5.4	111	40	4:15	26.9	40	5	10	67	40	7:00						
51		1	100	10.6	4.8	133	40	4:35	26.9	40	5	10	69	40	7:20						
52		1	100	9.6	4.4	131	40	4:35	26.9	40	5	10	67	40	7:20						
53		1	100	17.9	41.0	26	40	2:50	30.4	46	5	10	95	40	6:10						
54		1	100	4.1	40.3	6	40	2:30	28.9	43	5	10	56	40	5:05						
55		1	100	9.2	44.5	12	40	2:35	28.9	43	5	10	68	40	5:25						
56		1	100	9.2	44.5	12	40	2:35	28.9	43	5	10	68	40	5:25						
57		1	100	5.3	44.5	7	40	2:30	28.9	43	5	10	58	40	5:10						
58		1	100	8.5	34.2	15	40	2:35	26.9	40	5	10	65	40	5:20						
59		1	100	6.5	33.5	12	40	2:35	26.9	40	5	10	60	40	5:10						
60		1	100	7.0	34.2	12	40	2:35	26.9	40	5	10	61	40	5:15						



Table 8-13. Transit Dependent Evacuation Time Estimates - Snow

		One-Wave							Two-Wave						
		Bus Number	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)
Route Number															
1		1	110	18.5	8.7	128	50	4:50	26.9	46	5	10	105	50	8:30
2		1	110	16.6	8.7	114	50	4:35	26.9	46	5	10	99	50	8:05
3		1	110	16.2	38.6	25	50	3:10	28.9	50	5	10	101	50	6:50
4		1	110	9.7	39.0	15	50	2:55	28.9	50	5	10	80	50	6:10
5		1	110	8.7	38.1	14	50	2:55	28.9	50	5	10	77	50	6:10
6		1	110	9.9	39.3	15	50	3:00	28.9	50	5	10	81	50	6:20
7		1	110	10.2	38.3	16	50	3:00	30.4	52	5	10	84	50	6:25
8		1	110	9.2	38.7	14	50	2:55	30.4	52	5	10	81	50	6:15
9		1	110	10.4	35.0	18	50	3:00	30.4	52	5	10	86	50	6:25
10		1	110	8.3	37.7	13	50	2:55	30.4	52	5	10	78	50	6:10
11		1	110	10.3	41.6	15	50	2:55	30.4	52	5	10	84	50	6:20
12		1	110	11.1	5.2	129	50	4:50	26.9	46	5	10	82	50	8:05
13		1	110	12.5	6.4	118	50	4:40	26.9	46	5	10	86	50	8:00
14		1	110	17.1	7.3	141	50	5:05	26.9	46	5	10	101	50	8:40
15		1	110	17.7	8.3	127	50	4:50	26.9	46	5	10	103	50	8:25
16		1	110	19.0	9.1	125	50	4:50	26.9	46	5	10	106	50	8:30
17		1	110	7.1	38.8	11	50	2:55	28.9	50	5	10	72	50	6:05
18		1	110	10.4	38.8	16	50	3:00	28.9	50	5	10	82	50	6:20
19		1	110	9.8	37.1	16	50	3:00	35.4	61	5	10	93	50	6:40
20		1	110	8.9	39.3	14	50	2:55	35.4	61	5	10	89	50	6:30

Route Number	Bus Number	One-Wave							Distance to R. C. (miles)	Two-Wave					
		Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Travel Time to R. C. (min)		Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	
21	1	110	16.3	30.0	33	50	3:15	35.4	61	5	10	117	50	7:20	
22	1	110	12.1	37.2	20	50	3:00	30.4	52	5	10	91	50	6:30	
23	1	110	8.3	37.2	13	50	2:55	30.4	52	5	10	79	50	6:15	
24	1	110	6.9	39.3	11	50	2:55	35.4	61	5	10	82	50	6:25	
25	1	110	10.5	5.9	107	50	4:30	26.9	46	5	10	80	50	7:45	
26	1	110	11.2	5.9	114	50	4:35	26.9	46	5	10	82	50	7:50	
27	1	110	9.9	5.6	106	50	4:30	26.9	46	5	10	78	50	7:40	
28	1	110	8.2	6.9	71	50	3:55	26.9	46	5	10	72	50	7:00	
29	1	110	9.8	5.4	109	50	4:30	26.9	46	5	10	77	50	7:40	
30	1	110	8.2	5.0	98	50	4:20	26.9	46	5	10	72	50	7:25	
31	1	110	8.8	5.0	105	50	4:30	26.9	46	5	10	74	50	7:35	
32	1	110	3.4	4.8	43	50	3:25	26.9	46	5	10	56	50	6:15	
33	1	110	7.9	4.8	99	50	4:20	26.9	46	5	10	70	50	7:25	
34	1	110	8.0	4.8	100	50	4:25	26.9	46	5	10	71	50	7:30	
35	1	110	8.6	5.0	103	50	4:25	26.9	46	5	10	73	50	7:30	
36	1	110	6.5	11.9	33	50	3:15	26.8	46	5	10	67	50	6:15	
37	1	110	9.2	10.5	53	50	3:35	26.8	46	5	10	76	50	6:45	
38	1	110	6.5	10.5	37	50	3:20	26.8	46	5	10	67	50	6:20	
39	1	110	7.6	7.0	65	50	3:45	26.8	46	5	10	70	50	6:50	
40	1	110	6.6	10.7	37	50	3:20	26.8	46	5	10	68	50	6:20	

		One-Wave										Two-Wave									
Route Number	Bus Number	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)						
41	1	110	8.3	4.3	117	50	4:40	26.8	46	5	10	73	50	7:45							
42	1	110	8.7	5.0	104	50	4:25	26.8	46	5	10	74	50	7:35							
43	1	110	10.0	5.3	112	50	4:35	26.8	46	5	10	79	50	7:50							
44	1	110	9.9	7.9	75	50	3:55	26.8	46	5	10	78	50	7:05							
45	1	110	9.8	5.2	112	50	4:35	26.8	46	5	10	78	50	7:45							
46	1	110	9.2	7.9	70	50	3:55	26.8	46	5	10	76	50	7:05							
47	1	110	8.4	38.1	13	50	2:55	28.9	50	5	10	76	50	6:10							
48	1	110	8.6	38.2	14	50	2:55	28.9	50	5	10	77	50	6:10							
49	1	110	10.7	5.2	124	50	4:45	26.9	46	5	10	80	50	8:00							
50	1	110	10.0	5.3	114	50	4:35	26.9	46	5	10	77	50	7:45							
51	1	110	10.6	4.6	139	50	5:00	26.9	46	5	10	79	50	8:10							
52	1	110	9.6	5.4	107	50	4:30	26.9	46	5	10	76	50	7:40							
53	1	110	17.9	37.1	29	50	3:10	30.4	52	5	10	109	50	7:00							
54	1	110	4.1	35.9	7	50	2:50	28.9	50	5	10	63	50	5:50							
55	1	110	9.2	39.3	14	50	2:55	28.9	50	5	10	78	50	6:10							
56	1	110	9.2	39.3	14	50	2:55	28.9	50	5	10	78	50	6:10							
57	1	110	5.3	39.3	8	50	2:50	28.9	50	5	10	66	50	5:55							
58	1	110	8.5	17.7	29	50	3:10	26.9	46	5	10	74	50	6:20							
59	1	110	6.5	21.3	18	50	3:00	26.9	46	5	10	68	50	6:00							
60	1	110	7.0	17.7	24	50	3:05	26.9	46	5	10	69	50	6:10							

		One-Wave							Distance to R. C. (miles)	Two-Wave						
		Bus Number	Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)		Travel Time to R. C. (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	
Route Number	1								110							7.4
	62	1	110	6.7	17.7	23	50	3:05	26.9	46	5	10	68	50	6:05	
	63	1	110	5.2	36.2	9	50	2:50	26.8	46	5	10	63	50	5:45	
	64	1	110	5.2	35.1	9	50	2:50	26.8	46	5	10	63	50	5:45	
	65	1	110	7.6	38.5	12	50	2:55	26.8	46	5	10	70	50	6:00	
	66	1	110	4.4	38.5	7	50	2:50	26.8	46	5	10	60	50	5:45	
	67	1	110	4.6	38.5	7	50	2:50	26.8	46	5	10	61	50	5:45	
	68	1	110	6.1	38.5	10	50	2:50	26.8	46	5	10	66	50	5:50	
	69	1	110	5.6	36.2	9	50	2:50	26.8	46	5	10	64	50	5:50	
	70	1	110	9.7	6.9	85	50	4:05	26.8	46	5	10	77	50	7:15	
	71	1	110	8.4	7.1	71	50	3:55	26.8	46	5	10	73	50	7:00	
	72	1	110	5.8	4.7	74	50	3:55	37.7	65	5	10	83	50	7:30	
	73	1	110	3.9	4.0	59	50	3:40	37.7	65	5	10	77	50	7:10	
	74	1	110	4.2	4.4	57	50	3:40	37.7	65	5	10	78	50	7:10	
	75	1	110	11.1	4.6	145	50	5:10	26.9	46	5	10	80	50	8:25	
	76	1	110	4.7	39.3	7	50	2:50	35.4	61	5	10	75	50	6:15	
									Maximum ETE: 5:05						Maximum ETE: 8:40	
									Average ETE: 3:40						Average ETE: 6:55	

Table 8-14. 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)
Bishop Commons at St Luke's	Ambulatory	90	1	66	20	6.8	50	2:40
	Wheelchair bound	90	5	2	10	6.8	53	2:35
Ladies Home of Oswego	Ambulatory	90	1	15	15	4.5	76	3:05
Oswego Behavioral Health Services	Ambulatory	90	1	15	15	7.6	55	2:40
	Wheelchair bound	90	5	2	10	7.6	58	2:40
Pontiac Nursing Home	Ambulatory	90	1	25	20	6.8	50	2:40
Simeon-Dewitt Apts.	Wheelchair bound	90	5	55	10	6.8	53	2:35
	Ambulatory	90	1	150	20	7.7	55	2:45
St Luke Health Services	Ambulatory	90	1	57	20	6.8	50	2:40
	Wheelchair bound	90	5	115	10	6.8	53	2:35
	Bedridden	90	15	20	30	6.8	48	2:50
	Ambulatory	90	1	28	20	7.8	55	2:45
Valehaven Home for Adults	Ambulatory	90	1	17	17	8.9	55	2:45
Morning Star Nursing Home	Wheelchair bound	90	5	96	10	8.9	62	2:45
	Bedridden	90	15	4	30	8.9	59	3:00
	Ambulatory	90	1	55	20	3.7	73	3:05
	Wheelchair bound	90	5	7	10	3.7	76	3:00
Oswego Hospital	Bedridden	90	15	3	30	3.7	70	3:10
Pontiac Terrace Apts	Ambulatory	90	1	72	20	8.2	53	2:45
	Wheelchair bound	90	5	8	10	8.2	60	2:40
Fravor Rd IRA	Ambulatory	90	1	7	7	2.9	5	1:45
	Wheelchair bound	90	5	2	10	2.9	5	1:45
Parkview Manor Apts	Ambulatory	90	1	23	20	2.3	3	1:55
	Wheelchair bound	90	5	1	5	2.3	3	1:40
Sabill Drive IRA	Ambulatory	90	1	5	5	3.4	5	1:40
	Wheelchair bound	90	5	1	5	3.4	5	1:40
Springside at Seneca Hill	Ambulatory	90	1	74	20	5.5	41	2:35
	Wheelchair bound	90	5	1	5	5.5	39	2:15
The Manor at Seneca Hill	Wheelchair bound	90	5	116	10	3.1	32	2:15
Minetto Senior Housing	Ambulatory	90	1	37	20	4.7	14	2:05
	Wheelchair bound	90	5	1	5	4.7	14	1:50
Maximum ETE:								3:10
Average ETE:								2:25

**Table 8-15. Medical Facility Evacuation Time Estimates - Rain**

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)
Bishop Commons at St Luke's	Ambulatory	100	1	66	20	6.8	69	3:10
	Wheelchair bound	100	5	2	10	6.8	72	3:05
Ladies Home of Oswego	Ambulatory	100	1	15	15	4.5	82	3:20
Oswego Behavioral Health Services	Ambulatory	100	1	15	15	7.6	68	3:05
	Wheelchair bound	100	5	2	10	7.6	75	3:05
Pontiac Nursing Home	Ambulatory	100	1	25	20	6.8	69	3:10
	Wheelchair bound	100	5	55	10	6.8	72	3:05
Simeon-Dewitt Apts.	Ambulatory	100	1	150	20	7.7	67	3:10
St Luke Health Services	Ambulatory	100	1	57	20	6.8	69	3:10
	Wheelchair bound	100	5	115	10	6.8	72	3:05
	Bedridden	100	15	20	30	6.8	63	3:15
	Ambulatory	100	1	28	20	7.8	67	3:10
Valehaven Home for Adults	Ambulatory	100	1	17	17	8.9	73	3:10
Morning Star Nursing Home	Wheelchair bound	100	5	96	10	8.9	78	3:10
	Bedridden	100	15	4	30	8.9	63	3:15
	Ambulatory	100	1	55	20	3.7	79	3:20
	Wheelchair bound	100	5	7	10	3.7	81	3:15
Oswego Hospital	Bedridden	100	15	3	30	3.7	73	3:25
	Ambulatory	100	1	72	20	8.2	68	3:10
Pontiac Terrace Apts	Wheelchair bound	100	5	8	10	8.2	71	3:05
Fravor Rd IRA	Ambulatory	100	1	7	7	2.9	5	1:55
	Wheelchair bound	100	5	2	10	2.9	5	1:55
Parkview Manor Apts	Ambulatory	100	1	23	20	2.3	4	2:05
	Wheelchair bound	100	5	1	5	2.3	4	1:50
Sabill Drive IRA	Ambulatory	100	1	5	5	3.4	5	1:50
	Wheelchair bound	100	5	1	5	3.4	5	1:50
Springside at Seneca Hill	Ambulatory	100	1	74	20	5.5	65	3:05
	Wheelchair bound	100	5	1	5	5.5	66	2:55
The Manor at Seneca Hill	Wheelchair bound	100	5	116	10	3.1	58	2:50
Minetto Senior Housing	Ambulatory	100	1	37	20	4.7	15	2:15
	Wheelchair bound	100	5	1	5	4.7	14	2:00
Maximum ETE:								3:25
Average ETE:								2:50

**Table 8-16. Medical Facility Evacuation Time Estimates - 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)
Bishop Commons at St Luke's	Ambulatory	110	1	66	20	6.8	81	3:35
	Wheelchair bound	110	5	2	10	6.8	89	3:30
Ladies Home of Oswego	Ambulatory	110	1	15	15	4.5	91	3:40
Oswego Behavioral Health Services	Ambulatory	110	1	15	15	7.6	85	3:30
	Wheelchair bound	110	5	2	10	7.6	86	3:30
Pontiac Nursing Home	Ambulatory	110	1	25	20	6.8	81	3:35
	Wheelchair bound	110	5	55	10	6.8	89	3:30
Simeon-Dewitt Apts.	Ambulatory	110	1	150	20	7.7	85	3:35
	Ambulatory	110	1	57	20	6.8	81	3:35
St Luke Health Services	Wheelchair bound	110	5	115	10	6.8	89	3:30
	Bedridden	110	15	20	30	6.8	82	3:45
Valehaven Home for Adults	Ambulatory	110	1	28	20	7.8	85	3:35
	Ambulatory	110	1	17	17	8.9	89	3:40
Morning Star Nursing Home	Wheelchair bound	110	5	96	10	8.9	92	3:35
	Bedridden	110	15	4	30	8.9	88	3:50
Oswego Hospital	Ambulatory	110	1	55	20	3.7	88	3:40
	Wheelchair bound	110	5	7	10	3.7	91	3:35
Pontiac Terrace Apts	Bedridden	110	15	3	30	3.7	86	3:50
	Ambulatory	110	1	72	20	8.2	87	3:40
Fravor Rd IRA	Wheelchair bound	110	5	8	10	8.2	89	3:30
	Ambulatory	110	1	7	7	2.9	6	2:05
Parkview Manor Apts	Wheelchair bound	110	5	2	10	2.9	6	2:10
	Ambulatory	110	1	23	20	2.3	4	2:15
Sabill Drive IRA	Wheelchair bound	110	5	1	5	2.3	4	2:00
	Ambulatory	110	1	5	5	3.4	6	2:05
Springside at Seneca Hill	Wheelchair bound	110	5	1	5	3.4	6	2:05
	Ambulatory	110	1	74	20	5.5	76	3:30
The Manor at Seneca Hill	Wheelchair bound	110	5	1	5	5.5	88	3:25
	Ambulatory	110	5	116	10	3.1	82	3:25
Minetto Senior Housing	Wheelchair bound	110	1	37	20	4.7	17	2:30
	Wheelchair bound	110	5	1	5	4.7	25	2:20
<b>Maximum ETE:</b>								<b>3:50</b>
<b>Average ETE:</b>								<b>3:10</b>

**Table 8-17. Homebound Special Needs Population Evacuation Time Estimates**

Vehicle Type	People Requiring Vehicle	Vehicles deployed	Stops	Weather Conditions	Mobilization Time (min)	Loading Time at 1 <sup>st</sup> Stop (min)	Travel to Subsequent Stops (min)	Total Loading Time at Subsequent Stops (min)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Wheelchair Vans	208	19	11	Normal	90	5	90	50	13	4:10
				Rain	100		100		15	4:30
				Snow	110		110		16	4:55
Maximum ETE:										4:55
Average ETE:										4:35

**Table 8-18. Correctional Facilities Evacuation Time Estimates**

Correctional Facility	Weather Conditions	Mobilization (min)	Number of Buses	Loading Rate (min per person)	Number of Inmates	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Oswego County Jail	Normal	90	6	2	160	60	5.5	38	3:10
	Rain	100						39	3:20
	Snow	110						61	3:55
Maximum ETE:									3:55
Average ETE:									3:30

## 9 TRAFFIC MANAGEMENT STRATEGY

This section discusses the suggested traffic control and 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).
- Traffic Control Devices to assist these personnel in the performance of their tasks. These devices should comply with the guidance of the Manual of Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration (FHWA) of the U.S.D.O.T. 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 existing TCPs and ACPs identified by the offsite agencies in their existing emergency plans serve as the basis of the traffic management plan, as per NUREG/CR-7002.
2. The existing TCPs and ACPs and how they were applied in this study are discussed in Appendix G.
3. Computer analysis of the evacuation traffic flow environment (see Figures 7-3 through 7-7). As discussed in Section 7.3, congestion within the EPZ is clear by 4 hours after the ATE. The existing traffic management plans place emphasis on appropriate intersections and are adequate. No additional TCPs or ACPs are identified as a result of this study.

The use of Intelligent Transportation Systems (ITS) technologies (if available) can reduce

manpower and equipment needs, 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 can also be placed outside of the EPZ to warn motorists to avoid using routes that may conflict with the flow of evacuees away from the power plants. Highway Advisory Radio (HAR) can be used to broadcast information to evacuees en route through their vehicle stereo systems. Automated Traveler 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 on board navigation systems (GPS units), cell phones, and pagers can be used to provide information en route. These are only several 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.

The ETE analysis treated all controlled intersections that are existing TCP locations in the offsite agency plans as being controlled by actuated signals.

Chapters 2N and 5G, and Part 6 of the 2009 MUTCD are particularly relevant and should be reviewed during emergency response training.

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 ACPs and TCPs.

Study Assumptions 5 and 6 in Section 2.3 discuss ACP and TCP staffing schedules and operations.

## 10 EVACUATION ROUTES

Evacuation routes are comprised of two distinct components:

- Routing from a ERPA 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.

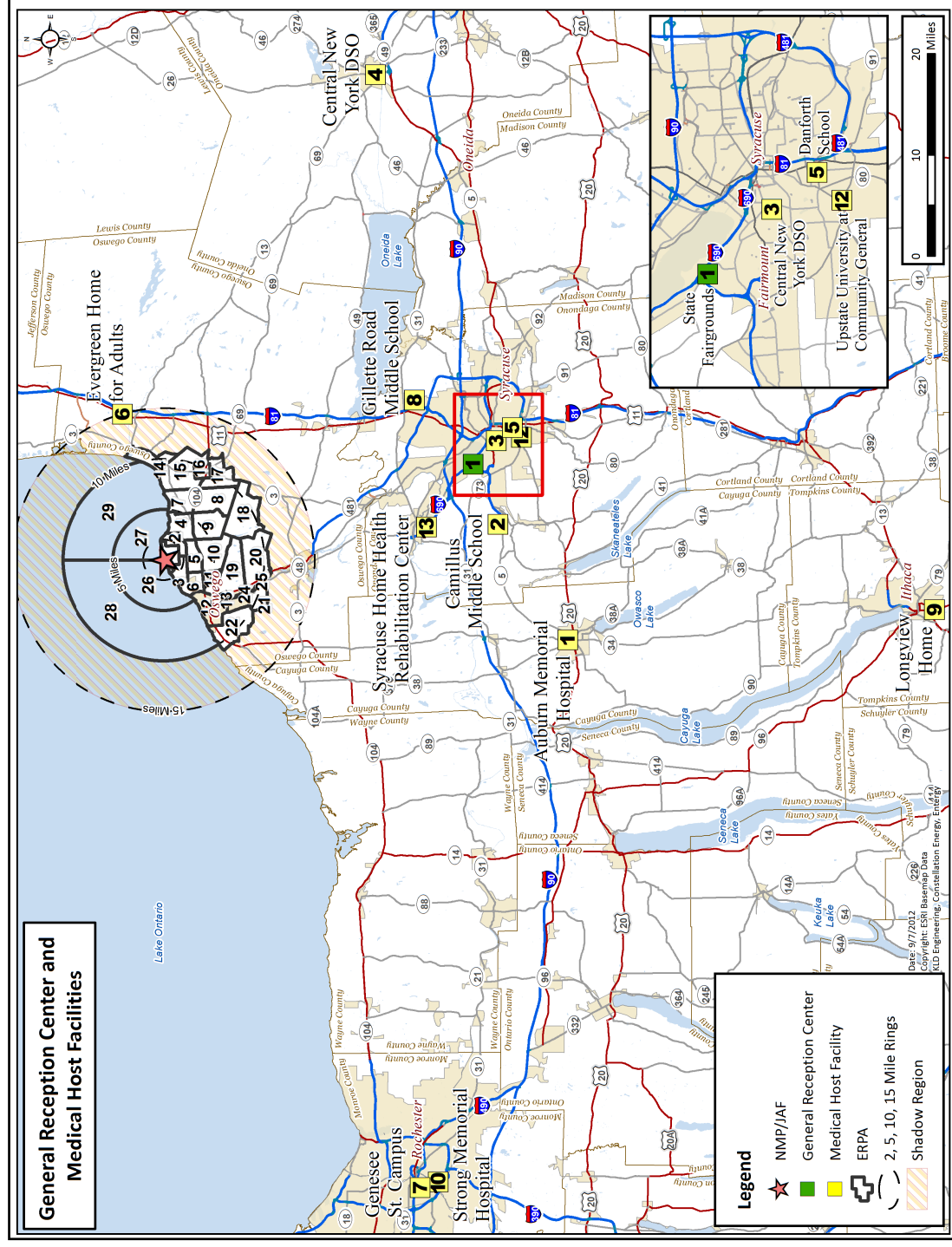
Evacuees will select routes within the EPZ in such a way as to minimize their exposure to risk. This expectation is met by the DYNEV II model routing traffic away from the location of NMP/JAF, to the extent practicable. The DTRAD model satisfies this behavior by routing traffic so as to balance traffic demand relative to the available highway capacity to the extent possible. See Appendices B through D for further discussion.

The routing of transit-dependent evacuees from the EPZ boundary to the general reception centers or to medical host facilities is designed to minimize the amount of travel outside the EPZ from the points where these routes cross the EPZ boundary.

The Oswego County radiological emergency plans identify the New York State Fairgrounds as the reception center for school children as well as the general population. Several host facilities are identified throughout the region to house those living or receiving treatment at various medical facilities and nursing homes within the EPZ.

Figure 10-1 presents a map showing the general reception center as well as the medical host facilities for evacuees. The major evacuation routes for the EPZ are presented in Figure 10-2.

It is assumed that all school evacuees will be taken to the New York State Fairgrounds and subsequently picked up by parents or guardians. Transit-dependent evacuees are transported to the main Fairground location as well. This study does not consider the transport of evacuees from reception centers to congregate care centers, if the county does make the decision to relocate evacuees.



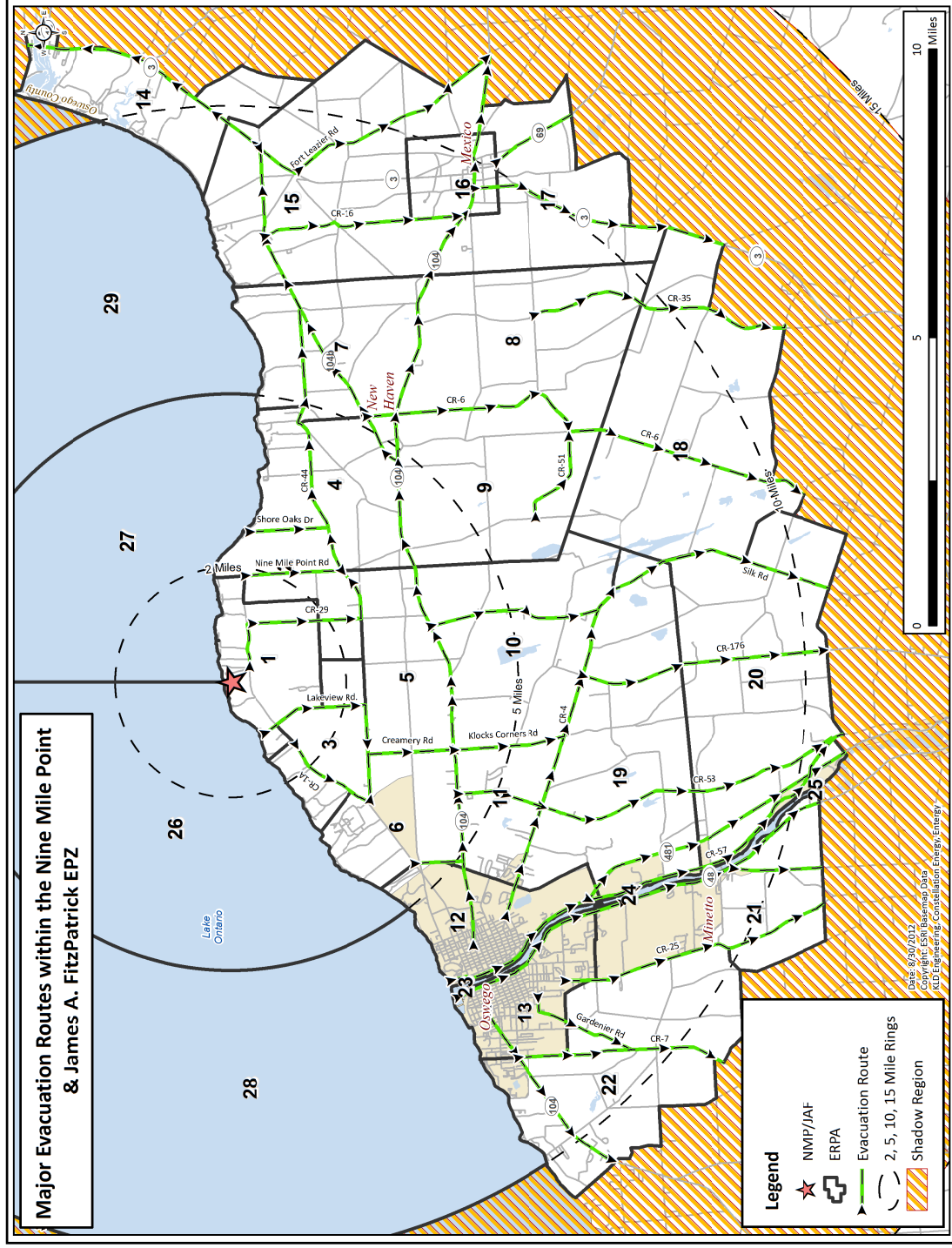


Figure 10-2. Evacuation Route Map

## 11 SURVEILLANCE OF EVACUATION OPERATIONS

There is a need for surveillance of traffic operations during the evacuation. There is also a need to clear any blockage of roadways arising from accidents or vehicle disablement. Surveillance can take several forms.

1. Traffic control personnel, located at Traffic Control and Access Control points, provide fixed-point surveillance.
2. Ground patrols may be undertaken along well-defined paths to ensure coverage of those highways that serve as major evacuation routes.
3. Aerial surveillance of evacuation operations may also be conducted using helicopter or fixed-wing aircraft, if available.
4. Cellular phone calls (if cellular coverage exists) from motorists may also provide direct field reports of road blockages.

These concurrent surveillance procedures are designed to provide coverage of the entire EPZ as well as the area around its periphery. It is the responsibility of the county to support an emergency response system that can receive messages from the field and be in a position to respond to any reported problems in a timely manner. This coverage should quickly identify, and expedite the response to any blockage caused by a disabled vehicle.

### Tow Vehicles

In a low-speed traffic environment, any vehicle disablement is likely to arise due to a low-speed collision, mechanical failure or the exhaustion of its fuel supply. In any case, the disabled vehicle can be pushed onto the shoulder, thereby restoring traffic flow. Past experience in other emergencies indicates that evacuees who are leaving an area often perform activities such as pushing a disabled vehicle to the side of the road without prompting.

While the need for tow vehicles is expected to be low under the circumstances described above, it is still prudent to be prepared for such a need. Consideration should be given that tow trucks with a supply of gasoline be deployed at strategic locations within, or just outside, the EPZ. These locations should be selected so that:

- They permit access to key, heavily loaded, evacuation routes.
- Responding tow trucks would most likely travel counter-flow relative to evacuating traffic.

Consideration should also be given that the state and local emergency management agencies encourage gas stations to remain open during the evacuation.

## 12 CONFIRMATION TIME

It is necessary to confirm that the evacuation process is effective in the sense that the public is complying with the Advisory to Evacuate. The Oswego County radiological emergency plans state that the County Sheriff is assigned the responsibility of traffic control and is tasked with patrolling the plume exposure EPZ for confirmation of evacuation and the provision of security in the evacuated area. This process takes place during the maintenance phase of the evacuation. In addition to this activity, the following complementary approach is suggested.

The suggested procedure employs a stratified random sample and a telephone survey. The size of the sample is dependent on the expected number of households that do not comply with the Advisory to Evacuate. It is reasonable to assume, for the purpose of estimating sample size that at least 80 percent of the population within the EPZ will comply with the Advisory to Evacuate. On this basis, an analysis could be undertaken (see Table 12-1) to yield an estimated sample size of approximately 300.

The confirmation process should start at about 2 hours after the Advisory to Evacuate, which is when approximately 90 percent of resident evacuees have completed their mobilization activities (see Table 5-9). At this time, virtually all evacuees will have departed on their respective trips and the local telephone system will be largely free of traffic.

As indicated in Table 12-1, approximately 7½ person hours are needed to complete the telephone survey. If six people are assigned to this task, each dialing a different set of telephone exchanges (e.g., each person can be assigned a different set of ERPAs), then the confirmation process will extend over a timeframe of about 75 minutes. Of course, fewer people would be needed for this survey if the Evacuation Region were only a portion of the EPZ. Use of modern automated computer controlled dialing equipment or other technologies (e.g., reverse 911 or equivalent if available) can significantly reduce the manpower requirements and the time required to undertake this type of confirmation survey.

If this method is indeed used by the offsite agencies, consideration should be given to maintain a list of telephone numbers within the EPZ in the EOC at all times. Such a list could be purchased from vendors and should be periodically updated. As indicated above, the confirmation process should not begin until 2 hours after the Advisory to Evacuate, to ensure that households have had enough time to mobilize. This 2-hour timeframe will enable telephone operators to arrive at their workplace, obtain a call list and prepare to make the necessary phone calls.

Should the number of telephone responses (i.e., people still at home) exceed 20 percent, then the telephone survey should be repeated after an hour's interval until the confirmation process is completed.

Other techniques could also be considered. After traffic volumes decline, the personnel manning TCPs can be redeployed to travel through residential areas to observe and to confirm evacuation activities.

**Table 12-1. Estimated Number of Telephone Calls Required for Confirmation of Evacuation**

Problem Definition

Estimate number of phone calls,  $n$ , needed to ascertain the proportion,  $F$  of households that have not evacuated.

Reference: Burstein, H., Attribute Sampling, McGraw Hill, 1971

Given:

- No. of households plus other facilities,  $N$ , within the EPZ (est.) = 17,600
- Est. proportion,  $F$ , of households that will not evacuate = 0.20
- Allowable error margin,  $e$ : 0.05
- Confidence level,  $\alpha$ : 0.95 (implies  $A = 1.96$ )

Applying Table 10 of cited reference,

$$p = F + e = 0.25; \quad q = 1 - p = 0.75$$

$$n = \frac{A^2 pq + e}{e^2} = 308$$

Finite population correction:

$$n_F = \frac{nN}{n + N - 1} = 303$$

Thus, some 300 telephone calls will confirm that approximately 20 percent of the population has not evacuated. If only 10 percent of the population does not comply with the Advisory to Evacuate, then the required sample size,  $n_F = 213$ .

Est. Person Hours to complete 300 telephone calls

Assume:

- Time to dial using touch tone (random selection of listed numbers): 30 seconds
- Time for 6 rings (no answer): 36 seconds
- Time for 4 rings plus short conversation: 60 sec.
- Interval between calls: 20 sec.

Person Hours:

$$\frac{300[30 + 0.8(36) + 0.2(60) + 20]}{3600} = 7.6$$

## **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 vehicles per hour (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 vehicles per hour (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.
Traffic Volume	The number of vehicles that pass over a section of roadway in one direction, expressed in vehicles per hour (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 vehicles per hour (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 section 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 (OD) 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 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”.

### 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 NMP/JAF 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.

### 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.

## 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 D-TRAD 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 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  $\alpha$ ,  $\beta$ , and  $\gamma$  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 traffic assignment 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 NMP/JAF:

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

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

$d_n$  = Distance of node, n, from NMP/JAF

$d_0$  = Distance from NMP/JAF where there is zero risk

$\beta$  = Scaling factor

The value of  $d_0 = 15$  miles, the outer distance of the shadow region. Note that the supplemental cost,  $s_a$ , of link, a, is (high, low), if its downstream node, n, is (near, far from) NMP/JAF.

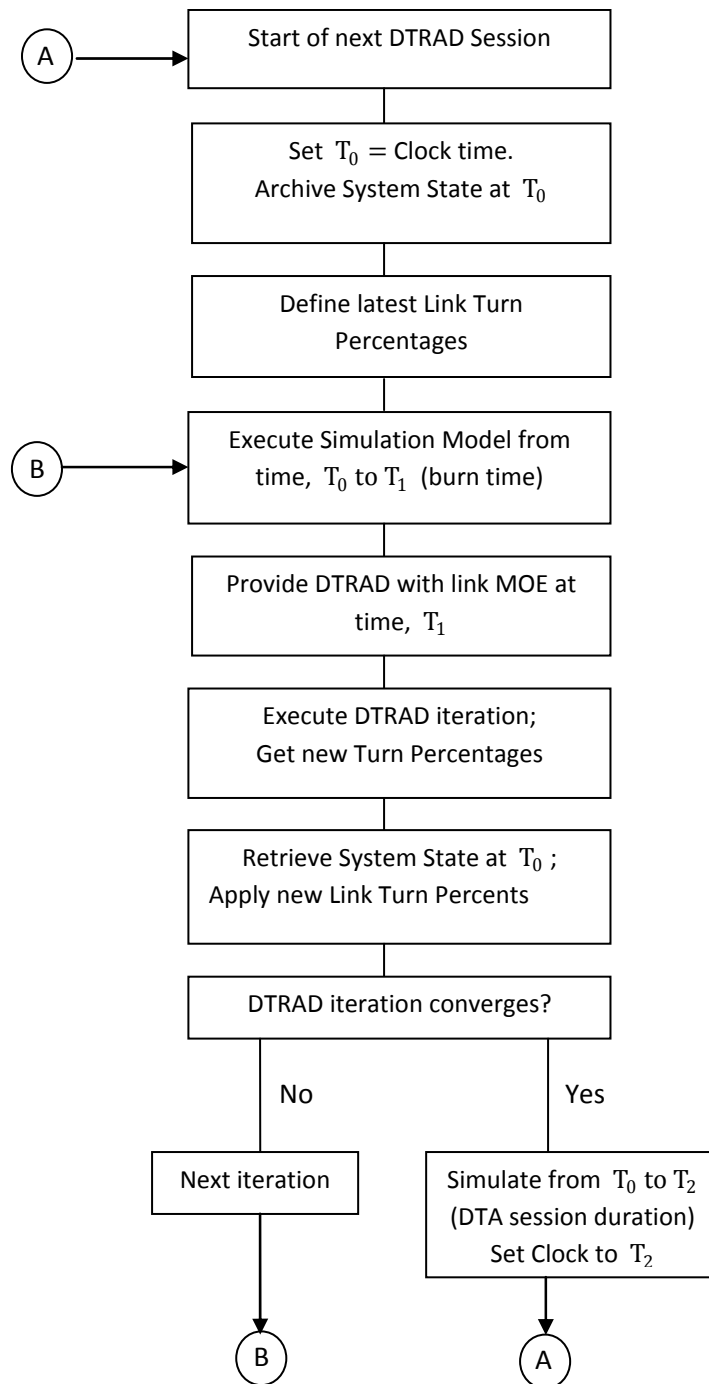
## Network Equilibrium

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

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 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, 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.

**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**

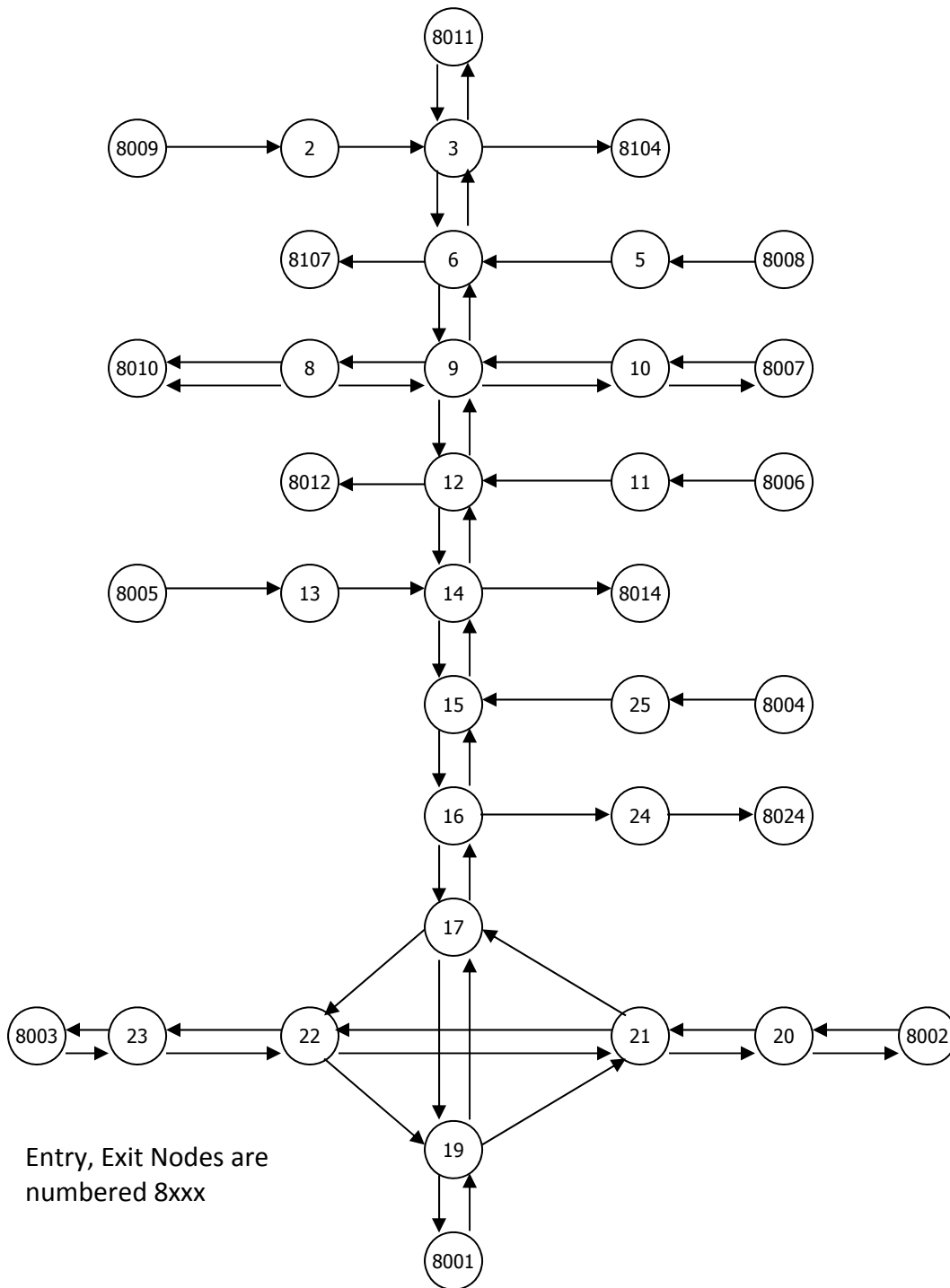
- Driver's (vehicle-specific) response mechanisms: free-flow speed, discharge headway
- Bus route designation.

**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



**Figure C-1. Representative Analysis Network**

## C.1 Methodology

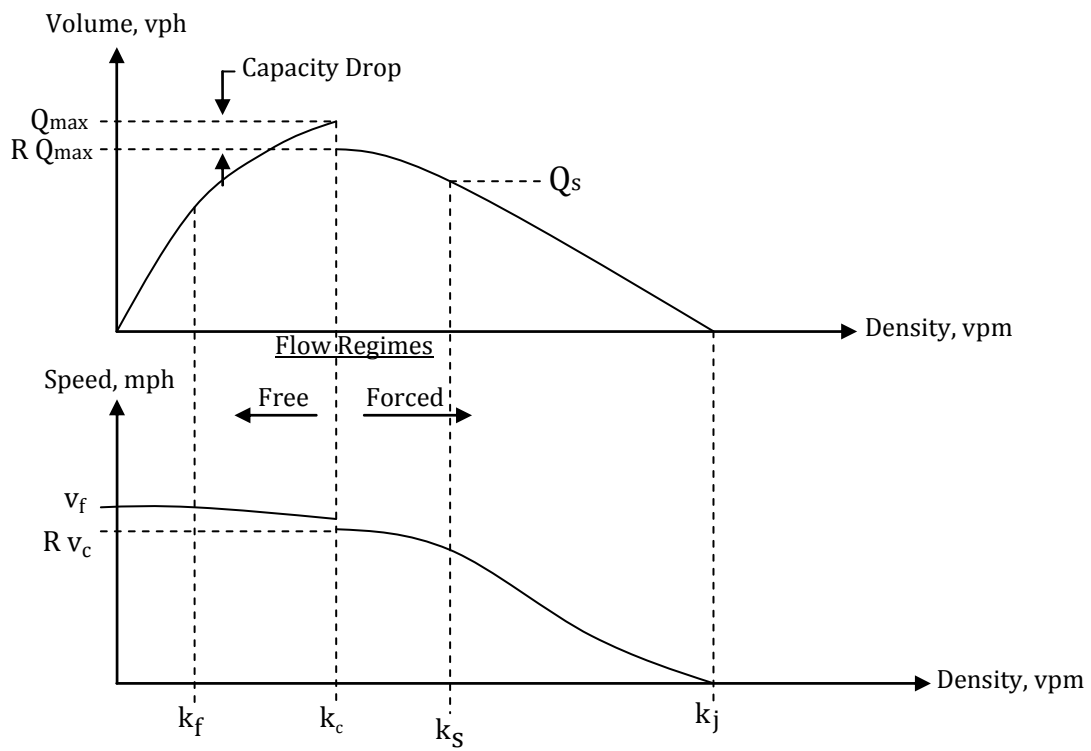
### C.1.1 The Fundamental Diagram

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”,  $(1-R)Q_{\max}$ , 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.



**Figure C-2. Fundamental Diagrams**

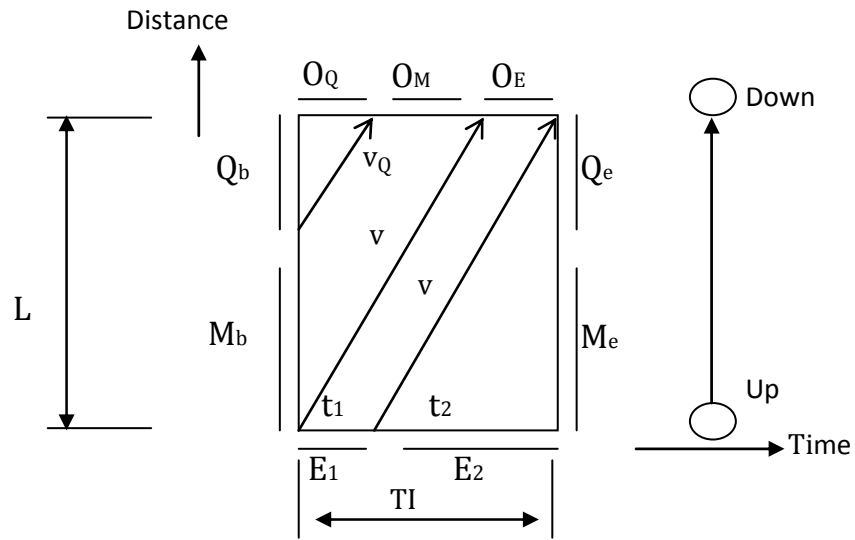


Figure C-3. A UNIT Problem Configuration with  $t_1 > 0$

**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 HCM.
$R$	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.

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  $t_1 > 0$ ,  $O_M = M_b$ ,  $O_E = \min\left(RCap - M_b, \frac{t_1 \text{Cap}}{TI}\right) \geq 0$   
 $Q'_e = E_1 - O_E$   
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
11. Calculate a new estimate of average density,  $\bar{k}_n = \frac{1}{4}[k_b + 2k_m + k_e]$ ,  
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  $\epsilon$  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

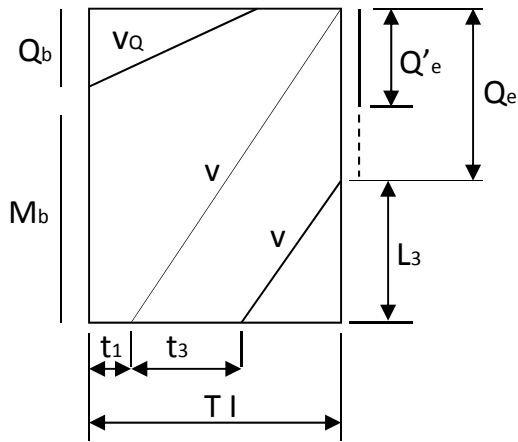
The number of excess vehicles that cause spillback is:  $SB = Q_e + M_e - \frac{(L-W) \cdot LN}{L_v}$  ,  
where  $W$  is the width of the upstream intersection. To prevent spillback, meter the outflow from the feeder approaches and from the source flow,  $S$ , during this TI by the amount,  $SB$ . That 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  $t_3 = TI - t_1$ .

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

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 measures of effectiveness 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.

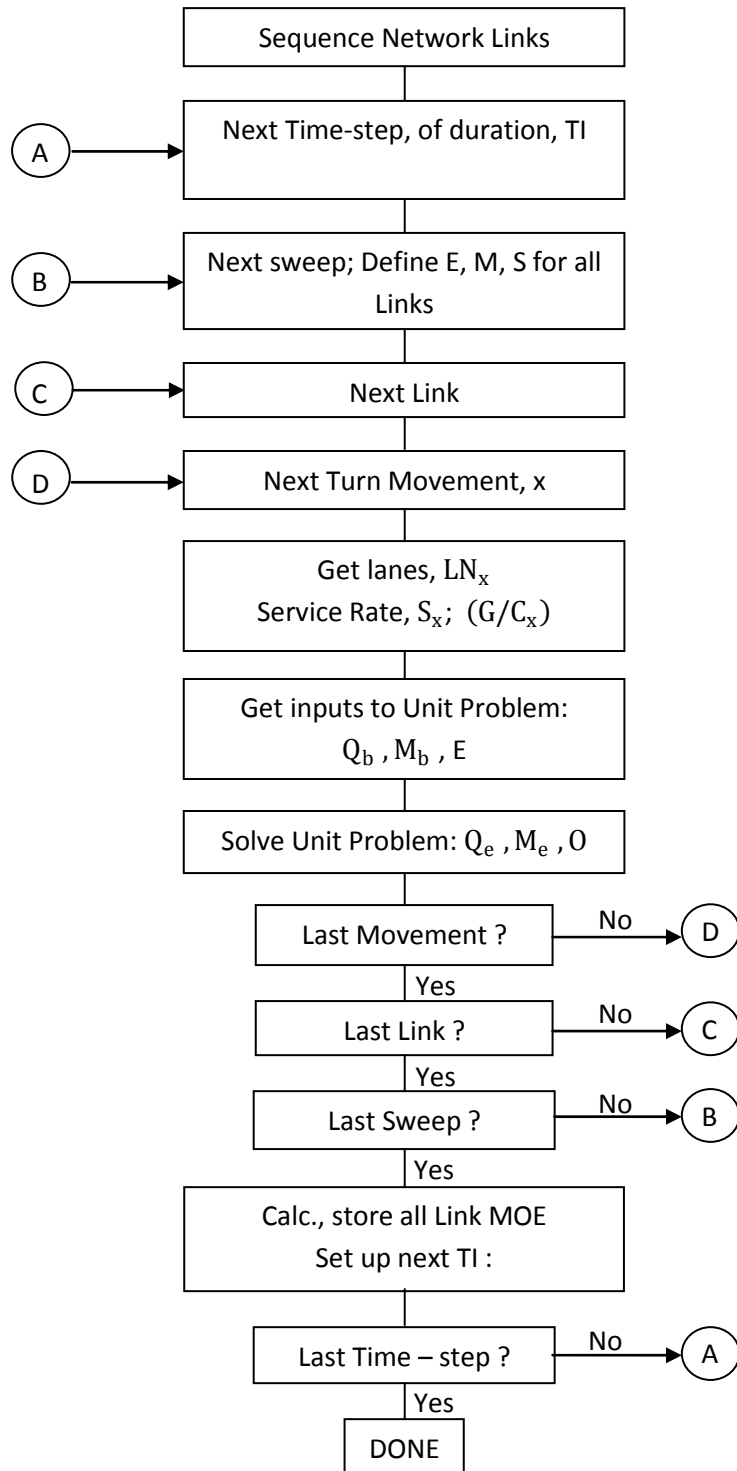


Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3)

### 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 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.

## **APPENDIX D**

### Detailed Description of Study Procedure

## **D. DETAILED DESCRIPTION OF STUDY PROCEDURE**

This appendix describes the activities that were performed to compute Evacuation Time Estimates. 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 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 NMP/JAF location. The base map incorporates the local roadway topology, a suitable topographic background and the EPZ boundary.

### **Step 2**

2010 Census block information was obtained in GIS format. This information was used to estimate the 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 and transient data were obtained from local emergency management agencies and from phone calls to transient attractions. Information concerning schools, medical and other types of special facilities within the EPZ was obtained from county and municipal sources.

### **Step 3**

A kickoff meeting was conducted with major stakeholders (state and local emergency managers, on-site and off-site utility emergency managers, local and state law enforcement agencies). 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 local emergency 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, and to make the necessary observations needed to estimate realistic values of roadway capacity.

### **Step 5**

A telephone survey of households within the EPZ was conducted to identify household dynamics, trip generation characteristics, and evacuation-related demographic information of the EPZ population. 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 UNITES software 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). 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. 2010 Census data 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 29 ERPAs. 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 model, 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 which operates on data produced by DYNEV II) 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, 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 and for 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 are executed using the DYNEV II System 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.

#### Step 16

Once vehicular evacuation results are accepted, average travel speeds for transit and special facility routes were used to compute evacuation time estimates for transit-dependent permanent residents, schools, hospitals, and other special facilities.

#### Step 17

The simulation results are analyzed, tabulated and graphed. The results were then documented, as required by NUREG/CR-7002.

#### Step 18

Following the completion of documentation activities, the ETE criteria checklist (see Appendix N) was completed. An appropriate report reference is provided for each criterion provided in the checklist.

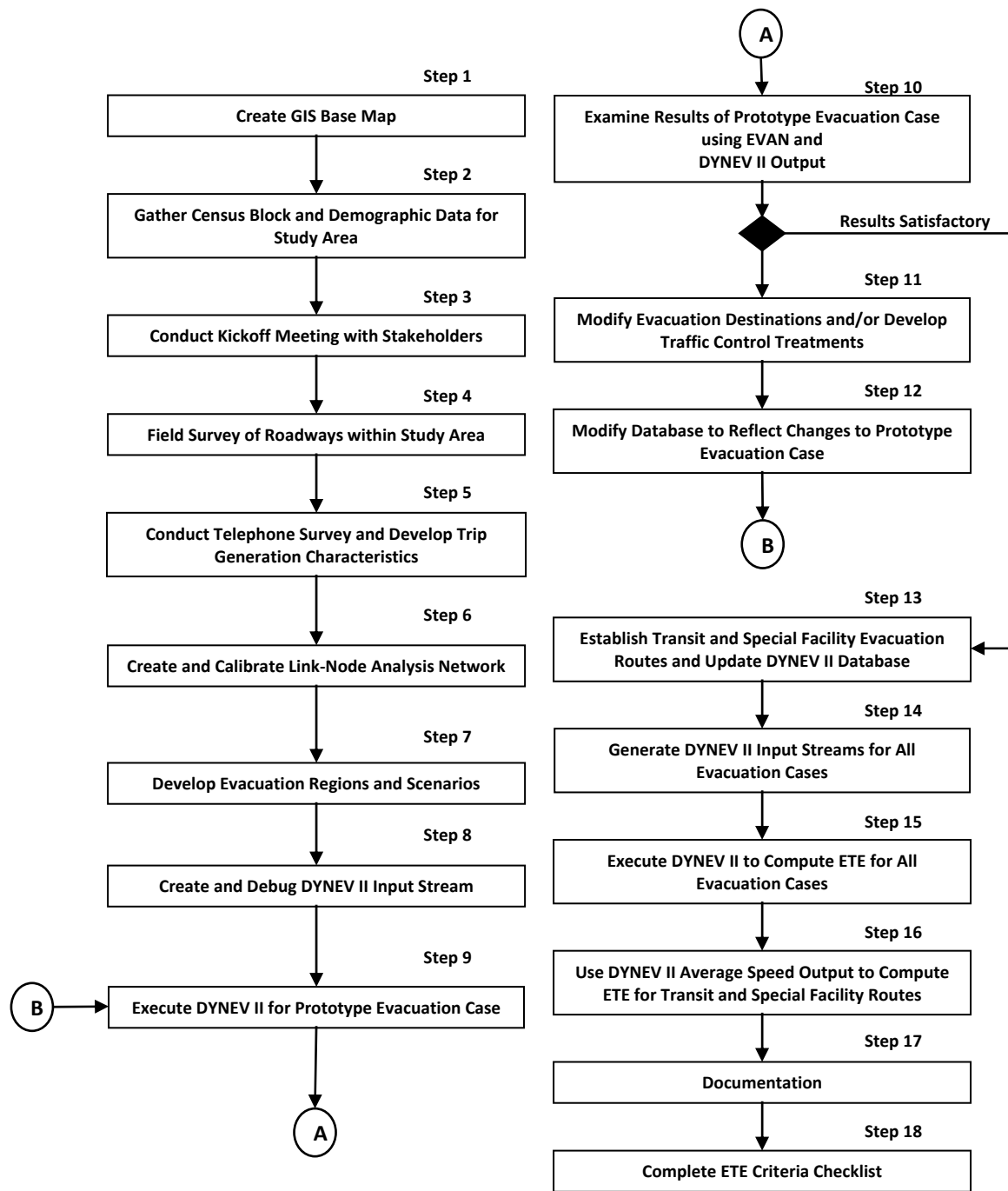


Figure D-1. Flow Diagram of Activities

**APPENDIX E**  
Special Facility Data

## E. SPECIAL FACILITY DATA

The following tables list population information, as of May 2012, for special facilities, transient attractions and major employers that are located within the NMP/JAF EPZ. Special facilities are defined as schools, day care centers, hospitals, other medical care facilities, and correctional facilities. Transient population data is included in the tables for recreational areas and lodging facilities. Employment data is included in the tables for major employers. The location of the facility is defined by its straight-line distance (miles) and direction (magnetic bearing) from the center point of NMP/JAF. Maps of each school, day care center, recreational area, lodging facility, and major employer are also provided.

**Table E-1. Schools, Preschools and Daycares within the EPZ**

ERPA	Distance (miles)	Dire- ction	School Name	Street Address	Municipality	Phone	Enrollment	Staff
1	1.1	WSW	Ontario Bible Conference	385 Lakeview Rd	Oswego	(315) 343-6111	91	12
4	5.2	ESE	New Haven Elementary School	4320 SR 104	New Haven	(315) 963-8400	238	45
10	4.0	SSW	School Age Children Care Program	5495 SR 104E	Oswego	(315) 342-6919	33	5
12	6.7	SW	Charles E. Riley Elementary	268 E 8th St	Oswego	(315) 341-2980	497	75
12	6.2	SW	Fitzhugh Park Elementary School	195 E Bridge St	Oswego	(315) 341-2940	416	70
12	6.4	SW	Headstart of Oswego	43 E Schuyler St	Oswego	(315) 342-0629	80	11
12	6.7	SW	Little Luke's Childcare Center	10 Burkle St	Oswego	(315) 342-4600	100	35
12	5.6	SW	Oswego Community Christian School	400 E Albany St	Oswego	(315) 342-9322	76	20
12	6.5	SW	Trinity Catholic School	115 E 5th St	Oswego	(315) 343-6700	173	30
13	8.0	SW	Children's Center of SUNY Oswego	131 Sheldon Hall	Oswego	(315) 342-9322	100	15
13	7.7	SW	Frederick Leighton Elementary School	1 Buccaneer Blvd	Oswego	(315) 341-2970	485	80
13	7.3	SW	Kingsford Park Elementary	W 5th & Niagara Sts	Oswego	(315) 341-2950	381	60
13	7.6	SW	Oswego High School	2 Buccaneer Blvd	Oswego	(315) 341-2920	1281	150
13	7.9	SW	Oswego Middle School	100 Mark Fitzgibbons Dr	Oswego	(315) 341-2930	597	80
13	7.0	SW	Oswego YMCA School's Out Program	249 W 1st St	Oswego	(315) 343-1981	60	5
16	9.5	ESE	Mexico Elementary School	26 Academy St	Mexico	(315) 963-8400	255	60
16	9.7	ESE	Mexico High School	3338 Main St	Mexico	(315) 963-8400	700	108
16	9.0	ESE	Mexico Middle School	16 Fravor Rd	Mexico	(315) 963-8400	701	115
17	8.5	ESE	Oswego County BOCES	176 CR 64	Oswego	(315) 963-4481	446	100
21	9.4	SSW	Minetto Elementary School	2411 CR 8	Minetto	(315) 341-2960	367	78
22	8.0	SW	SUNY Oswego	7060 SR 104	Oswego	(315) 312-2500	8,300 <sup>1</sup>	1721
<b>TOTAL:</b>							<b>15,377</b>	<b>2,875</b>

<sup>1</sup> All SUNY Oswego students are reported in the enrollment figure although students who commute from outside the EPZ are also listed as transients in Table E-4.

Table E-2. Medical Facilities within the EPZ

ERPA	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Phone	Capacity	Current Census	Ambulatory Patients	Wheel- chair Patients	Bed- ridden Patients
Kewaunee County											
12	6.8	SW	Bishop Commons at St Luke's	4 Burkle St	Oswego	(315) 349-0798	68	68	66	2	0
12	6.7	SW	Ladies Home of Oswego	43 E Utica St	Oswego	(315) 343-6951	21	15	15	0	0
12	6.4	SW	Oswego Health Behavioral Health Services	74 Bunner St	Oswego	(315) 326-4100	28	17	15	2	0
12	6.8	SW	Pontiac Nursing Home	303 E River Rd	Oswego	(315) 343-1800	80	80	25	55	0
12	6.8	SW	Simeon-Dewitt Apts.	150 E 1st St	Oswego	(315) 343-0440	150	150	150	0	0
12	6.8	SW	St Luke Health Services	299 E River Rd	Oswego	(315) 342-3166	200	192	57	115	20
12	6.7	SW	Valehaven Home for Adults	24 E Oneida St	Oswego	(315) 342-3959	35	28	28	0	0
13	8.0	SW	Morning Star Nursing Home	17 Sunrise Dr	Oswego	(315) 342-4790	120	117	17	96	4
13	7.2	SW	Oswego Hospital	110 W 6th St	Oswego	(315) 349-5526	100	65	55	7	3
13	6.9	SW	Pontiac Terrace Apts	225 W 1st St	Oswego	(315) 342-1101	80	80	72	8	0
15	8.9	ESE	Fravor Rd IRA	43 Fravor Rd	Mexico	(315) 963-3995	10	9	7	2	0
16	9.7	ESE	Parkview Manor Apts	3313 Main St	Mexico	(315) 343-3167	24	24	23	1	0
17	8.6	ESE	Sabill Drive IRA	9 Sabill Dr	Mexico	(315) 963-8529	6	6	5	1	0
20	8.9	SSW	Springside at Seneca Hill	10 CR 45A	Oswego	(315) 343-5658	75	75	74	1	0
20	9.0	SSW	The Manor at Seneca Hill	20 Manor Dr	Oswego	(315) 349-5300	120	116	0	116	0
21	9.1	SSW	Minetto Senior Housing	12 Schuyler St	Oswego	(315) 343-2513	38	38	37	1	0
TOTAL:							1,155	1,080	646	407	27

**Table E-3. Major Employers within the EPZ**

ERPA	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Phone	Employees (max shift)	% Non-EPZ	Employees (Non EPZ)
1	0.0	N/A	James A. FitzPatrick Nuclear Power Plant	268 Lake Rd	Oswego	(315) 342-3840	450	57%	257
1	0.0	N/A	Nine Mile Point Nuclear Station	Lake Rd	Oswego	(315) 343-2110	724	60%	434
6	3.1	SW	Novelis Corporation	448 CR 1A	Oswego	(315) 342-0039	454	35%	159
6	4.3	SW	Oswego Wire Inc	1 Wire Dr	Oswego	(315) 343-0524	65	52%	34
12	4.8	SW	Great Lakes Veneer	375 Mitchell St	Oswego	(315) 342-9178	47	52%	24
12	5.2	SW	Lowe's Home Improvement	445 SR 104	Oswego	(315) 326-5030	77	52%	40
12	6.8	SW	St Luke Health Services	299 E River Rd	Oswego	(315) 349-0700	131	52%	68
12	5.6	SW	Walmart	341 SR 104	Oswego	(315) 342-6210	70	10%	7
13	7.6	SW	Oswego Harbor Power LLC	261 Washington Blvd	Oswego	(315) 349-2200	53	52%	28
13	8.0	SW	Sunrise Residential Healthcare	17 Sunrise Dr	Oswego	(315) 342-4790	88	52%	46
22	8.2	SW	Eagle Beverage Co Inc	1043 CR 25	Oswego	(315) 343-9464	54	52%	28
22	8.3	SW	SUNY Oswego	7060 SR 104	Oswego	(315) 312-2500	1132	52%	589
<b>TOTAL:</b>							<b>3345</b>	<b>-</b>	<b>1714</b>

**Table E-4. Recreational Attractions and Major Commuter Schools within the EPZ**

ERPA	Distance (miles)	Direction	Facility Name	Facility Type	Street Address	Municipality	Phone	Transients	Vehicles
4	4.4	E	Catfish Creek Fishing Camps	Campgrounds	118 Chase Drive	New Haven	(315) 963-7310	68	24
4	4.4	E	Catfish Creek Fishing Camps Marina	Marina	118 Chase Drive	New Haven	(315) 963-7310	22	18
6	3.2	SW	K & G Lodge	Campgrounds	1881 CR 1	Oswego	(315) 343-8171	242	69
6	3.8	SW	Tamarak Golf Club	Golf	2021 CR 1	Oswego	(315) 315-3426	24	16
7	6.8	E	Dowie Dale Campground	Campground	Dowie Dale Beach Rd	Mexico	(315) 963-7895	670	272
7	6.8	E	Dowie Dale Marina	Marina	Dowie Dale Beach Rd	Mexico	(315) 963-7895	74	62
12	6.6	SW	Oswego Marina	Marina	3 Basin Street	Oswego	(315) 342-0436	71	59
12	5.8	SW	Oswego Speedway	Race Track	300 E Albany St.	Oswego	(315) 343-3829	2,440	1,021
13	7.2	SW	Oswego Country Club	Golf	610 W 1st Street	Oswego	(315) 343-4664	35	23
13	6.9	SW	Oswego International Marina	Marina	19 Lake Street	Oswego	(315) 343-0086	84	70
13	6.9	SW	Wright's Landing Marina	Marina	Lake Street	Oswego	(315) 342-8186	191	160
14	10.9	E	Bears Sleepy Hollow State Park	Campground	7065 SR 3	Pulaski	(315) 298-5560	121	43
14	10.3	E	Chedcardo Campsite	Campground	110 Patrick Dr	Pulaski	(315) 298-5739	188	75
14	10.9	E	Selkirk Shores State Park	Campground	7101 SR 3	Pulaski	(315) 298-5737	34	11
15	7.7	E	Mexico Point State Boat Launch	Marina	245 CR 40	Mexico	(315) 963-3656	66	55
15	8.0	E	Mikes Marina Sales & Service	Marina	266 SR 104B	Mexico	(315) 963-3119	131	110
15	8.0	E	Mike's Marina Sales & Service	Campground	266 SR 104B	Mexico	(315) 963-3119	10	3
15		E	Salmon Country Inc. Marina & Campground	Campground	58 Mexico Point Dr West	Mexico	(315) 963-8049	102	36
15	7.8	E	Salmon Country Inc. Marina & Campground	Marina	58 Mexico Point Dr West	Mexico	(315) 963-8049	109	91
15	7.6	E	Yellow Rose Campground	Campground	159 Ladd Rd	Mexico	(315) 963-2060	38	15
15	8.1	ESE	Yogi Bear's Jellystone Park	Campground	601 CR 16	Mexico	(315) 963-7096	300	105
15	8.0	ESE	Yogi Bear's Jellystone Park	Marinas	601 CR 16	Mexico	(315) 963-7096	22	18
22	8.0	SW	SUNY Oswego <sup>2</sup>	Commuter School	7060 SR 104	Oswego	(315) 312-2500	2,349	2,155
<b>TOTAL:</b>								<b>7,391</b>	<b>4,511</b>

<sup>2</sup> Only those students whom commute from outside of the EPZ to attend class are listed

**Table E-5. Lodging Facilities within the EPZ**

ERPA	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Phone	Transients	Vehicles
5	4	S	All Seasons Motel	5422 SR 104	Oswego	(315) 342-9771	54	21
7	5	ESE	Sticks Sports Bar/Grill and Motel	3738 CR 6	New Haven	(315) 963-3084	40	20
10	4	SSE	Evergreen Motel	5047 SR 104	Oswego	(315) 343-6880	32	24
12	7	SW	Best Western Captain's Quarters	26 E 1st St	Oswego	(315) 342-4040	200	109
12	6	SW	Days Inn	101 SR 104E	Oswego	(315) 343-3136	135	44
12	6	SW	Oswego Inn	180 E 10th St	Oswego	(315) 342-6200	30	13
12	7	SW	Quality Inn and Suites	70 E 1st St	Oswego	(315) 343-1600	200	92
13	7	SW	Beacon Hotel	75 W Bridge St	Oswego	(315) 343-3300	42	14
13	8	SW	The Thomas Inn	309 W Seneca St	Oswego	(315) 343-4900	100	71
14	11	ENE	Port Lodge Motel	7351 SR 3	Pulaski	(315) 298-6876	91	45
<b>TOTAL:</b>							<b>924</b>	<b>453</b>

**Table E-6. Correctional Facilities within the EPZ**

ERPA	Distance (miles)	Direction	Facility Name	Street Address	Municipality	Phone	Capacity
12	7.2	SSW	Oswego County Jail - Public Safety Center	39 Churchill Rd	Oswego	(315) 349-3302	160
<b>TOTAL:</b>							<b>160</b>

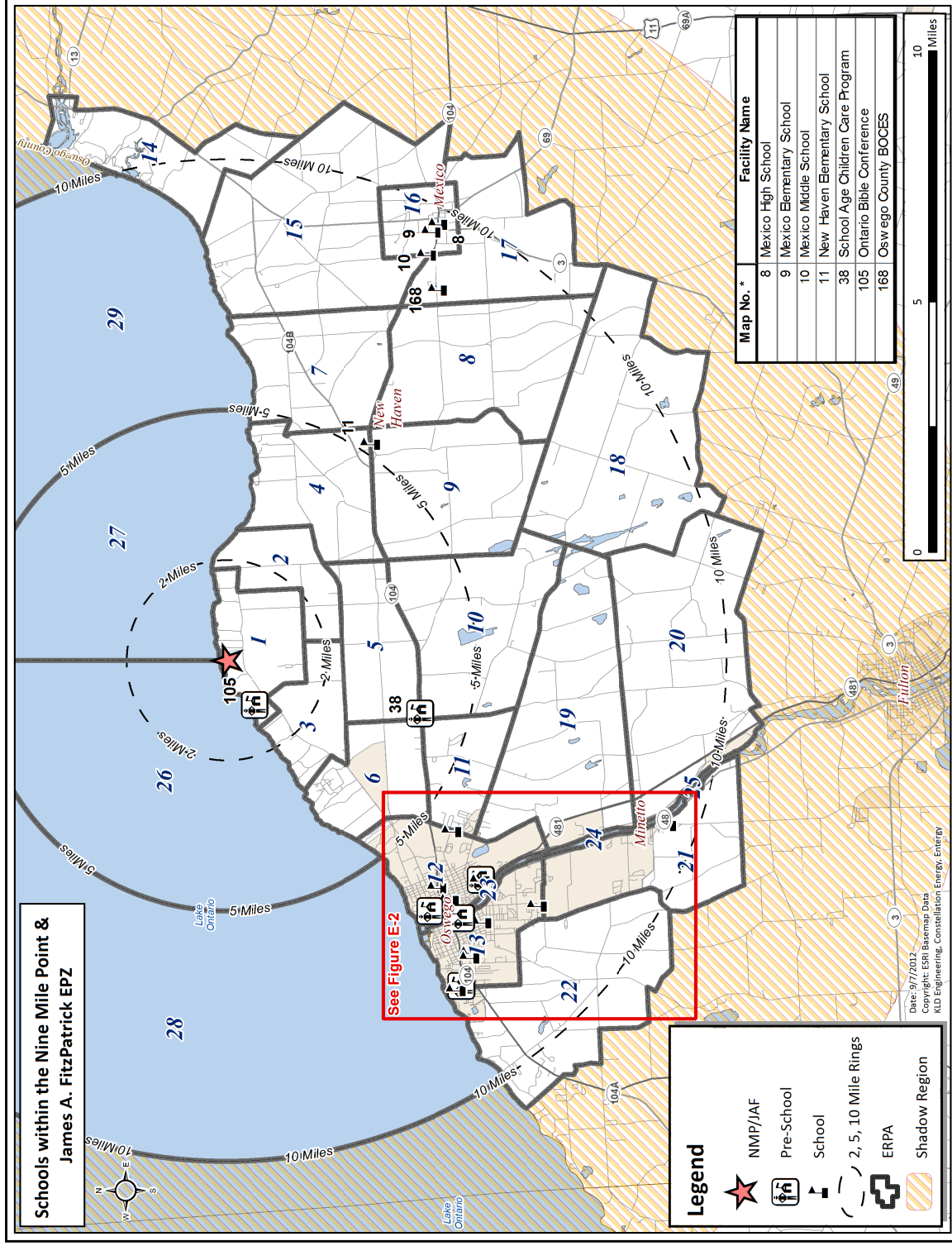


Figure E-1. Schools and Preschools within the EPZ

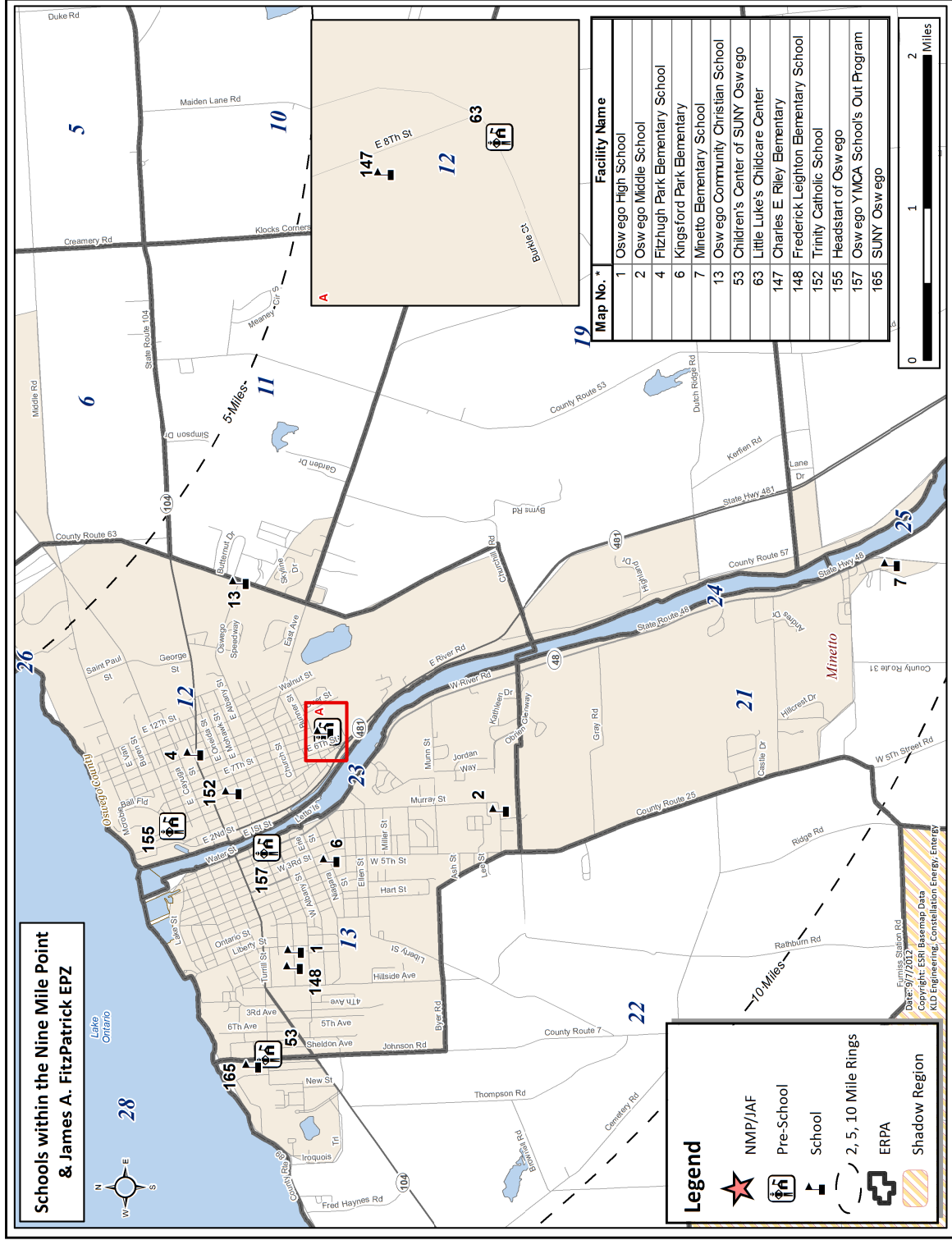


Figure E-2. Schools and Preschools within the City of Oswego

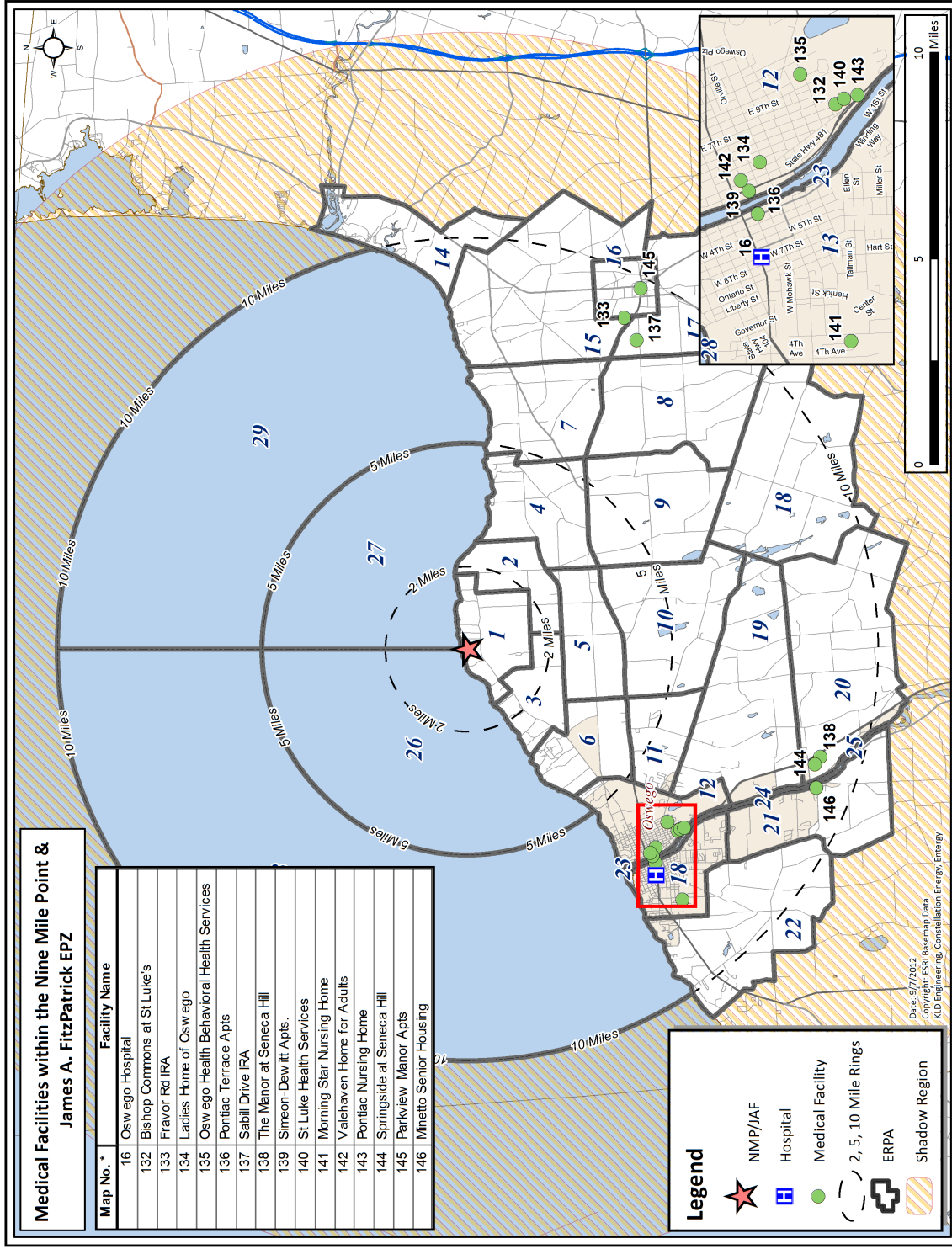


Figure E-3. Medical Facilities within the EPZ

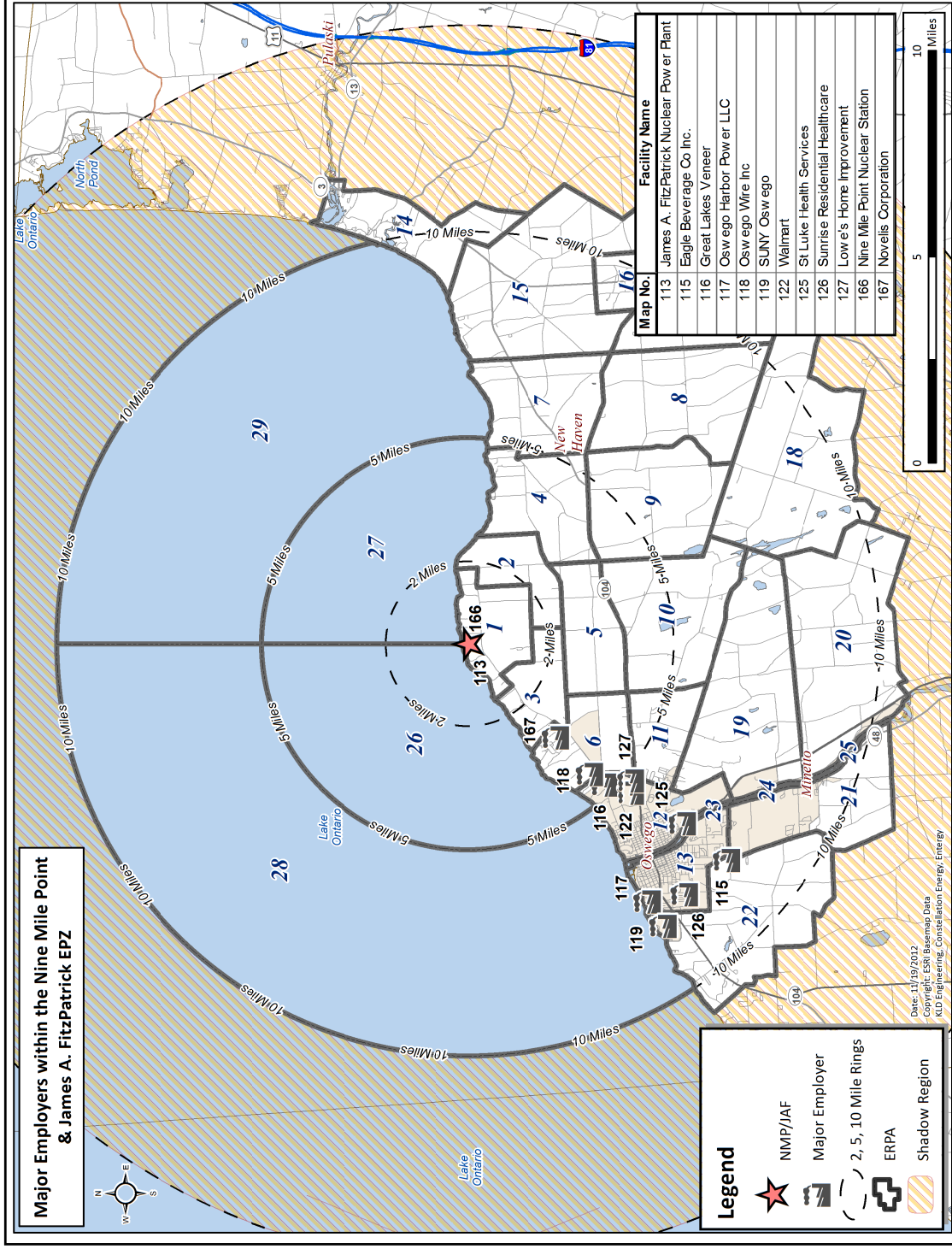


Figure E-4. Major Employers within the EPZ

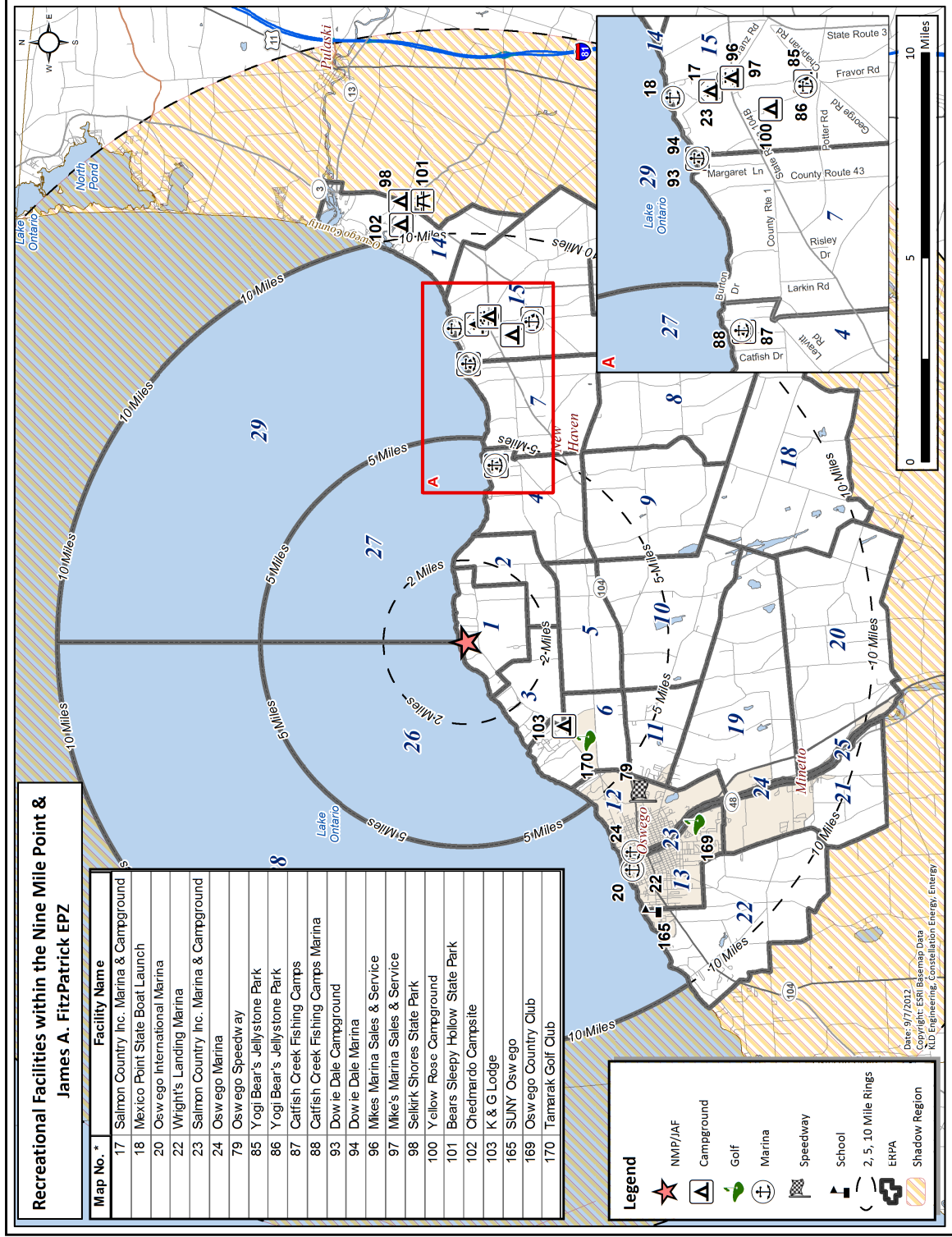


Figure E-5. Campgrounds, Recreational Facilities, and Commuter Schools within the EPZ

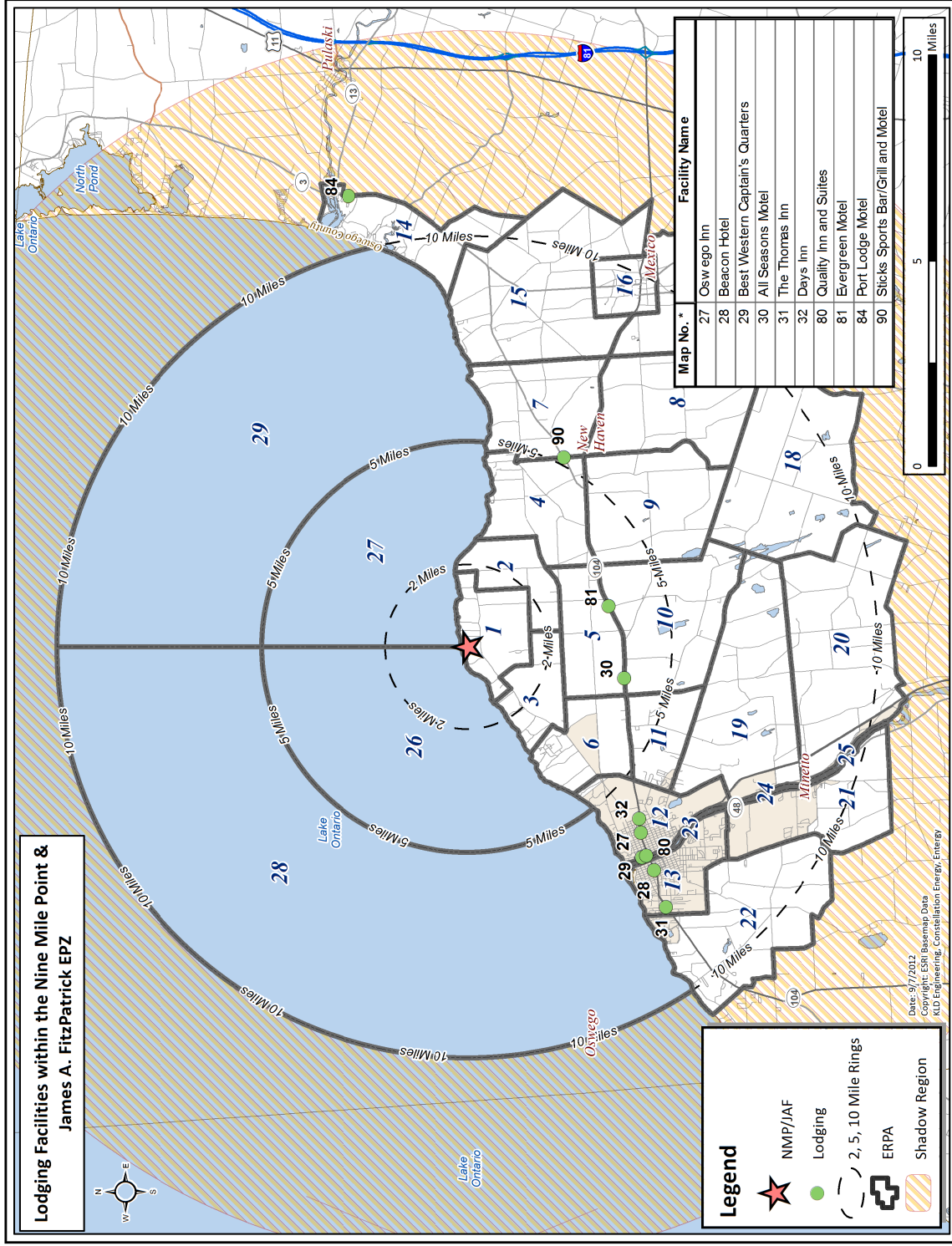


Figure E-6. Lodging Facilities within the EPZ

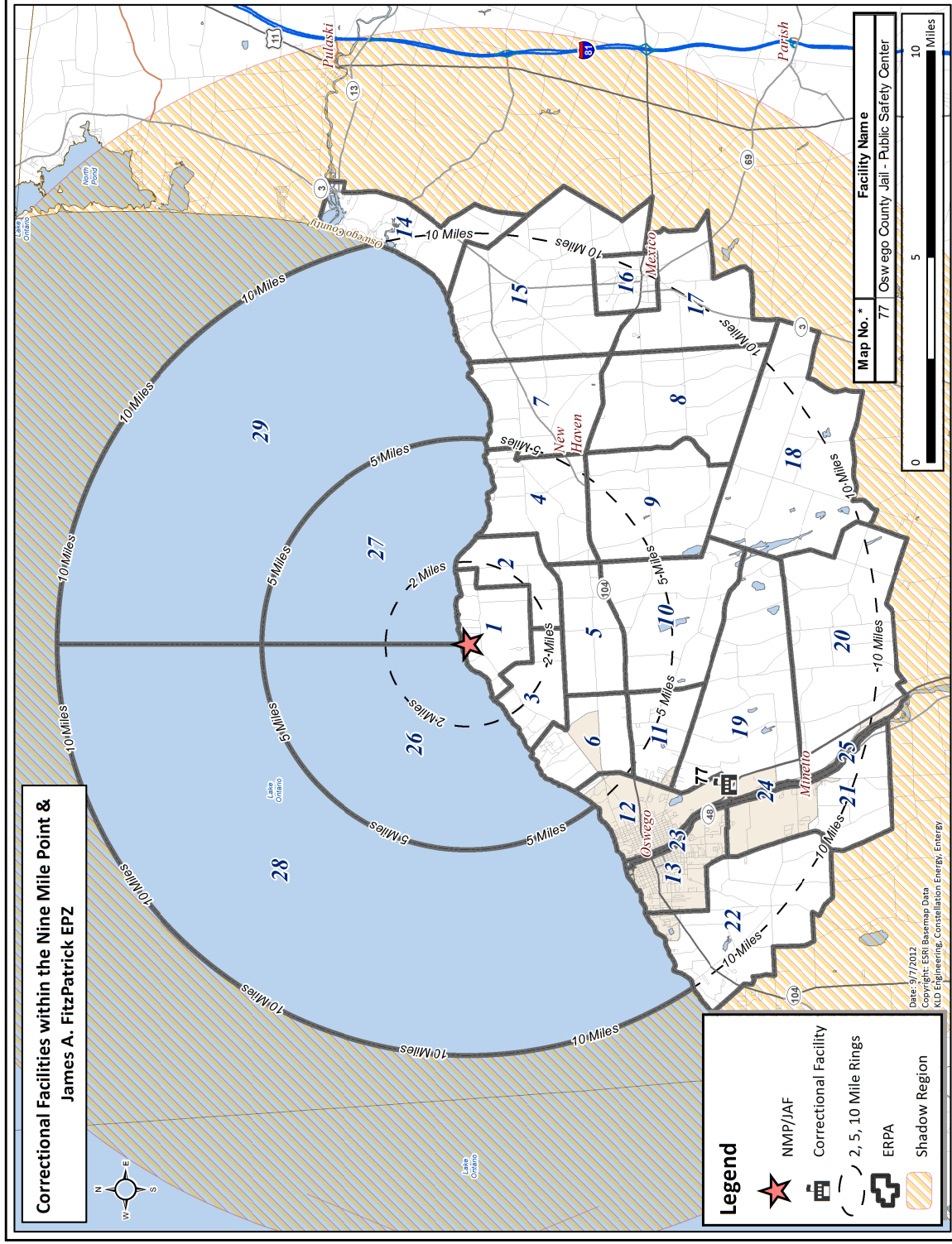


Figure E-7. Correctional Facilities within the EPZ

## **APPENDIX F**

### Telephone Survey

## F. TELEPHONE SURVEY

### F.1 Introduction

The development of evacuation time estimates for the NMP/JAF EPZ 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 telephone 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. 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. A sample size of approximately 500 **completed** survey forms yields 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 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.

The completed survey adhered to the sampling plan.

**Table F-1. NMP/JAF Telephone Survey Sampling Plan**

<b>Zip Code</b>	<b>Population within EPZ (2010)</b>	<b>Households</b>	<b>Required Sample</b>
<b>13036</b>	<b>84</b>	<b>36</b>	<b>1</b>
<b>13069</b>	<b>1,640</b>	<b>621</b>	<b>20</b>
<b>13114</b>	<b>5,465</b>	<b>2,096</b>	<b>68</b>
<b>13126</b>	<b>34,515</b>	<b>12,620</b>	<b>408</b>
<b>13142</b>	<b>183</b>	<b>78</b>	<b>3</b>
<b>Average Household Size:</b>			<b>2.52</b>
<b>Total Sample Required:</b>			<b>500</b>

### 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 “don’t know” (DK) or “refused” entry for a response. It is accepted practice in conducting surveys of this type to accept the answers of a respondent who offers a DK response for a few questions or who refuses to answer a few questions. To address the issue of occasional DK/refused 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 DK/refused 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. The average household contains 2.39 people. The estimated household size (2.52 persons) used to determine the survey sample (Table F-1) was drawn from Census data. The close agreement between the average household size obtained from the survey and from the Census is an indication of the reliability of the survey.

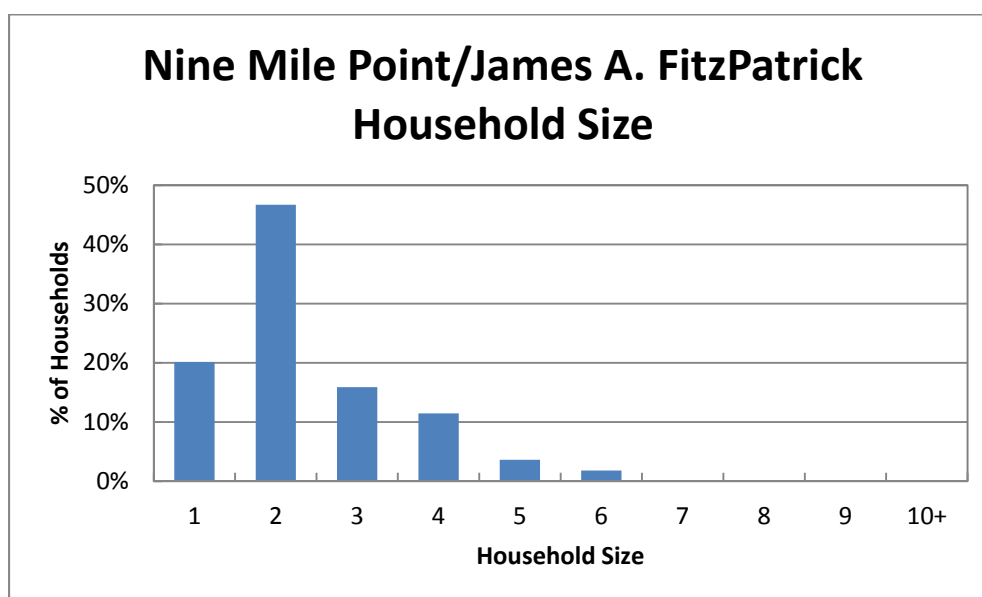


Figure F-1. Household Size in the EPZ

### Automobile Ownership

The average number of automobiles available per household in the EPZ is 1.81. It should be noted that approximately 6.6 percent of households do not have access to an automobile. 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. Note that the majority of households without access to a car are single person households. As expected, nearly all households of 2 or more people have access to at least one vehicle.

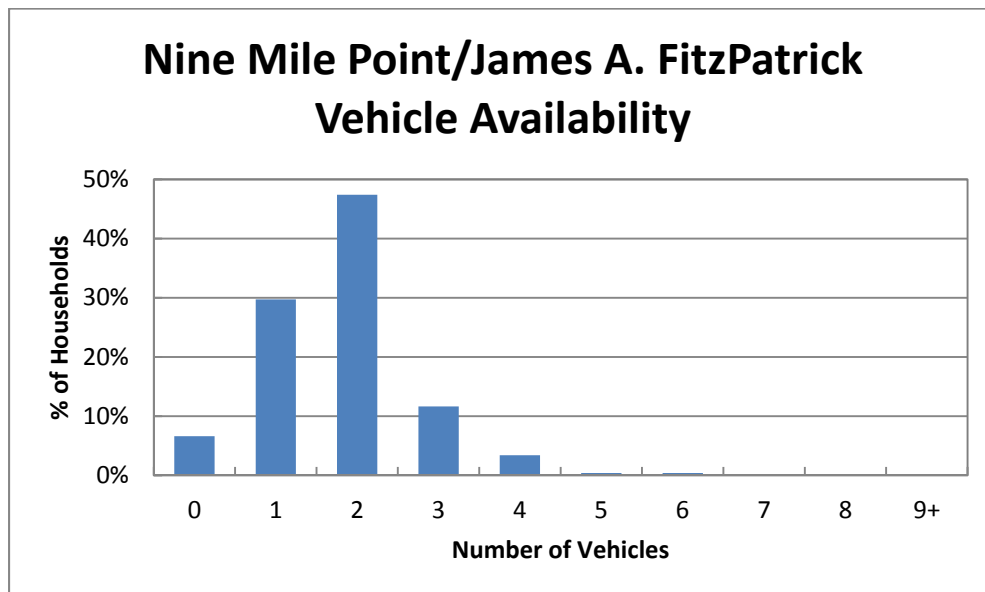


Figure F-2. Household Vehicle Availability

## Distribution of Vehicles by HH Size 1-5 Person Households

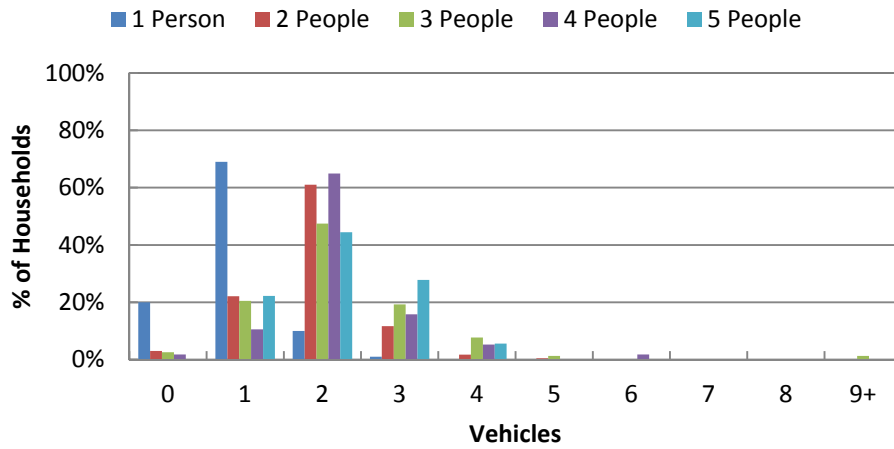


Figure F-3. Vehicle Availability - 1 to 5 Person Households

## Distribution of Vehicles by HH Size 6-9+ Person Households

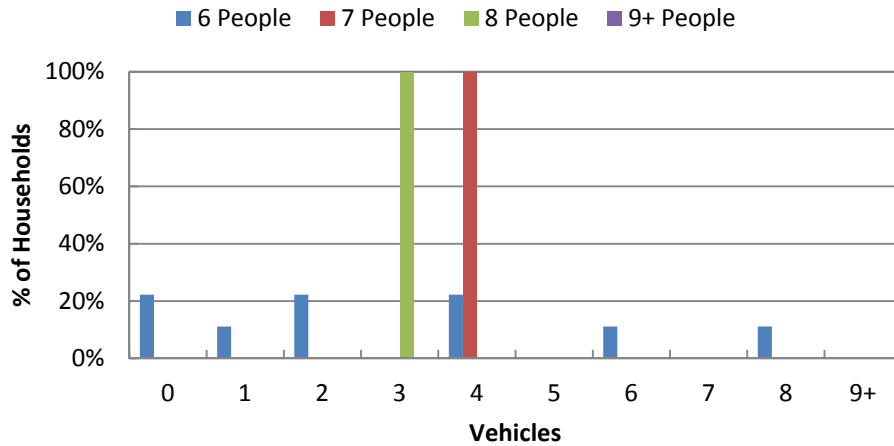
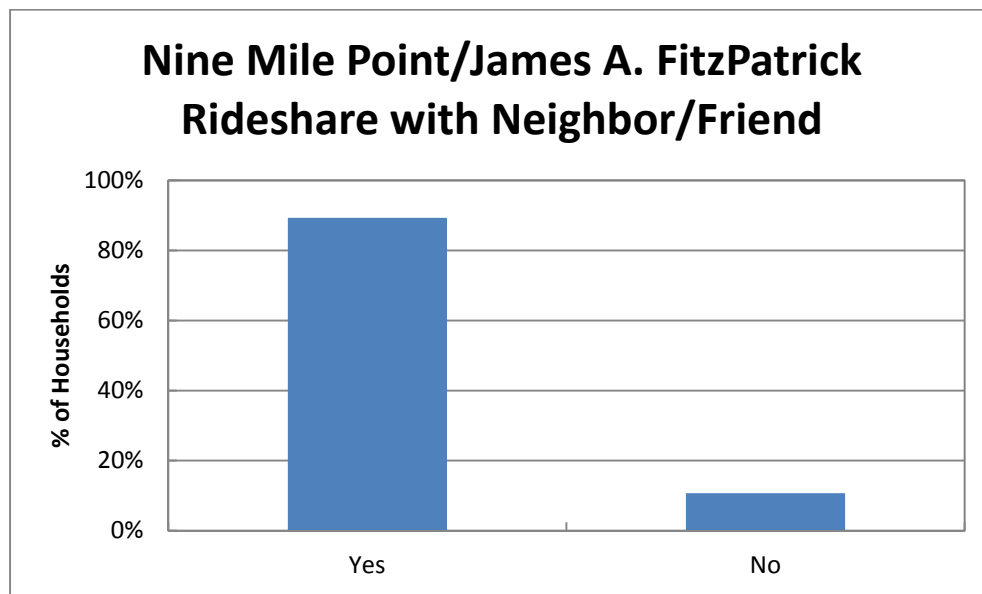


Figure F-4. Vehicle Availability - 6 to 9+ Person Households

## Ridesharing

89% of the households surveyed who do not own a vehicle 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. Note, however, that only those households with no access to a vehicle were asked this question and only 28 total responses were gathered out of the sample size of 500. Thus, the results are not statistically significant. As such, the NRC recommendation of 50% ridesharing is used throughout this study. Figure F-5 presents this response.



**Figure F-5. Household Ridesharing Preference**

## 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 0.98 commuters in each household in the EPZ, and 56% of households have at least one commuter.

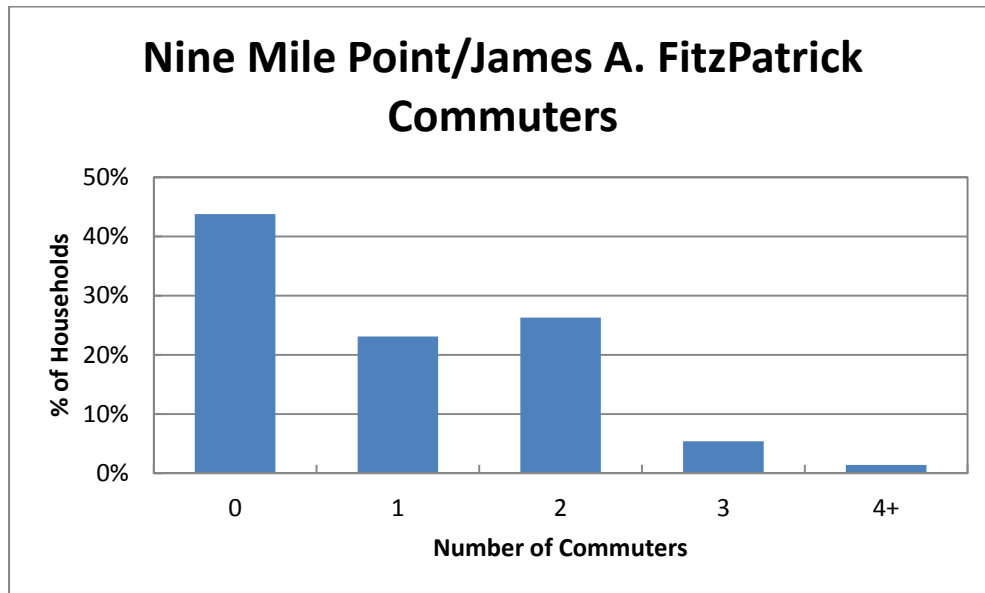


Figure F-6. Commuters in Households in the EPZ

## 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 1.09 employees per vehicle, assuming 2 people per vehicle – on average – for carpools.

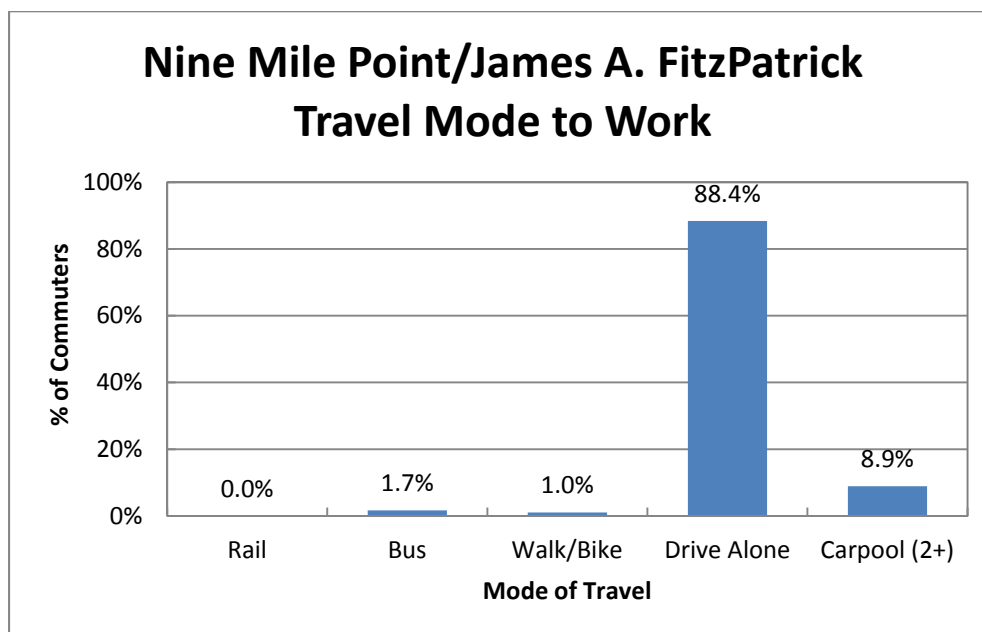


Figure F-7. Modes of Travel in the EPZ

### 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-8. On average, evacuating households would use 1.24 vehicles.

***"Would your family await the return of other family members prior to evacuating the area?"*** Of the survey participants who responded, 45 percent said they would await the return of other family members before evacuating and 55 percent indicated that they would not await the return of other family members.

***"If you had a household pet, would you take your pet with you if you were asked to evacuate the area?"*** Based on the responses to the survey, 78 percent of households have a family pet. Of the households with pets, 94 percent of them indicated that they would take their pets with them, as shown in Figure F-9.

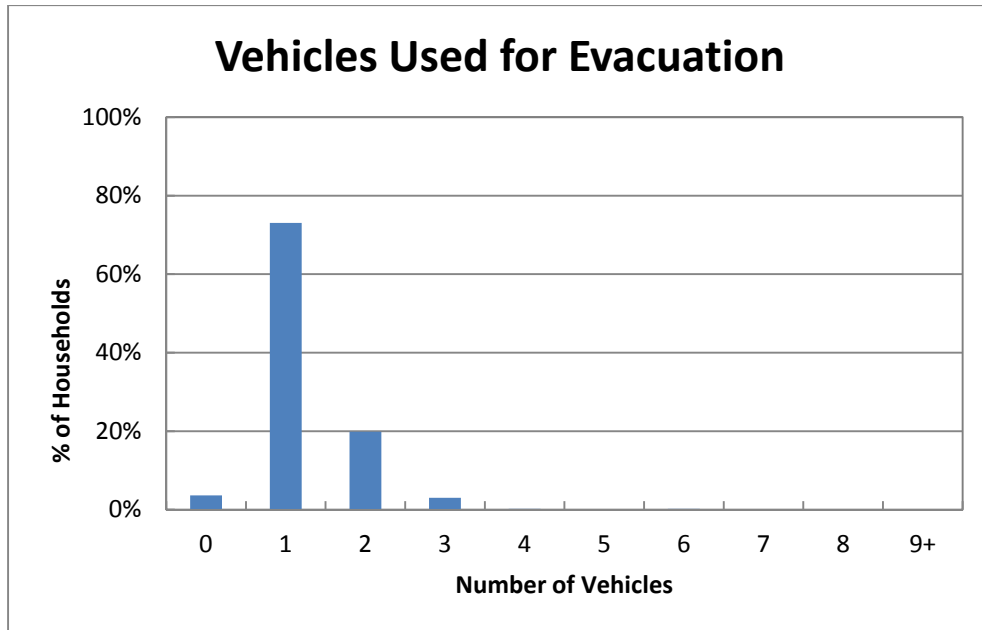


Figure F-8. Number of Vehicles Used for Evacuation

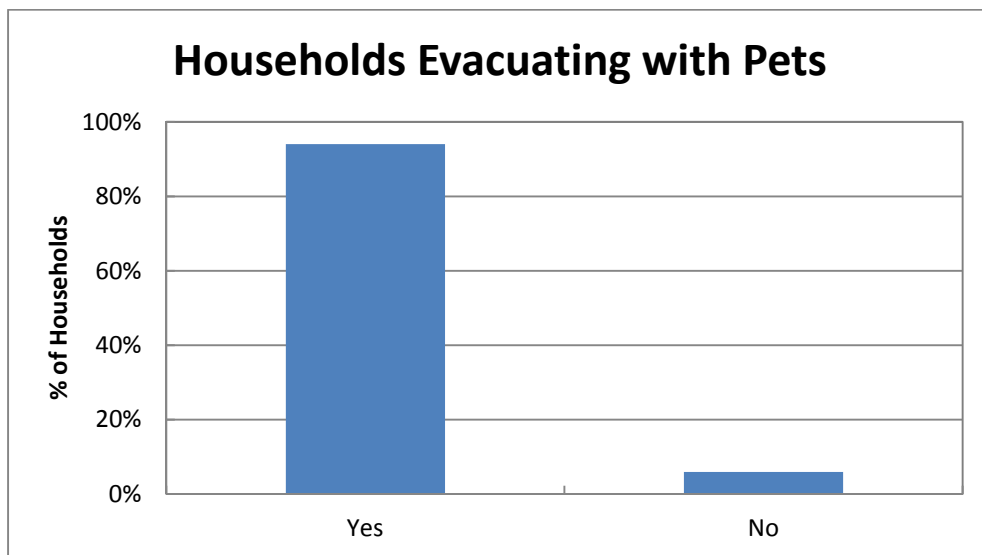


Figure F-9. Households Evacuating with Pets

***“Emergency officials advise you to take shelter at home in an emergency. Would you?”*** This question is designed to elicit information regarding compliance with instructions to shelter in place. The results indicate that 79 percent of households who are advised to shelter in place would do so; the remaining 21 percent would choose to evacuate the area. Note the baseline ETE study assumes 20 percent of households will not comply with the shelter advisory, as per Section 2.5.2 of NUREG/CR-7002. Thus, the data obtained above is in good agreement with the federal guidance.

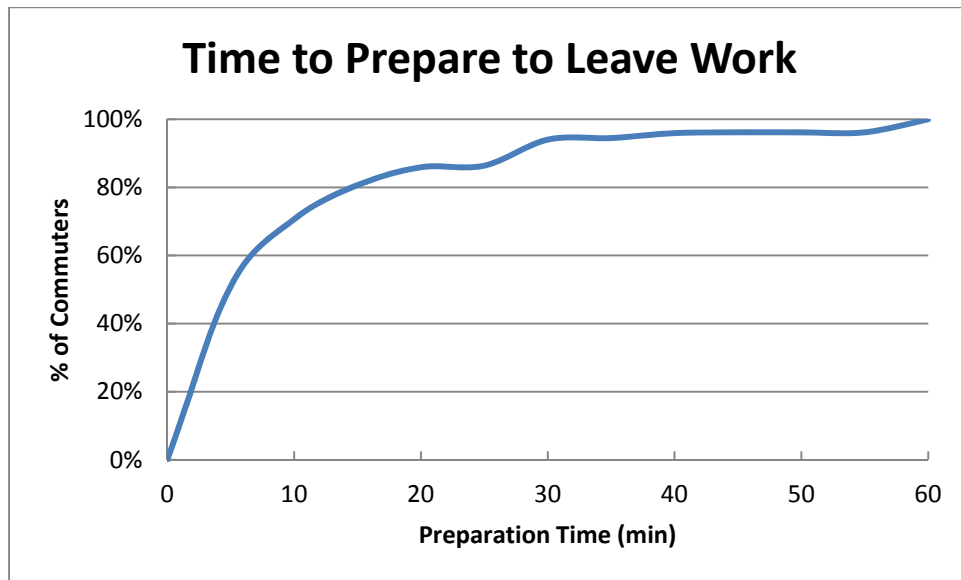
***“Emergency officials advise you to take shelter at home now in an emergency and possibly evacuate later while people in other areas are advised to evacuate now. Would you?”*** This question is designed to elicit information specifically related to the possibility of a staged evacuation. That is, asking a population to shelter in place now and then to evacuate after a specified period of time. Results indicate that 70 percent of households would follow instructions and delay the start of evacuation until so advised, while the balance of 30 percent would choose to begin evacuating immediately.

### 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.

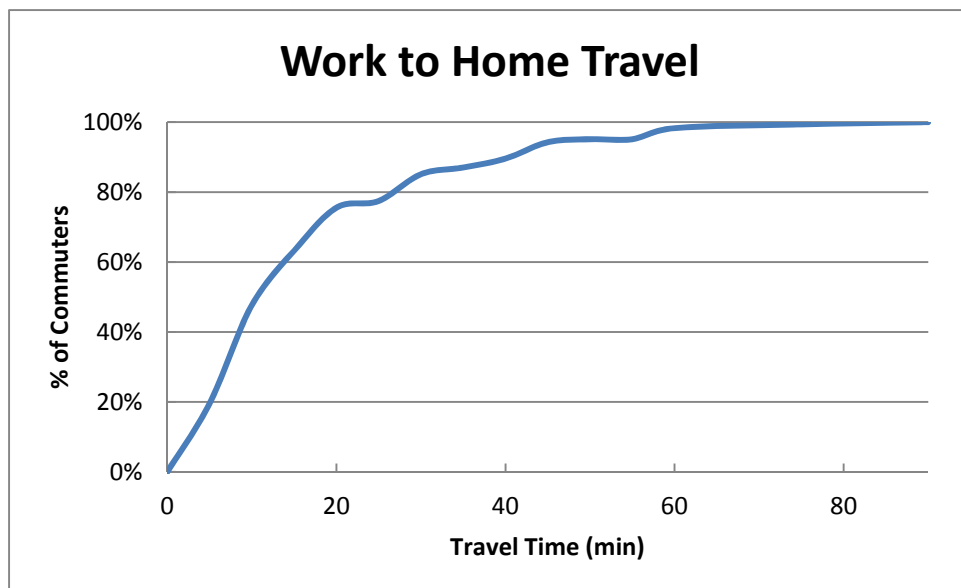
The mobilization distributions provided below are the result of having applied the analysis described in Section 5.4.1 on the component activities of the mobilization.

***“How long does it take the commuter to complete preparation for leaving work?”*** Figure F-10 presents the cumulative distribution; in all cases, the activity is completed by about 60 minutes. 85 percent can leave within 20 minutes.



**Figure F-10. Time Required to Prepare to Leave Work/School**

***“How long would it take the commuter to travel home?”*** Figure F-11 presents the work to home travel time for the EPZ. About 90 percent of commuters can arrive home within about 40 minutes of leaving work; all within 90 minutes.

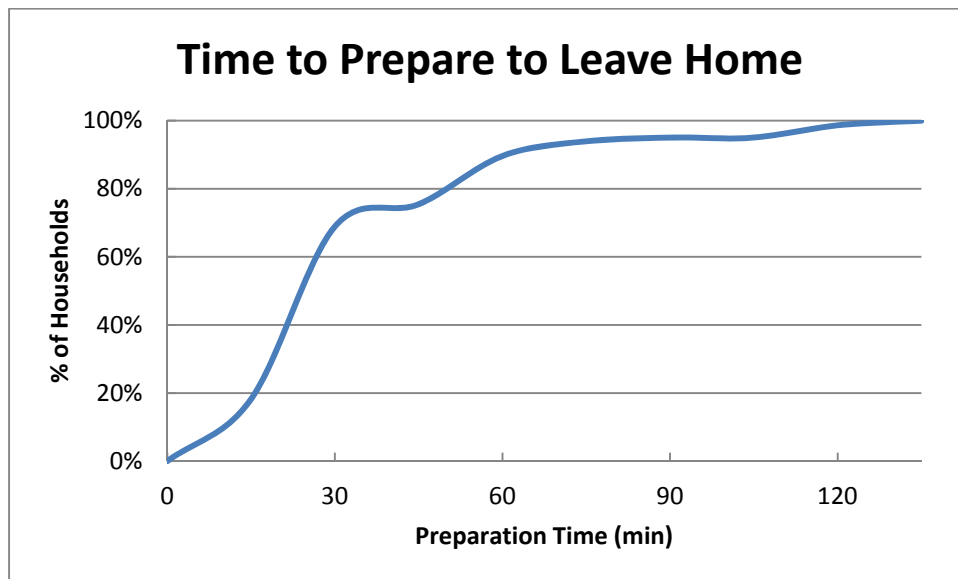


**Figure F-11. Work to Home Travel Time**

***“How long would it take the family to pack clothing, secure the house, and load the car?”***

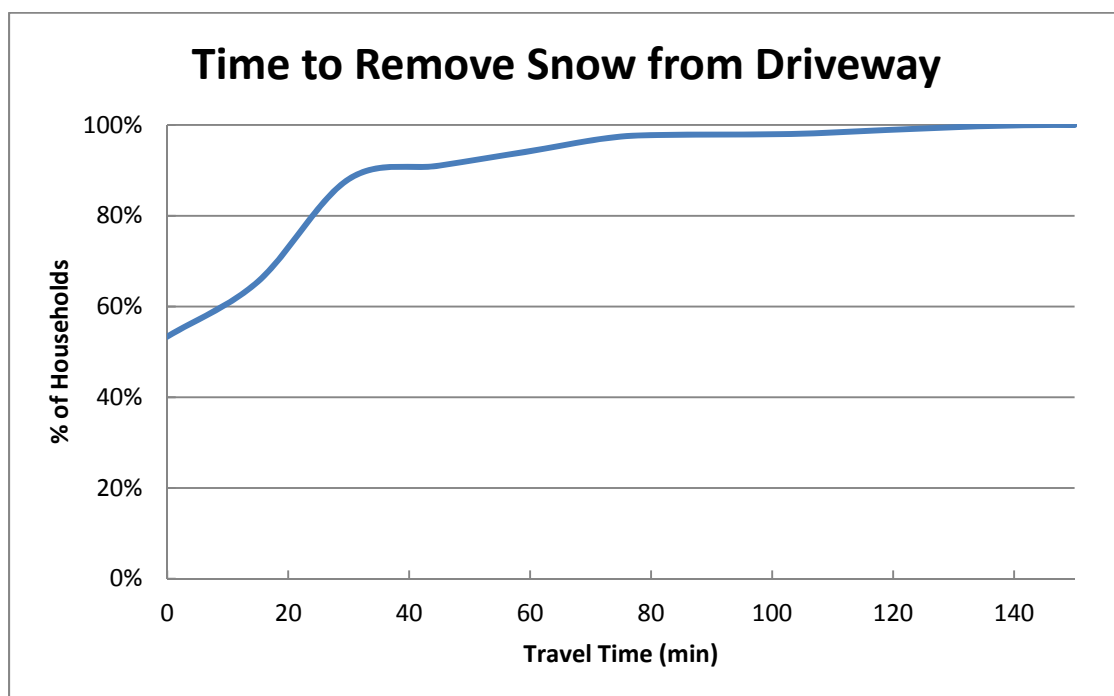
Figure F-12 presents the time required to prepare for leaving on an evacuation trip. In many ways this activity mimics a family’s preparation for a short holiday or weekend away from home. Hence, the responses represent the experience of the responder in performing similar activities.

The distribution shown in Figure F-12 has a long “tail.” About 90 percent of households can be ready to leave home within 60 minutes; the remaining households require up to an additional 75 minutes.



**Figure F-12. Time to Prepare Home for Evacuation**

***"How long would it take you to clear 6 to 8 inches of snow from your driveway?"*** 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. Figure F-13 presents the time distribution for removing 6 to 8 inches of snow from a driveway. The time distribution for clearing the driveway has a long tail; about 90 percent of driveways are passable within 45 minutes. The last driveway is cleared 150 minutes after the start of this activity. Note that those respondents (53%) 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.



**Figure F-13. Time to Clear Driveway of 6"-8" of Snow**

#### **F.4 Conclusions**

The telephone survey provides valuable, relevant data associated with the EPZ population, which have been used to quantify demographics specific to the EPZ, and "mobilization time" which can influence evacuation time estimates.

## ATTACHMENT A

### Telephone Survey Instrument

## Telephone Survey Instrument

Hello, my name is \_\_\_\_\_ and I'm working on a survey for your county emergency management agency to identify local behavior during emergency situations. This information will be used for emergency planning and will be shared with local officials to enhance emergency response plans in your area for all hazards; emergency planning for some hazards may require evacuation. Your responses will greatly contribute to local emergency preparedness. I will not ask for your name or any personal information, and the survey will take less than 10 minutes to complete.

COL. 1 Unused  
COL. 2 Unused  
COL. 3 Unused  
COL. 4 Unused  
COL. 5 Unused  
Sex COL. 8  
 1 Male  
 2 Female

INTERVIEWER: ASK TO SPEAK TO THE HEAD OF HOUSEHOLD OR THE SPOUSE OF THE HEAD OF HOUSEHOLD.  
 (Terminate call if not a residence.)

DO NOT ASK:

1A.	Record area code. To Be Determined	<u>COL. 9-11</u>
1B.	Record exchange number. To Be Determined	<u>COL. 12-14</u>
2.	What is your home zip code?	<u>COL. 15-19</u>
3A.	In total, how many running cars, or other vehicles are usually available to the household? (DO NOT READ ANSWERS)	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%; text-align: center;"> <u>COL. 20</u>            1 ONE            2 TWO            3 THREE            4 FOUR            5 FIVE            6 SIX            7 SEVEN            8 EIGHT            9 NINE OR MORE            0 ZERO (NONE)            X DON'T KNOW/REFUSED         </div> <div style="width: 45%; text-align: center;"> <u>SKIP TO</u>            Q. 4            Q. 4            Q. 4            Q. 4            Q. 4            Q. 4            Q. 4            Q. 4            Q. 4            Q. 3B            Q. 3B         </div> </div>
3B.	In an emergency, could you get a ride out of the area with a neighbor or friend?	<u>COL. 21</u> 1 YES 2 NO X DON'T KNOW/REFUSED
4.	How many people usually live in this household? (DO NOT READ ANSWERS)	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%; text-align: center;"> <u>COL. 22</u>            1 ONE            2 TWO            3 THREE            4 FOUR            5 FIVE            6 SIX         </div> <div style="width: 45%; text-align: center;"> <u>COL. 23</u>            0 TEN            1 ELEVEN            2 TWELVE            3 THIRTEEN            4 FOURTEEN            5 FIFTEEN         </div> </div>

	7 SEVEN	6 SIXTEEN
	8 EIGHT	7 SEVENTEEN
	9 NINE	8 EIGHTEEN
		9 NINETEEN OR MORE
		X DON'T KNOW/REFUSED
5. How many drivers in the household commute to a job, or to college on a daily basis?	<u>COL. 24</u>	<u>SKIP TO</u>
	0 ZERO	Q. 9
	1 ONE	Q. 6
	2 TWO	Q. 6
	3 THREE	Q. 6
	4 FOUR OR MORE	Q. 6
	5 DON'T KNOW/REFUSED	Q. 9

INTERVIEWER: For each person identified in Question 5, ask Questions 6, 7, and 8.

6. Thinking about commuter #1, how does that person usually travel to work or college? (REPEAT QUESTION FOR EACH COMMUTER)

	Commuter #1	Commuter #2	Commuter #3	Commuter #4
	<u>COL. 25</u>	<u>COL. 26</u>	<u>COL. 27</u>	<u>COL. 28</u>
Rail	1	1	1	1
Bus	2	2	2	2
Walk/Bicycle	3	3	3	3
Drive Alone	4	4	4	4
Carpool-2 or more people	5	5	5	5
Don't know/Refused	6	6	6	6

7. How much time on average, would it take Commuter #1 to travel home from work or college? (REPEAT QUESTION FOR EACH COMMUTER) (DO NOT READ ANSWERS)

<u>COMMUTER #1</u>		<u>COMMUTER #2</u>	
<u>COL. 29</u>	<u>COL. 30</u>	<u>COL. 31</u>	<u>COL. 32</u>
1 5 MINUTES OR LESS	1 46-50 MINUTES	1 5 MINUTES OR LESS	1 46-50 MINUTES
2 6-10 MINUTES	2 51-55 MINUTES	2 6-10 MINUTES	2 51-55 MINUTES
3 11-15 MINUTES	3 56 – 1 HOUR	3 11-15 MINUTES	3 56 – 1 HOUR
4 16-20 MINUTES	4 OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES	4 16-20 MINUTES	4 OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
5 21-25 MINUTES	5 BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES	5 21-25 MINUTES	5 BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
6 26-30 MINUTES	6 BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES	6 26-30 MINUTES	6 BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES

7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS	7	31-35 MINUTES	7	BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)	8	36-40 MINUTES	8	OVER 2 HOURS (SPECIFY _____)
9	41-45 MINUTES	9		9	41-45 MINUTES	9	
		0				0	
		X	DON'T KNOW /REFUSED			X	DON'T KNOW /REFUSED

<u>COMMUTER #3</u>		<u>COMMUTER #4</u>	
<u>COL. 33</u>	<u>COL. 34</u>	<u>COL. 35</u>	<u>COL. 36</u>
1 5 MINUTES OR LESS	1 46-50 MINUTES	1 5 MINUTES OR LESS	1 46-50 MINUTES
2 6-10 MINUTES	2 51-55 MINUTES	2 6-10 MINUTES	2 51-55 MINUTES
3 11-15 MINUTES	3 56 – 1 HOUR	3 11-15 MINUTES	3 56 – 1 HOUR
4 16-20 MINUTES	4 OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES	4 16-20 MINUTES	4 OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
5 21-25 MINUTES	5 BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES	5 21-25 MINUTES	5 BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
6 26-30 MINUTES	6 BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES	6 26-30 MINUTES	6 BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
7 31-35 MINUTES	7 BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS	7 31-35 MINUTES	7 BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
8 36-40 MINUTES	8 OVER 2 HOURS (SPECIFY _____)	8 36-40 MINUTES	8 OVER 2 HOURS (SPECIFY _____)
9 41-45 MINUTES	9	9 41-45 MINUTES	9
	0		0
	X DON'T KNOW /REFUSED		X DON'T KNOW /REFUSED

8. Approximately how much time does it take Commuter #1 to complete preparation for leaving work or college prior to starting the trip home? (REPEAT QUESTION FOR EACH COMMUTER) (DO NOT READ ANSWERS)

<u>COMMUTER #1</u>		<u>COMMUTER #2</u>	
<u>COL. 37</u>	<u>COL. 38</u>	<u>COL. 39</u>	<u>COL. 40</u>
1 5 MINUTES OR LESS	1 46-50 MINUTES	1 5 MINUTES OR LESS	1 46-50 MINUTES
2 6-10 MINUTES	2 51-55 MINUTES	2 6-10 MINUTES	2 51-55 MINUTES
3 11-15 MINUTES	3 56 – 1 HOUR	3 11-15 MINUTES	3 56 – 1 HOUR
4 16-20 MINUTES	4 OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES	4 16-20 MINUTES	4 OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
5 21-25 MINUTES	5 BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES	5 21-25 MINUTES	5 BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
6 26-30 MINUTES	6 BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES	6 26-30 MINUTES	6 BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
7 31-35 MINUTES	7 BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS	7 31-35 MINUTES	7 BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
8 36-40 MINUTES	8 OVER 2 HOURS (SPECIFY _____)	8 36-40 MINUTES	8 OVER 2 HOURS (SPECIFY _____)
9 41-45 MINUTES	9	9 41-45 MINUTES	9
	0		0

X DON'T KNOW /REFUSED

X DON'T KNOW /REFUSED

<u>COMMUTER #3</u>		<u>COMMUTER #4</u>	
<u>COL. 41</u>	<u>COL. 42</u>	<u>COL. 43</u>	<u>COL. 44</u>
1 5 MINUTES OR LESS	1 46-50 MINUTES	1 5 MINUTES OR LESS	1 46-50 MINUTES
2 6-10 MINUTES	2 51-55 MINUTES	2 6-10 MINUTES	2 51-55 MINUTES
3 11-15 MINUTES	3 56 – 1 HOUR	3 11-15 MINUTES	3 56 – 1 HOUR
4 16-20 MINUTES	4 OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES	4 16-20 MINUTES	4 OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
5 21-25 MINUTES	5 BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES	5 21-25 MINUTES	5 BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
6 26-30 MINUTES	6 BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES	6 26-30 MINUTES	6 BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
7 31-35 MINUTES	7 BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS	7 31-35 MINUTES	7 BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
8 36-40 MINUTES	8 OVER 2 HOURS (SPECIFY _____)	8 36-40 MINUTES	8 OVER 2 HOURS (SPECIFY _____)
9 41-45 MINUTES	9	9 41-45 MINUTES	9
	0		0
	X DON'T KNOW /REFUSED		X DON'T KNOW /REFUSED

9. If you were advised by local authorities to evacuate, how much time would it take the household to pack clothing, medications, secure the house, load the car, and complete preparations prior to evacuating the area? (DO NOT READ ANSWERS)

<u>COL. 45</u>	<u>COL. 46</u>
1 LESS THAN 15 MINUTES	1 3 HOURS TO 3 HOURS 15 MINUTES
2 15-30 MINUTES	2 3 HOURS 16 MINUTES TO 3 HOURS 30 MINUTES
3 31-45 MINUTES	3 3 HOURS 31 MINUTES TO 3 HOURS 45 MINUTES
4 46 MINUTES – 1 HOUR	4 3 HOURS 46 MINUTES TO 4 HOURS
5 1 HOUR TO 1 HOUR 15 MINUTES	5 4 HOURS TO 4 HOURS 15 MINUTES
6 1 HOUR 16 MINUTES TO 1 HOUR 30 MINUTES	6 4 HOURS 16 MINUTES TO 4 HOURS 30 MINUTES
7 1 HOUR 31 MINUTES TO 1 HOUR 45 MINUTES	7 4 HOURS 31 MINUTES TO 4 HOURS 45 MINUTES
8 1 HOUR 46 MINUTES TO 2 HOURS	8 4 HOURS 46 MINUTES TO 5 HOURS
9 2 HOURS TO 2 HOURS 15 MINUTES	9 5 HOURS TO 5 HOURS 30 MINUTES
0 2 HOURS 16 MINUTES TO 2 HOURS 30 MINUTES	0 5 HOURS 31 MINUTES TO 6 HOURS
X 2 HOURS 31 MINUTES TO 2 HOURS 45 MINUTES	X OVER 6 HOURS (SPECIFY _____)
Y 2 HOURS 46 MINUTES TO 3 HOURS	
Z WILL NOT EVACUATE ( <i>Optional response</i> )	<u>COL. 47</u>
	1 DON'T KNOW/REFUSED

- 
- 10 If there is 6-8" of snow on your driveway or curb, would you need to shovel out to evacuate? If yes, how much time, on average, would it take you to clear the 6-8" of snow to move the car from the driveway or curb to begin the evacuation trip? Assume the roads are passable. (DO NOT READ RESPONSES)

COL. 48

- 1 LESS THAN 15 MINUTES  
2 15-30 MINUTES  
3 31-45 MINUTES  
4 46 MINUTES – 1 HOUR  
5 1 HOUR TO 1 HOUR 15 MINUTES  
6 1 HOUR 16 MINUTES TO 1 HOUR 30 MINUTES  
7 1 HOUR 31 MINUTES TO 1 HOUR 45 MINUTES  
8 1 HOUR 46 MINUTES TO 2 HOURS  
9 2 HOURS TO 2 HOURS 15 MINUTES  
0 2 HOURS 16 MINUTES TO 2 HOURS 30 MINUTES  
X 2 HOURS 31 MINUTES TO 2 HOURS 45 MINUTES  
Y 2 HOURS 46 MINUTES TO 3 HOURS  
Z NO, WILL NOT SHOVEL OUT

COL. 49

- 1 OVER 3 HOURS (SPECIFY \_\_\_\_\_)  
2 DON'T KNOW/REFUSED

- 
11. Please choose one of the following (READ ANSWERS):

- A. I would await the return of household commuters to evacuate together.  
B. I would evacuate independently and meet other household members later.

COL. 50

- 1 A  
2 B  
X DON'T KNOW/REFUSED

- 
12. How many vehicles would your household use during an evacuation? (DO NOT READ ANSWERS)

COL. 51

- 1 ONE  
2 TWO  
3 THREE  
4 FOUR  
5 FIVE  
6 SIX  
7 SEVEN  
8 EIGHT  
9 NINE OR MORE  
0 ZERO (NONE)  
X DON'T KNOW/REFUSED
-

---

13A.	Emergency officials advise you to take shelter at home in an emergency. Would you: (READ ANSWERS)	<u>COL. 52</u>
	A. SHELTER; or	1    A
	B. EVACUATE	2    B
		X    DON'T KNOW/REFUSED

---

13B.	Emergency officials advise you to take shelter at home now in an emergency and possibly evacuate later while people in other areas are advised to evacuate now. Would you: (READ ANSWERS)	<u>COL. 53</u>
	A. SHELTER; or	1    A
	B. EVACUATE	2    B
		X    DON'T KNOW/REFUSED

---

14.	If you have a household pet, would you take your pet with you if you were asked to evacuate the area? (READ ANSWERS)	<u>COL. 54</u>
		1    DON'T HAVE A PET
		2    YES
		3    NO
		X    DON'T KNOW/REFUSED

---

Thank you very much. \_\_\_\_\_  
 (TELEPHONE NUMBER CALLED)

IF REQUESTED:

For additional information, contact your County Emergency Management Agency during normal business hours.

County	EMA Phone
Oswego	1-800-962-2792

## **APPENDIX G**

### Traffic Management Plan

## **G. TRAFFIC MANAGEMENT PLAN**

NUREG/CR-7002 indicates that the existing TCPs and ACPs identified by the offsite agencies should be used in the evacuation simulation modeling. The traffic and access control plans for the EPZ were provided by Oswego County.

These plans were reviewed and the TCPs were modeled accordingly.

### **G.1 Traffic Control Points**

As discussed in Section 9, traffic control points 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 traffic control point, the control type was changed to an actuated signal in the DYNEV II system. Table K-2 provides the control type and node number for those nodes which are controlled. If the existing control was changed due to the point being a Traffic Control Point, the control type is indicated as a “TCP” in Table K-2.

### **G.2 Access Control Points**

It is assumed that Access Control Points (ACPs), also known as TCPs to Prohibit EPZ Ingress, will be established within 2 hours of the advisory to evacuate to discourage through travelers from using major through routes which traverse the EPZ. As discussed in Section 3.7, external traffic was considered on the major through route which traverses the study area – I 81– in this analysis. In the simulation, the generation of the external trips on I 81 ceased at 2 hours after the advisory to evacuate due to the ACPs.

Figure G-1 maps the ACPs identified in the county emergency plans. These ACPs are concentrated on roadways giving access to the EPZ. These ACPs would be manned during evacuation by traffic guides who would direct evacuees in the proper direction away from NMP/JAF and facilitate the flow of traffic through the intersections.

This study did not identify any additional intersections that should be identified as TCPs or ACPs.

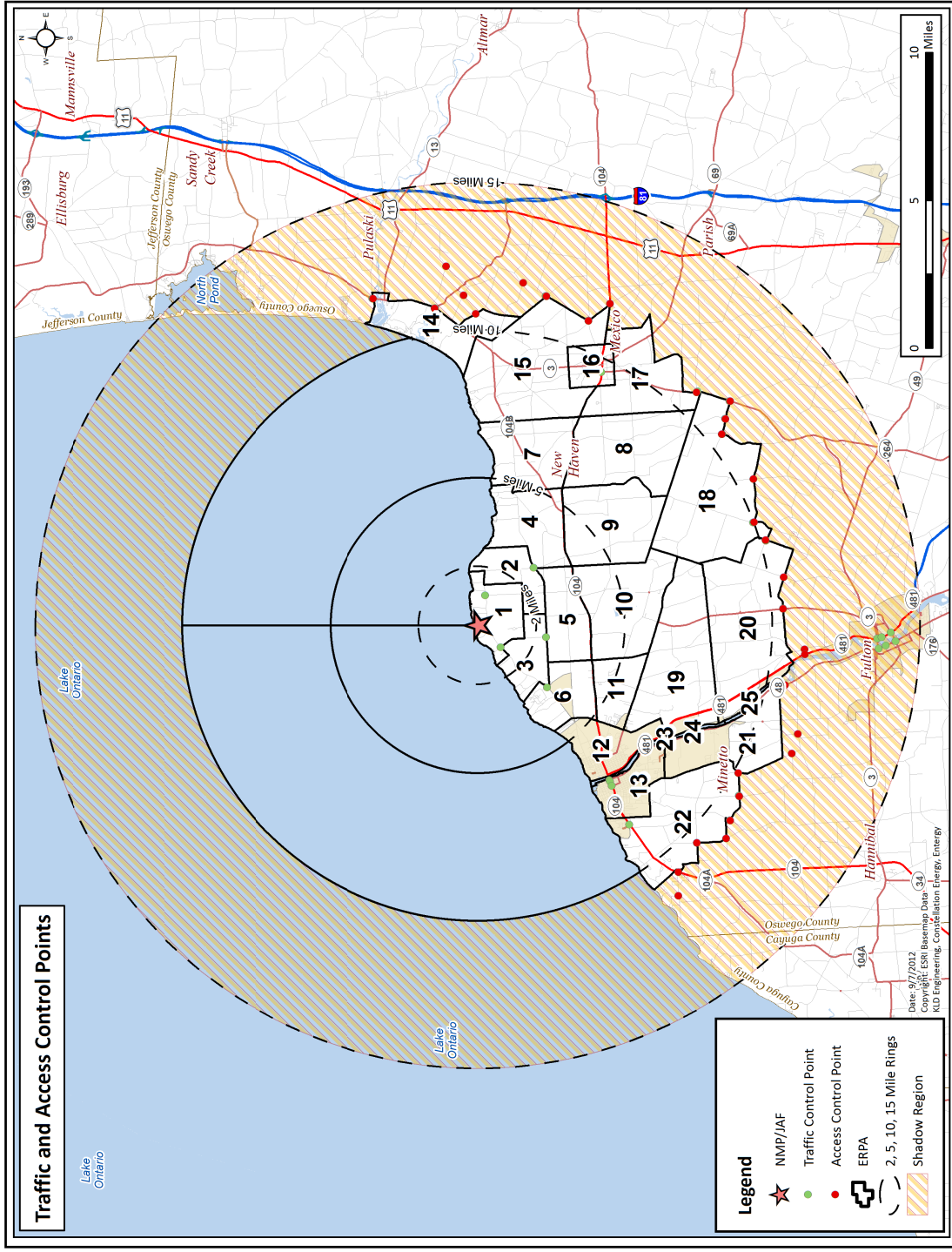


Figure G-1. Traffic and Access Control Points for Nine Mile Point/James a FitzPatrick

## H EVACUATION REGIONS

This appendix presents the evacuation percentages for each Evacuation Region (Table H-1) and maps of all Evacuation Regions. The percentages presented in Table H-1 are based on the methodology discussed in assumption 5 of Section 2.2 and shown in Figure 2-1.

Note the baseline ETE study assumes 20 percent of households will not comply with the shelter advisory, as per Section 2.5.2 of NUREG/CR-7002.

**Table H-1. Percent of Sub-Area Population Evacuating for Each Region**

[illegible]

Regions Specific to Nine Mile Point																																	
Evacuate 2-Mile Radius and Downwind to 5 Miles - Lake Breeze Adjusted (5 Mile Radius)																																	
Region	Wind Direction From*	ERP A																															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29			
N/A	115 to 222																																
N/A	223 to 240																																
N/A	241 to 262																																
N/A	263 to 278																																
N/A	279 to 311																																
R37	312 to 332	100%	100%	100%	100%	100%	100%	100%	20%	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R38	333 to 349	100%	100%	100%	100%	100%	100%	100%	20%	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%
N/A	350 to 356																																
R39	357 to 20	100%	100%	100%	100%	100%	100%	20%	20%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
N/A	21 to 51																																
N/A	52 to 61																																
R40	62 to 70	100%	100%	100%	20%	20%	100%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
N/A	71 to 89																																
R41	90 to 95	100%	100%	100%	20%	100%	100%	20%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R42	96 to 114	100%	100%	100%	20%	20%	100%	20%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 5 Miles																																	
Region	Wind Direction From*	ERP A																															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29			
N/A	96 to 233																																
R43	234 to 240	100%	100%	100%	20%	20%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R44	241 to 262	100%	100%	100%	100%	20%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R45	263 to 278	100%	100%	100%	100%	20%	20%	100%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R46	279 to 292	100%	100%	100%	100%	100%	100%	20%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R47	293 to 332	100%	100%	100%	100%	100%	100%	20%	20%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R48	333 to 349	100%	100%	100%	100%	100%	20%	20%	20%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R49	350 to 12	100%	100%	100%	20%	100%	100%	20%	20%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R50	13 to 51	100%	100%	100%	20%	100%	100%	20%	20%	20%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R51	52 to 61	100%	100%	100%	20%	100%	100%	20%	20%	20%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R52	62 to 70	100%	100%	100%	20%	20%	100%	20%	20%	20%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R53	71 to 95	100%	100%	100%	20%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
R54	5-Mile Region	100%	100%	100%	100%	100%	100%	100%	20%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	100%	100%	100%	20%	20%	
Shelter-in-Place until 90% ETE for R01, then Evacuate		Area(s) Shelter-in-Place													Area(s) Evacuate																		

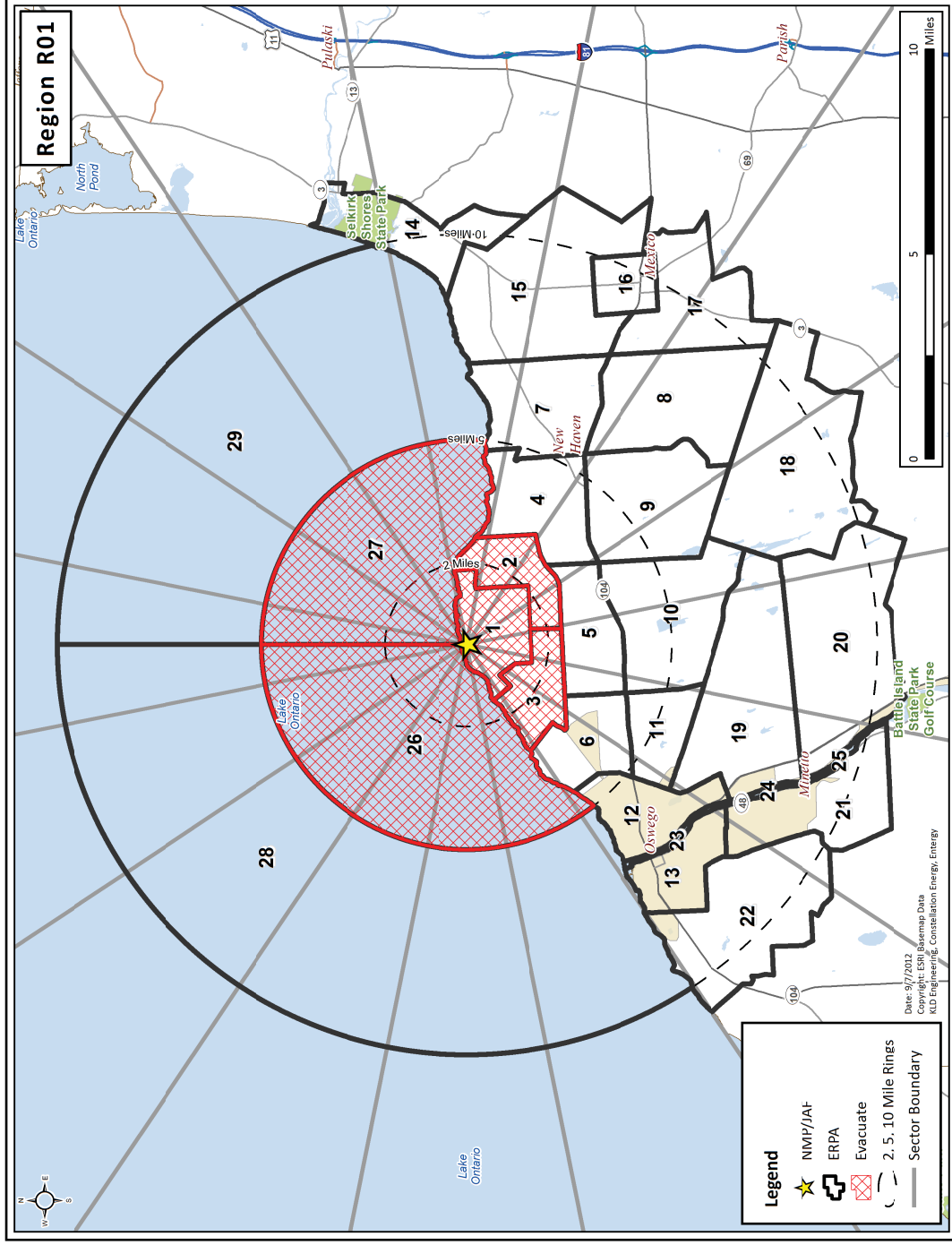


Figure H-1. Region R01

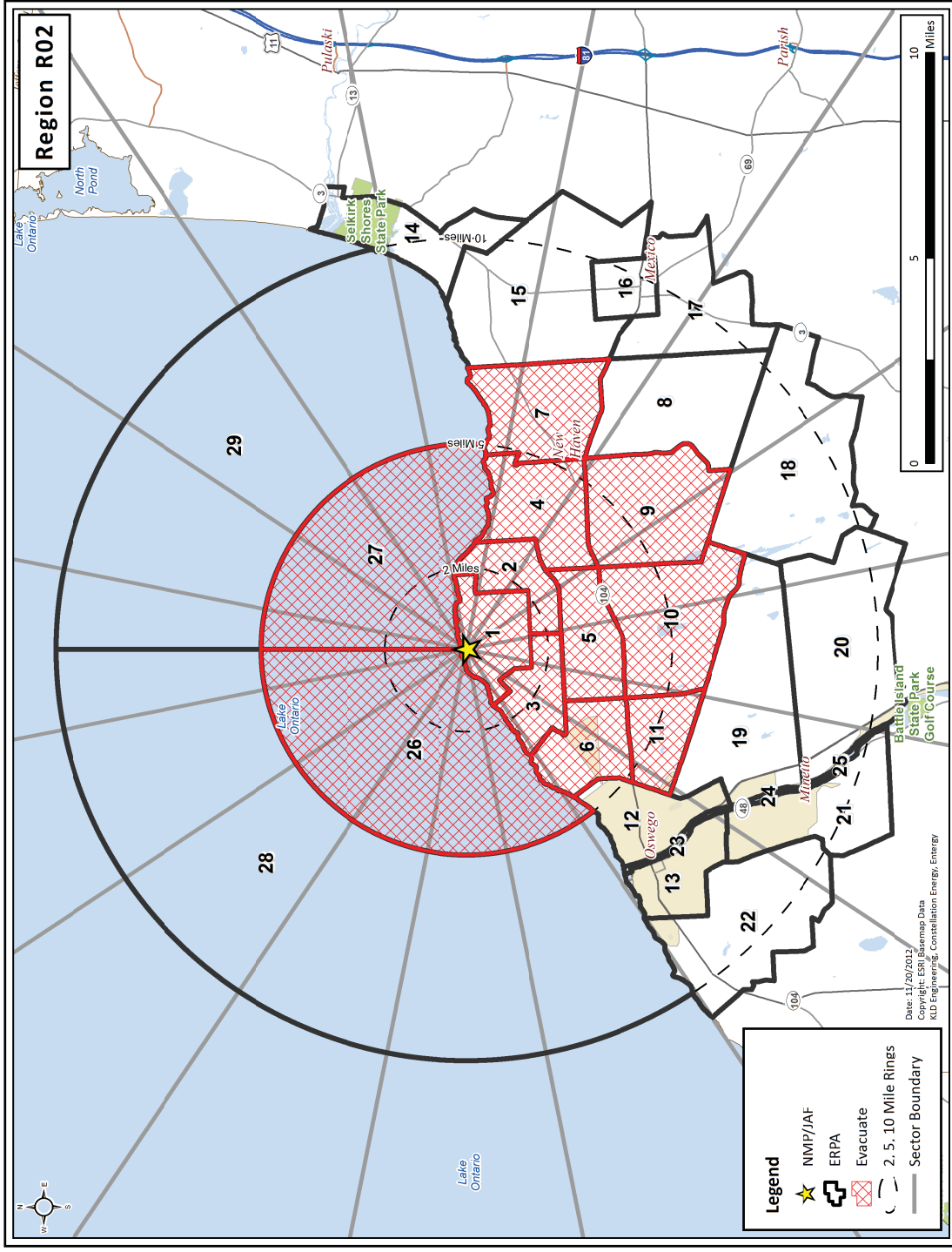


Figure H-2. Region R02

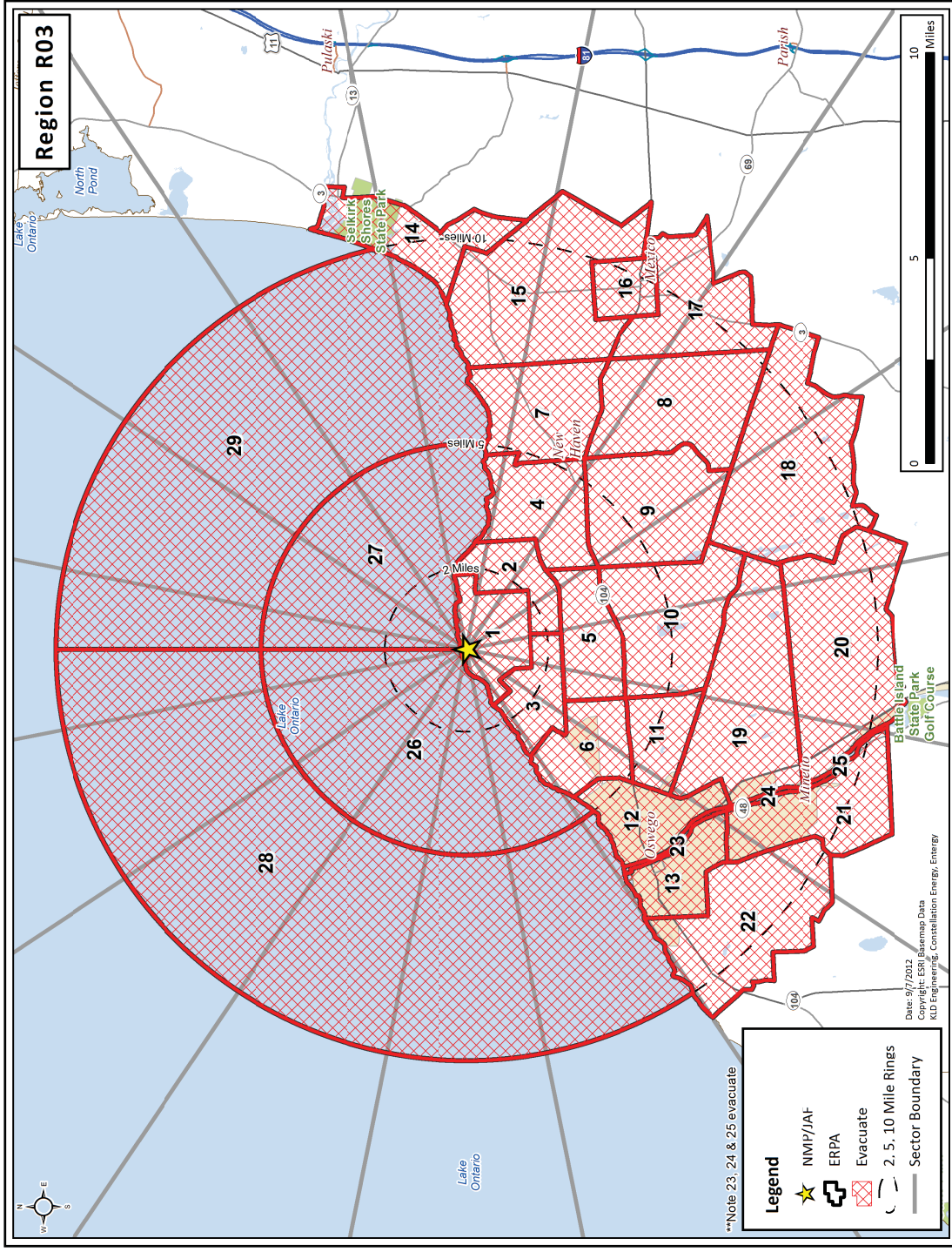


Figure H-3. Region R03

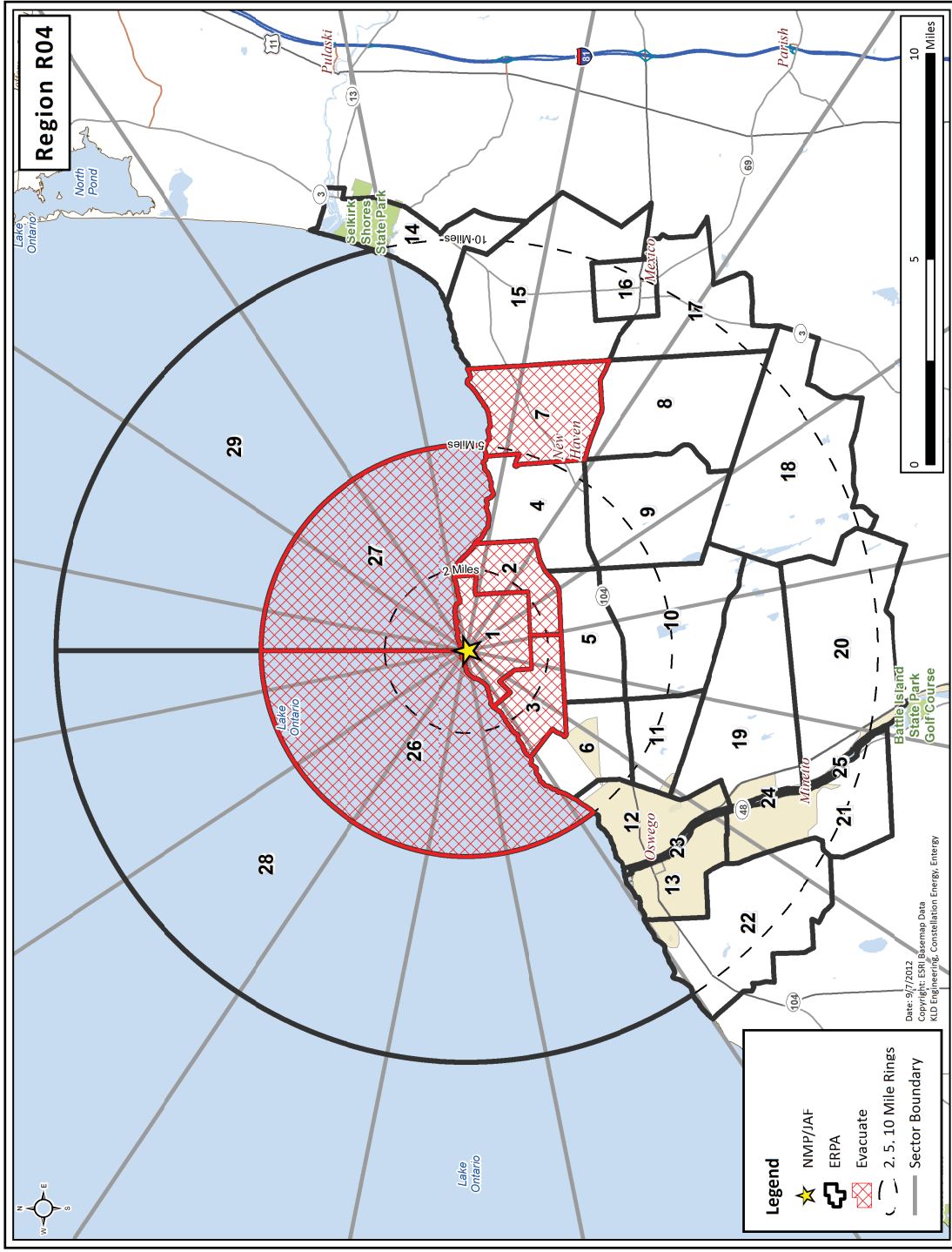


Figure H-4. Region R04

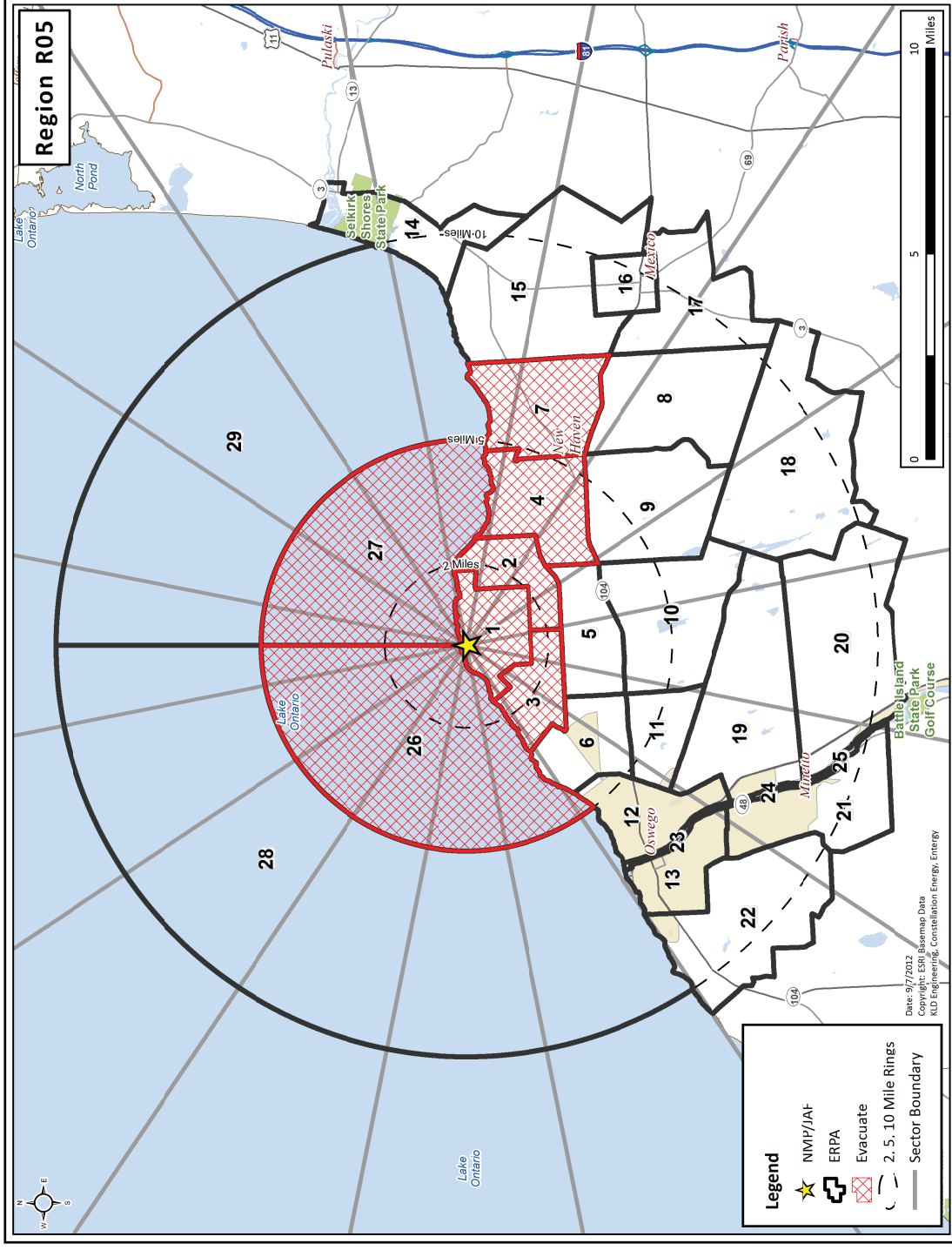


Figure H-5. Region R05

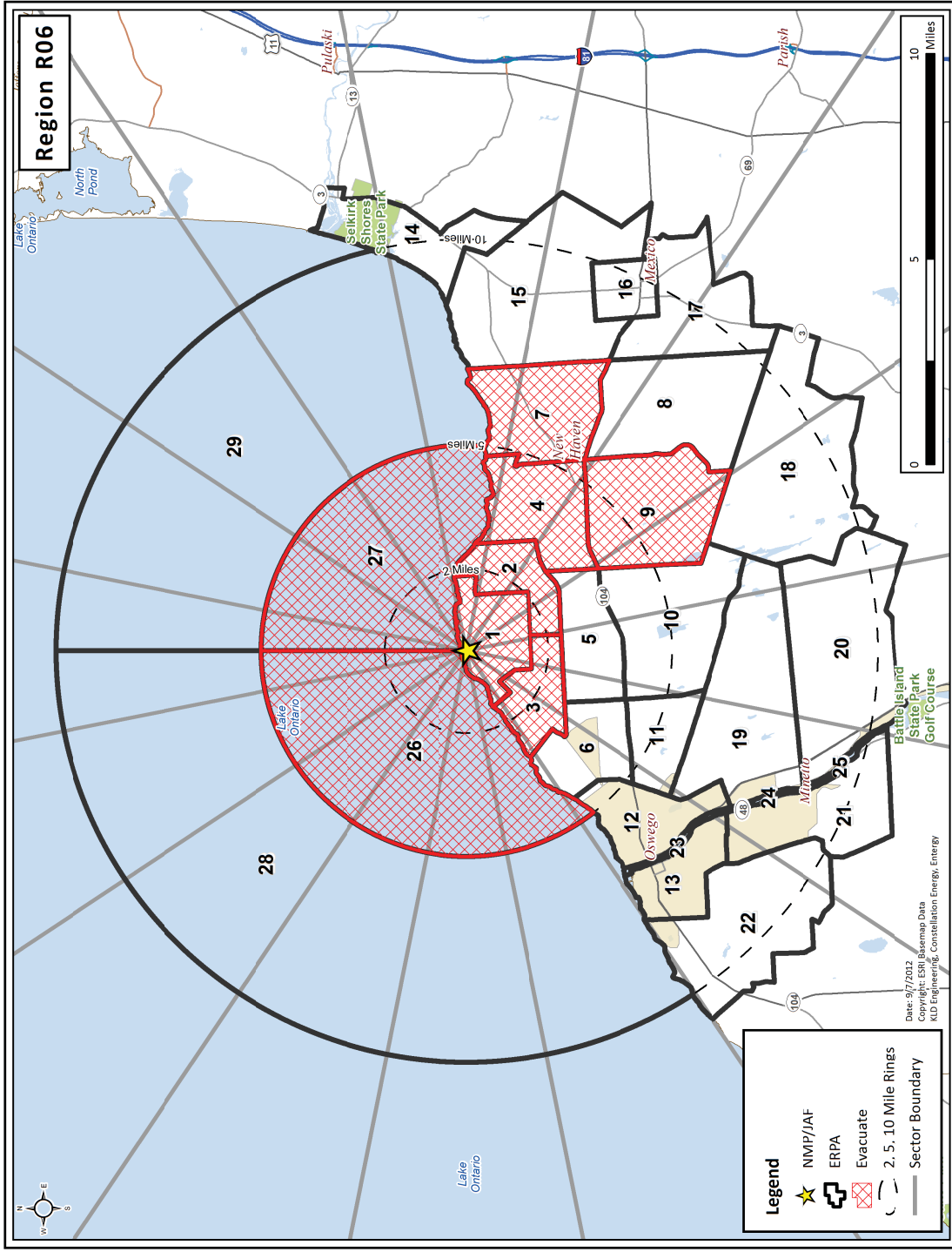


Figure H-6. Region R06

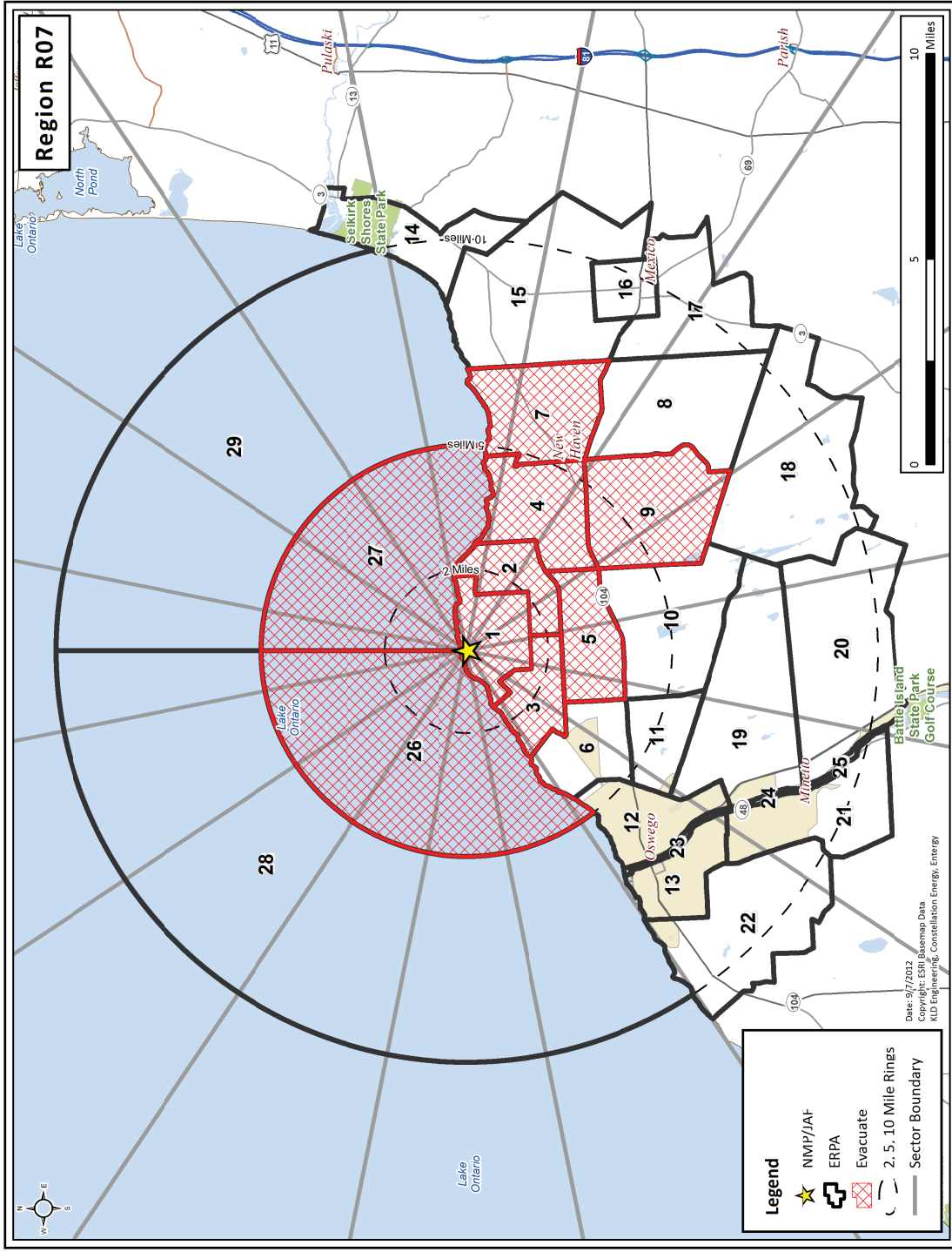


Figure H-7. Region R07

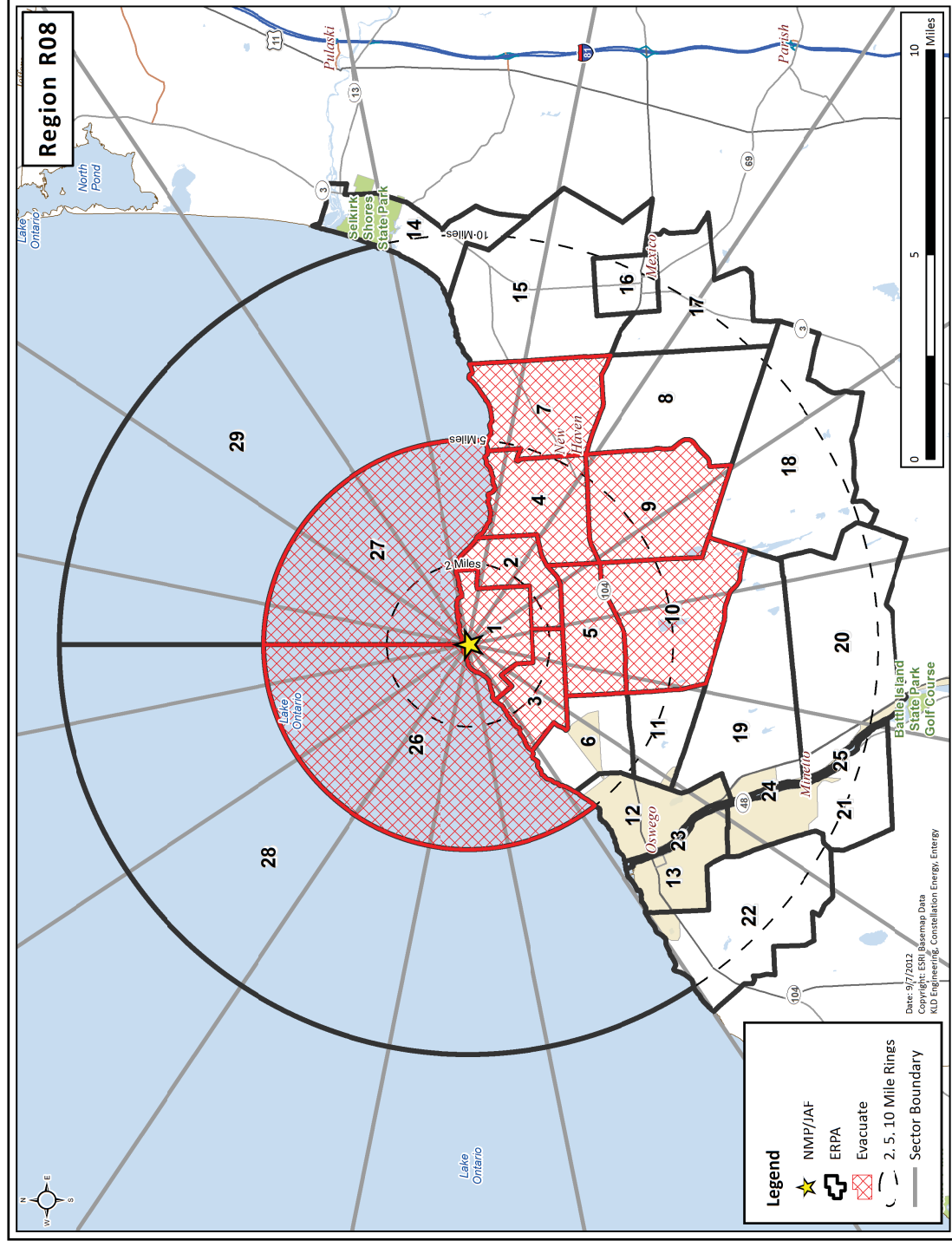


Figure H-8. Region R08

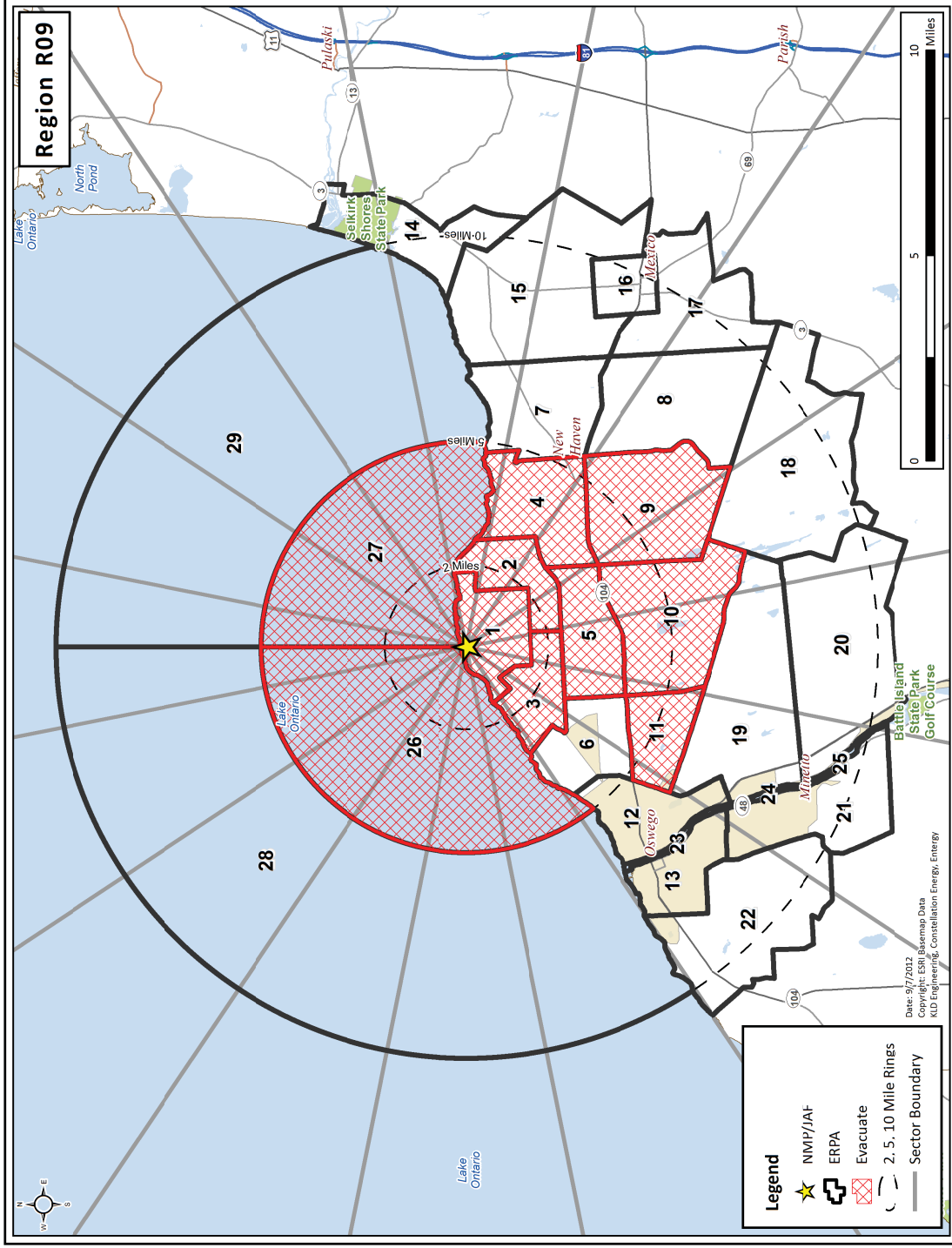


Figure H-9. Region R09

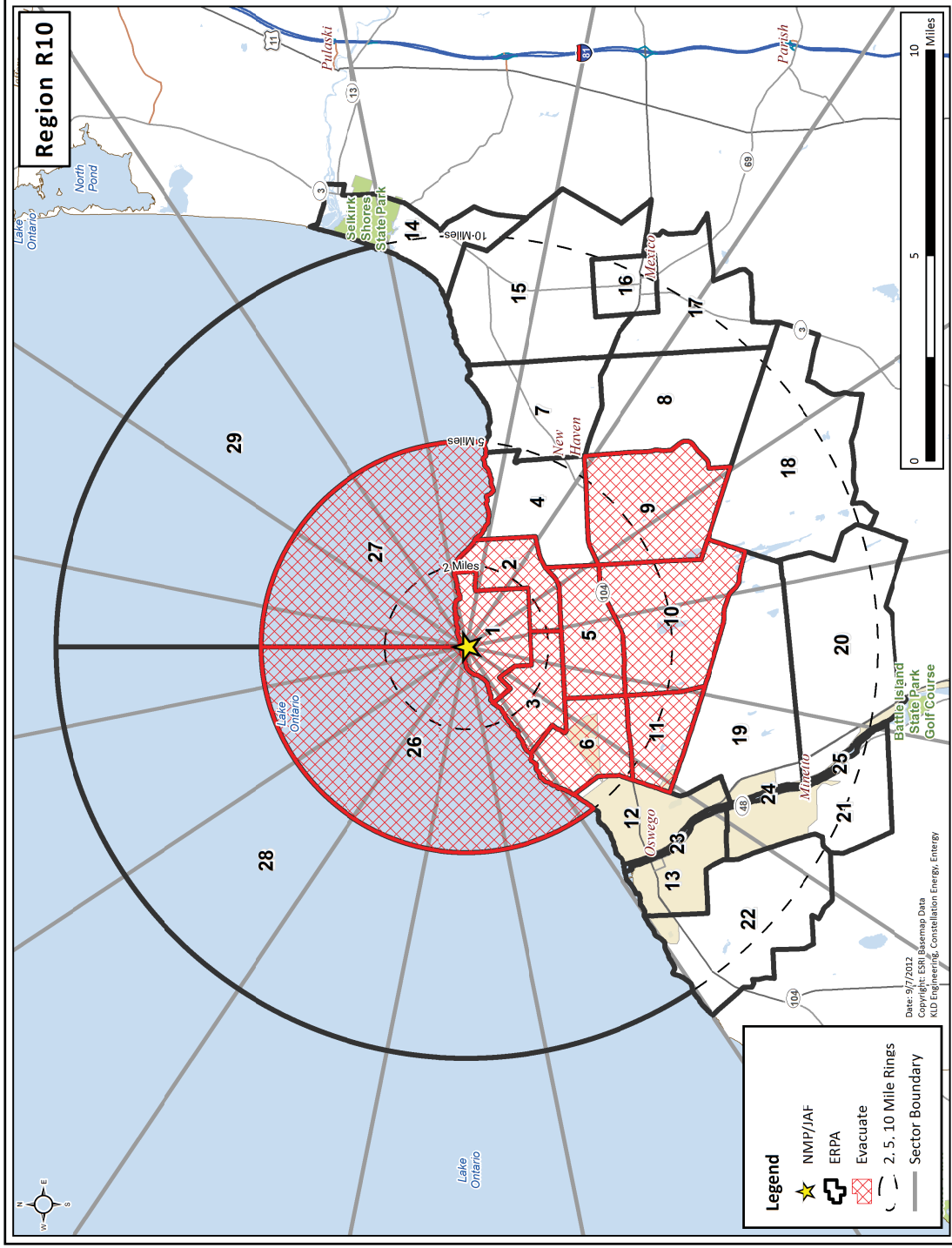


Figure H-10. Region R10

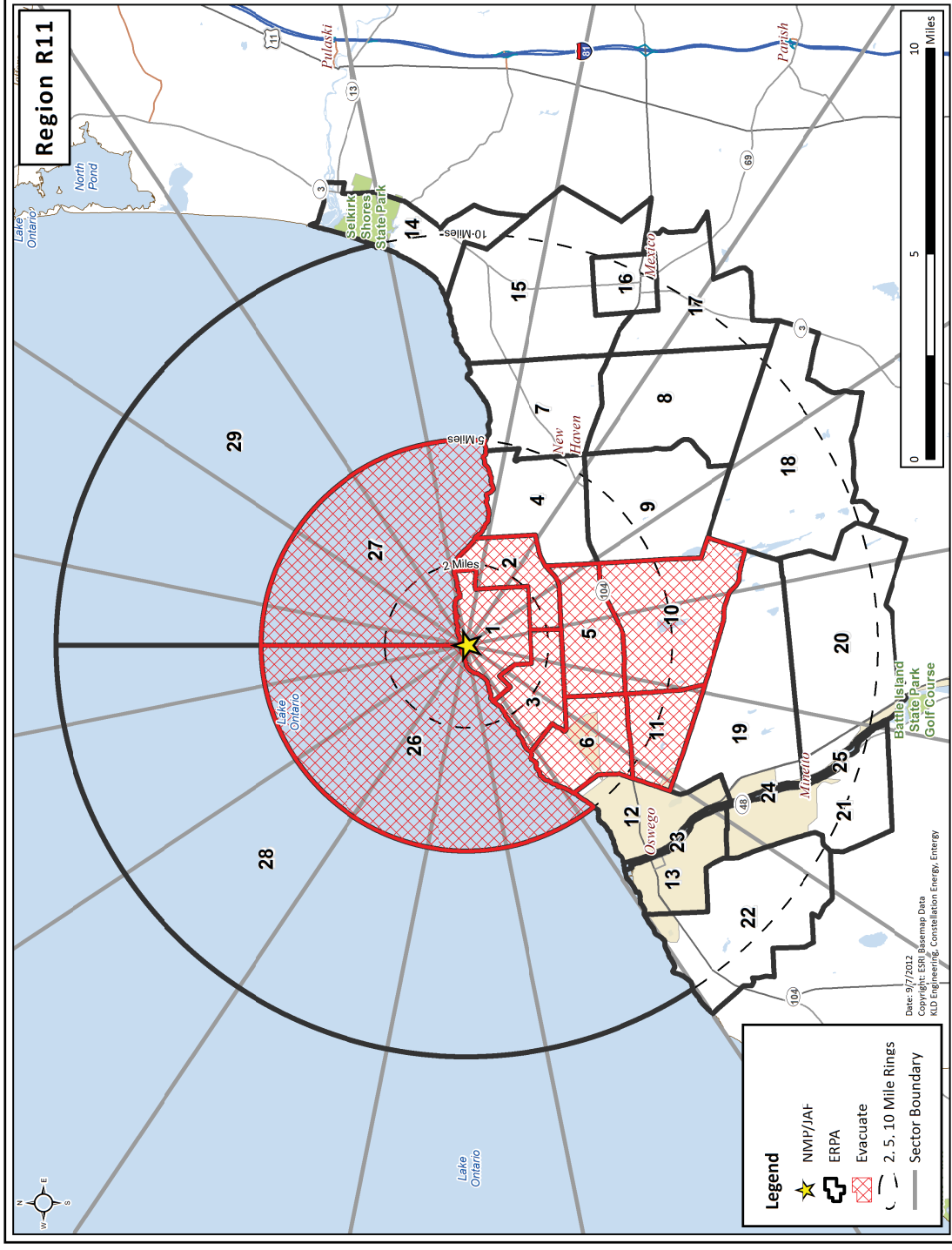


Figure H-11 Region R11

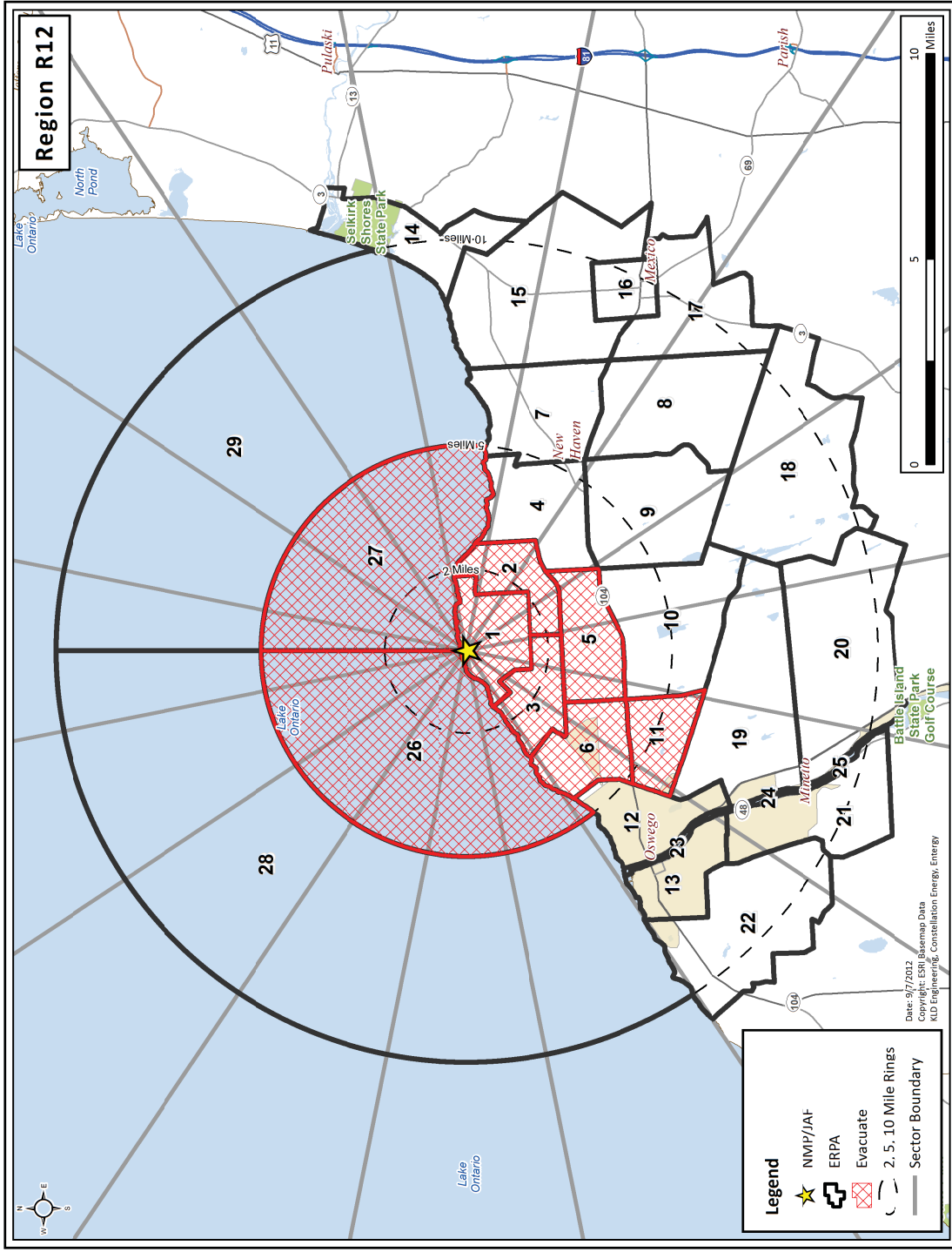


Figure H-12 Region R12

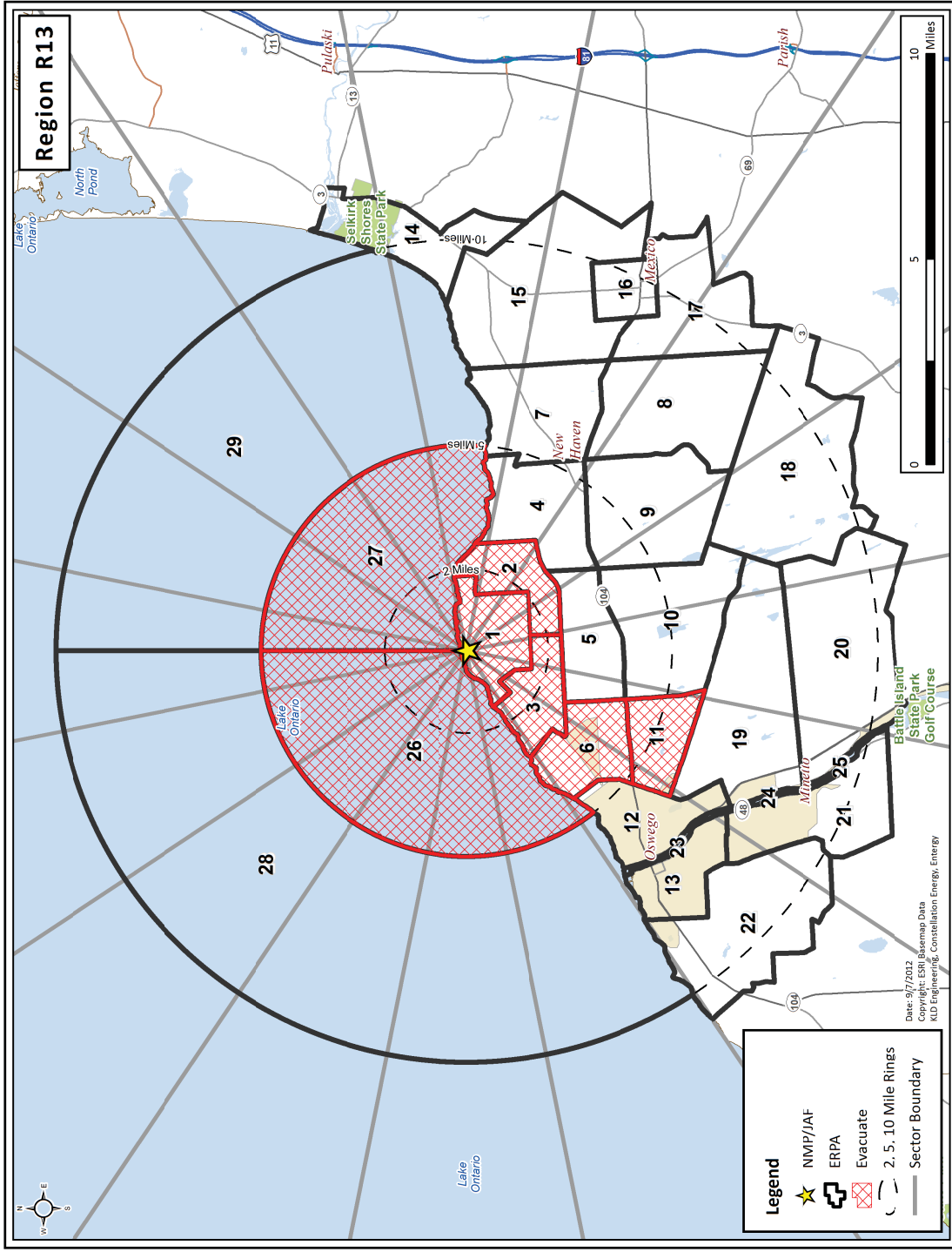


Figure H-13 Region R13

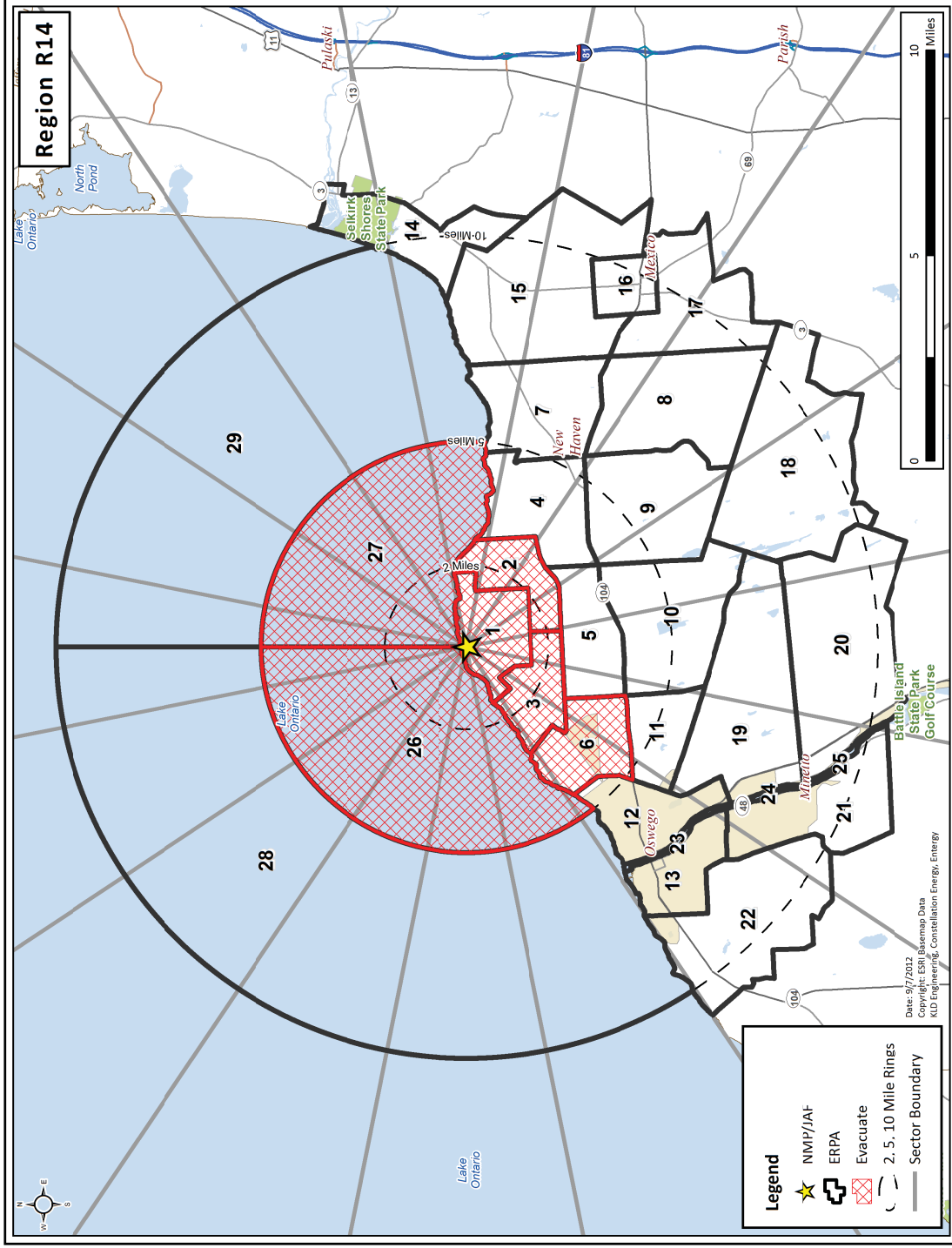


Figure H-14 Region R14

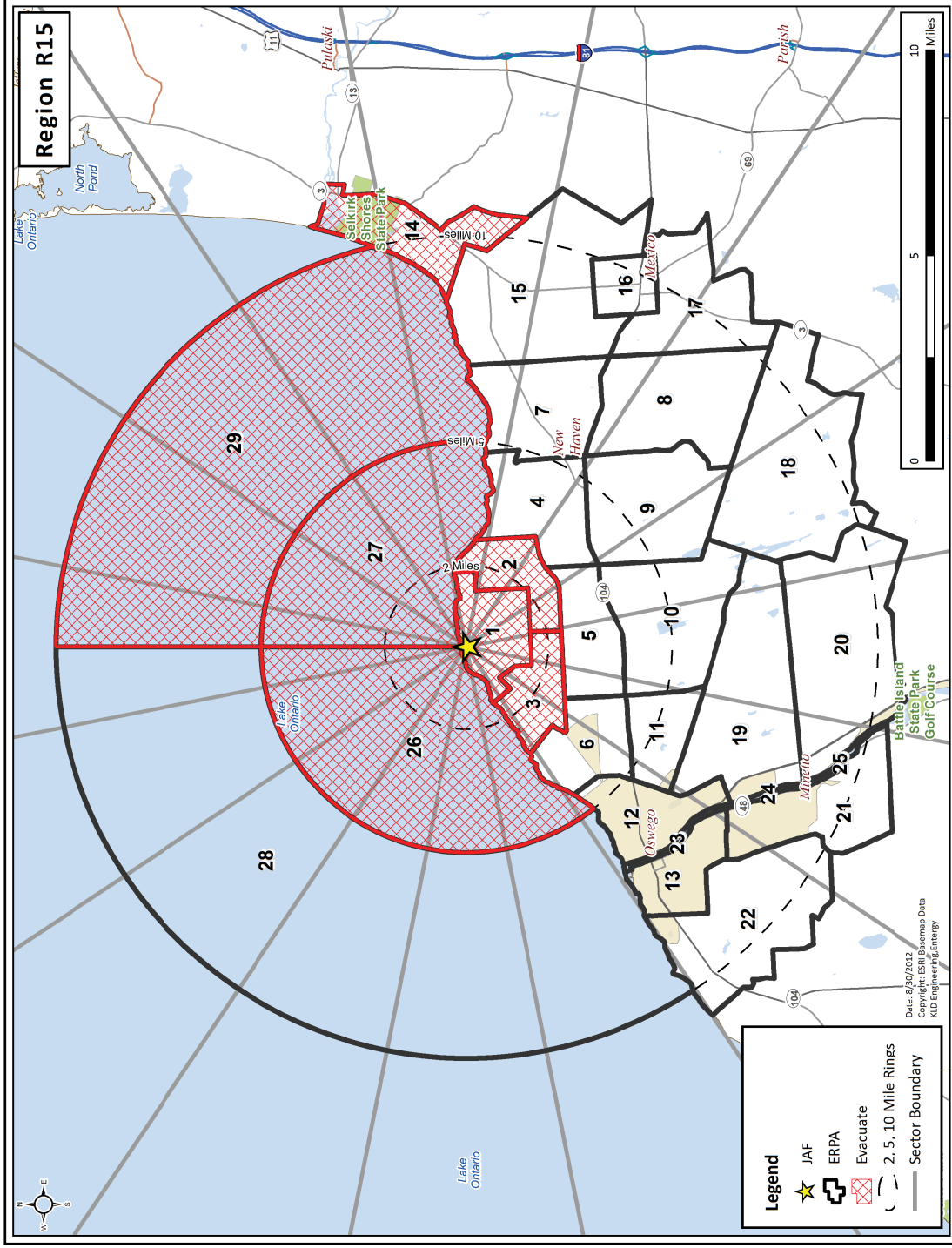


Figure H-15 Region R15

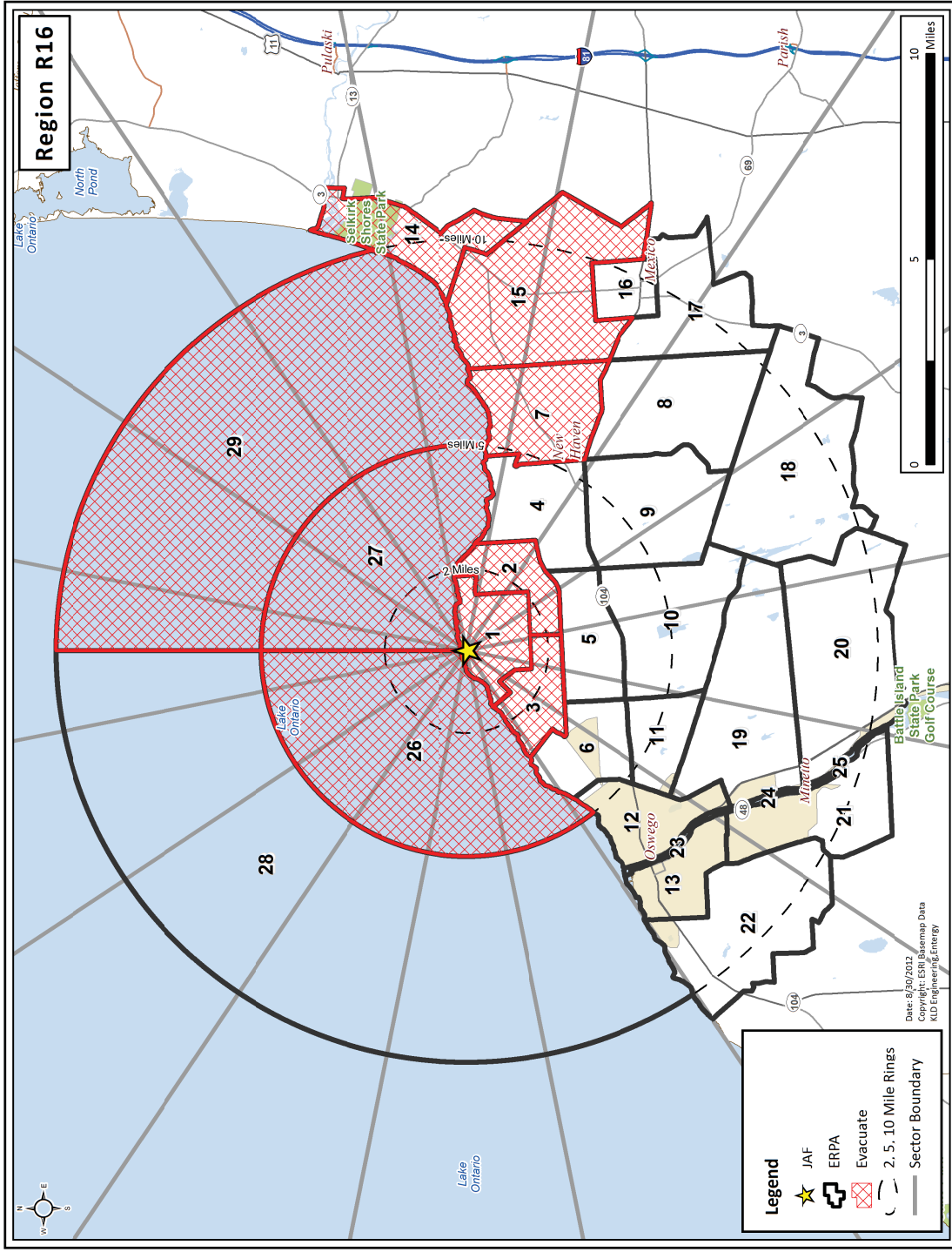


Figure H-16 Region R16

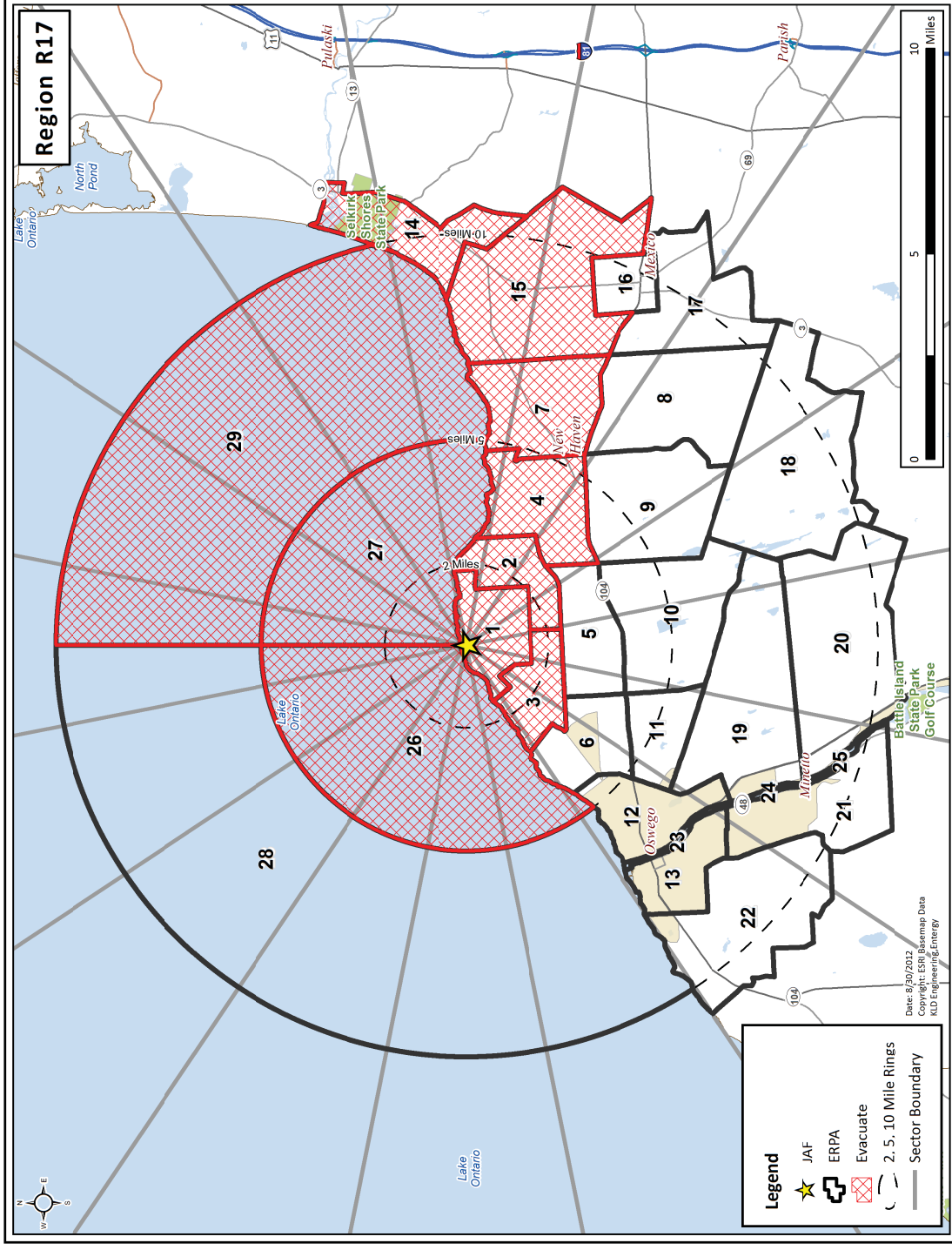


Figure H-17 Region R17

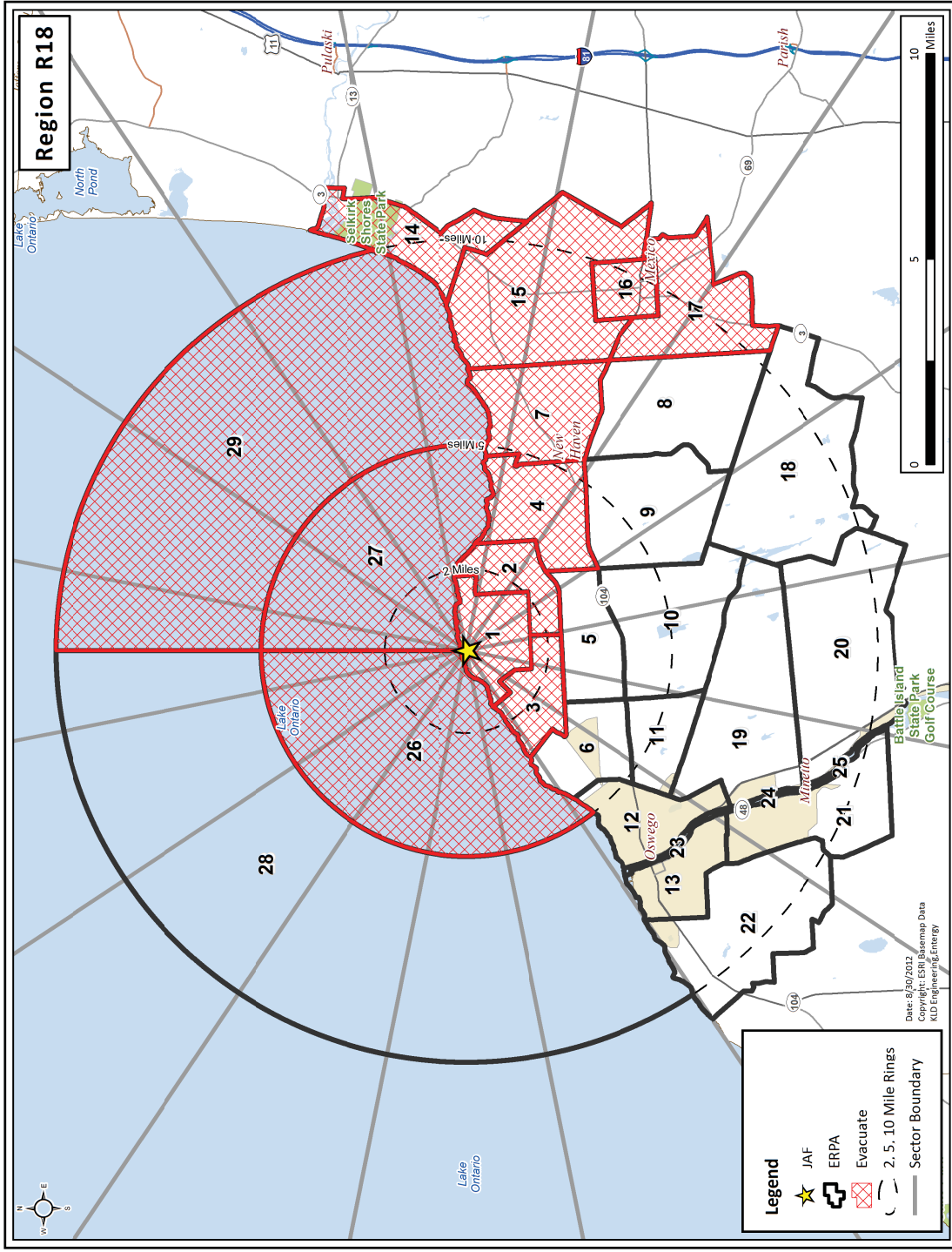


Figure H-18 Region R18

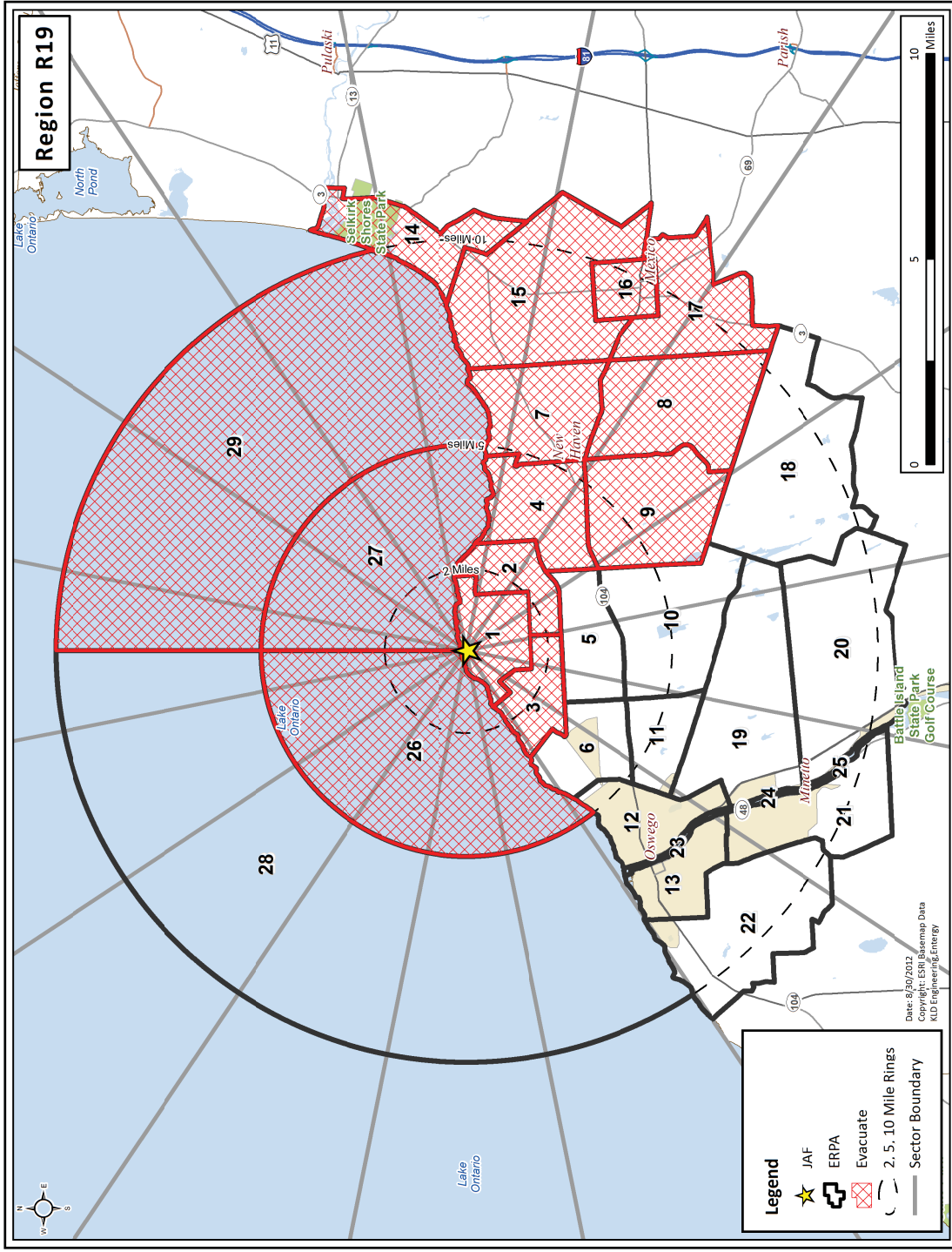


Figure H-19 Region R19

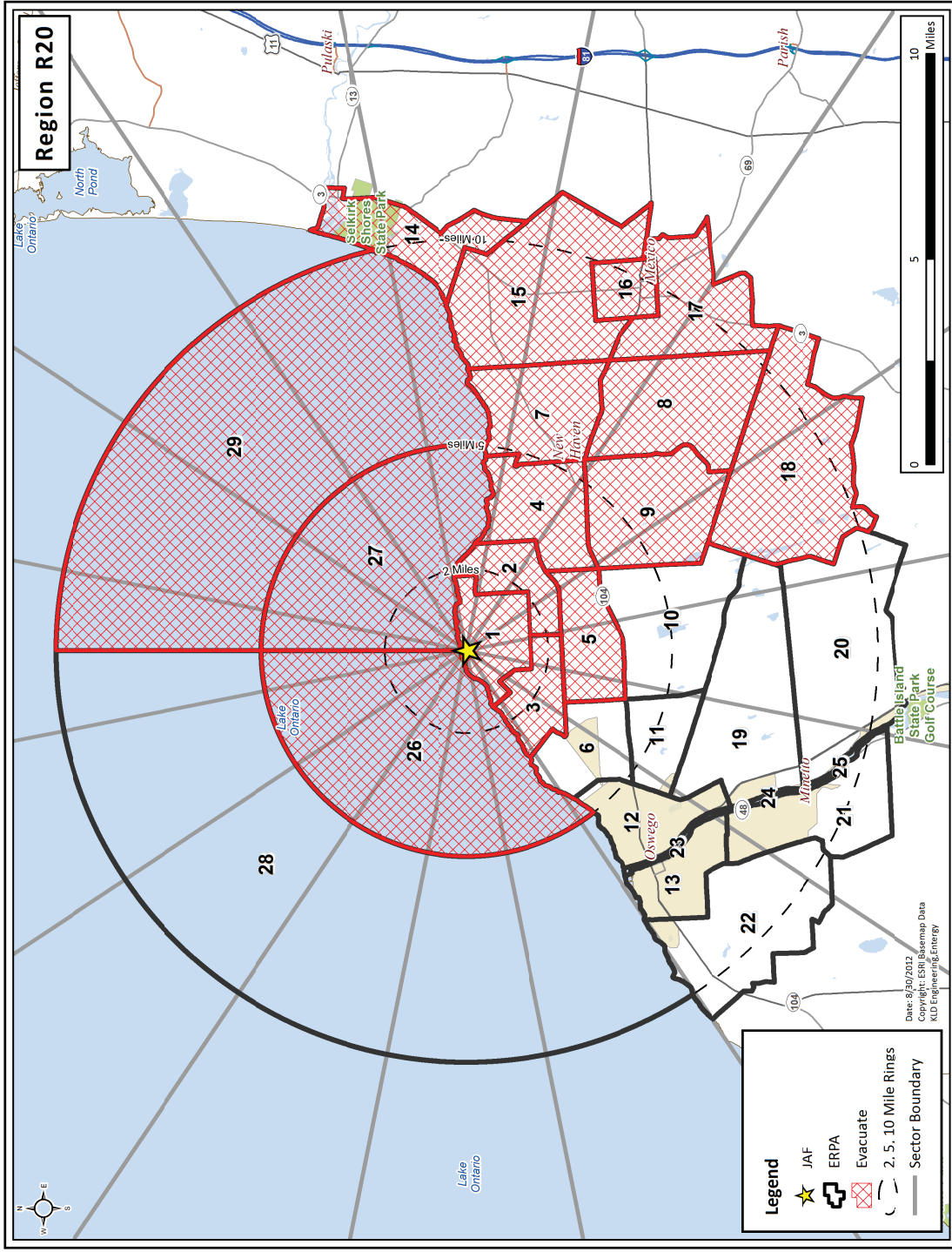


Figure H-20 Region R20

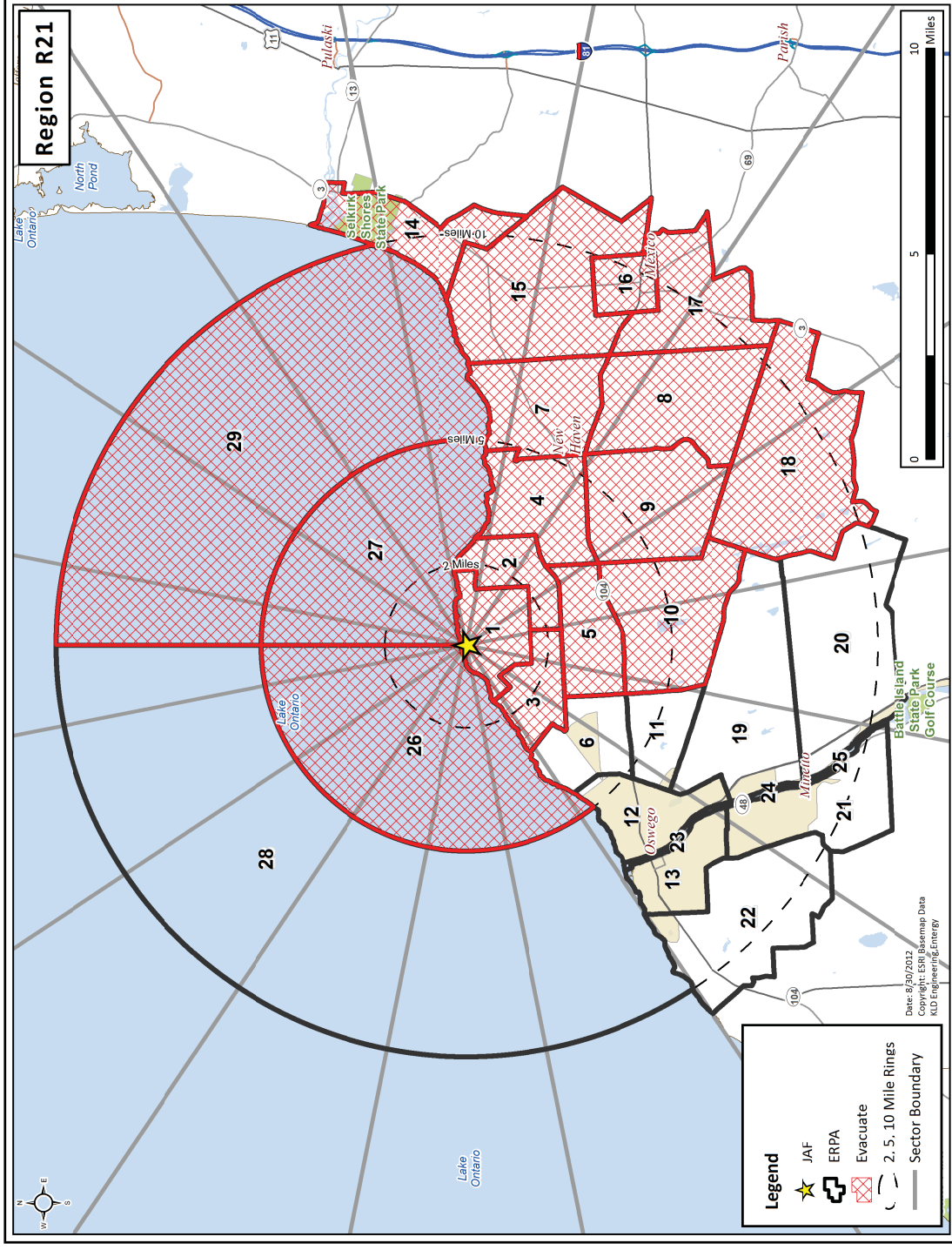


Figure H-21 Region R21

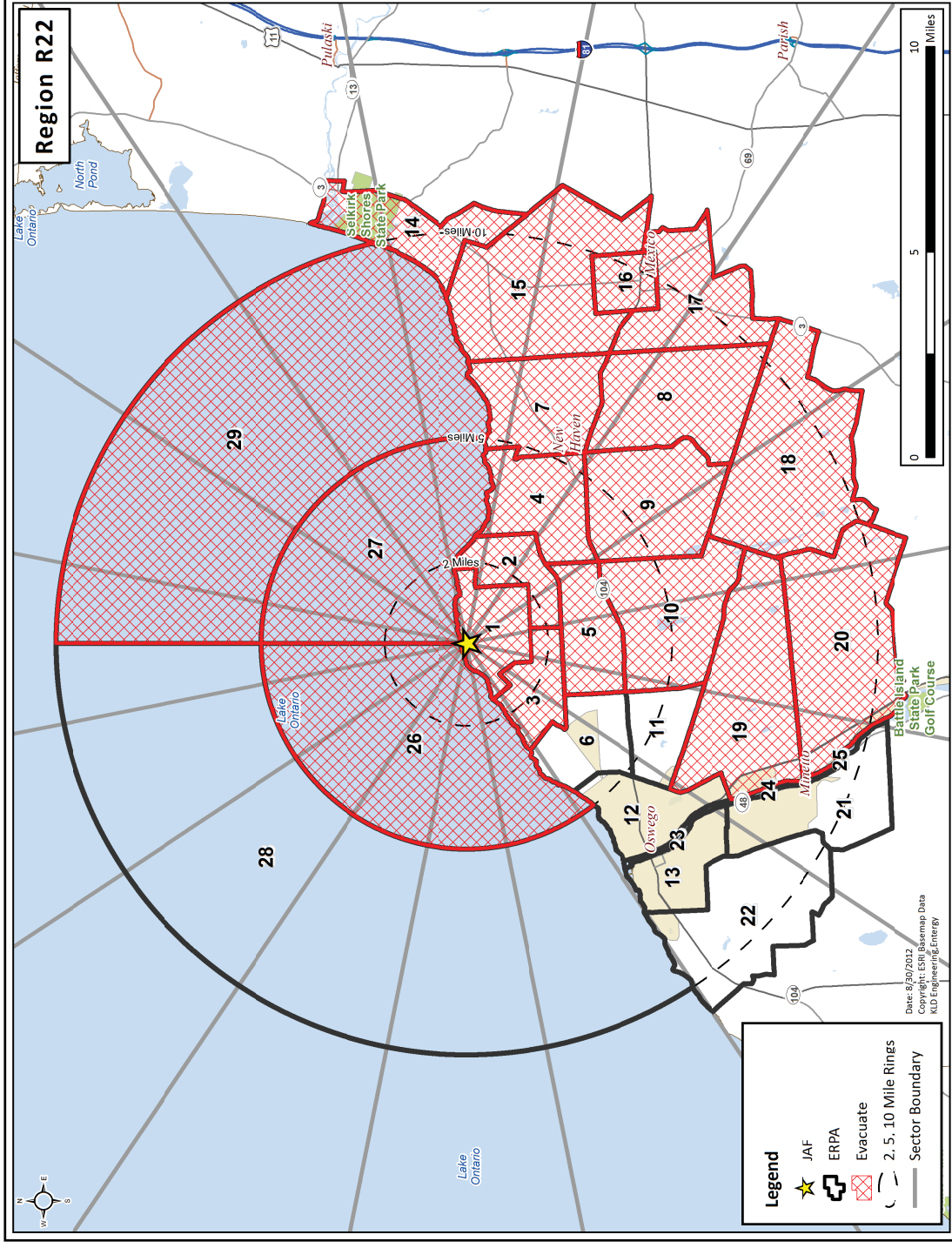


Figure H-22 Region R22

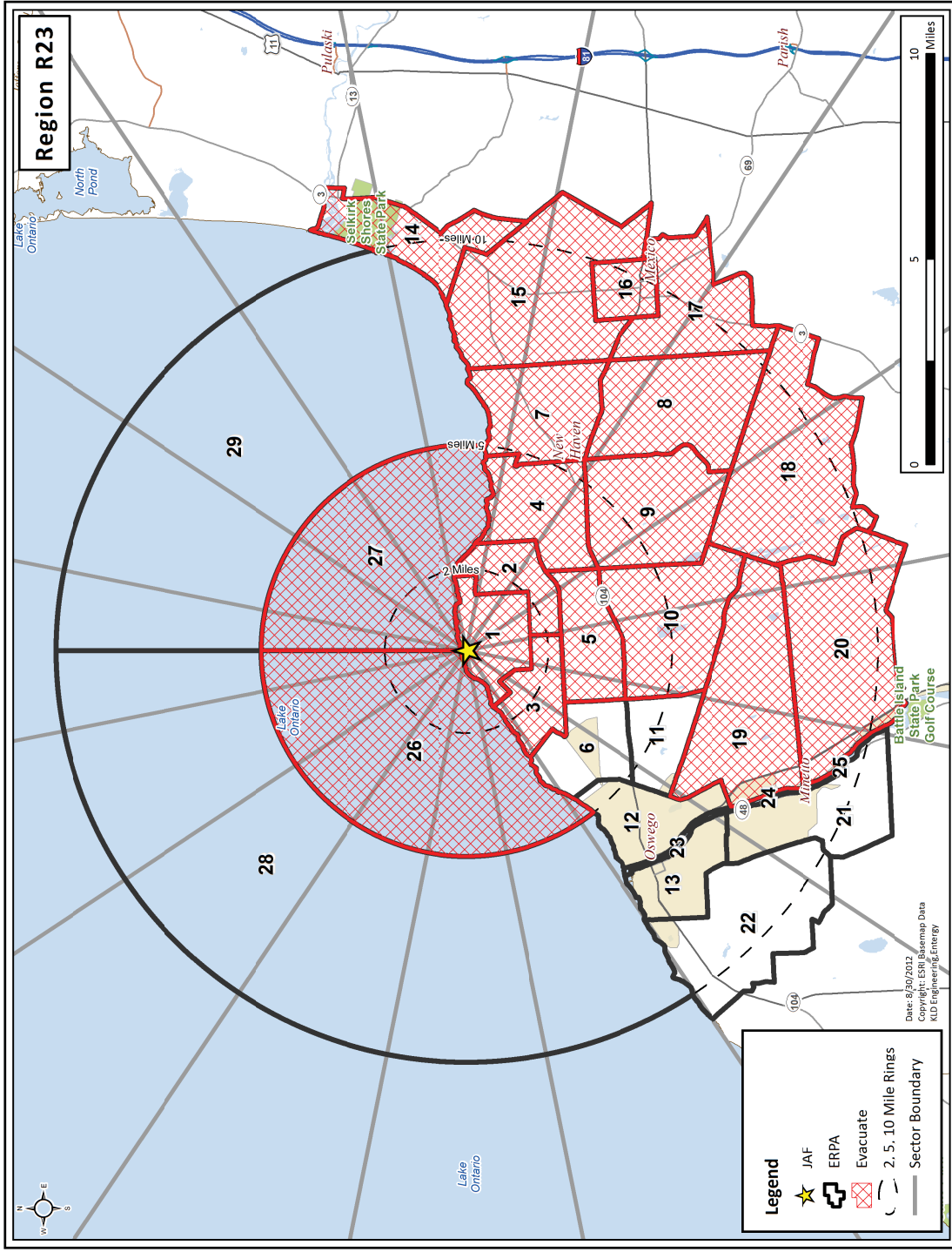


Figure H-23 Region R23

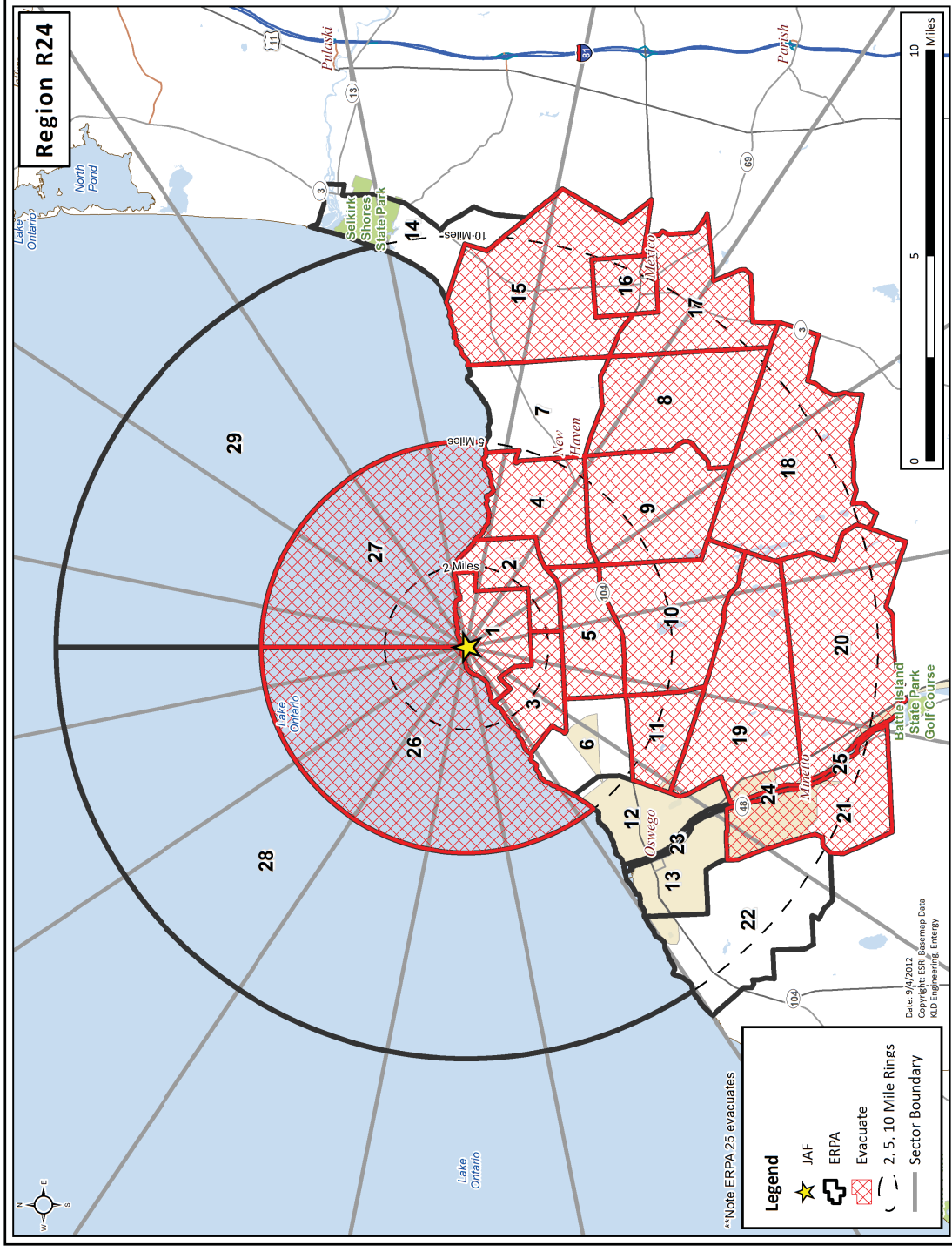


Figure H-24 Region R24

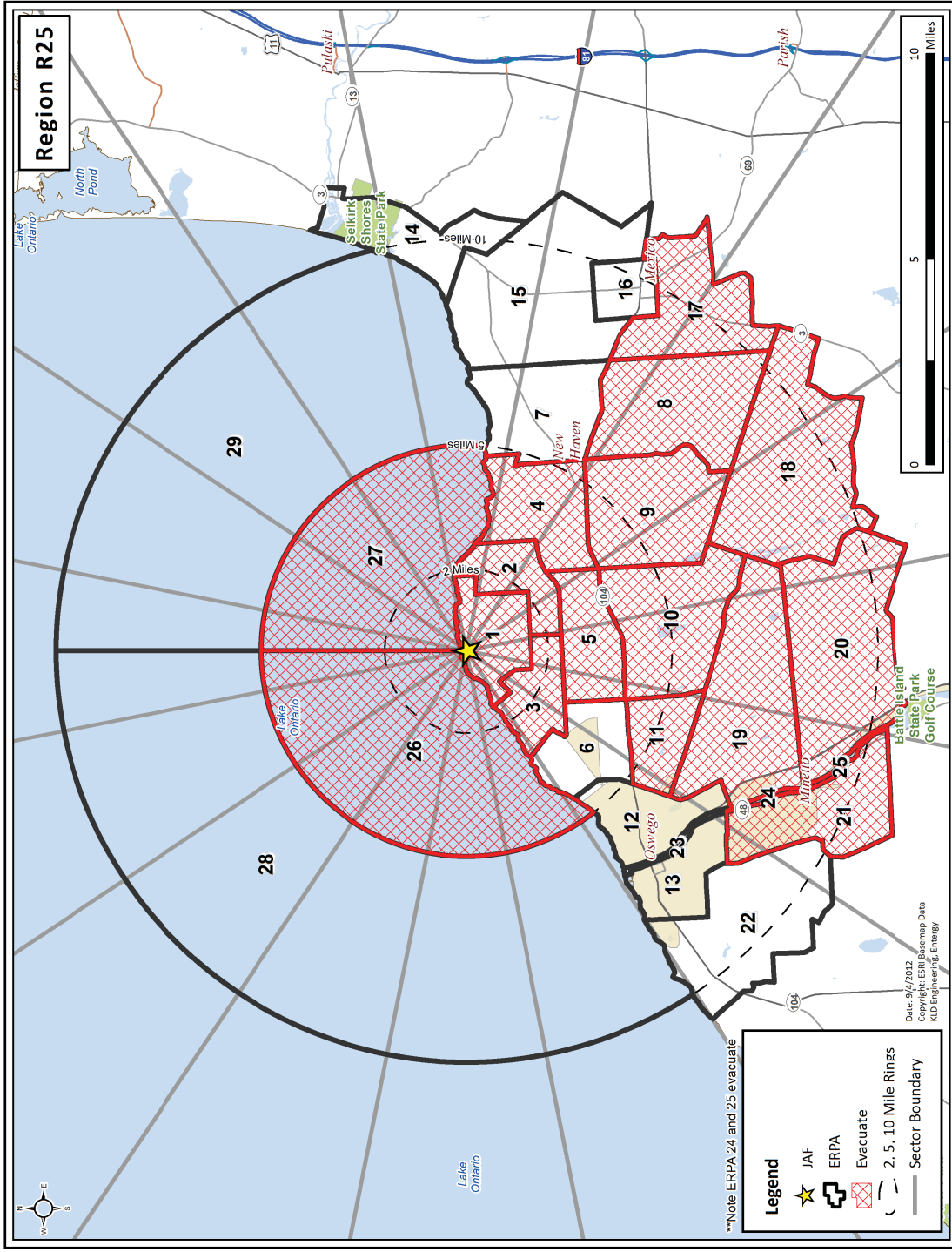


Figure H-25 Region R25

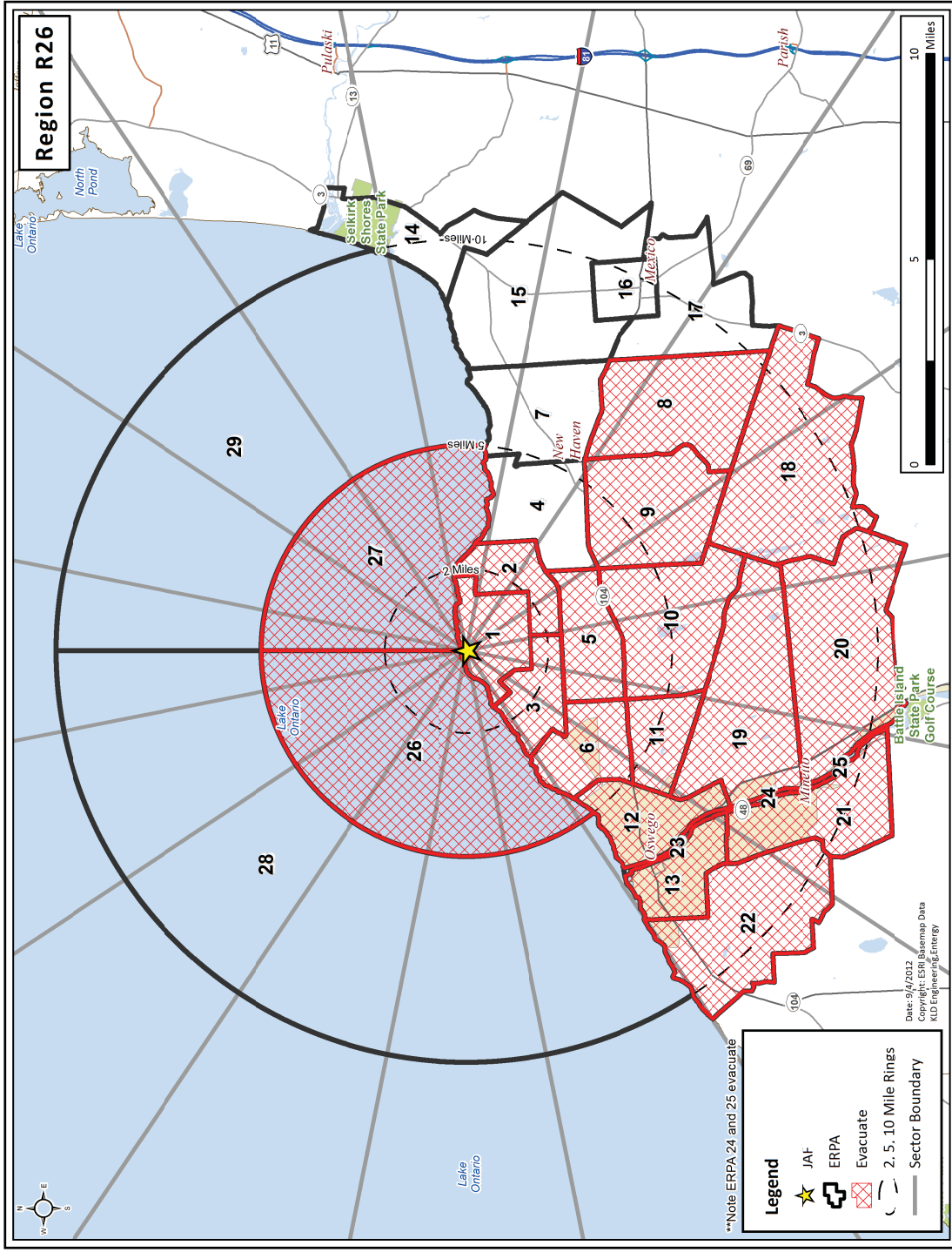


Figure H-26 Region R26

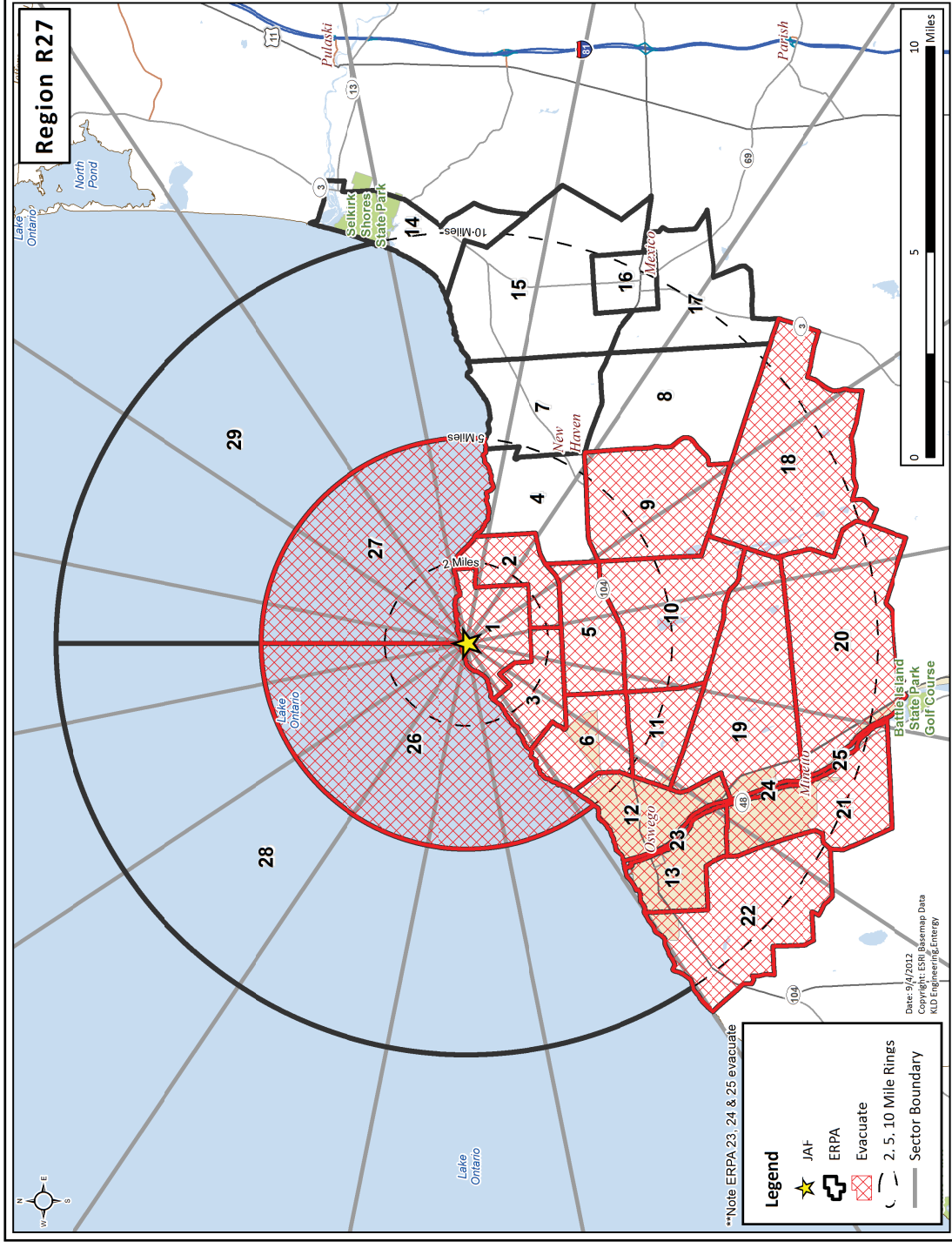


Figure H-27 Region R27

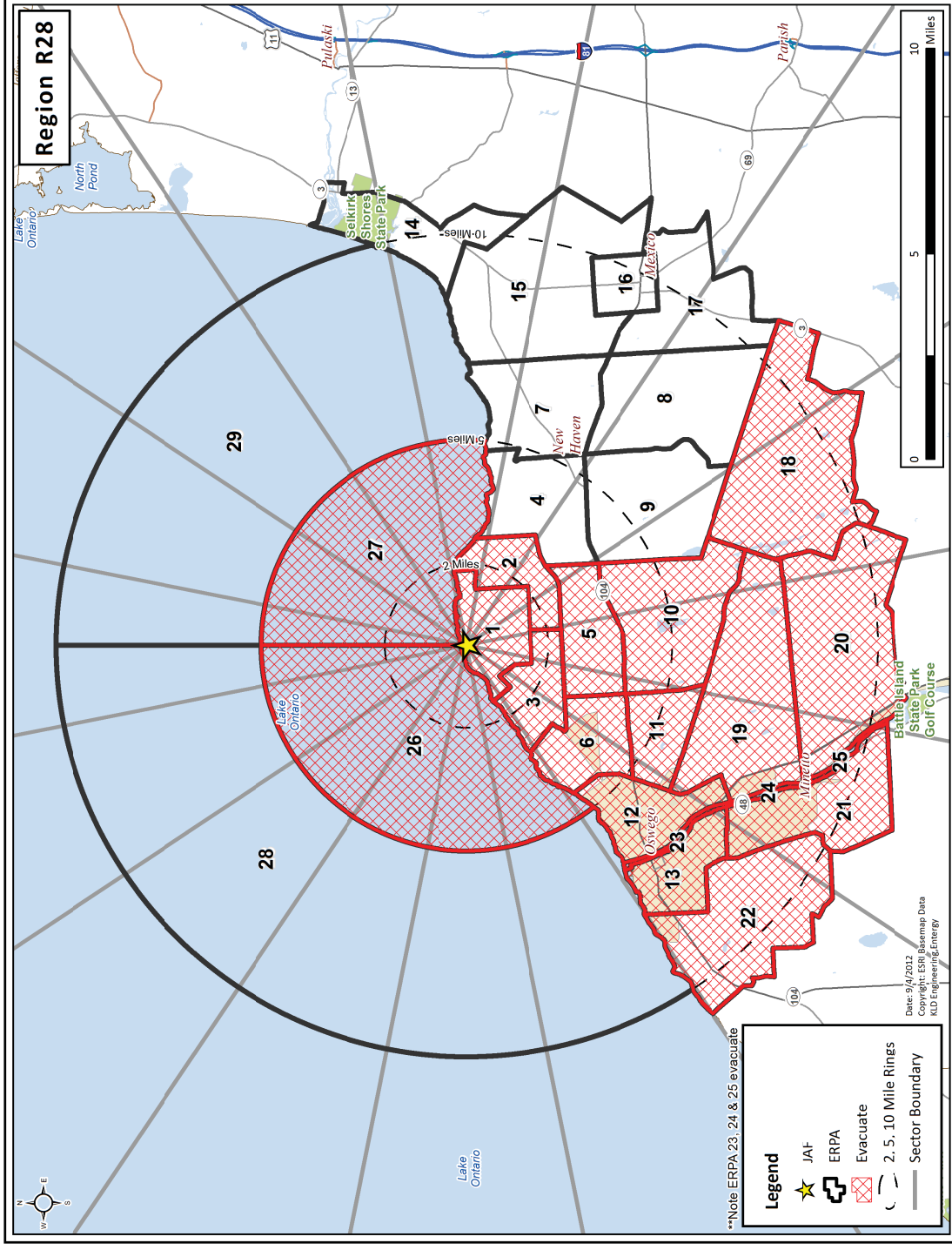


Figure H-28 Region R28

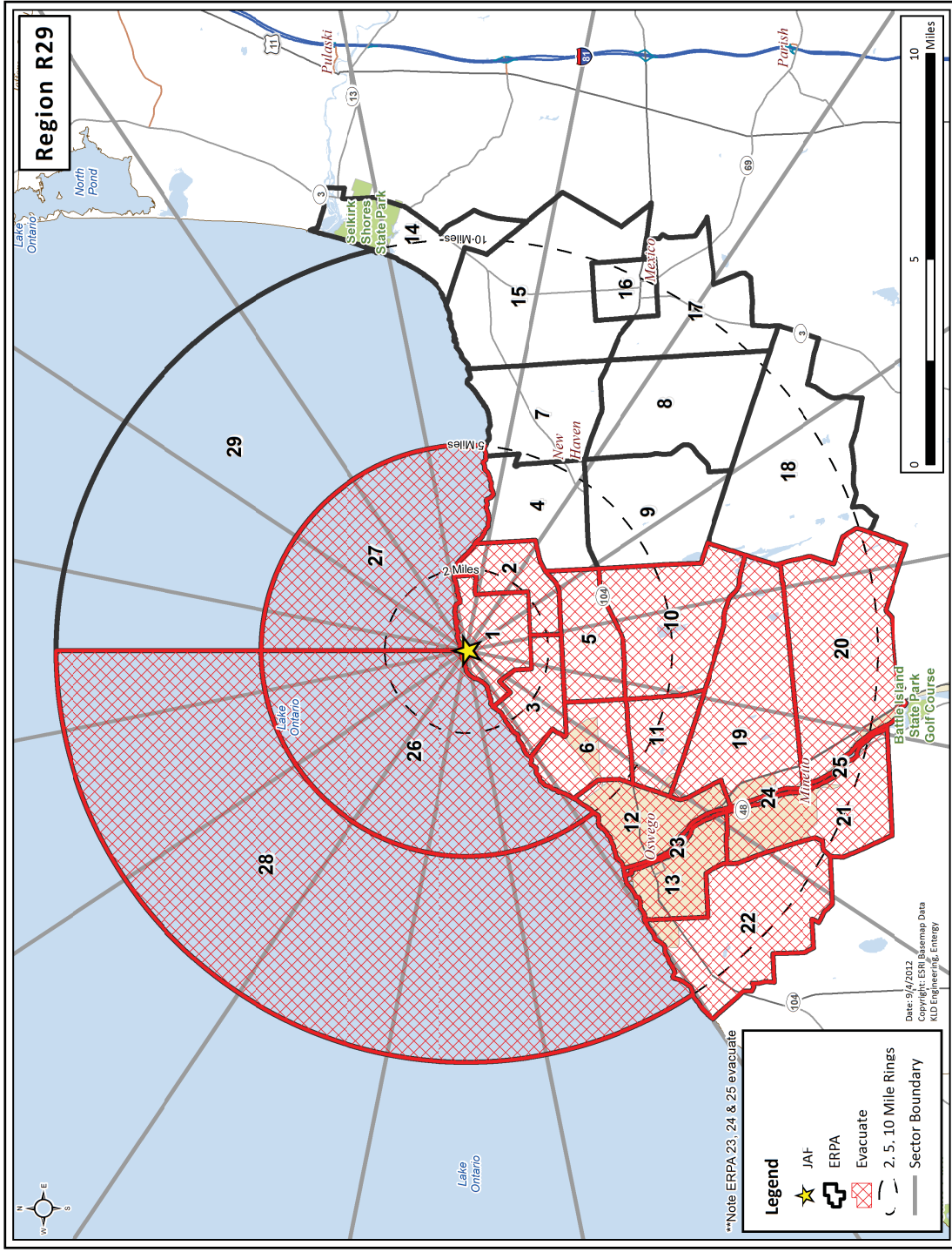


Figure H-29 Region R29

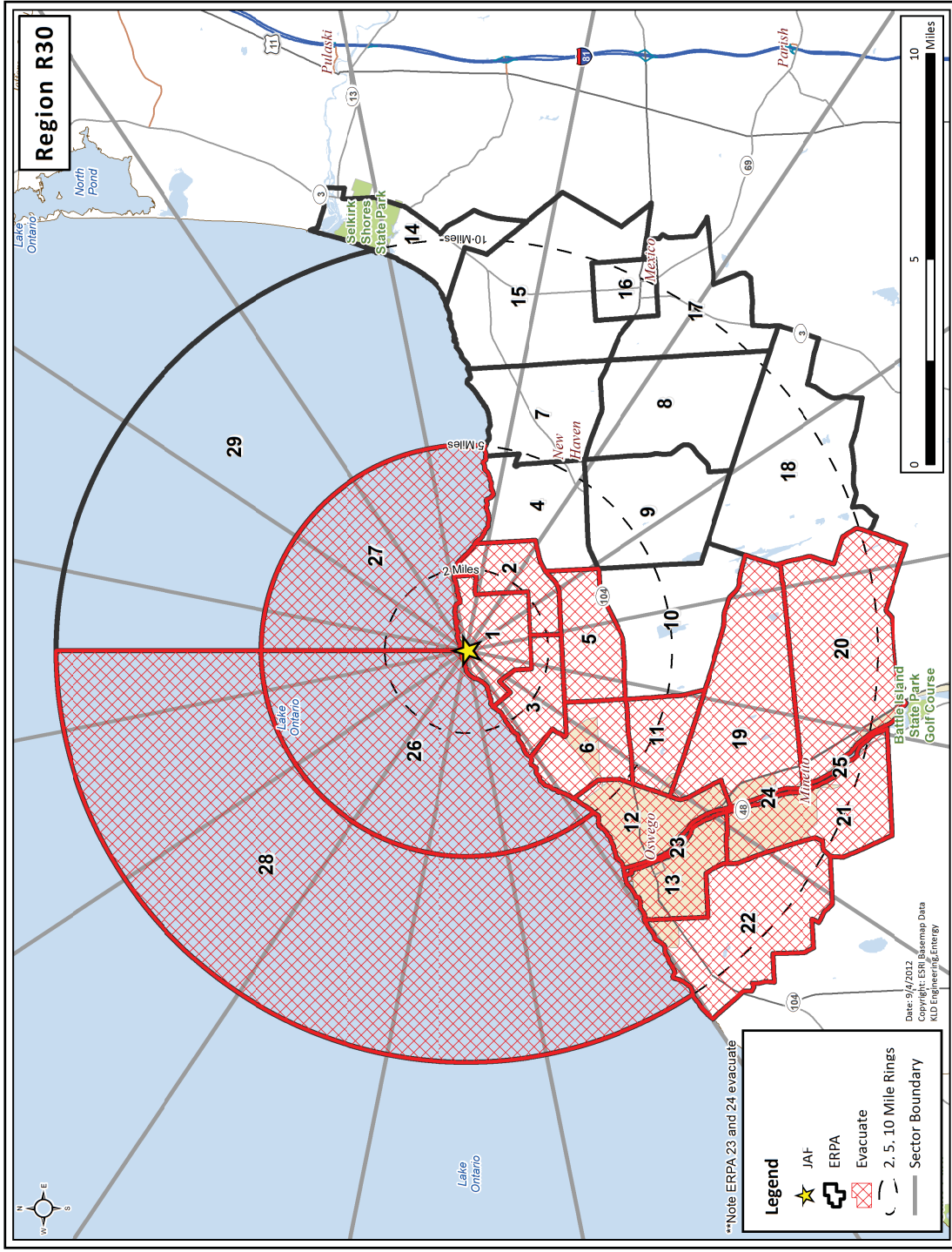


Figure H-30 Region R30

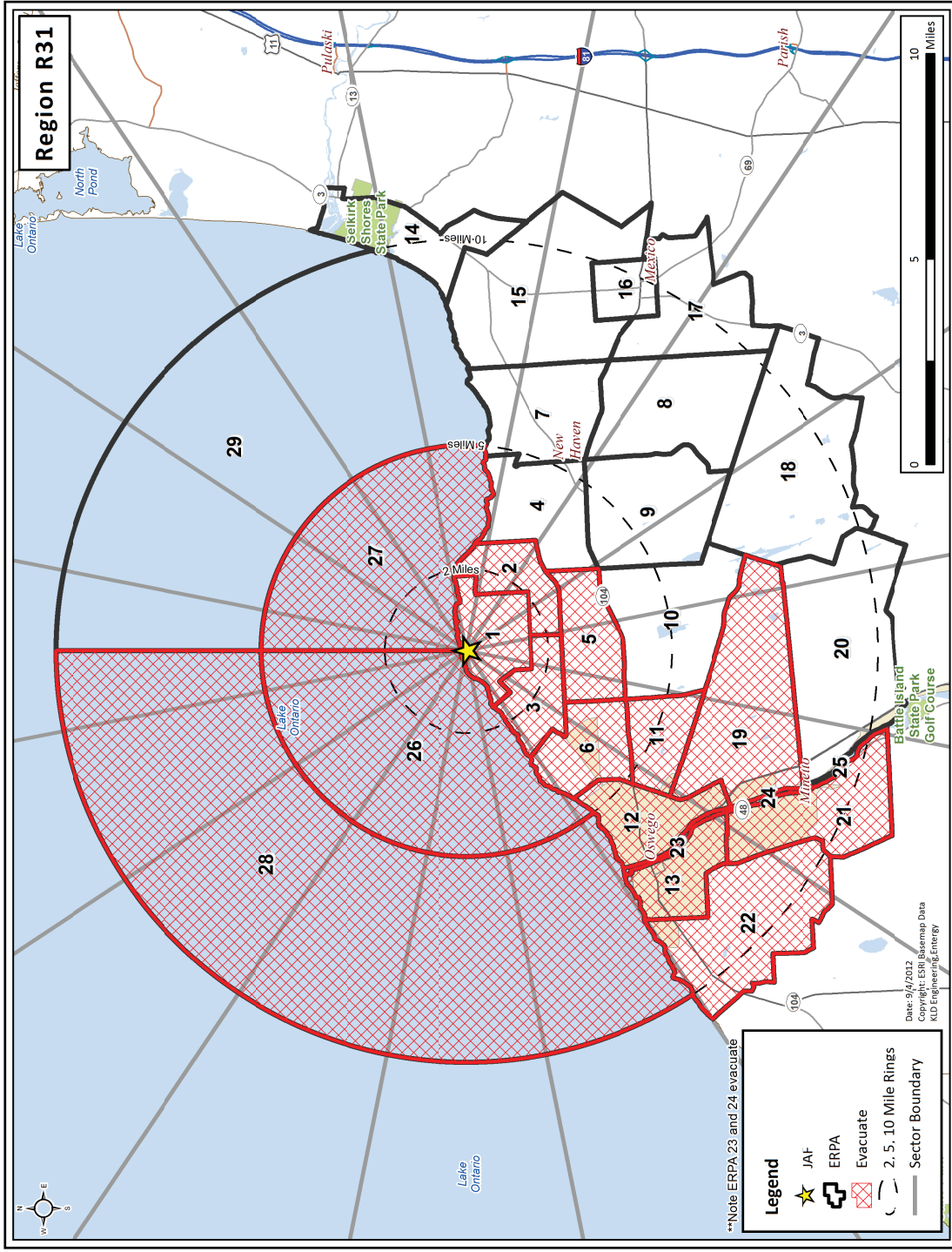


Figure H-31 Region R31

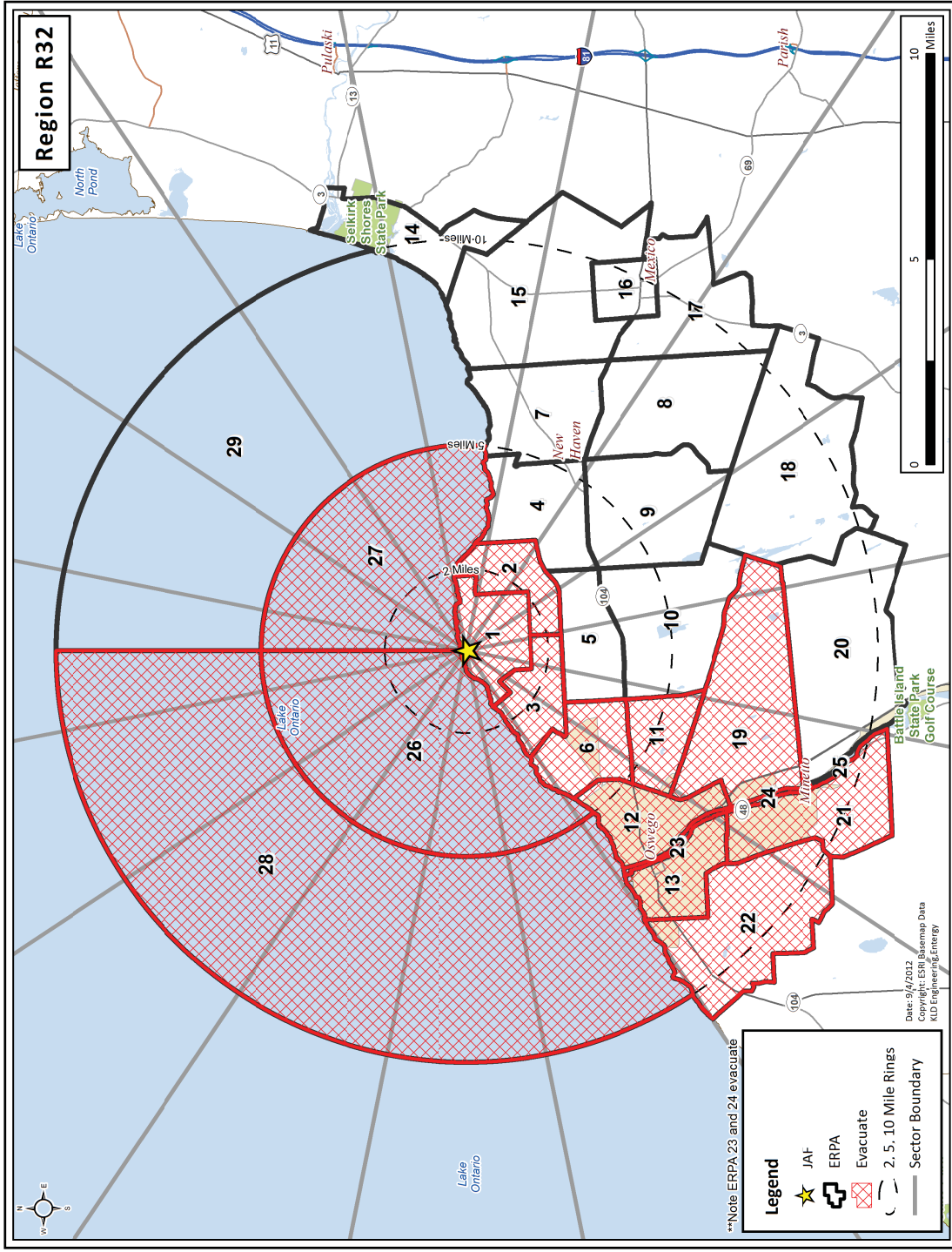


Figure H-32 Region R32

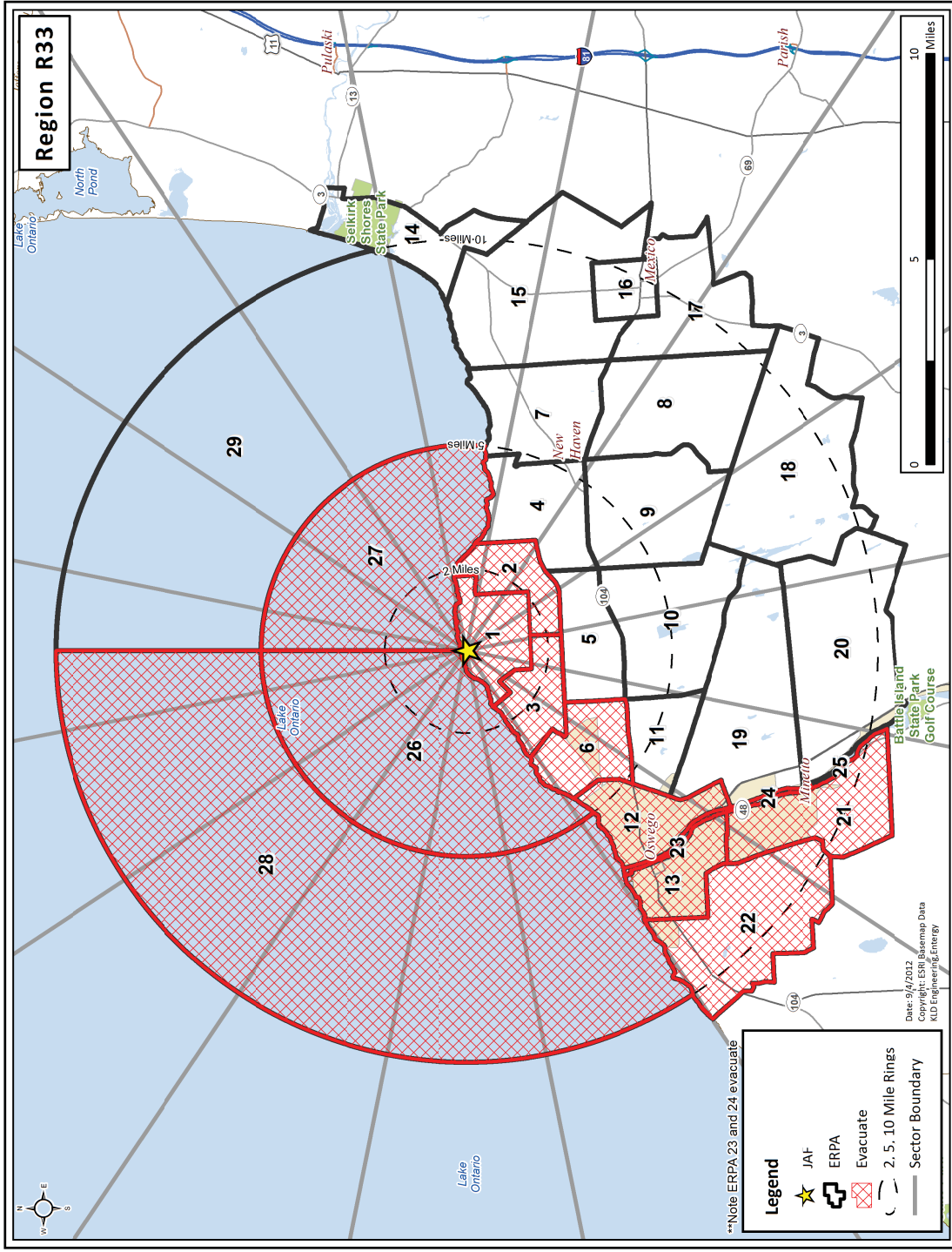


Figure H-33 Region R33

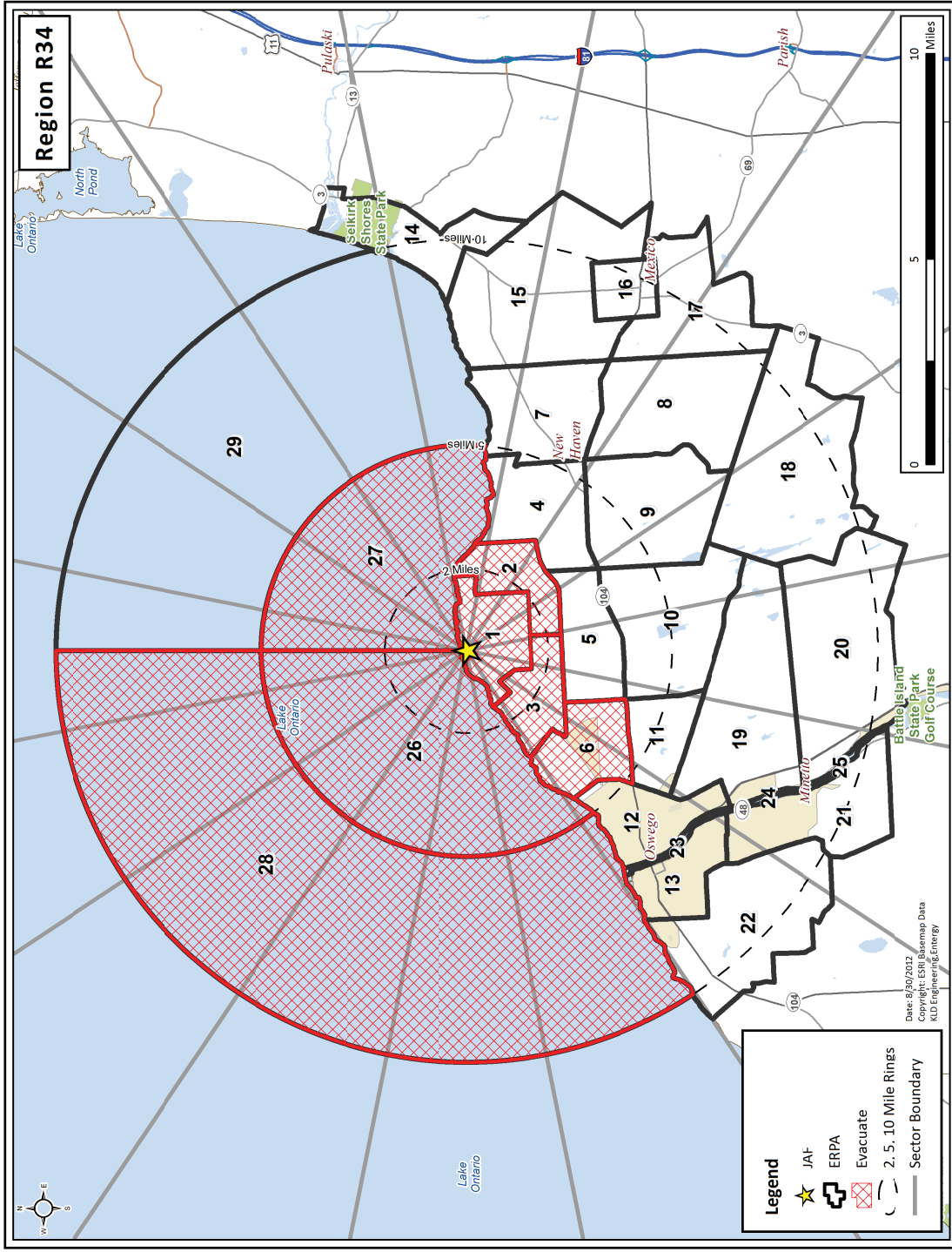


Figure H-34 Region R34

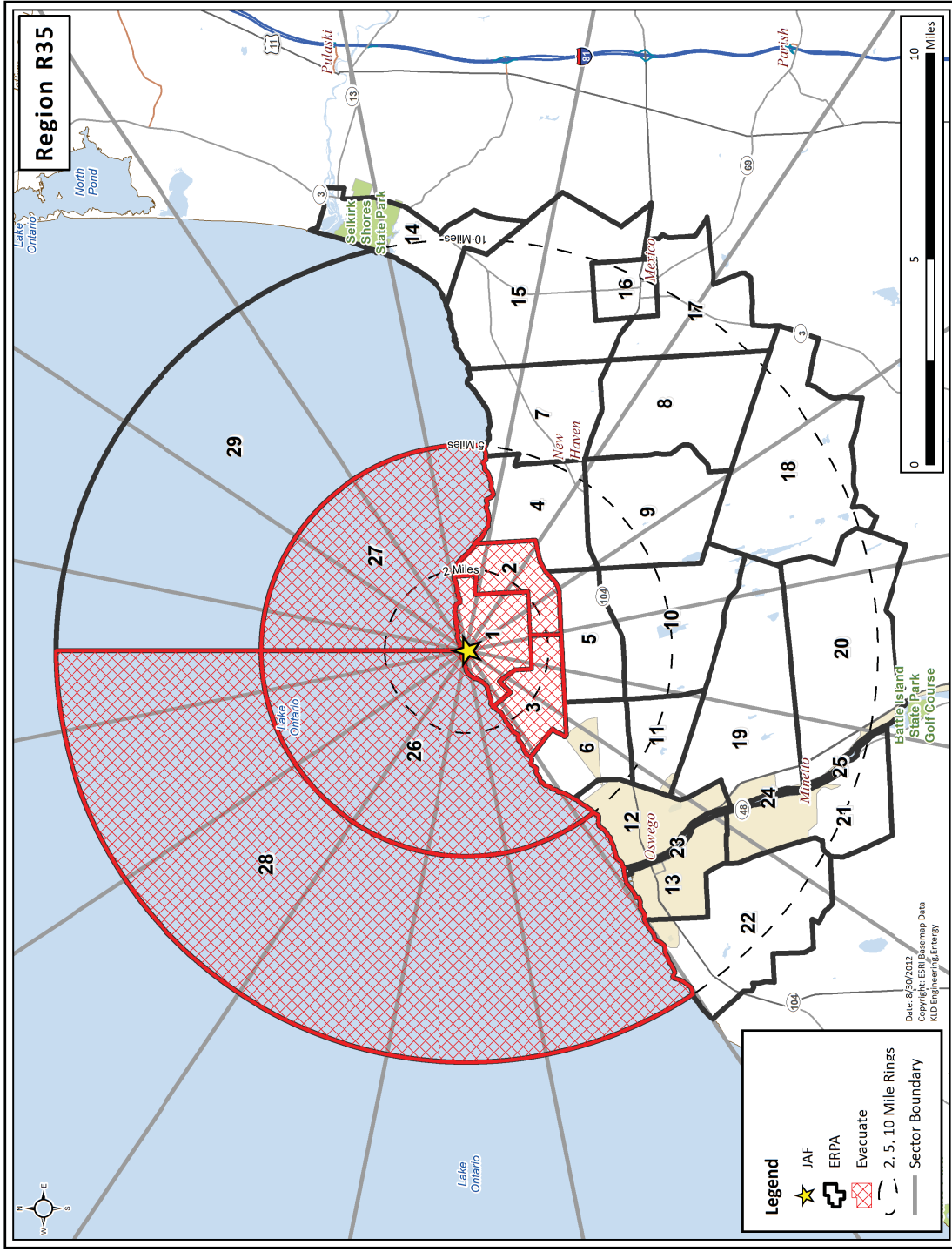


Figure H-35 Region R35

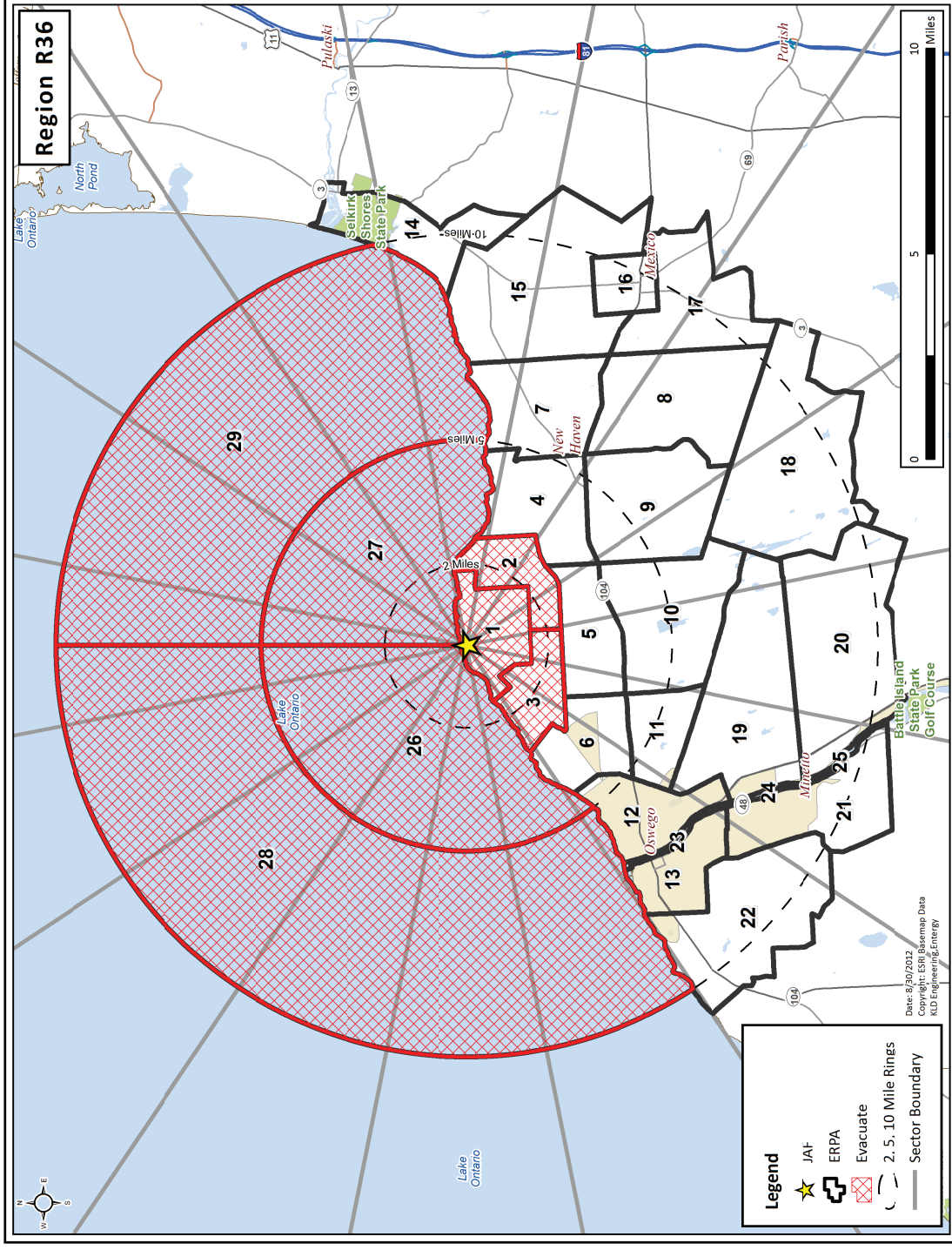


Figure H-36 Region R36

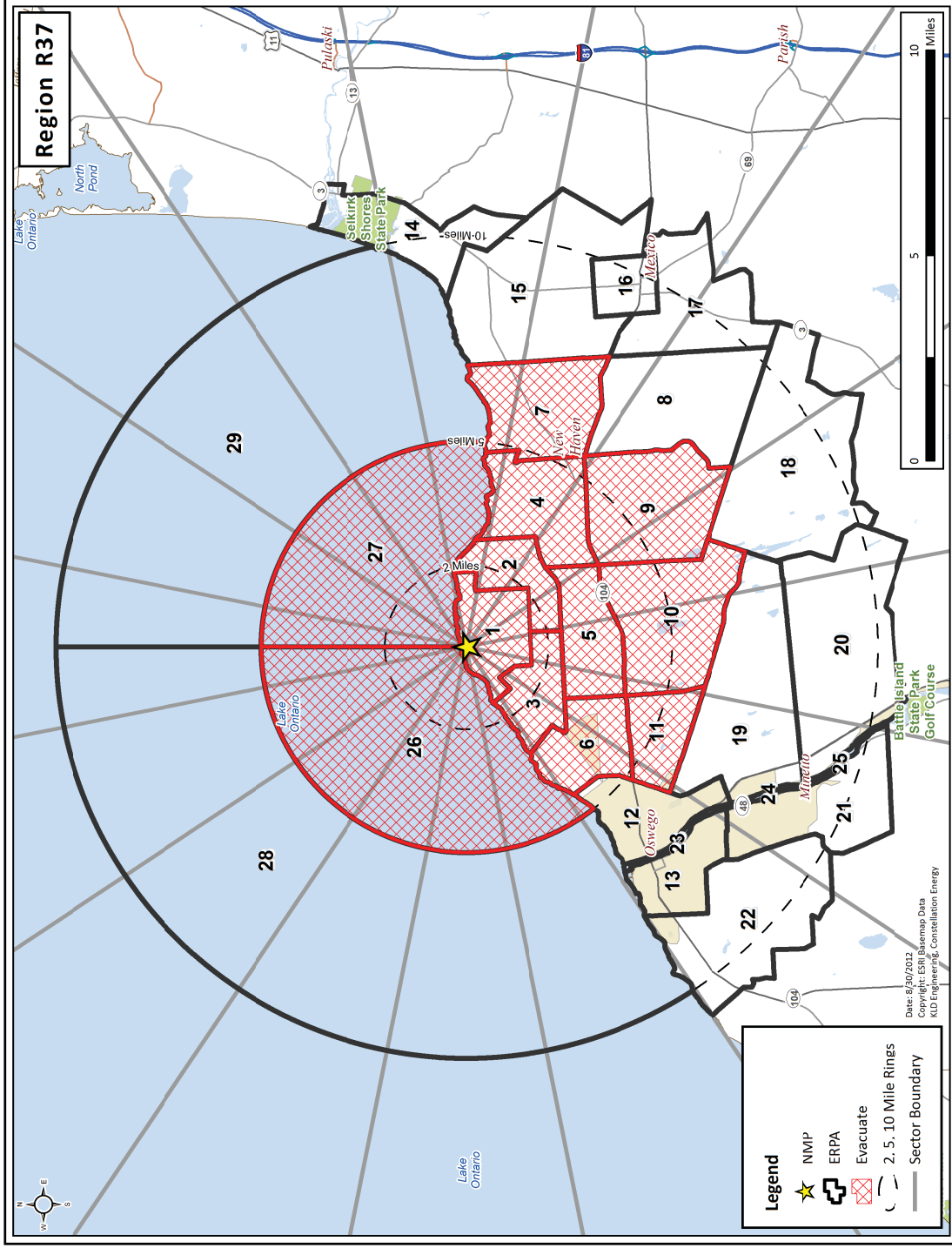


Figure H-37 Region R37

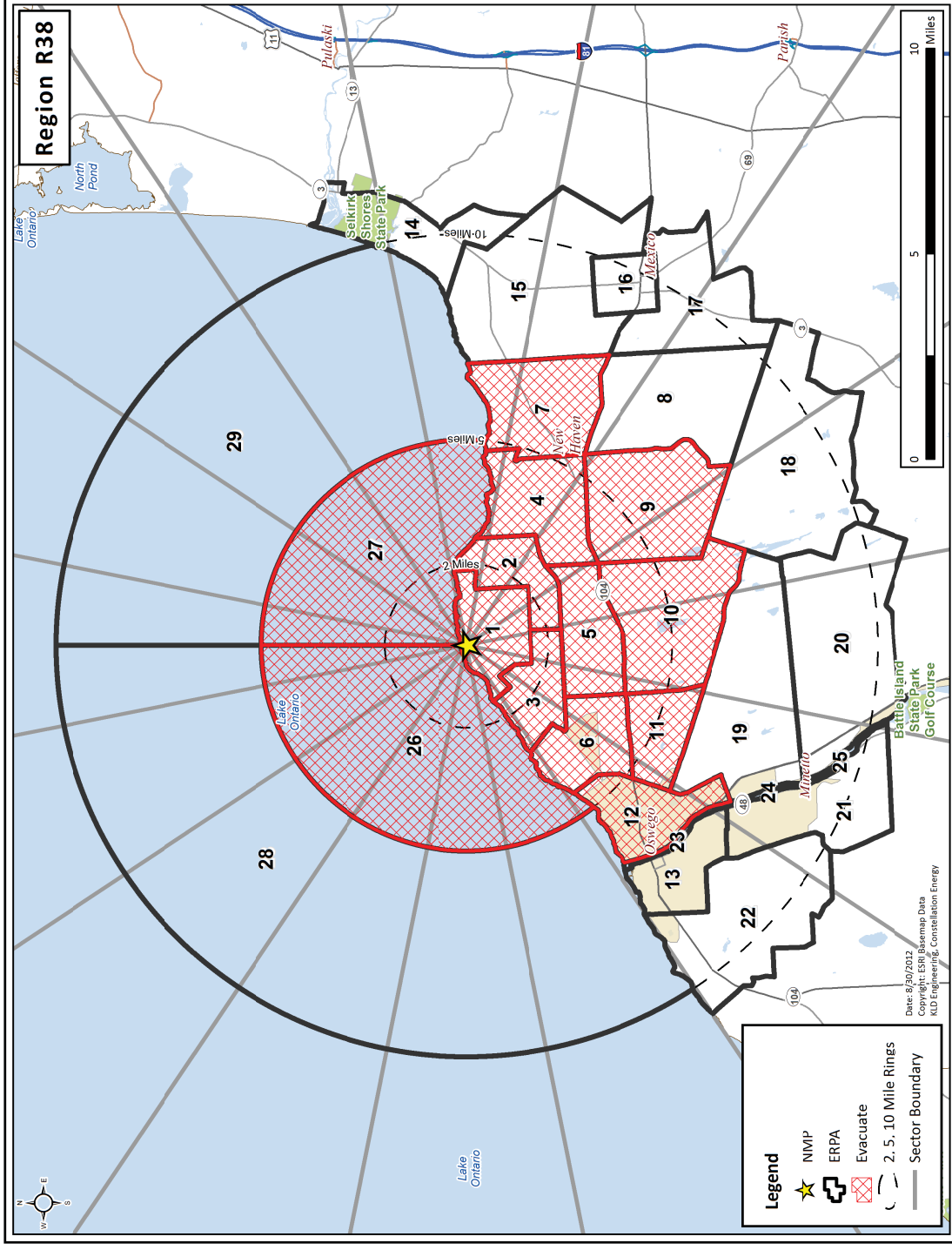


Figure H-38 Region R38

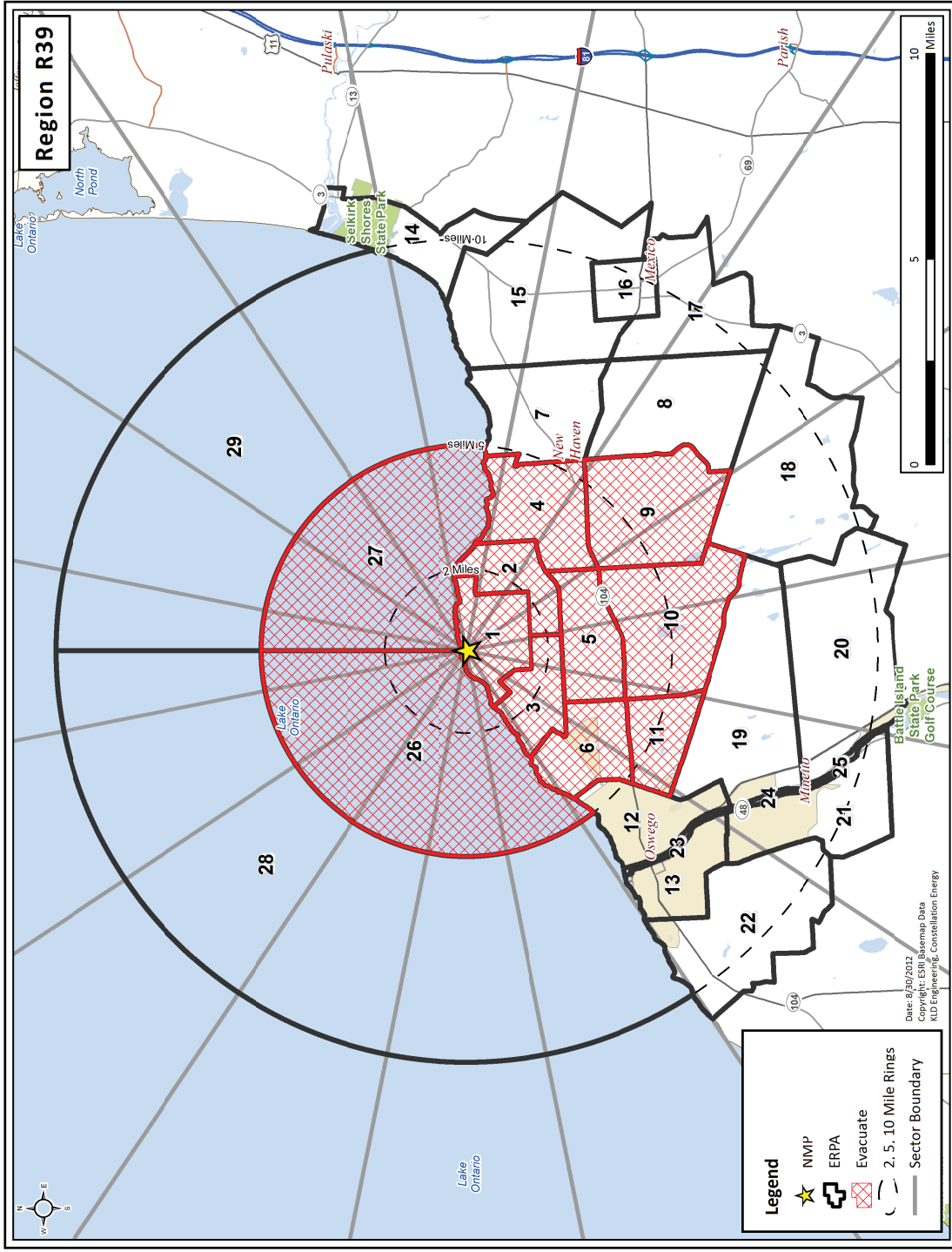


Figure H-39 Region R39

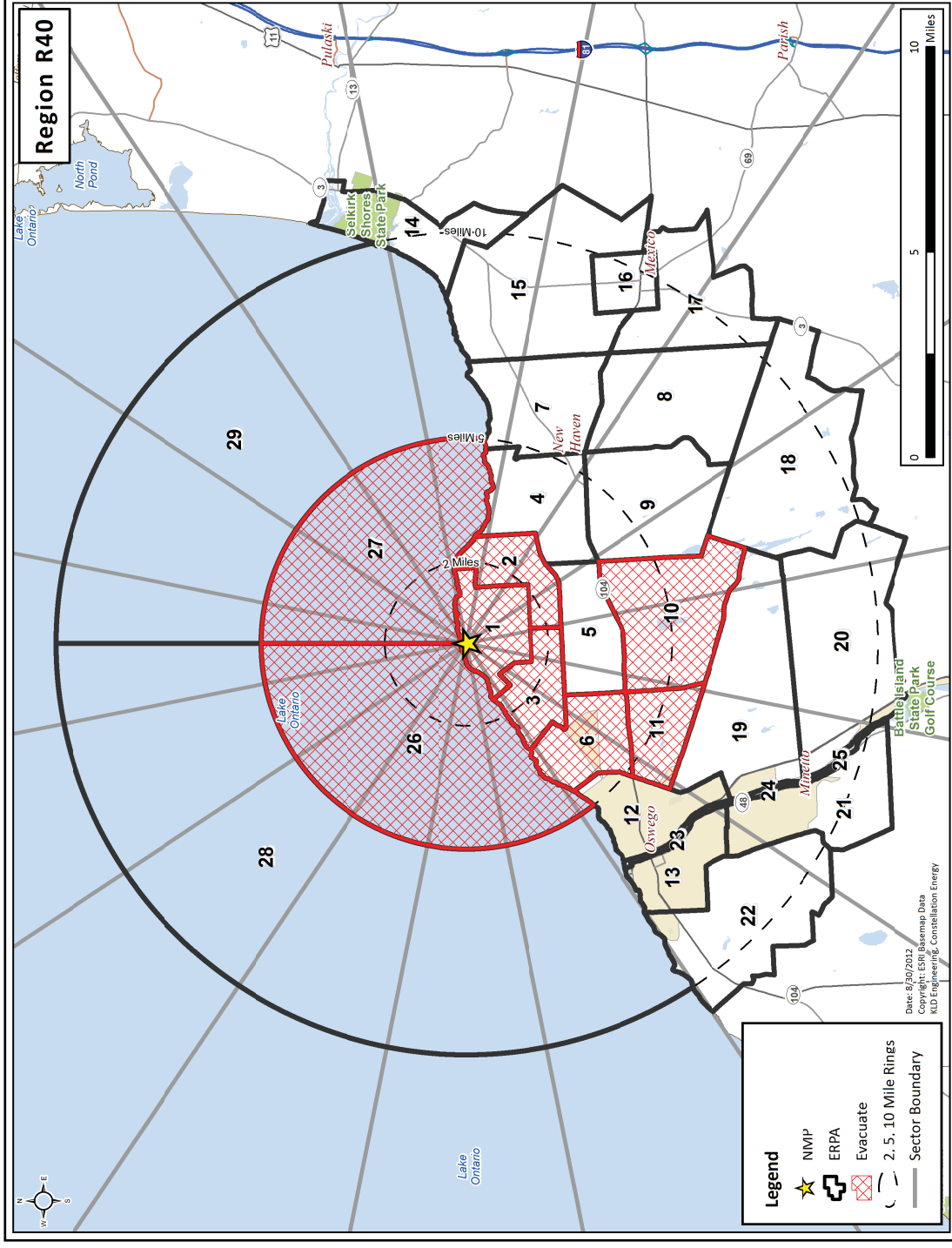


Figure H-40 Region R40

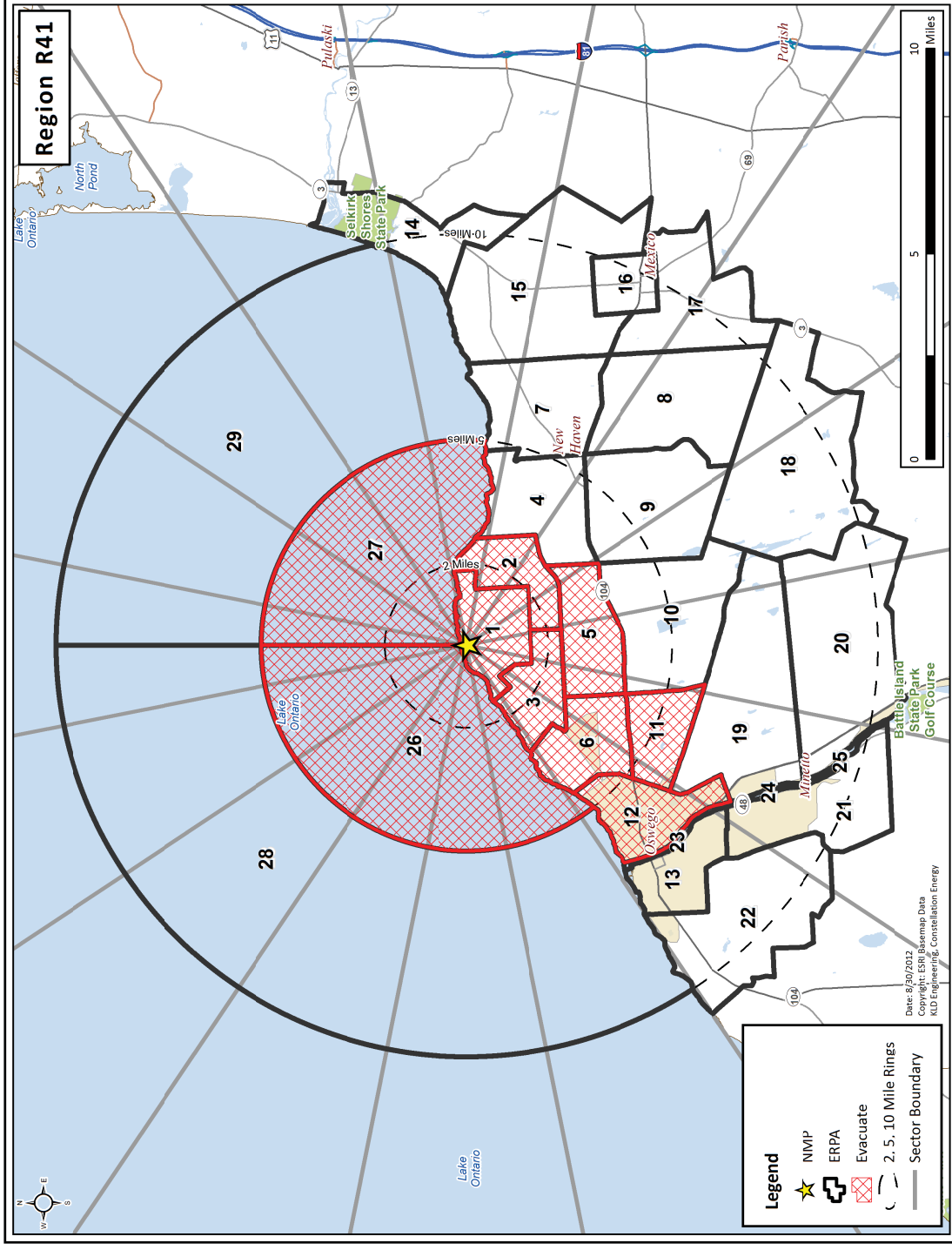


Figure H-41 Region R41

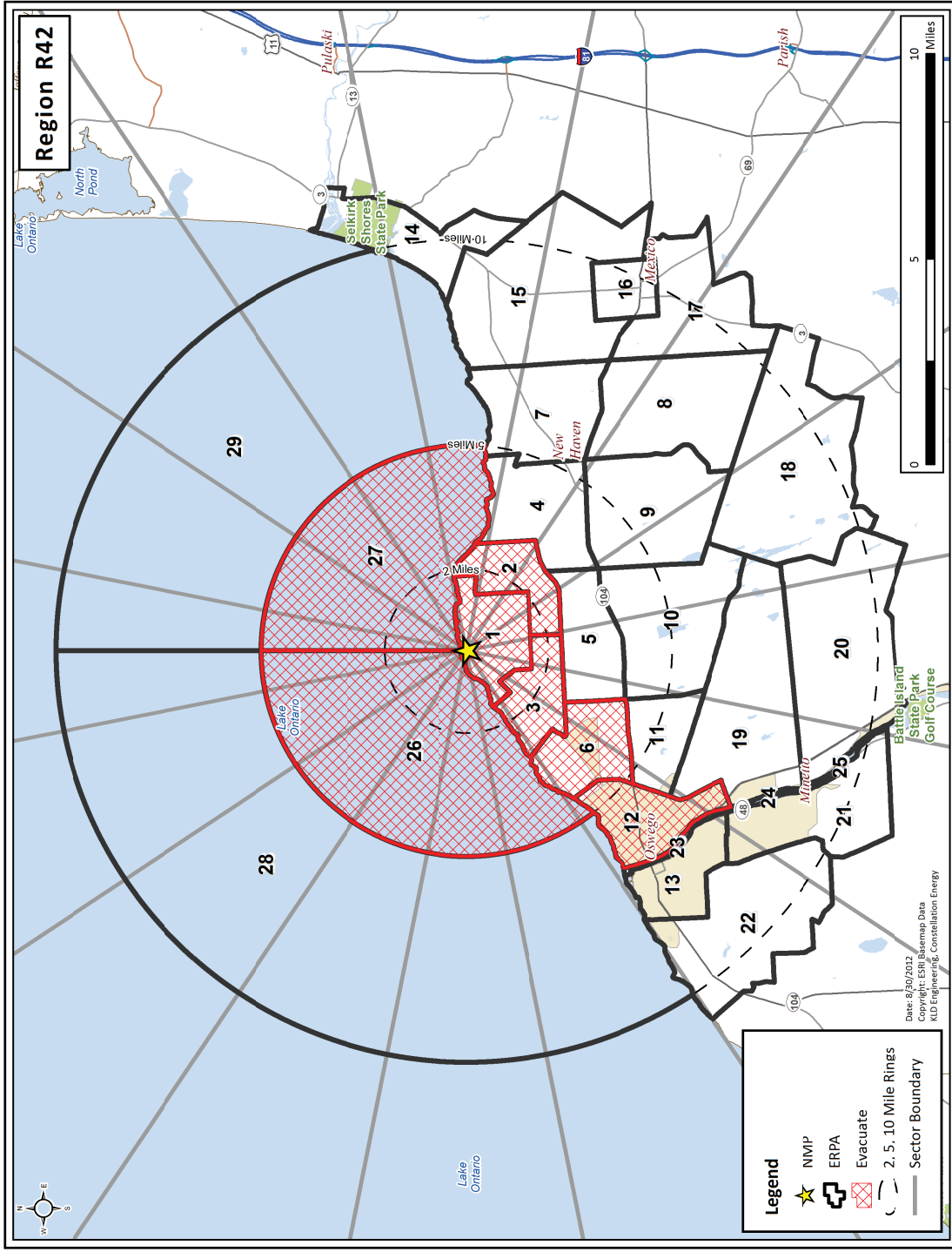


Figure H-42 Region R42

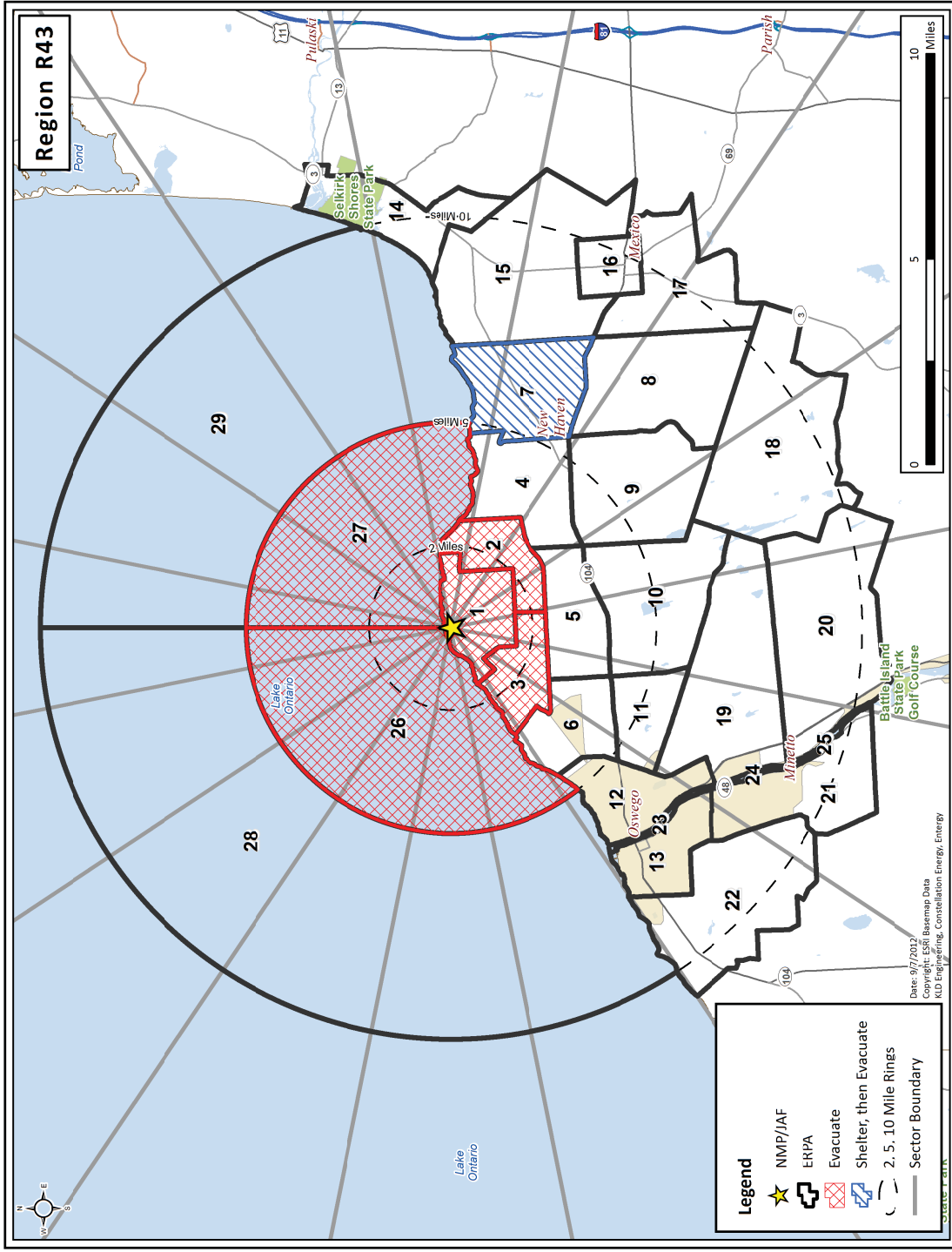


Figure H-43 Region R43

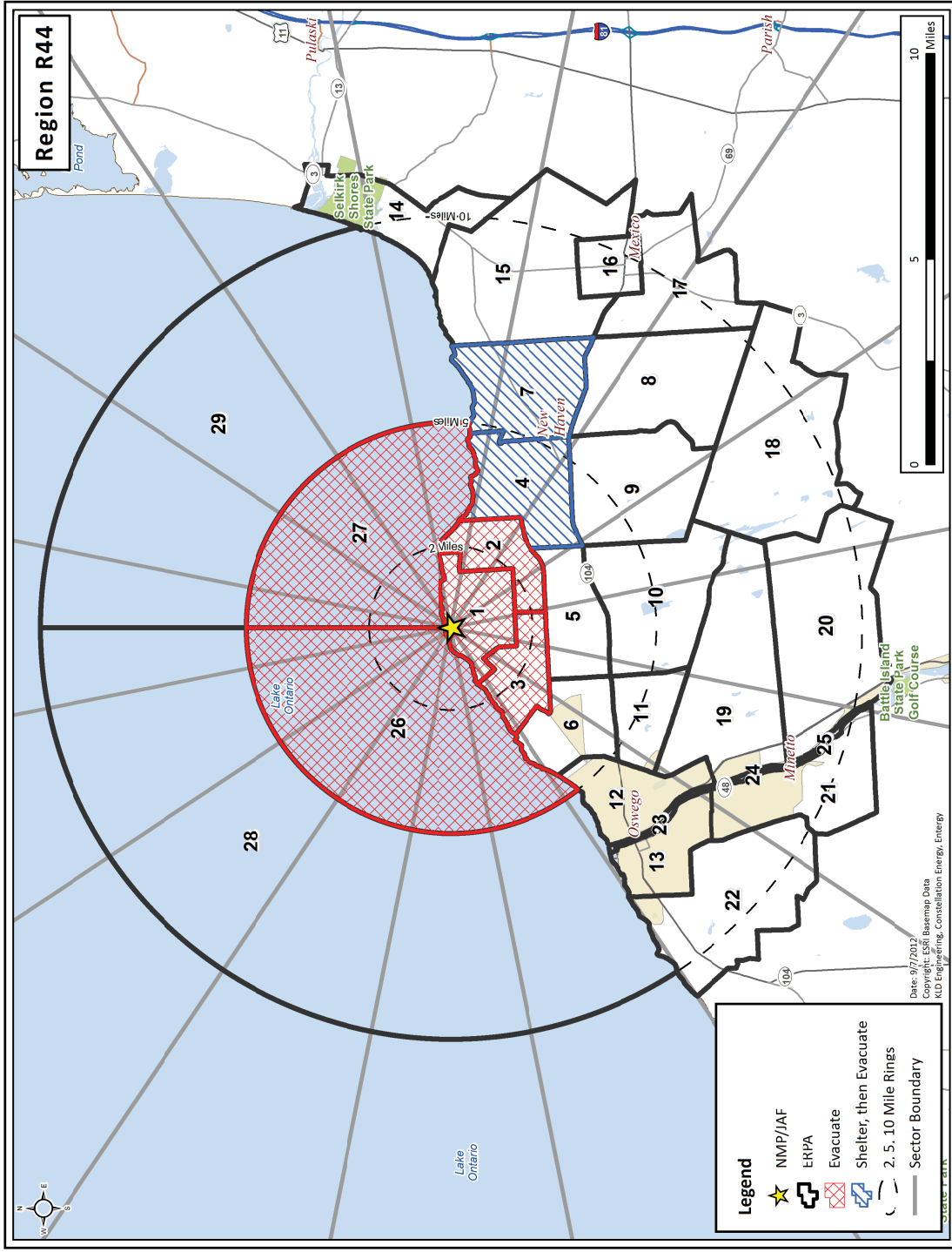


Figure H-44 Region R44

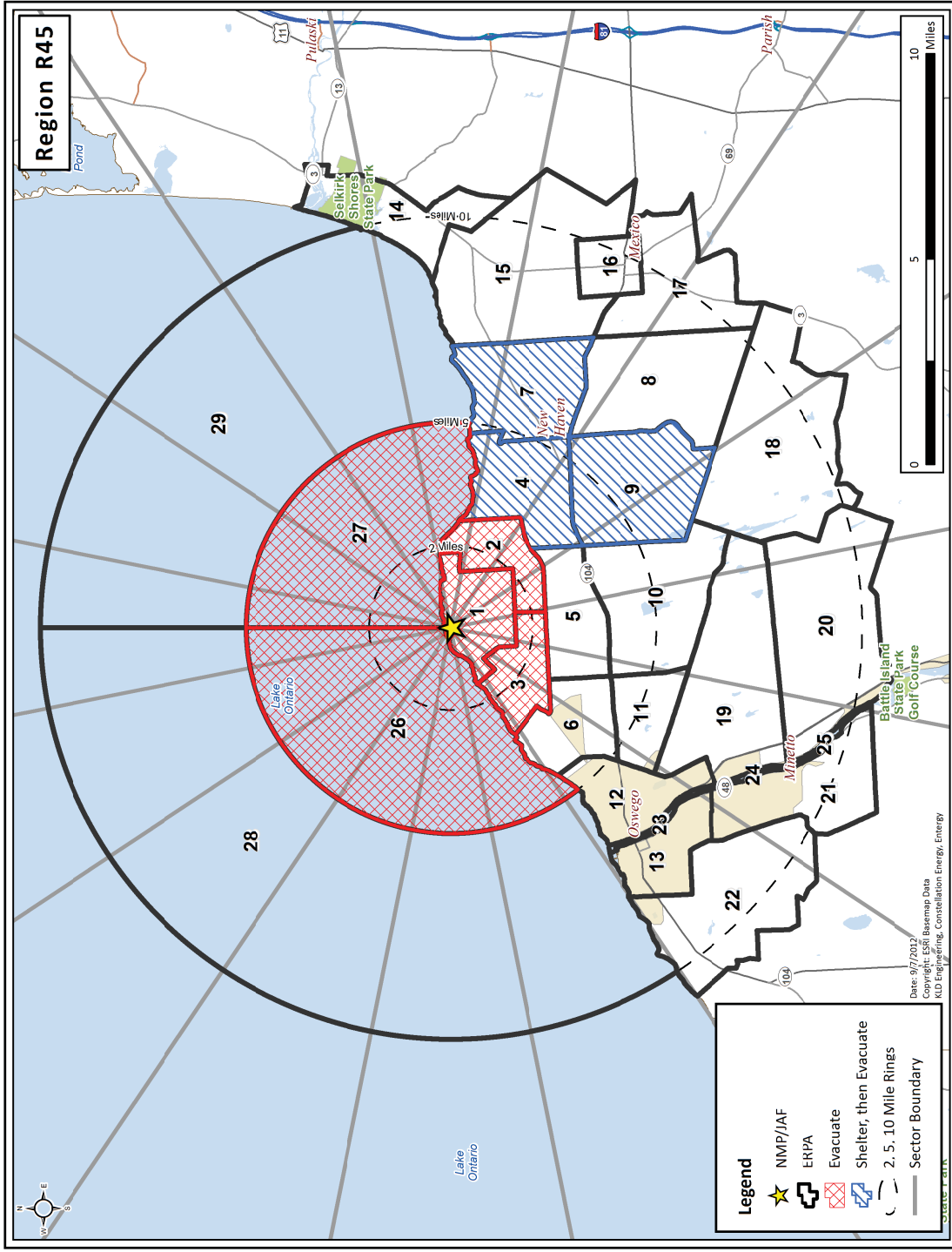


Figure H-45 Region R45

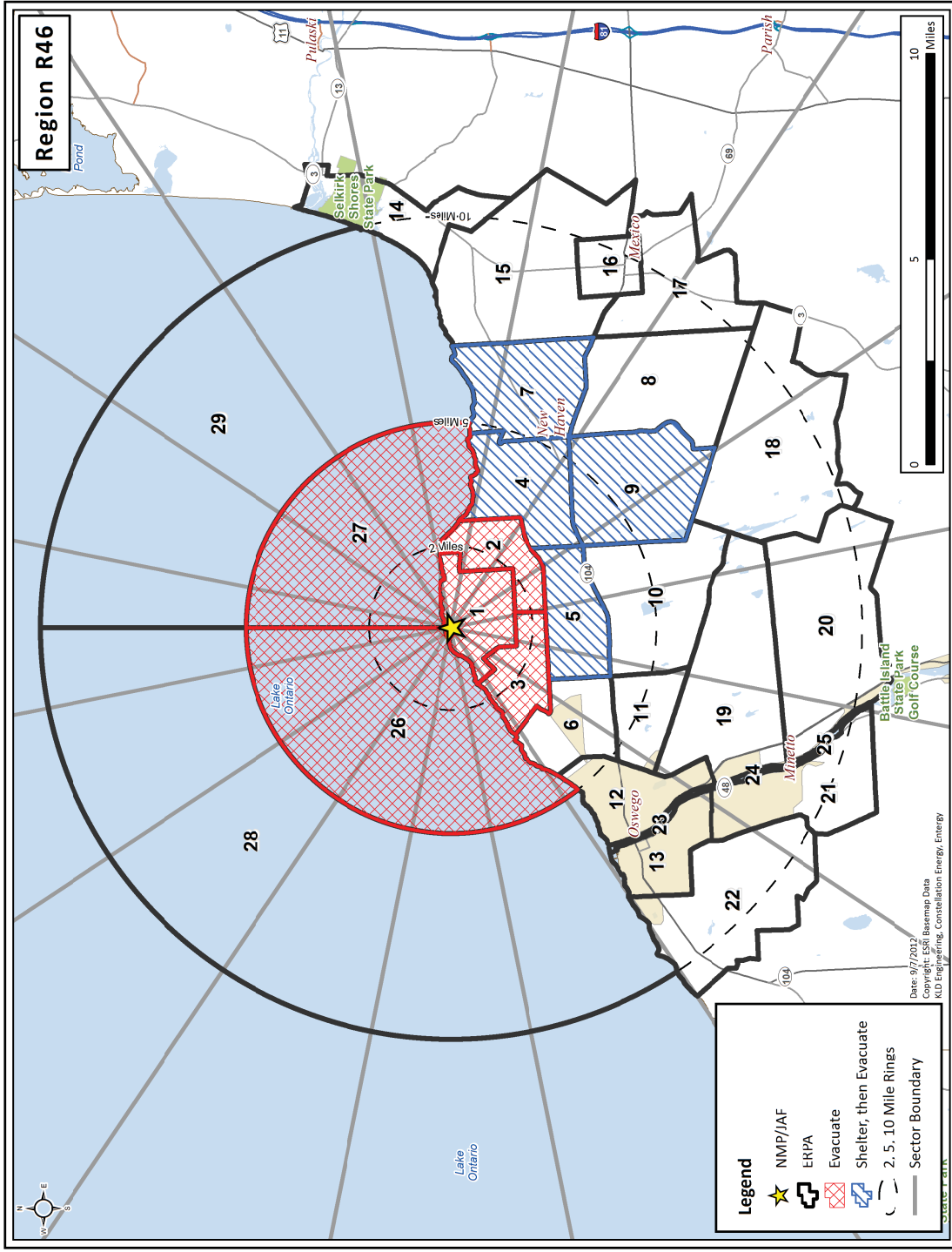


Figure H-46 Region R46

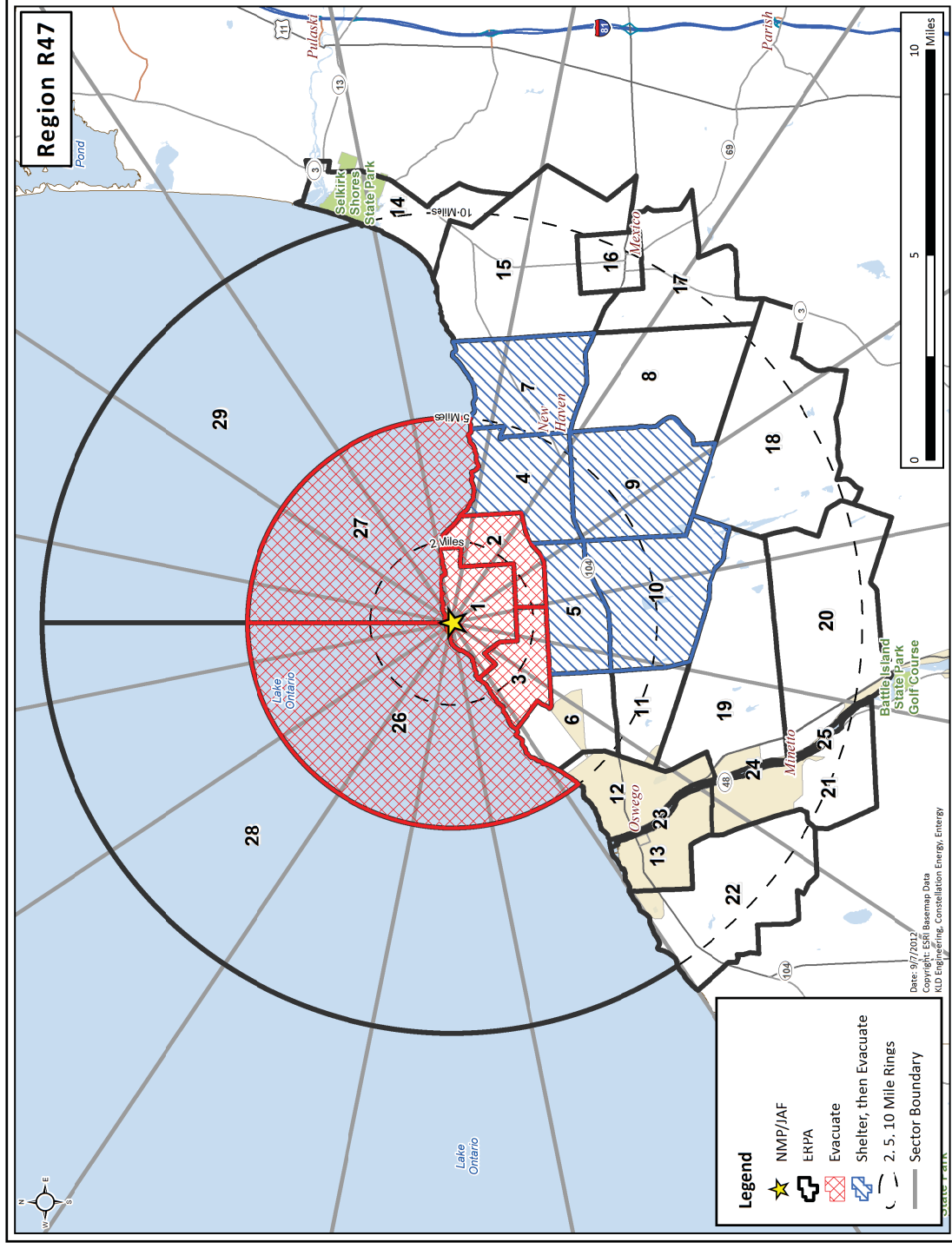


Figure H-47 Region R47

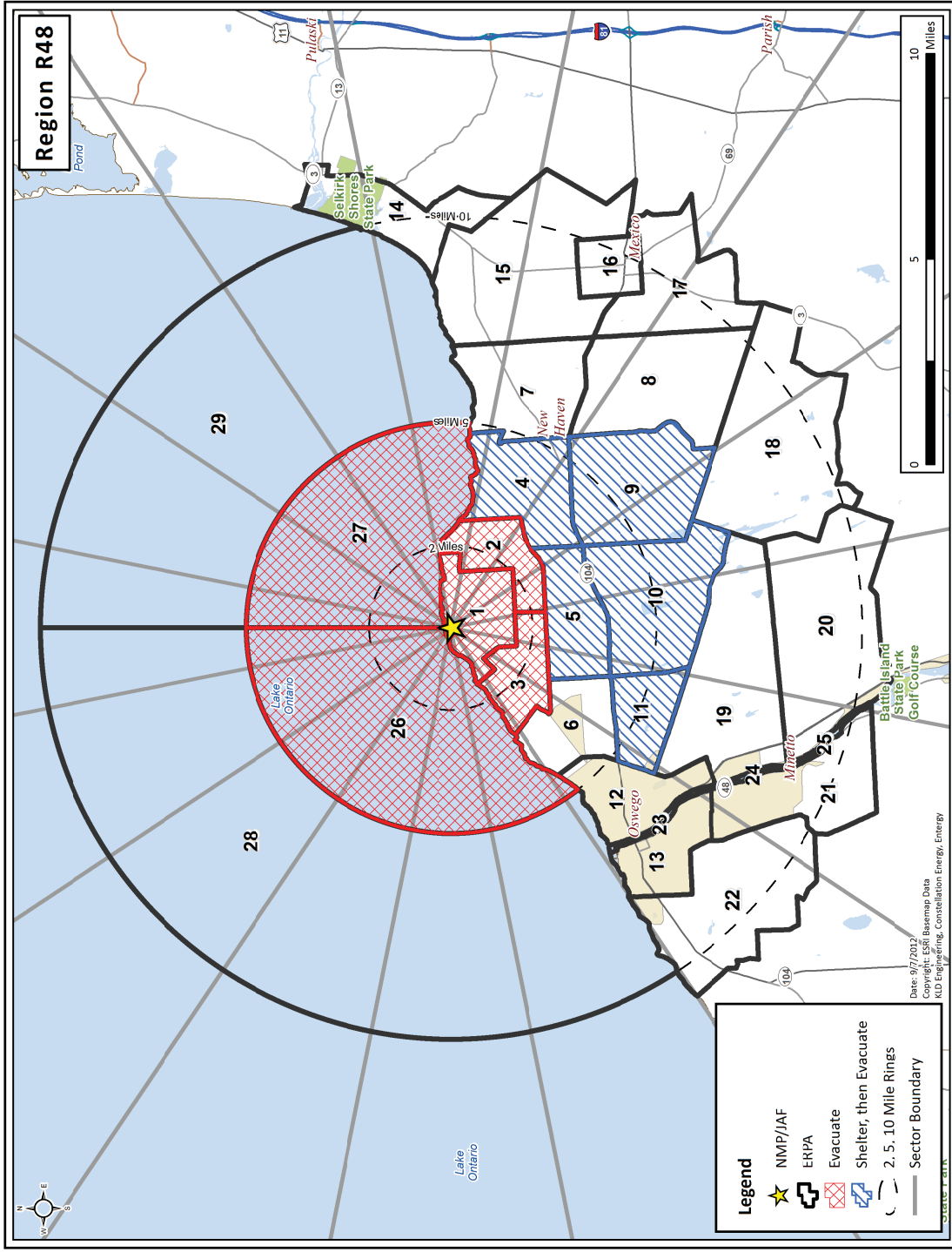


Figure H-48 Region R48

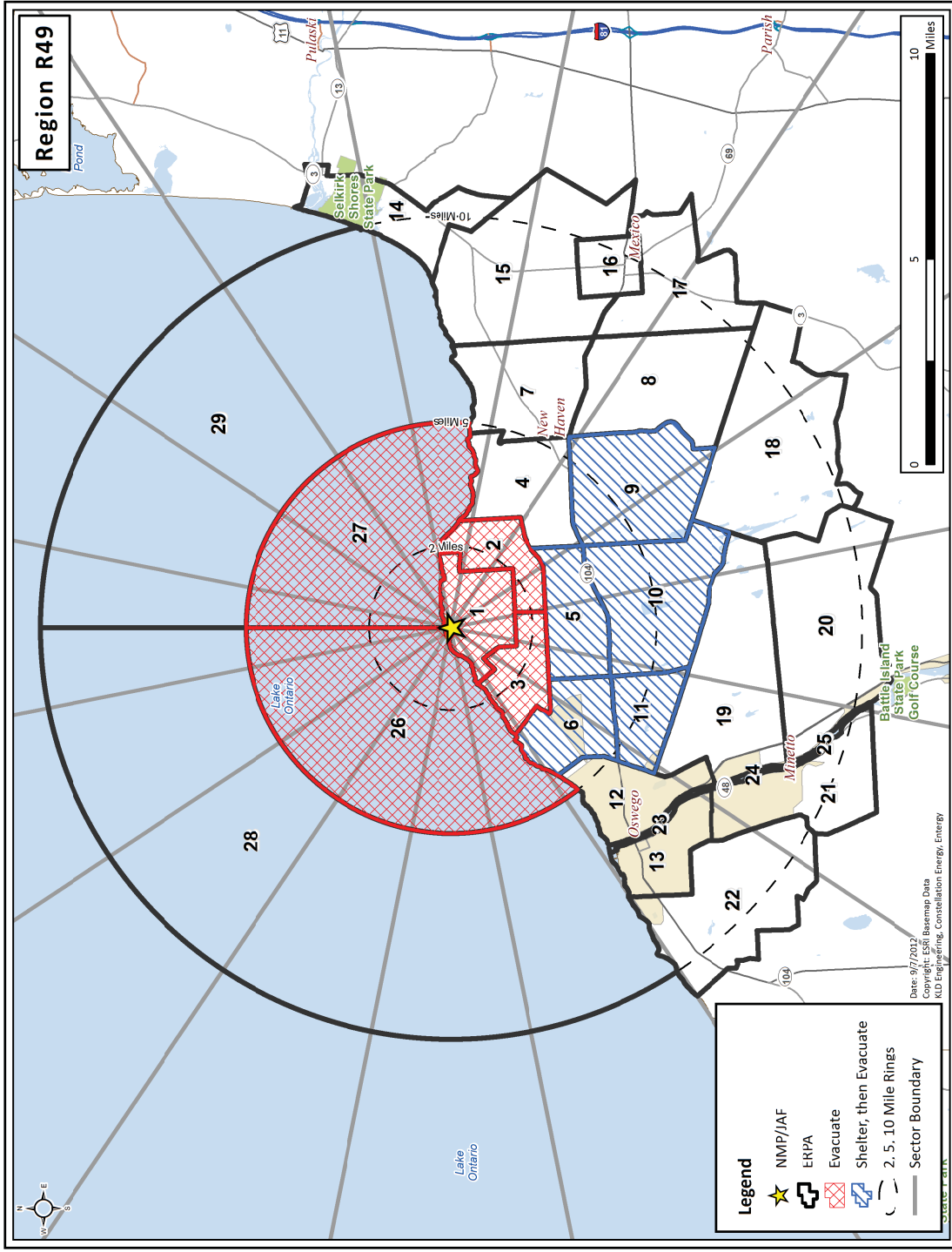
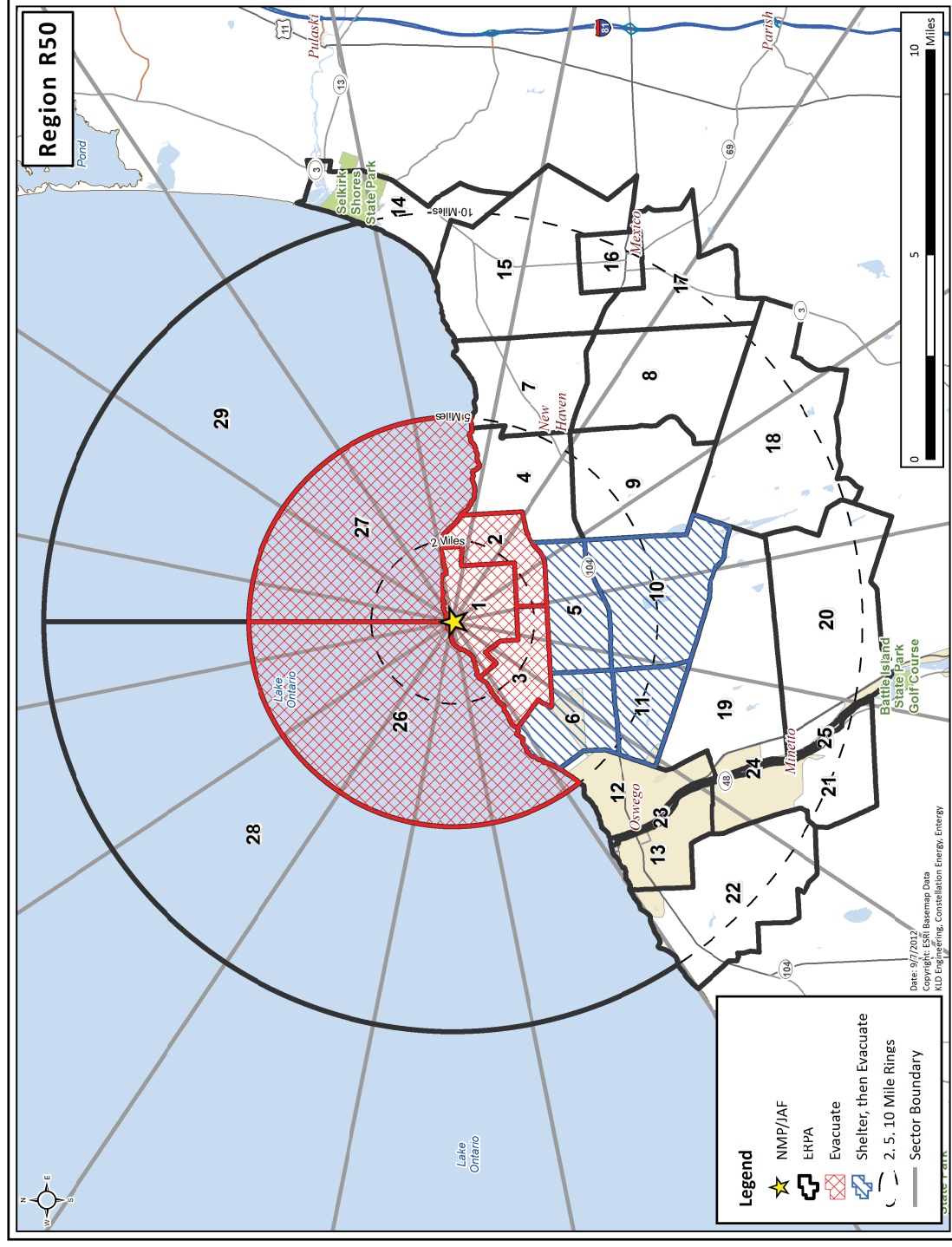


Figure H-49 Region R49



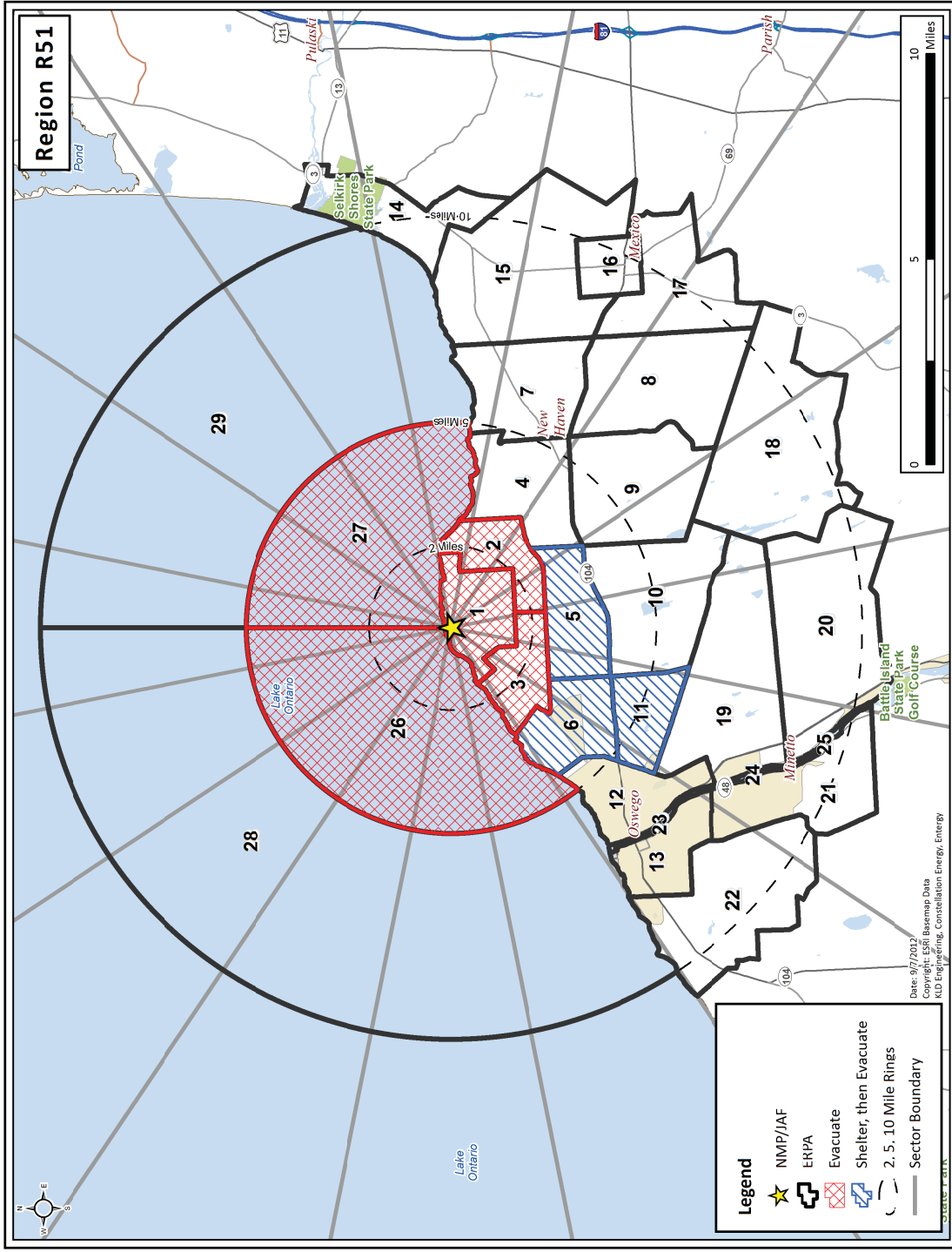


Figure H-51 Region R51

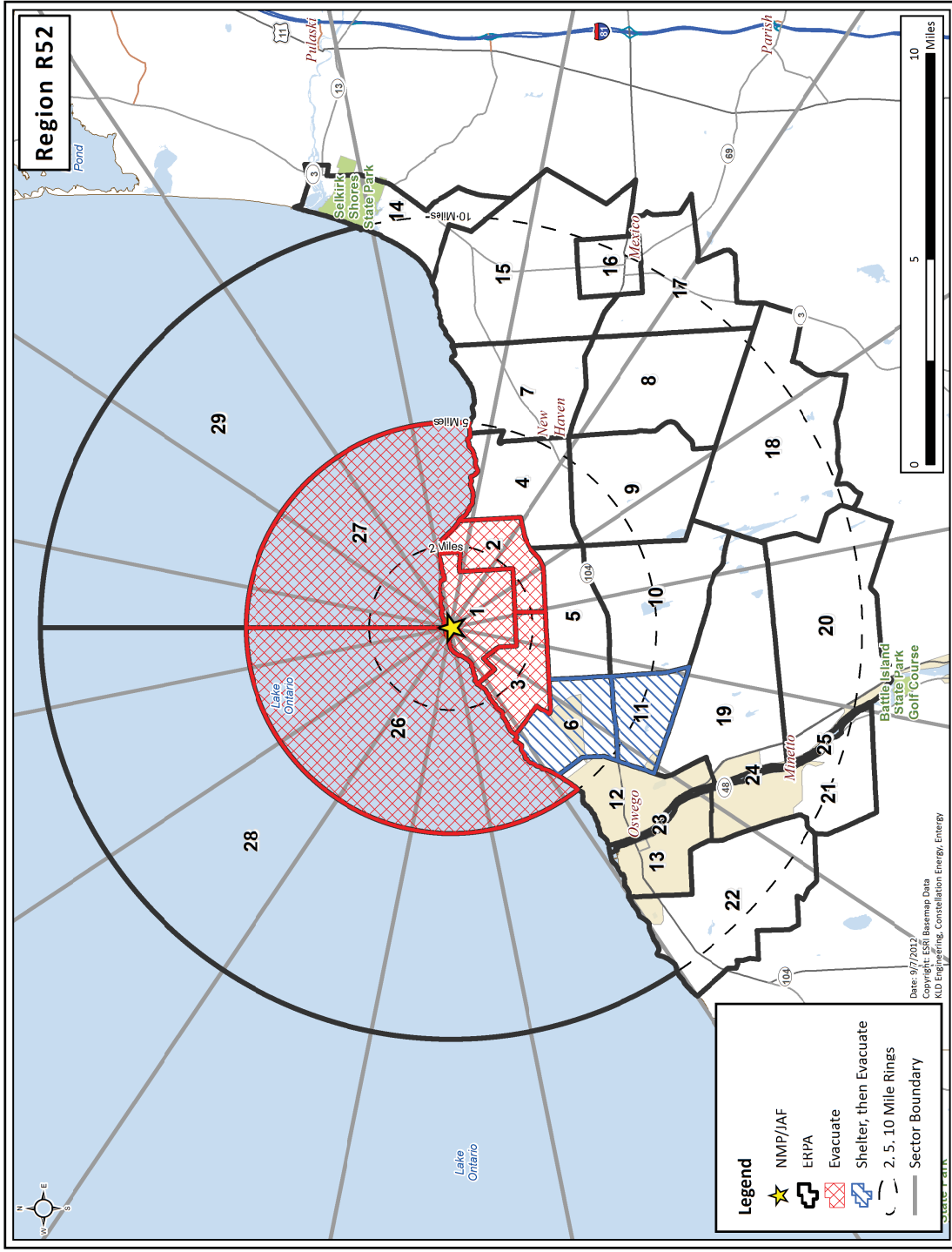


Figure H-52 Region R52

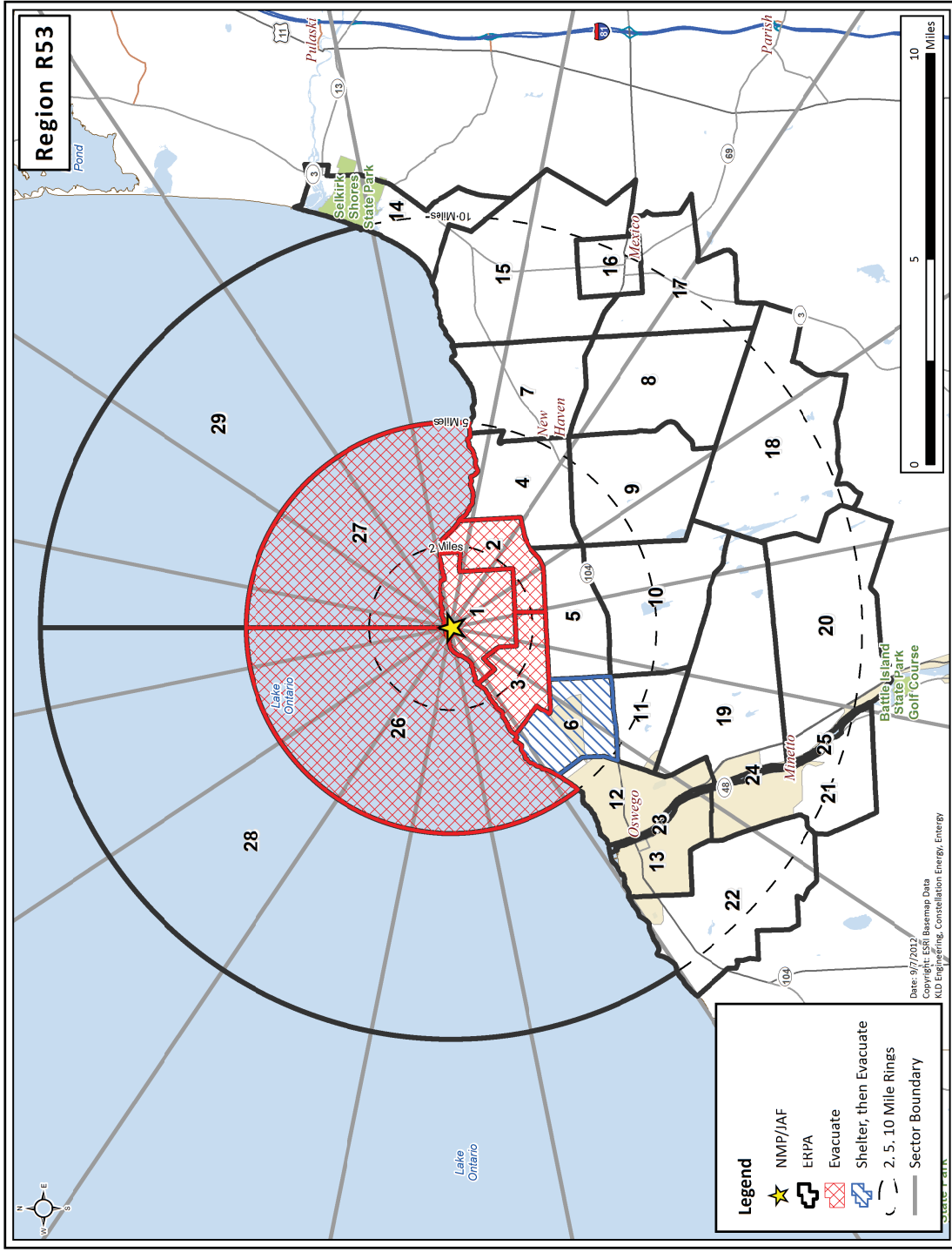


Figure H-53 Region R53

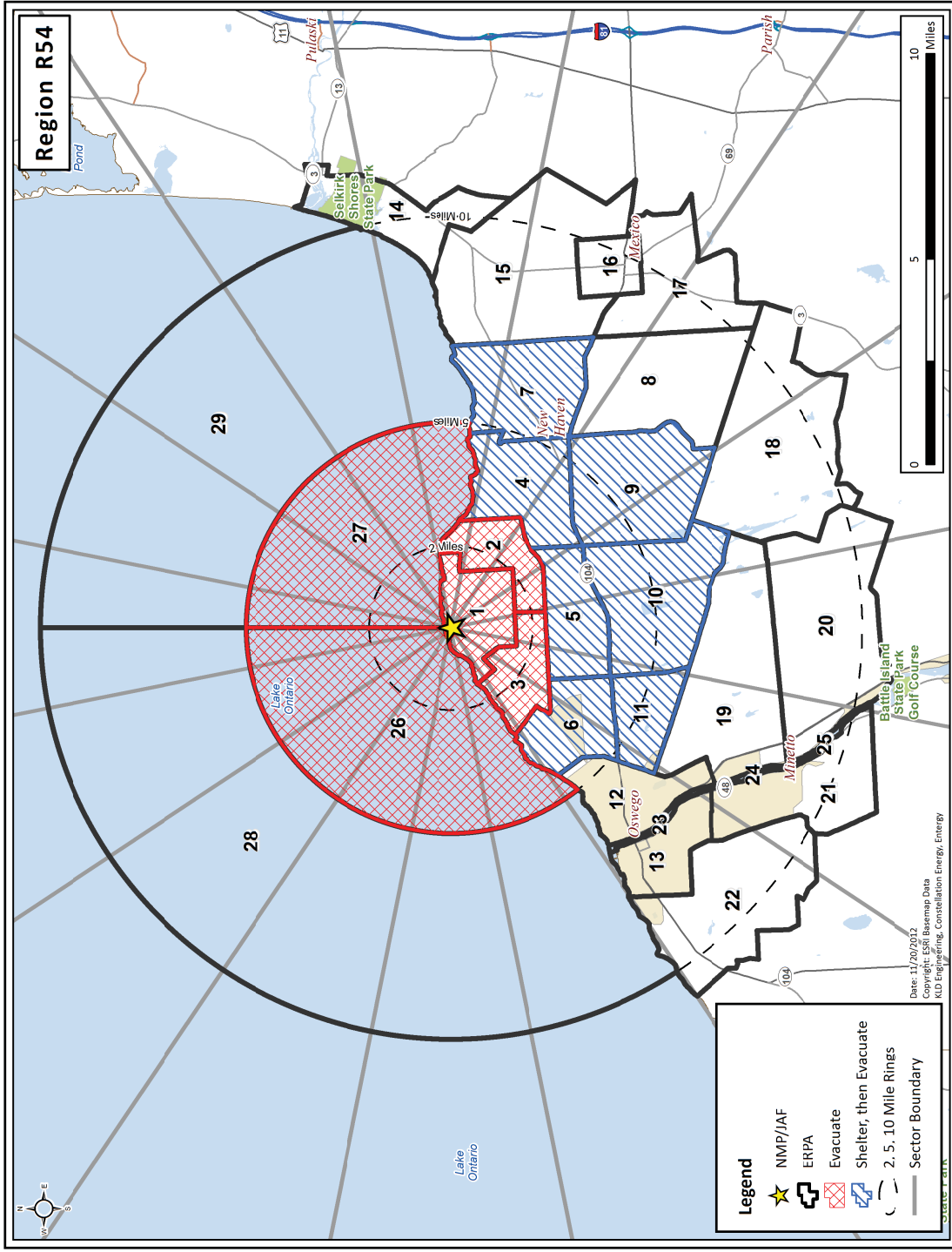


Figure H-54 Region R54

## **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 the volume and queues for the ten highest volume signalized intersections in the study area. A residual queue, existing at the start of the RED signal indication, indicates that the demand could not be entirely served by the GREEN phase. No residual queue indicates that the traffic movement is under-saturated (i.e., not congested) throughout the duration of evacuation. Refer to Table K-2 and the figures in Appendix K for a map showing the geographic location of each intersection.

Table J-1. Characteristics of the Ten Highest Volume Signalized Intersections provides source (vehicle loading) and destination information for several roadway segments (links) in the analysis network. Refer to Table K-1 and the figures in Appendix K for a map showing the geographic location of each link.

Table J-3 provides network-wide statistics (average travel time, average speed and number of vehicles) for an evacuation of the entire EPZ (Region R03) for each scenario. As expected, Scenarios 8 and 11, which are snow scenarios, exhibit the slowest average speed and longest average travel times of all non-special event scenarios. Table J-4 provides statistics (average speed and travel time) for the major evacuation routes –SR 481, SR 104, SR 48, and SR 3 – 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 7-7, SR 104 is congested for most of the evacuation. As such, the average speeds are comparably slower (and travel times longer) than other evacuation routes.

Table J-5 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 Table K-1 and the figures in Appendix K for a map showing the geographic location of each link.

Figure J-1 through Figure J-14 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-1 through Figure J-14, the curves are spatially separated as a result of the traffic congestion in the EPZ, which was discussed in detail in Section 7.3.

**Table J-1. Characteristics of the Ten Highest Volume Signalized Intersections**

Node	Location	Intersection Control	Approach (Up Node)	Total Volume (Veh)	Max. Turn Queue (Veh)
366	SR 481 and Oneida St	Actuated	653	1,533	0
			652	5,071	0
			651	2,555	0
			TOTAL	9,159	-
367	SR 481 and SR3	Actuated	368	6,056	0
			654	1,456	0
			371	1,239	0
			TOTAL	8,751	-
390	SR 481 and CR57 (S 1st St)	Actuated	392	0	0
			393	7,505	0
			TOTAL	7,505	-
387	SR 481 and Fay St	Actuated	397	2,166	158
			389	37	0
			399	5,266	29
			TOTAL	7,469	4
417	SR 104 and SR 3	Actuated	460	3,451	59
			459	2,812	82
			TOTAL	6,263	-
368	SR 481 and Rochester St	Actuated	366	5,957	0
			369	66	0
			400	19	0
			TOTAL	6,042	-
524	W 1st St and W Utica St	Actuated	346	2,024	28
			669	1,160	123
			539	0	0
			538	2,412	53
			TOTAL	5,596	-
406	SR 3 and SR 48	Actuated	409	2,527	16
			371	2,101	34
			644	865	0
			TOTAL	5,493	4
509	SR 104 and Sweet Rd	Actuated	678	1,572	344
			510	3,841	102
			TOTAL	5,413	-
401	SR 48 and Oneida St	Actuated	650	1,401	0
			410	3,961	0
			TOTAL	5,362	-

**Table J-2. Sample Simulation Model Input**

Link Number	Vehicles Entering Network on this Link	Directional Preference	Destination Nodes	Destination Capacity
3	4	E	8048	1,700
138	76	SE	8282	1,575
			8298	6,750
			8279	1,744
221	130	SE	8282	1,575
			8298	6,750
			8279	1,744
314	12	S	8456	1,700
			8431	1,700
			8442	1,575
456	37	S	8431	1,700
			8442	1,575
			8391	1,575
545	26	S	8431	1,700
			8442	1,575
			8391	1,575
641	0	SW	8640	1,700
			8457	1,700
			8456	1,700
718	44	SW	8391	1,575
822	111	SW	8440	2,250
984	242	SW	8452	1,700
			8640	1,700
			8457	1,700

Table J-3. Selected Model Outputs for the Evacuation of the Entire EPZ (Region R03)

Scenario	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Network-Wide Average Travel Time (Min/Veh-Mi)	2.7	2.9	2.8	3.1	2.9	2.7	2.9	3.3	2.6	2.9	3.0	2.9	5.7	2.7
Network-Wide Average Speed (mph)	22.7	20.5	21.3	19.2	20.4	22.6	20.4	18.5	23.1	20.8	19.9	20.8	10.5	22.3
Total Vehicles Exiting Network	36,718	36,752	37,458	37,658	31,353	38,412	38,384	38,789	34,734	34,949	35,002	30,689	55,714	36,714

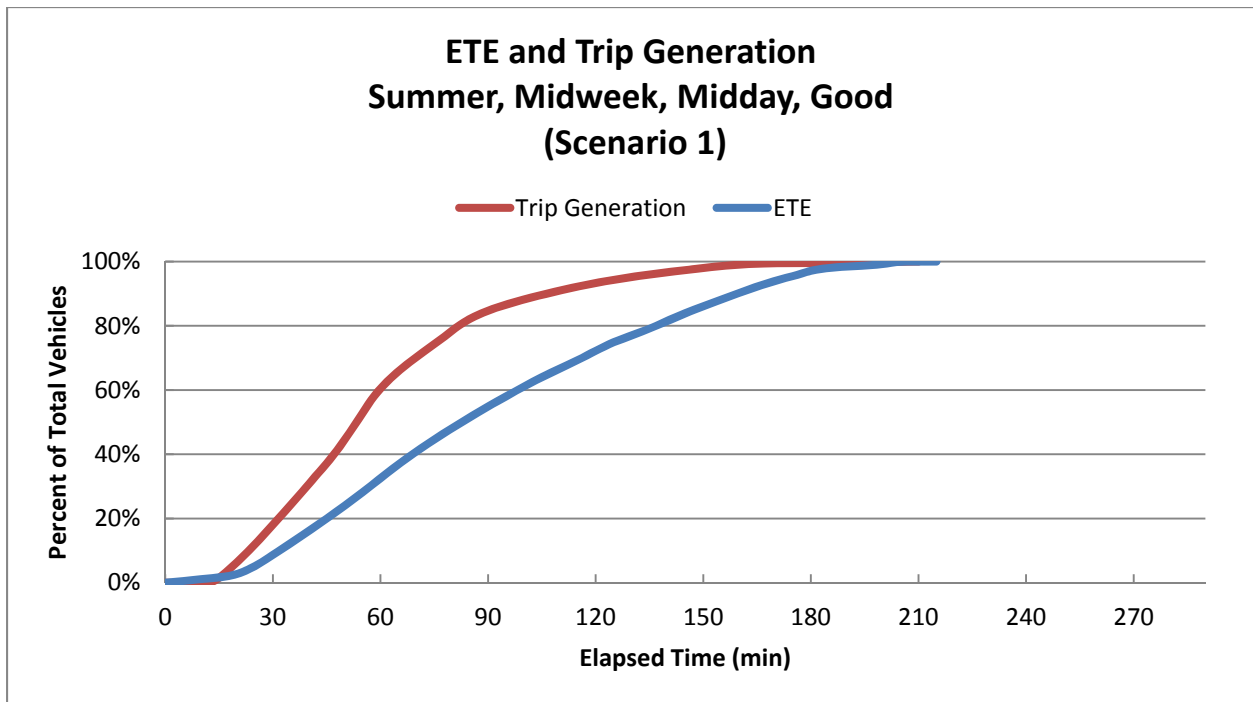
Table J-4. Average Speed (mph) and Travel Time (min) for Major Evacuation Routes (Region R03, Scenario 1)

Elapsed Time (hours)						
Route#	1		2		3	
	Length (miles)	Travel Time (min)		Travel Time	Speed	Travel Time
		Speed (mph)				
SR 481 SB	7.4	14.6	30.5	10.2	43.5	39.7
SR 104 WB	9.6	7.8	74.4	5.9	98.0	28.3
SR 48 SB	6.1	23.2	15.6	19.6	18.5	47.9
SR 104 EB	10.4	48.1	12.9	47.9	13.0	47.0
SR 3 NB	4.6	43.7	6.4	48.7	5.7	49.4
						5.6

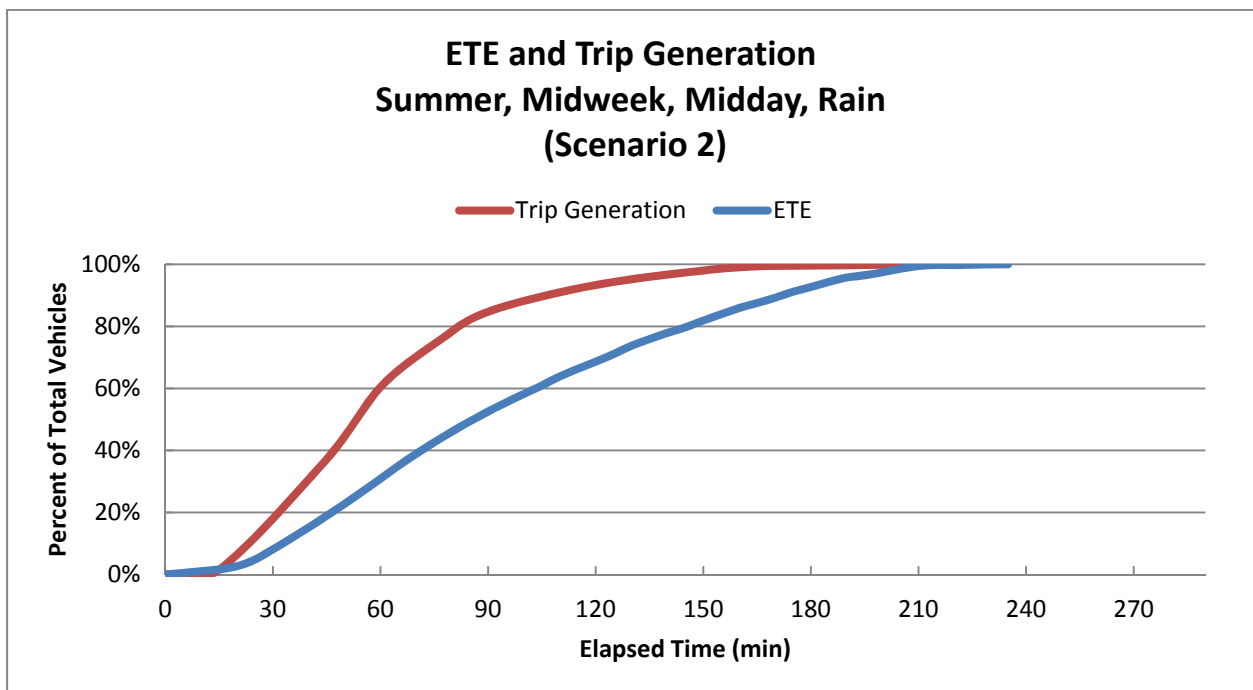
**Table J-5. Simulation Model Outputs at Network Exit Links for Region R03, Scenario 1**

Network Exit Link	Elapsed Time (hours)		
	1	2	3
	Cumulative Vehicles Discharged by the Indicated Time		
	Cumulative Percent of Vehicles Discharged by the Indicated Time		
0	0	0	0
	0	0	0
27	40	117	134
	0	0	0
37	87	218	241
	1	1	1
50	1,320	2,701	3,174
	15	11	9
53	30	139	168
	0	1	1
66	203	465	520
	2	2	2
74	323	846	940
	4	4	3
85	224	546	614
	3	2	2
94	111	300	342
	1	1	1
360	345	883	995
	4	4	3
393	165	663	788
	2	3	2
396	76	343	416
	1	1	1
397	1,458	3,178	3,743
	17	13	11
541	375	1,246	2,099
	4	5	6
552	616	1,949	2,906
	7	8	9

Network Exit Link	Elapsed Time (hours)		
	1	2	3
	Vehicles Discharged by the Indicated Time		
	Cumulative Percent of Vehicles Discharged by the Indicated Time		
586	345	1,466	2,363
	4	6	7
627	822	2,171	3,539
	9	9	10
628	717	2,223	3,560
	8	9	11
633	468	1,049	1,637
	5	4	5
635	47	183	350
	1	1	1
636	471	1,310	2,139
	5	5	6
913	0	0	0
	0	0	0
935	586	1,906	3,152
	7	8	9



**Figure J-1. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1)**



**Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2)**

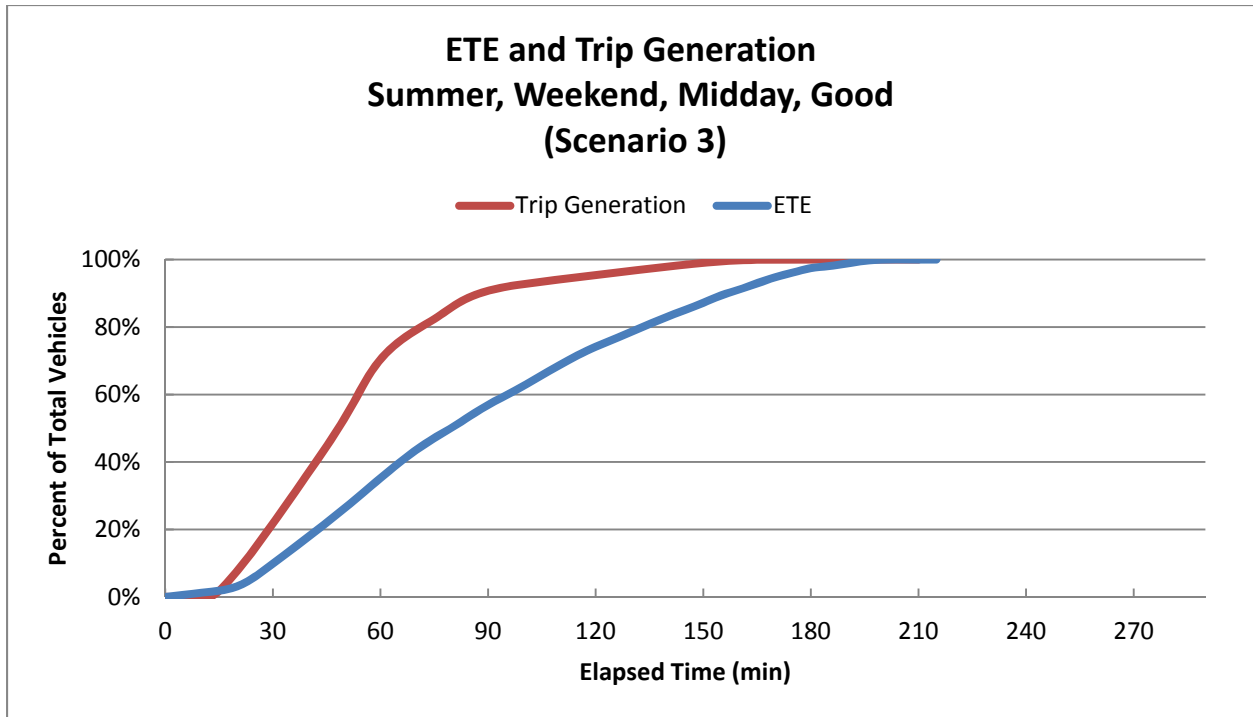


Figure J-3. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3)

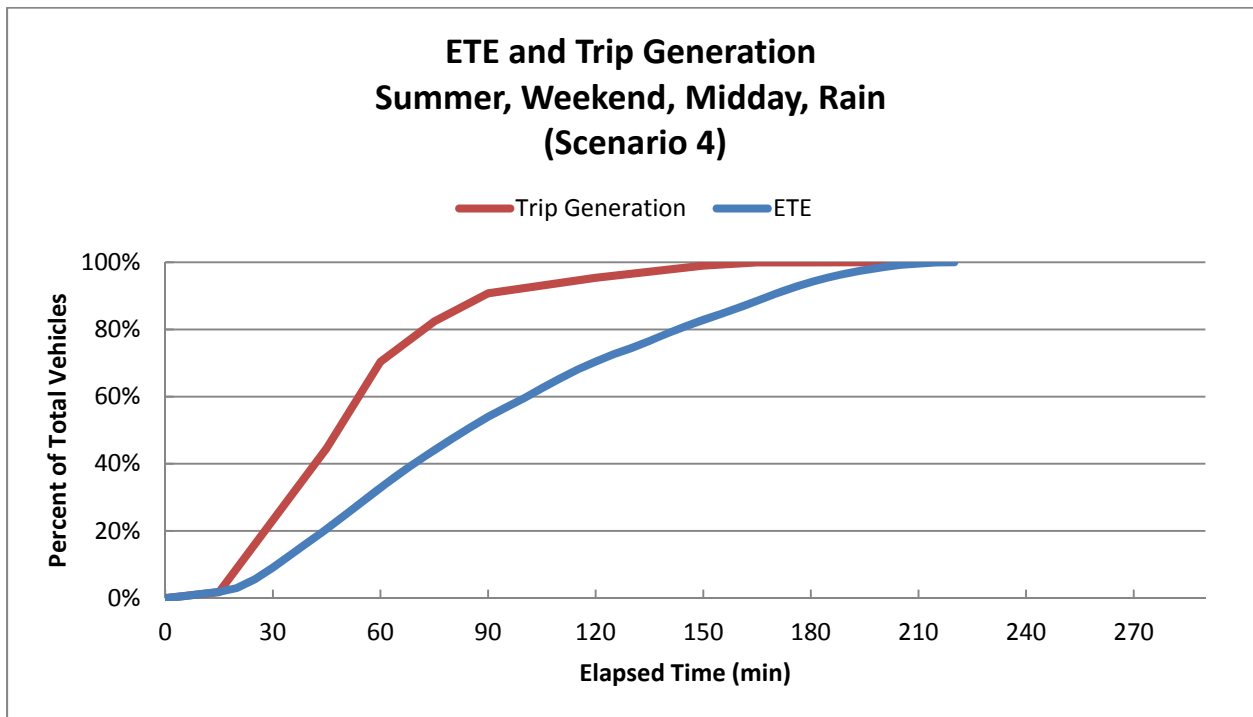


Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4)

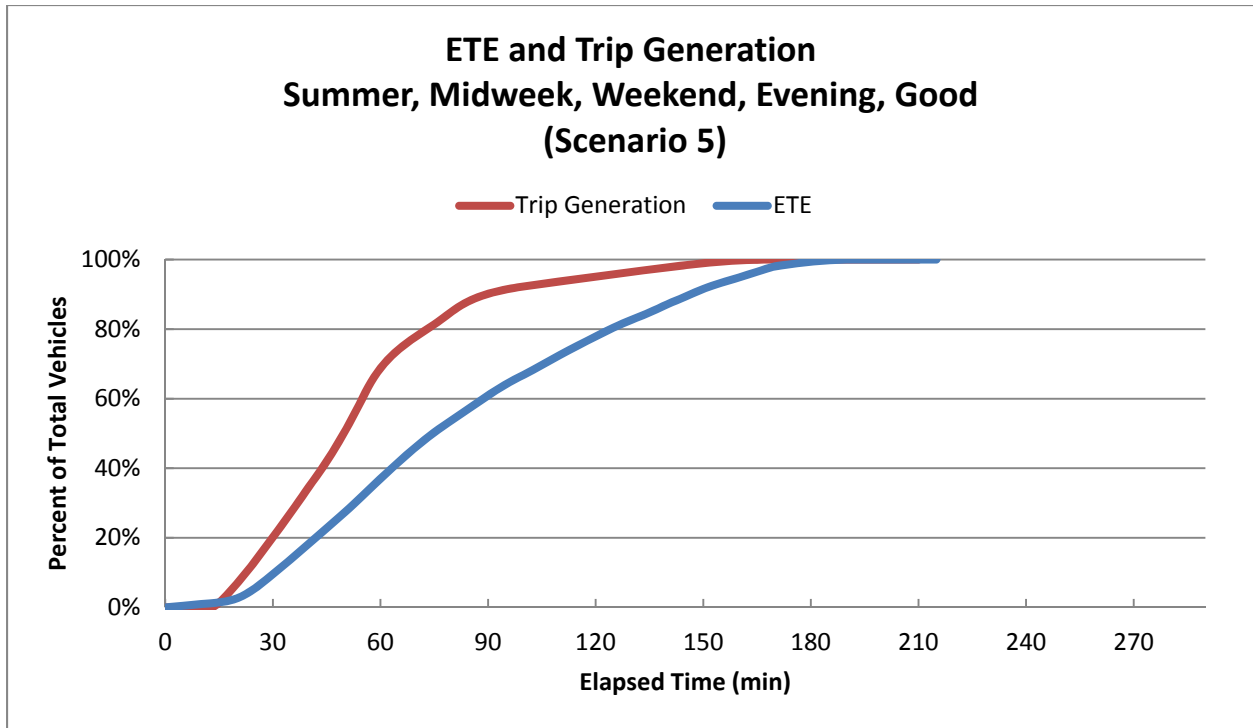


Figure J-5. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5)

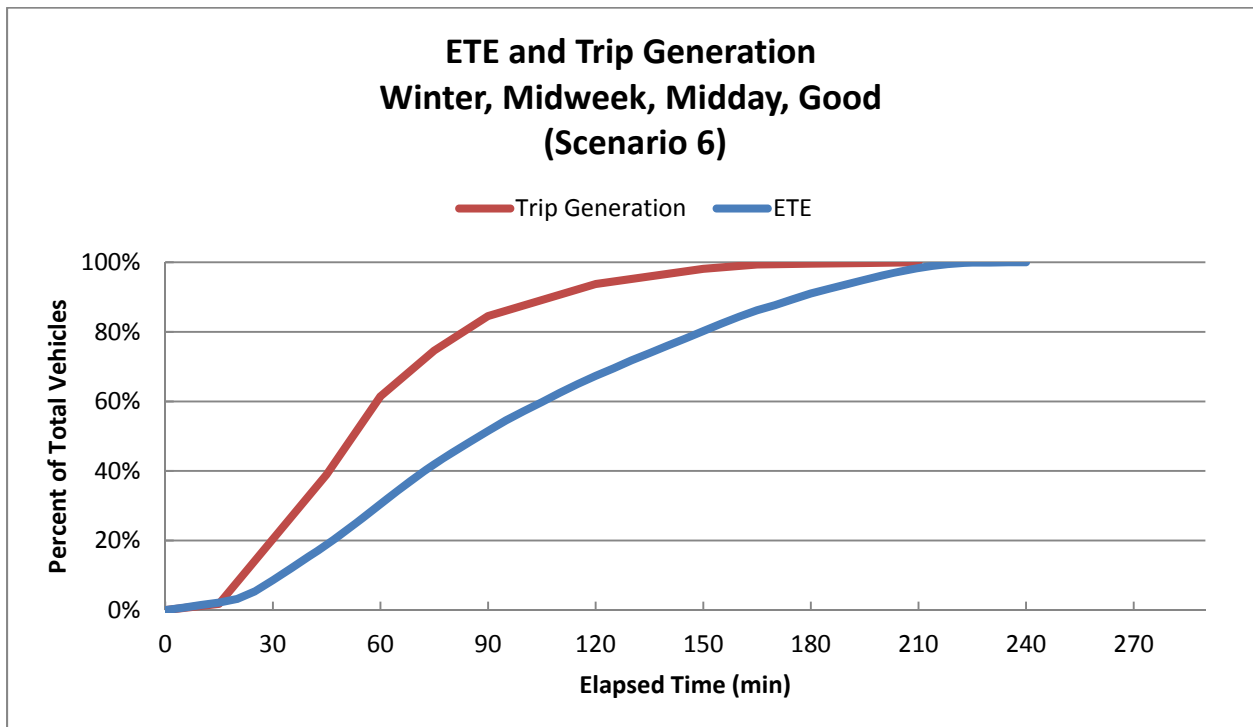


Figure J-6. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6)

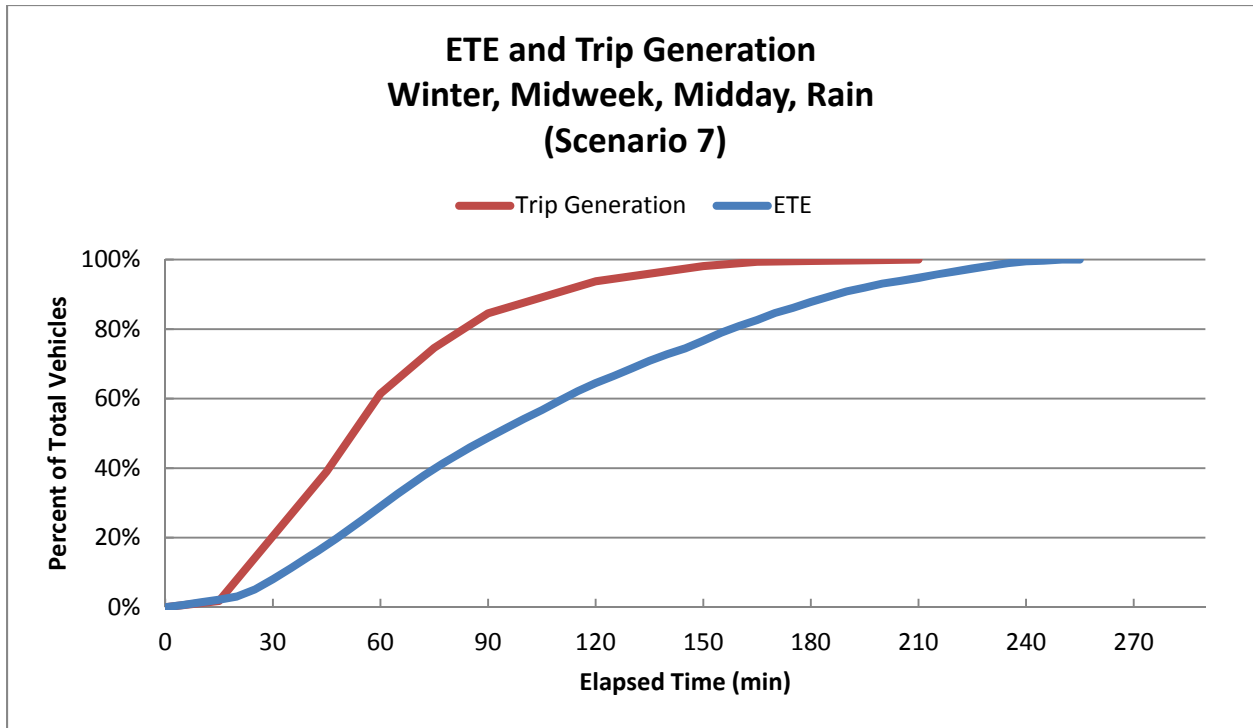


Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Rain (Scenario 7)

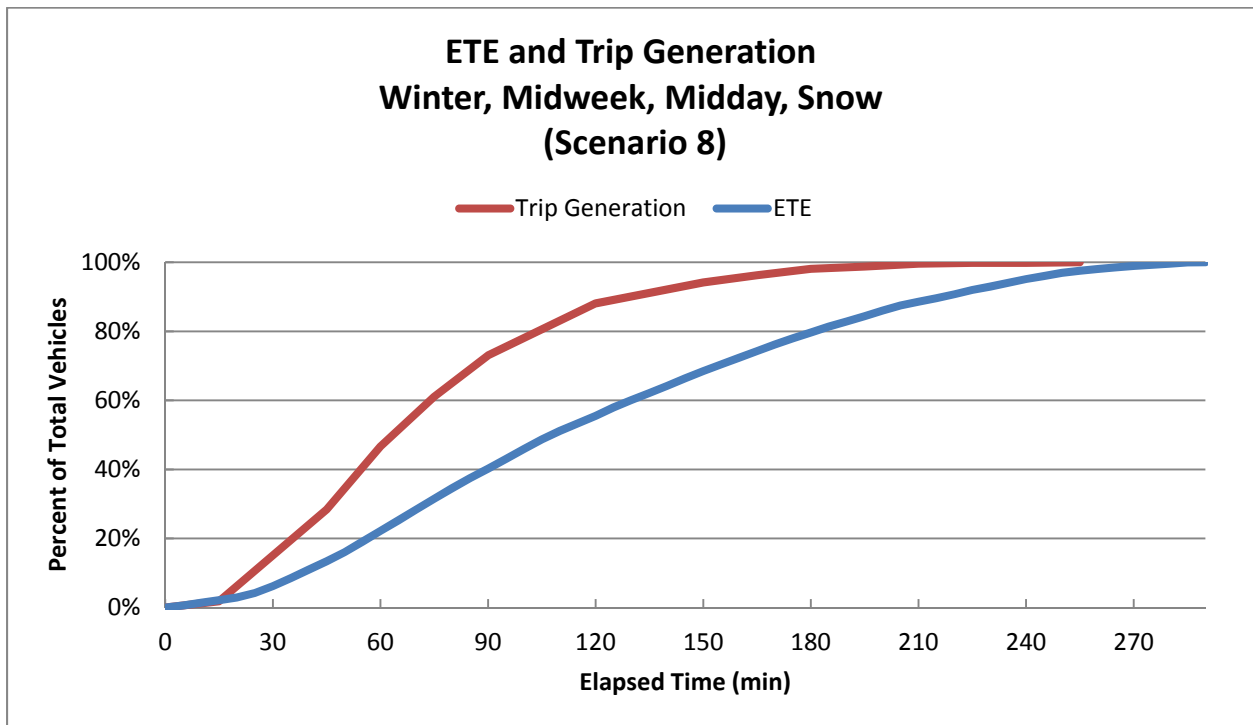


Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Snow (Scenario 8)

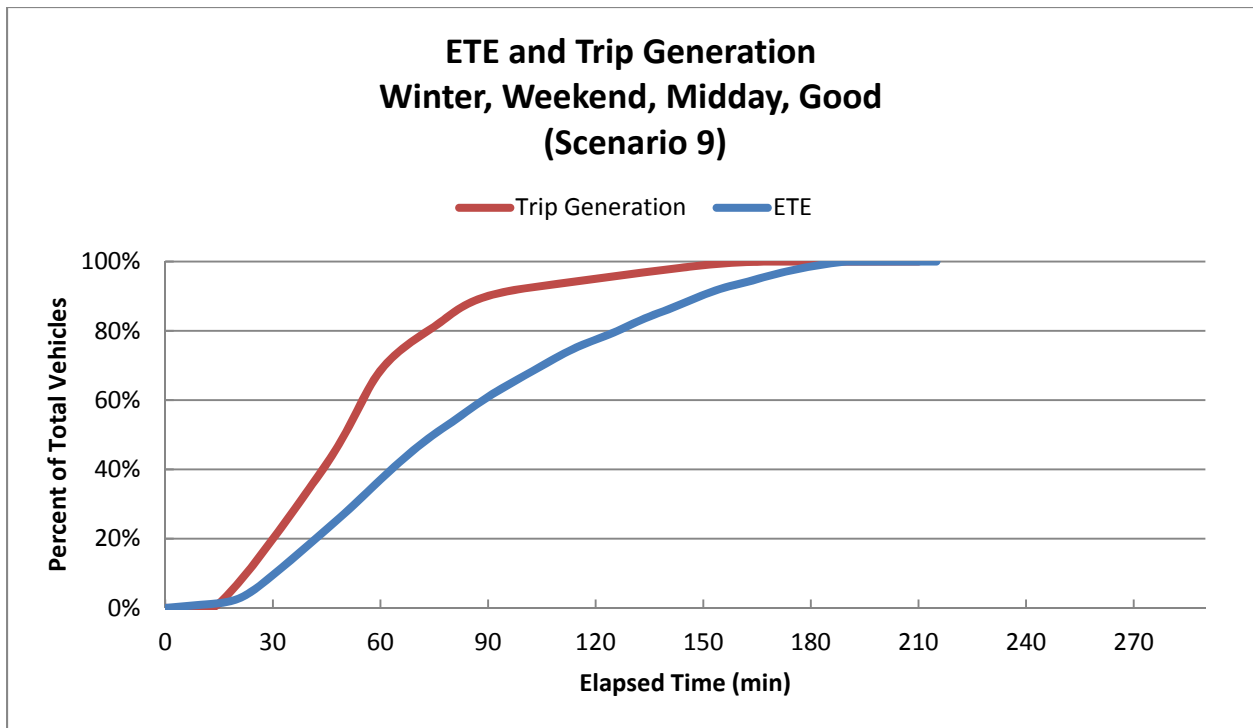


Figure J-9. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 9)

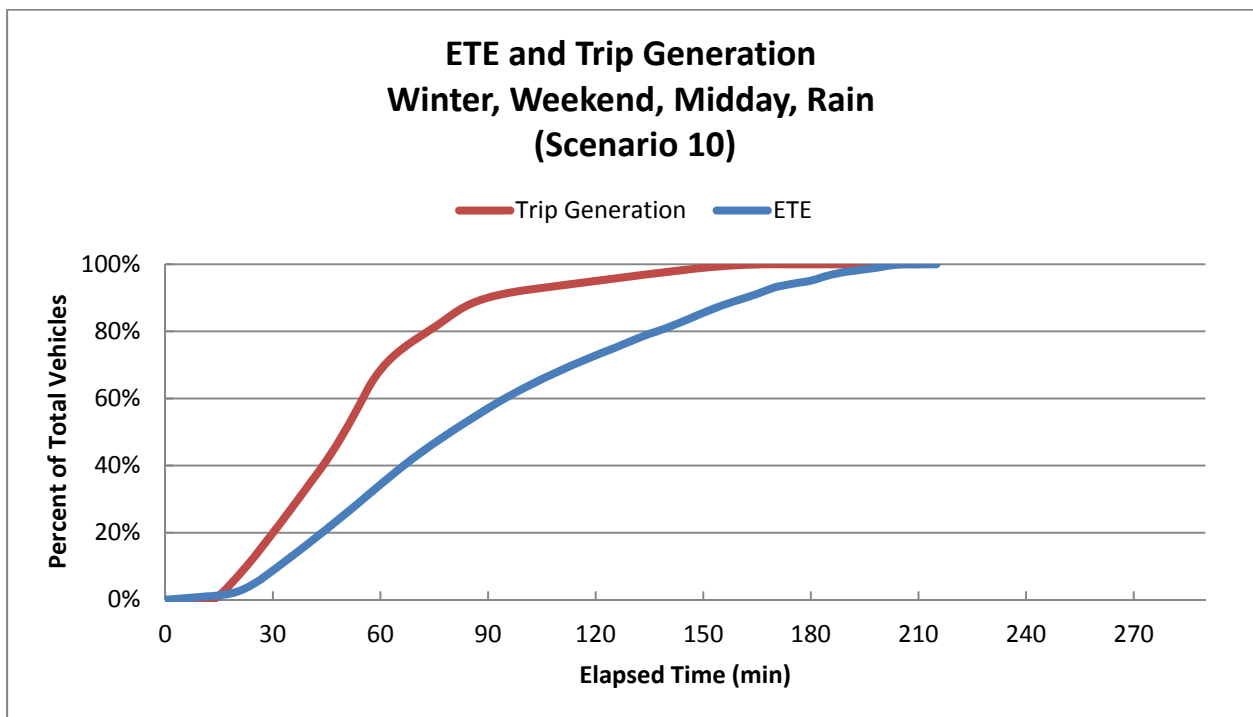


Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Rain (Scenario 10)

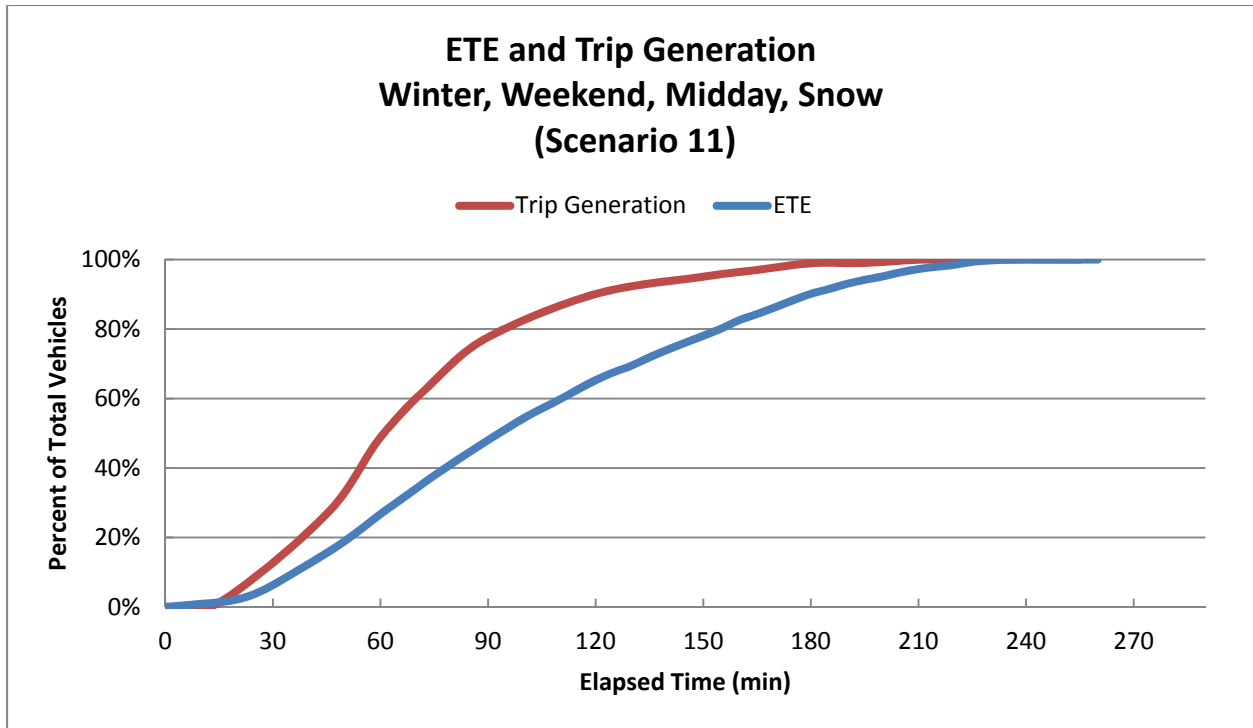


Figure J-11. ETE and Trip Generation: Winter, Weekend, Midday, Snow (Scenario 11)

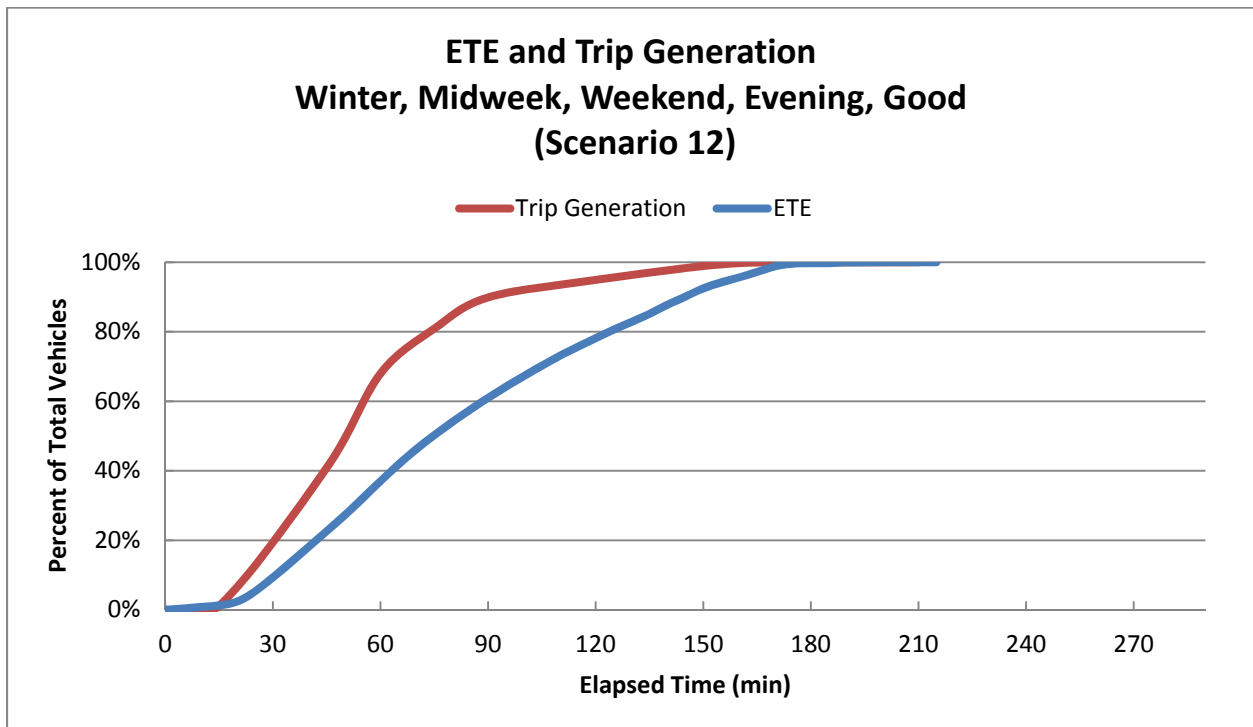


Figure J-12. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 12)

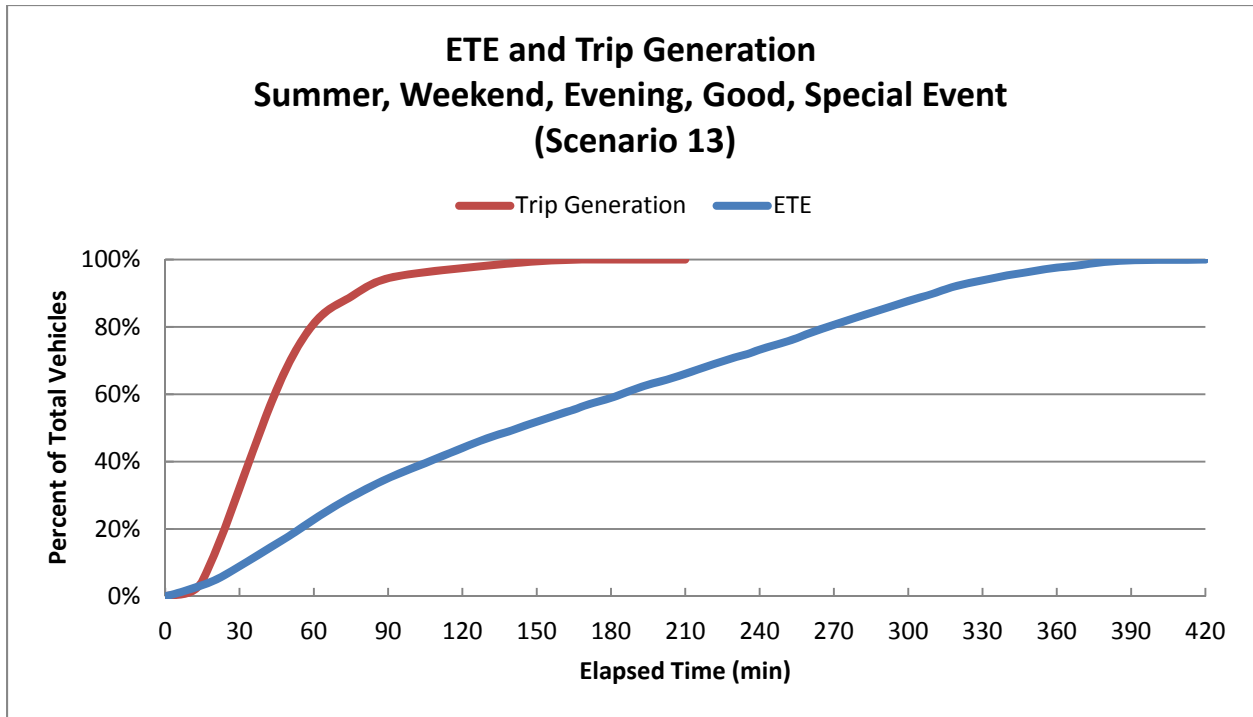


Figure J-13. ETE and Trip Generation: Summer, Weekend, Evening, Good Weather, Special Event (Scenario 13)

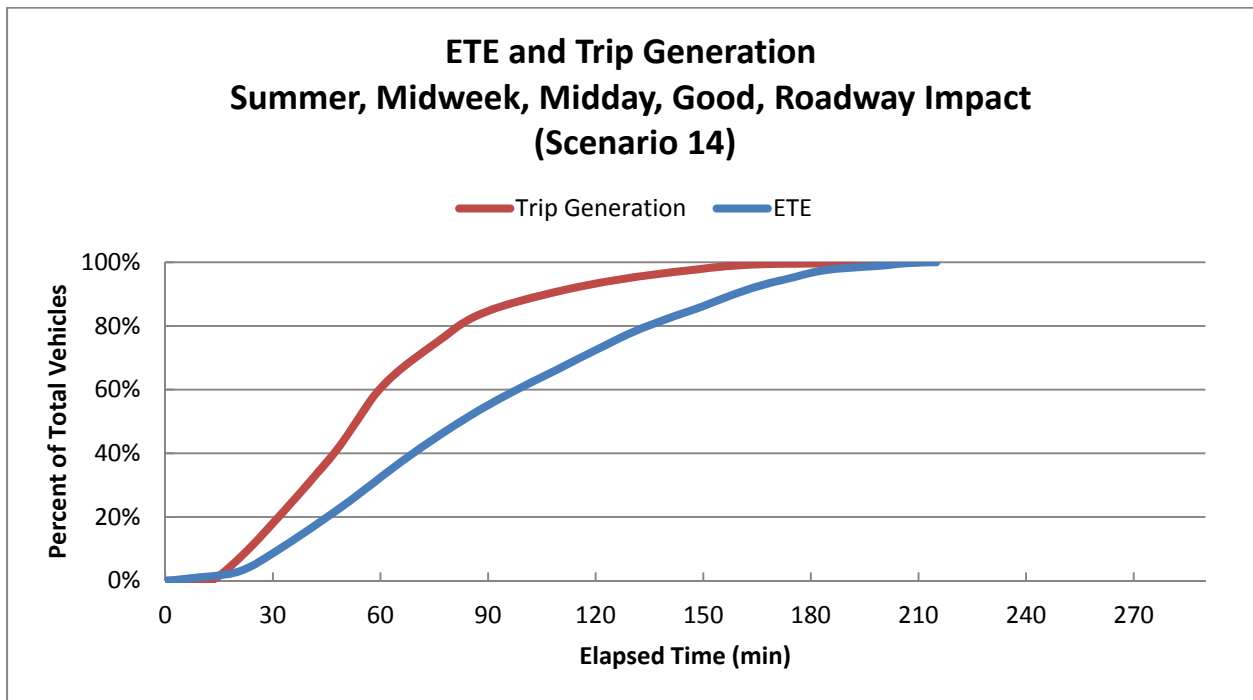


Figure J-14. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather, Roadway Impact (Scenario 14)

## 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 21 more detailed figures (Figure K-2 through Figure K-33) which show each of the links and nodes in the network.

The analysis network was calibrated using the observations made during the field survey conducted in March 2012. Table K-1 lists the characteristics of each roadway section modeled in the ETE analysis. Each link is identified by its road name and the upstream and downstream node numbers. The geographic location of each link can be observed by referencing the grid map number provided in Table K-1. The roadway type identified in Table K-1 is generally 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
- Minor arterial: 2 or more lanes in each direction
- Collector: single lane in each direction
- Local roadways: single lane in each direction, local roads with low free flow speeds

The term, “No. of Lanes” in Table K-1 identifies the number of lanes that extend throughout the length of the link. Many links have additional lanes on the immediate approach to an intersection (turn pockets); these have been recorded and entered into the input stream for the DYNEV II System.

As discussed in Section 1.3, lane width and shoulder width were not physically measured during the road survey. Rather, estimates of these measures were based on visual observations and recorded images.

Table K-2 identifies each node in the network that is controlled and the type of control (stop sign, yield sign, pre-timed signal, actuated signal, traffic control point) at that node. Uncontrolled nodes are not included in Table K-2. The location of each node can be observed by referencing the grid map number provided.

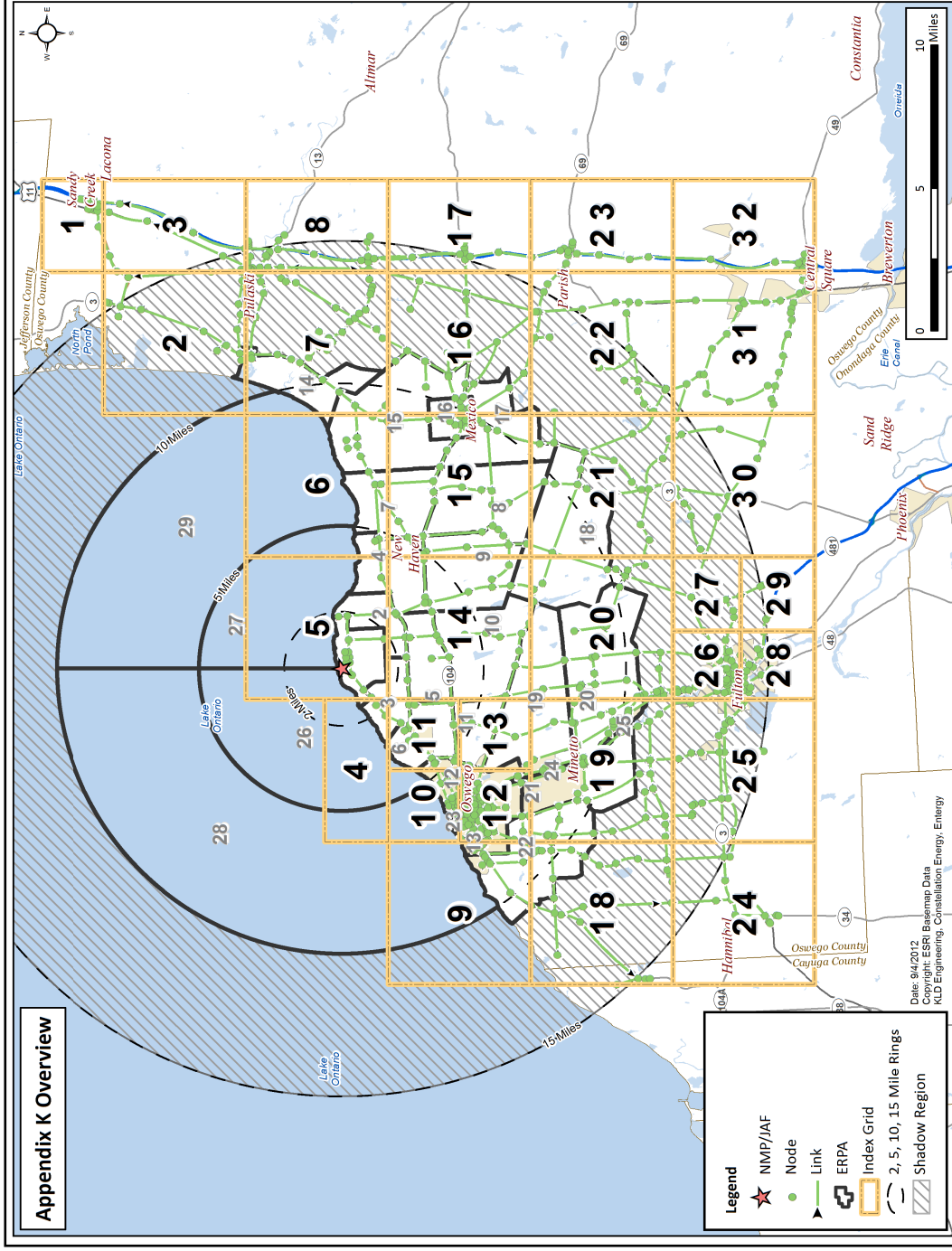
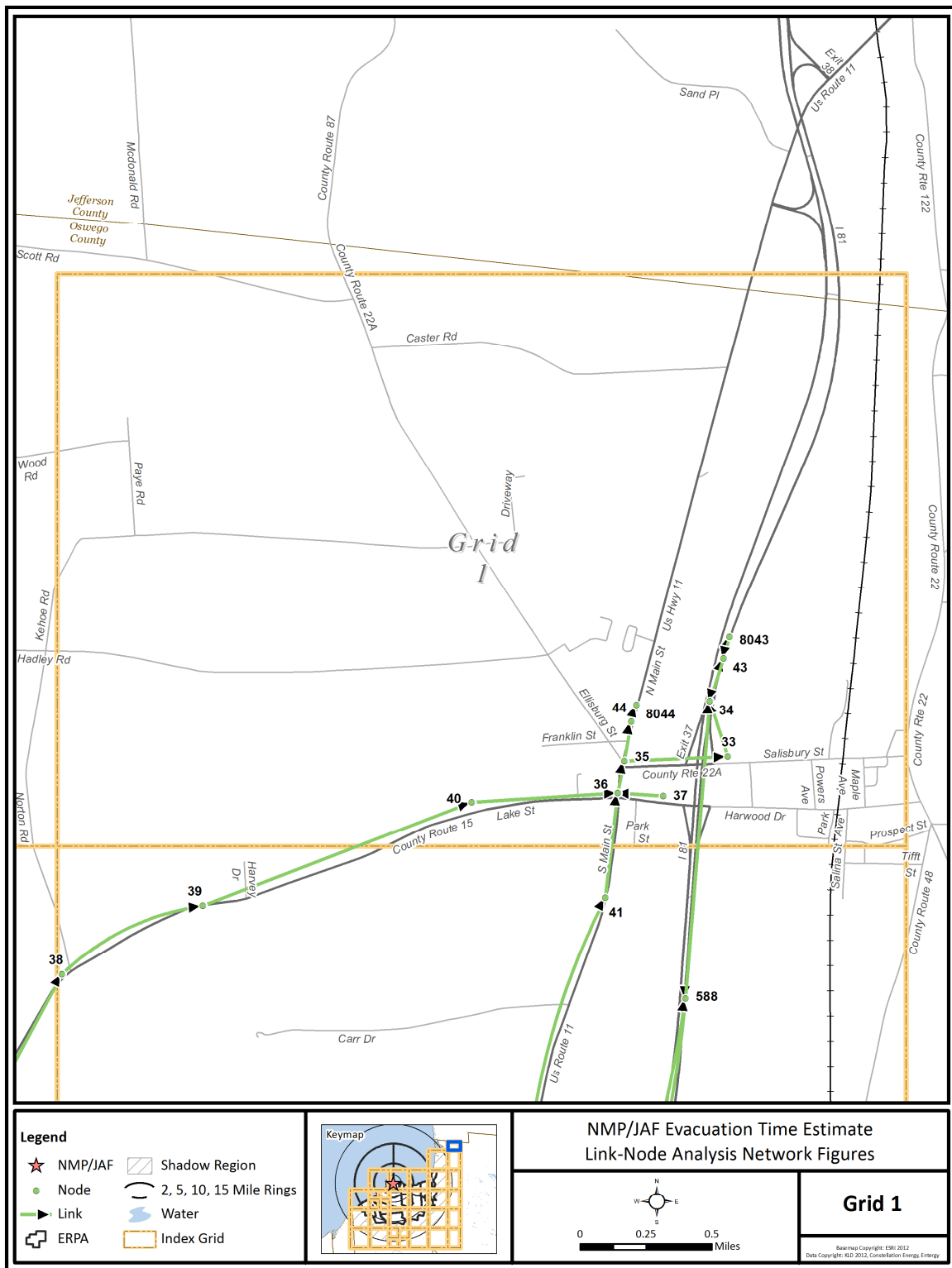


Figure K-1. Nine Mile Point/James A. FitzPatrick Link-Node Analysis Network



**Figure K-2. Link-Node Analysis Network – Grid 1**

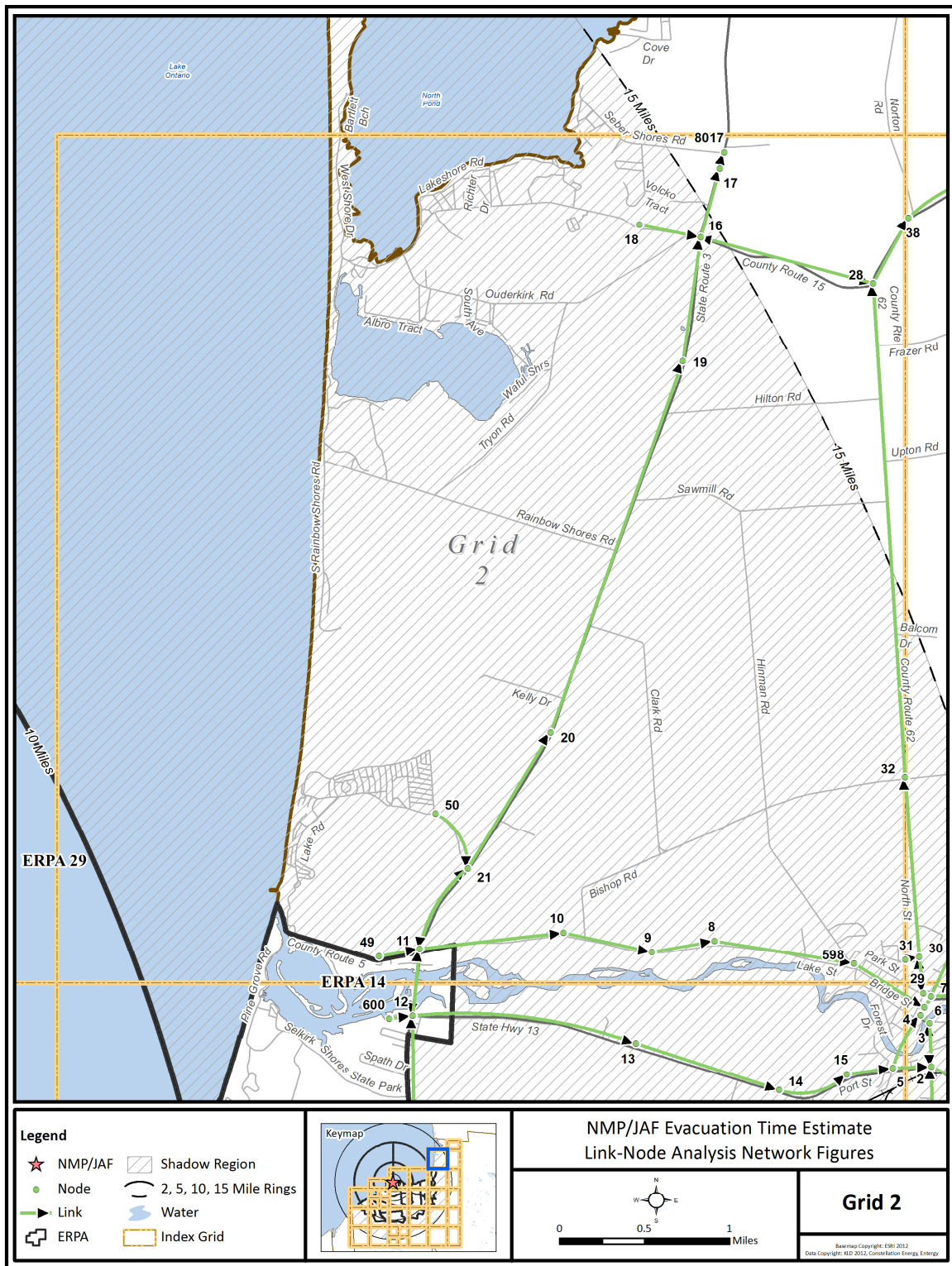


Figure K-3. Link-Node Analysis Network – Grid 2

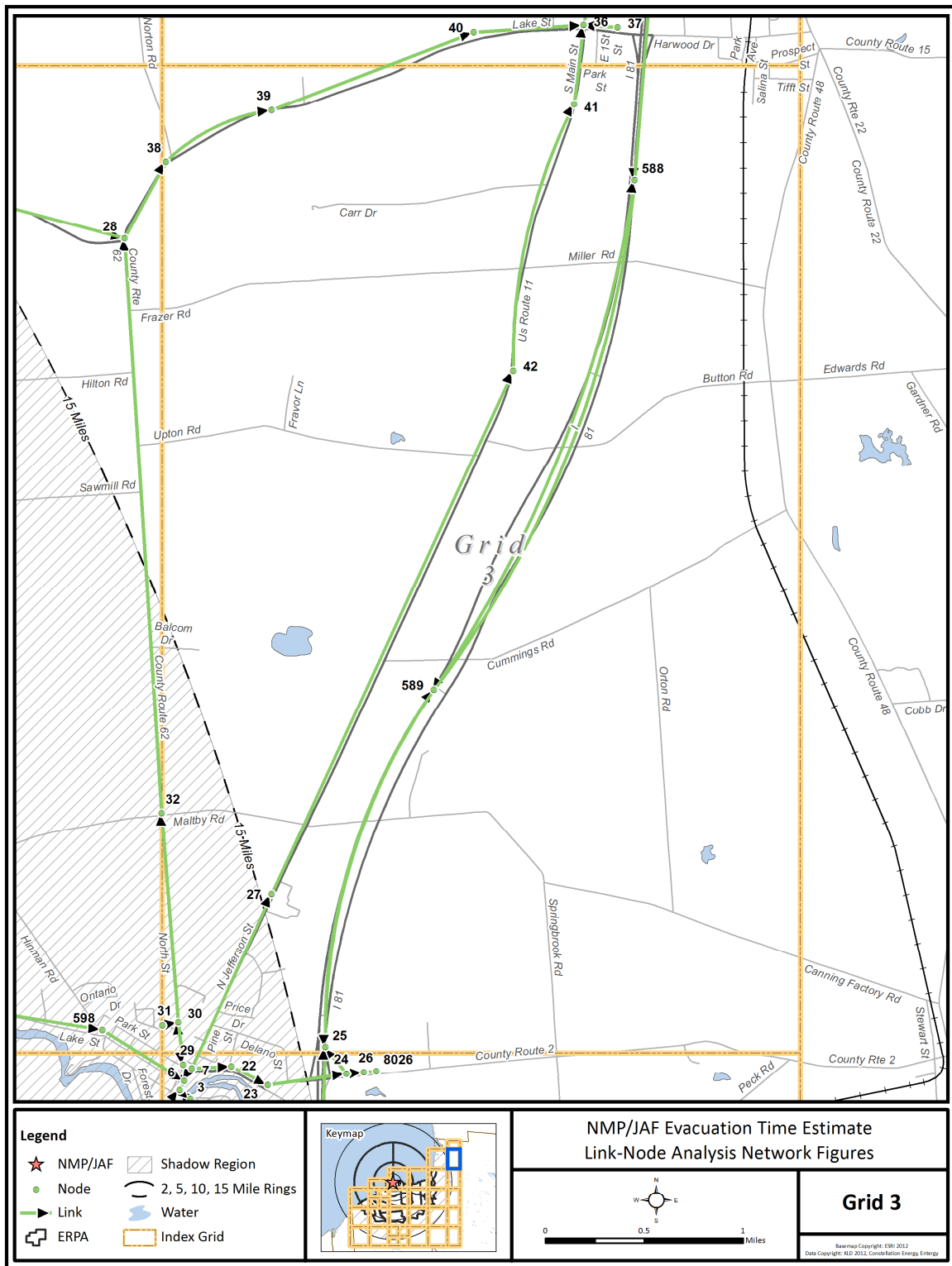


Figure K-4. Link-Node Analysis Network – Grid 3

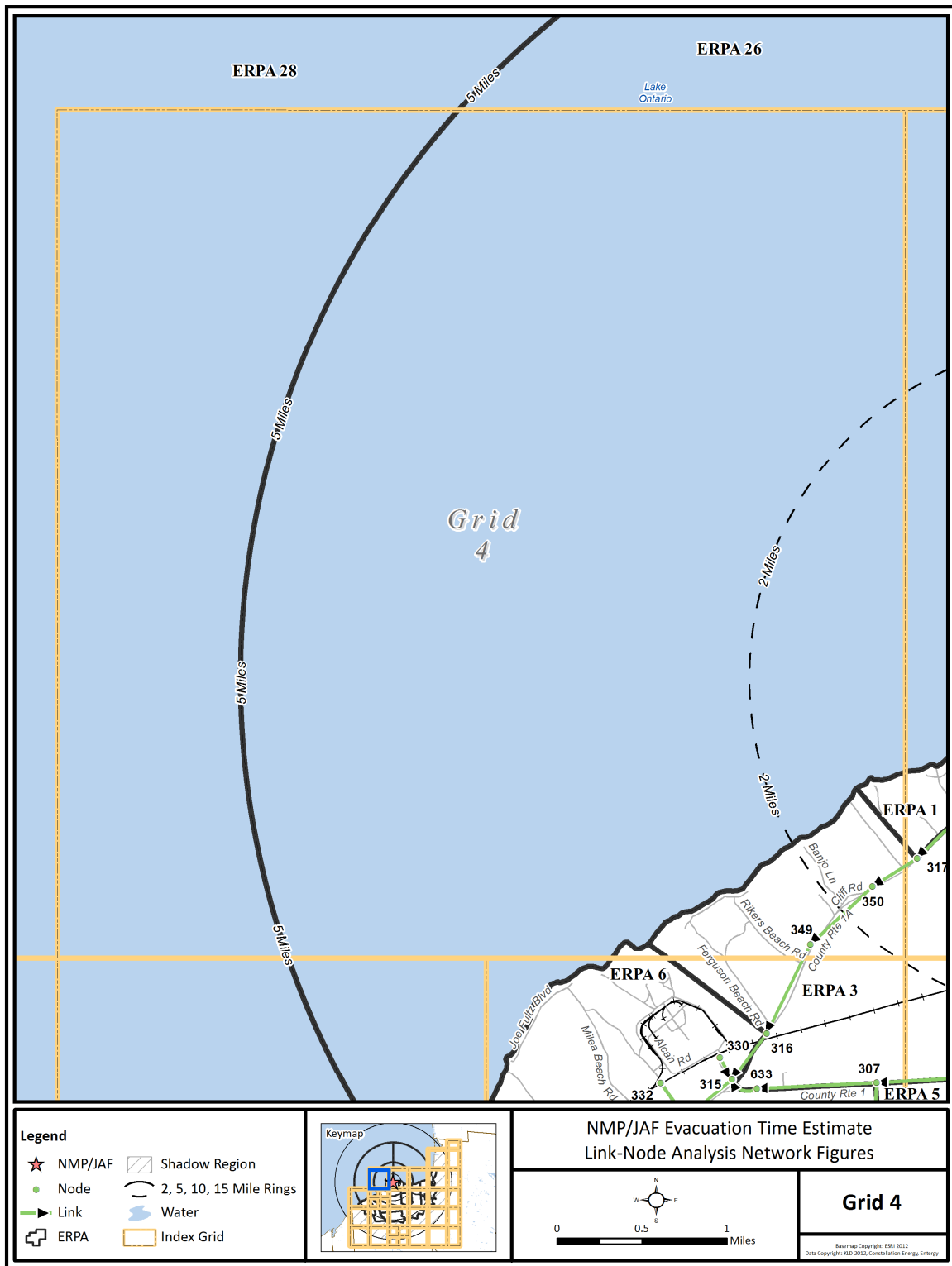


Figure K-5. Link-Node Analysis Network – Grid 4

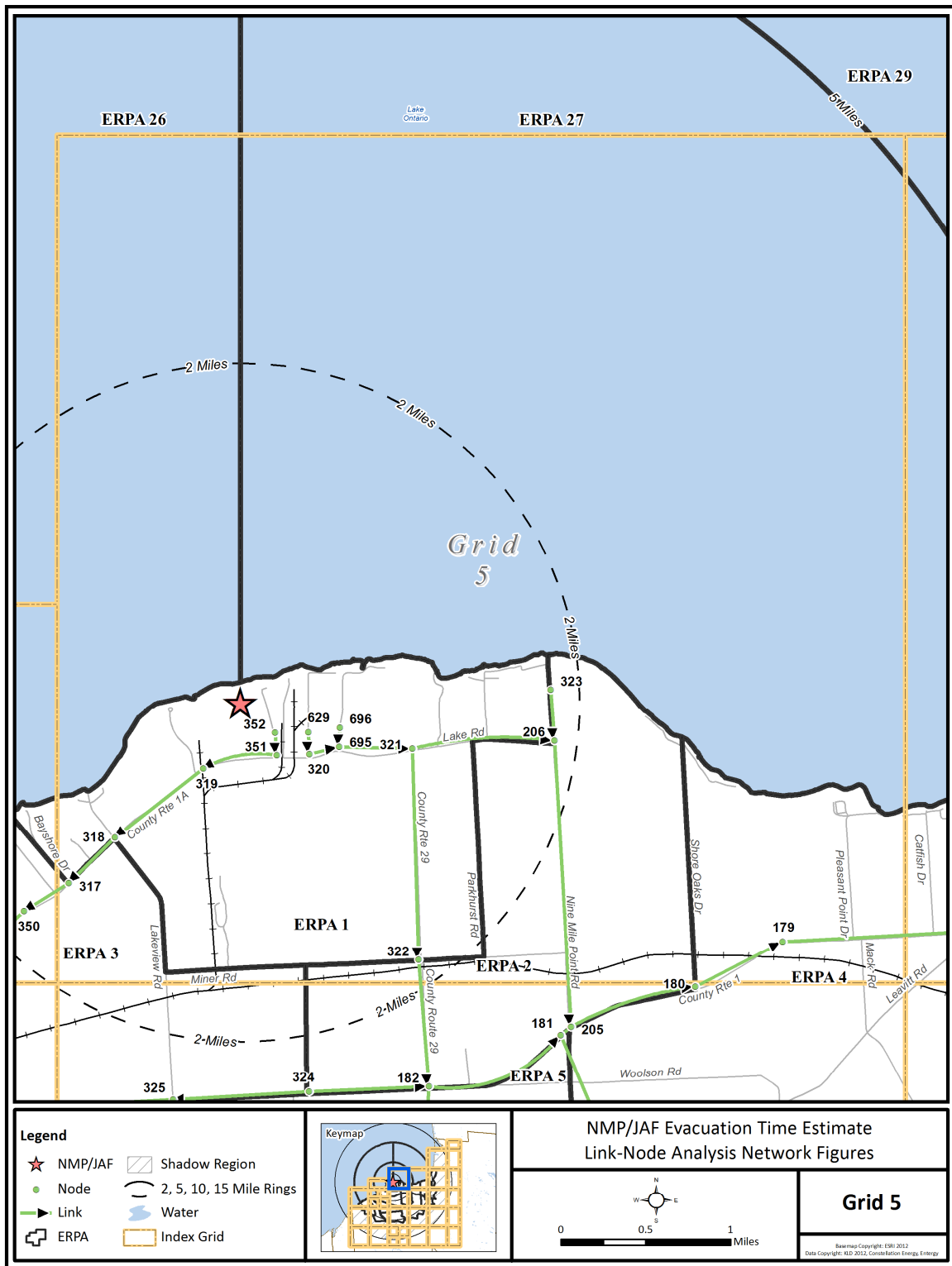


Figure K-6. Link-Node Analysis Network – Grid 5

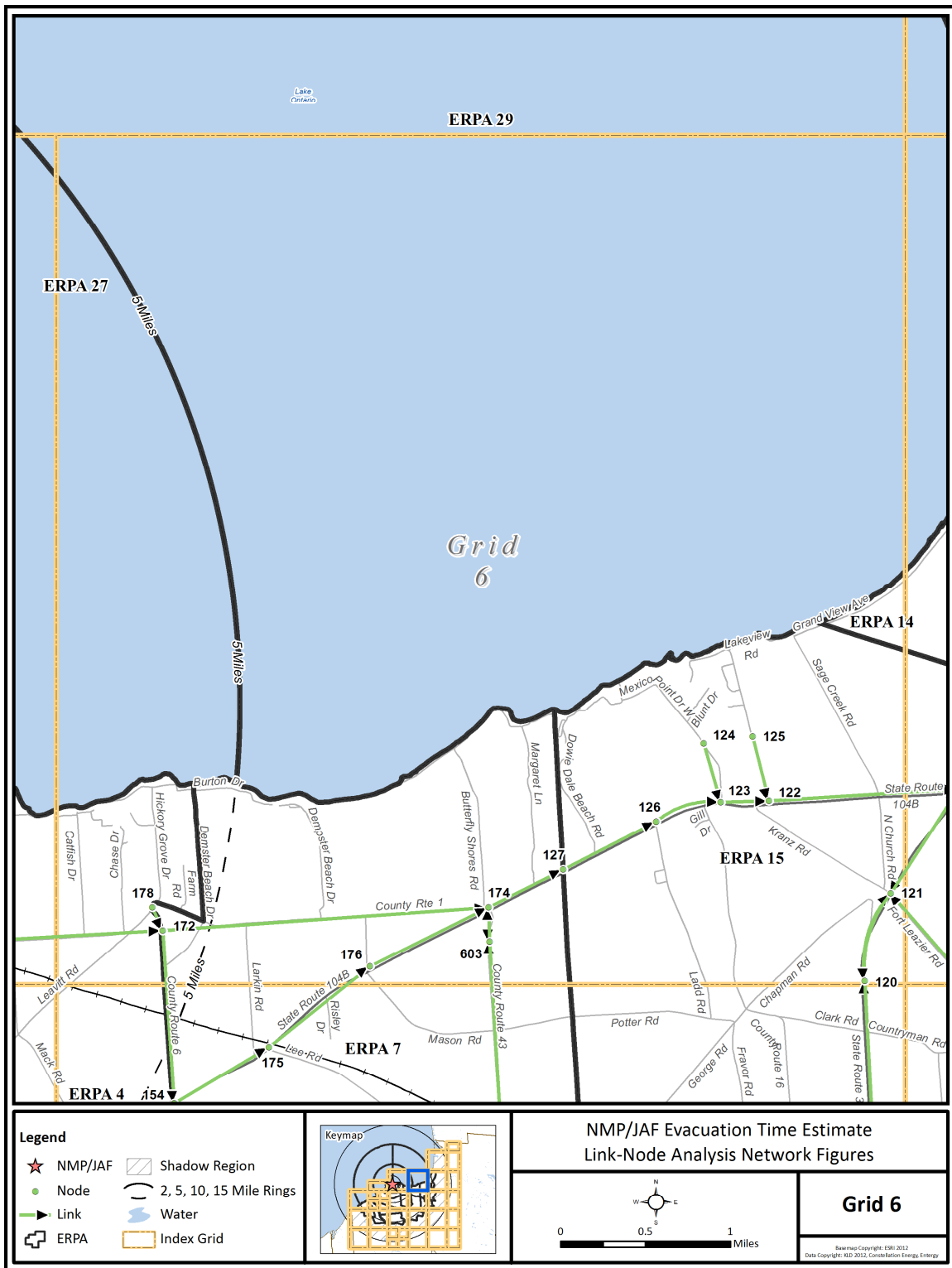


Figure K-7. Link-Node Analysis Network – Grid 6

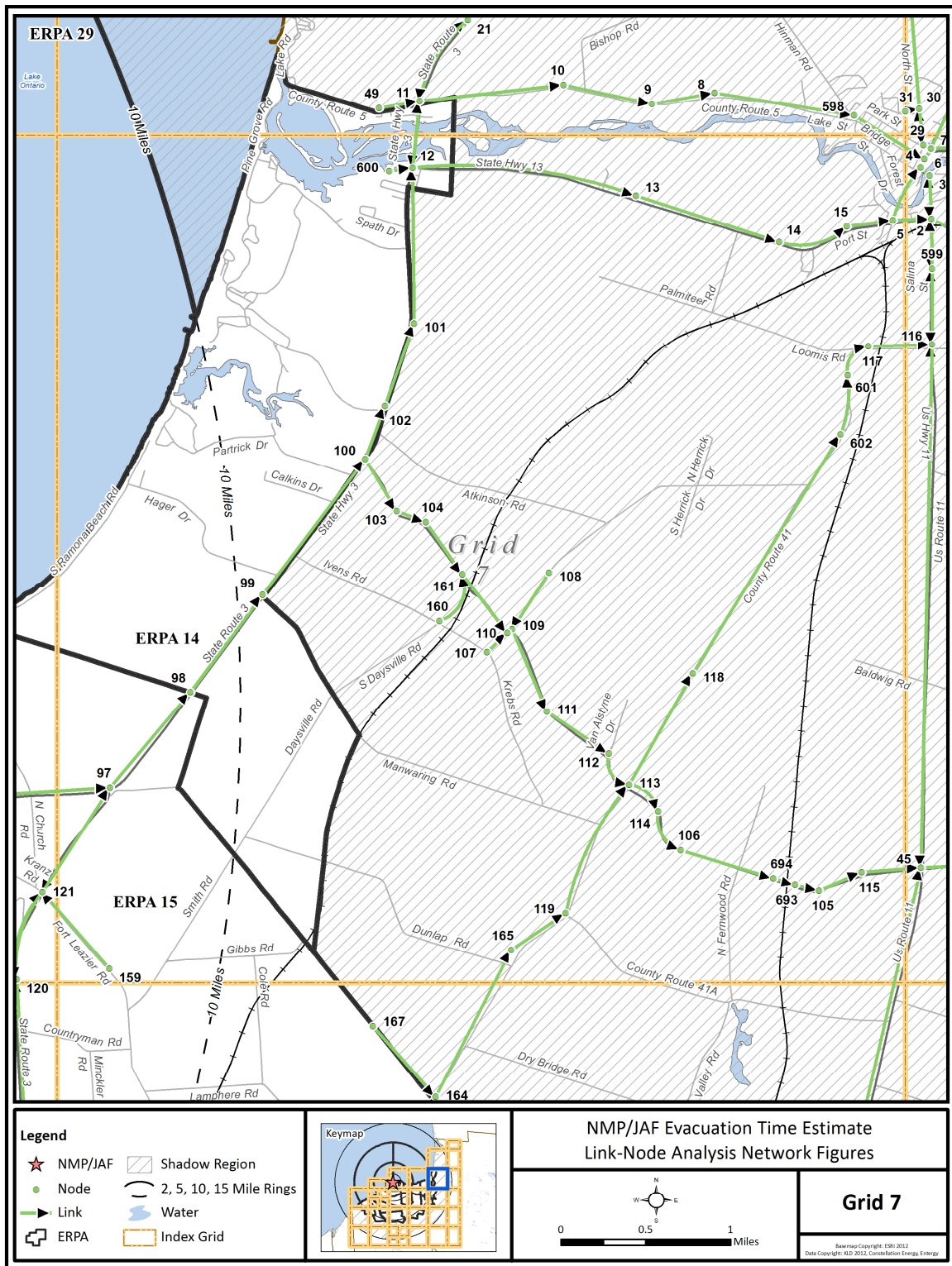


Figure K-8. Link-Node Analysis Network – Grid 7

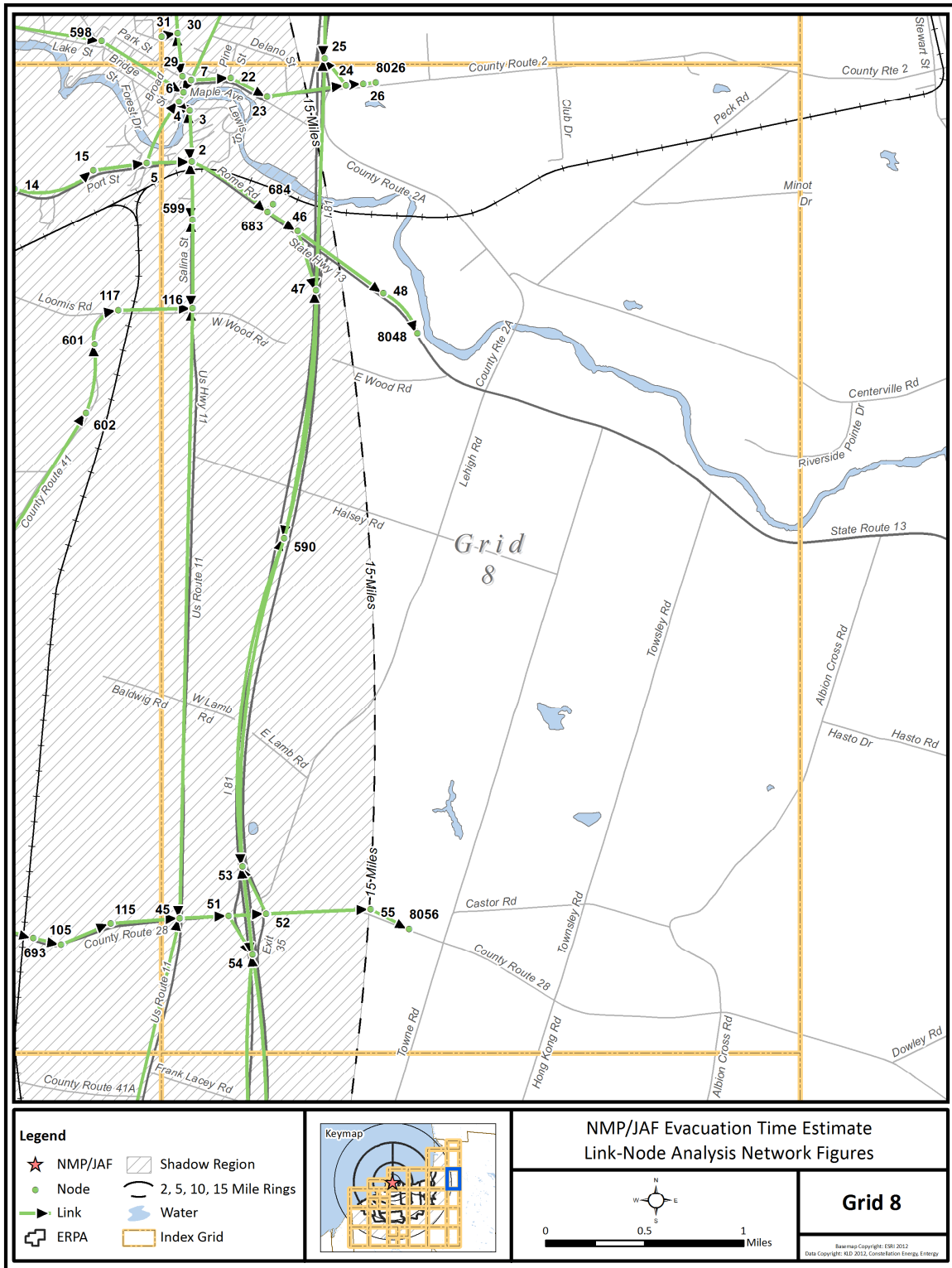
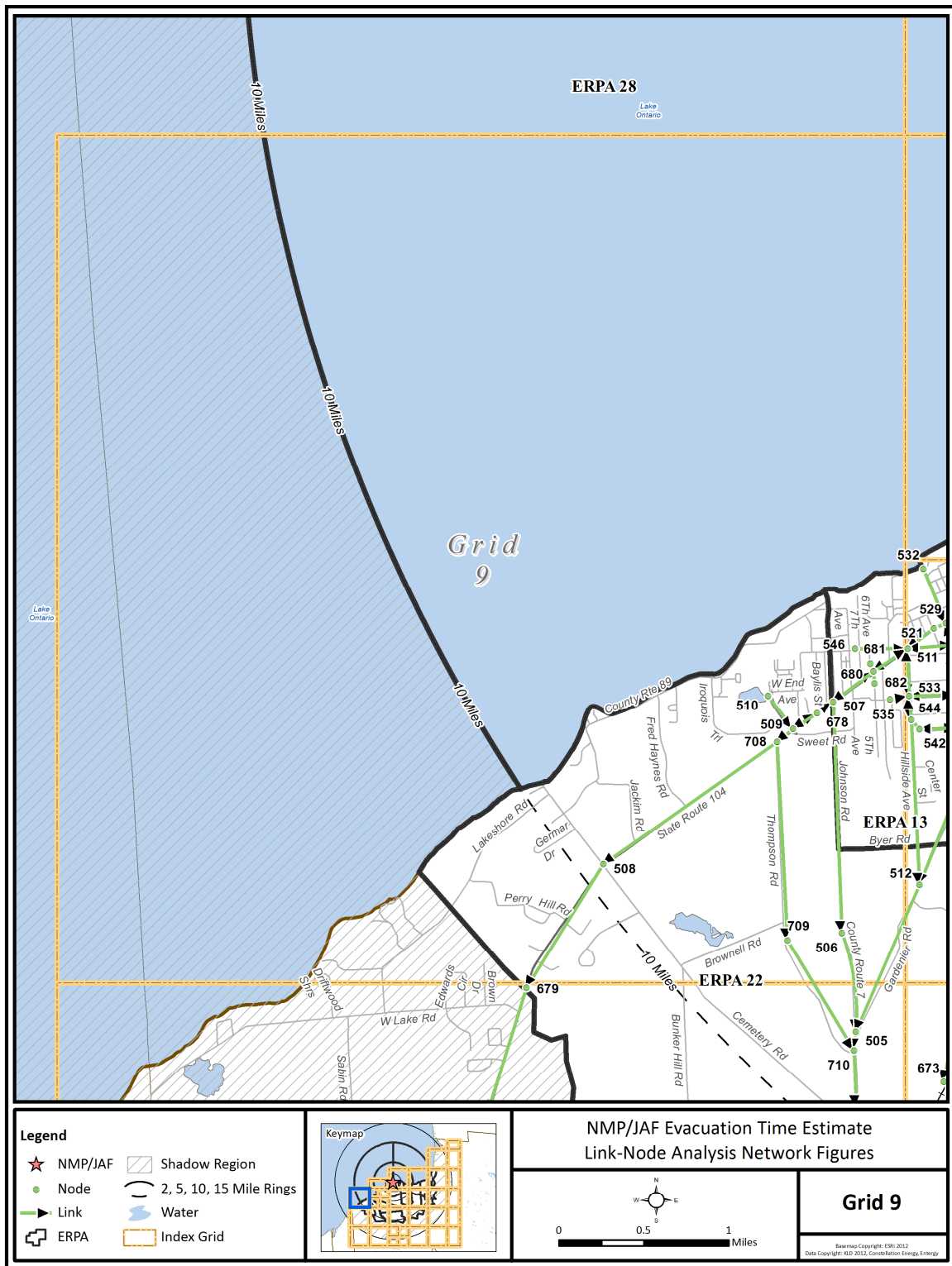


Figure K-9. Link-Node Analysis Network – Grid 8



**Figure K-10. Link-Node Analysis Network – Grid 9**

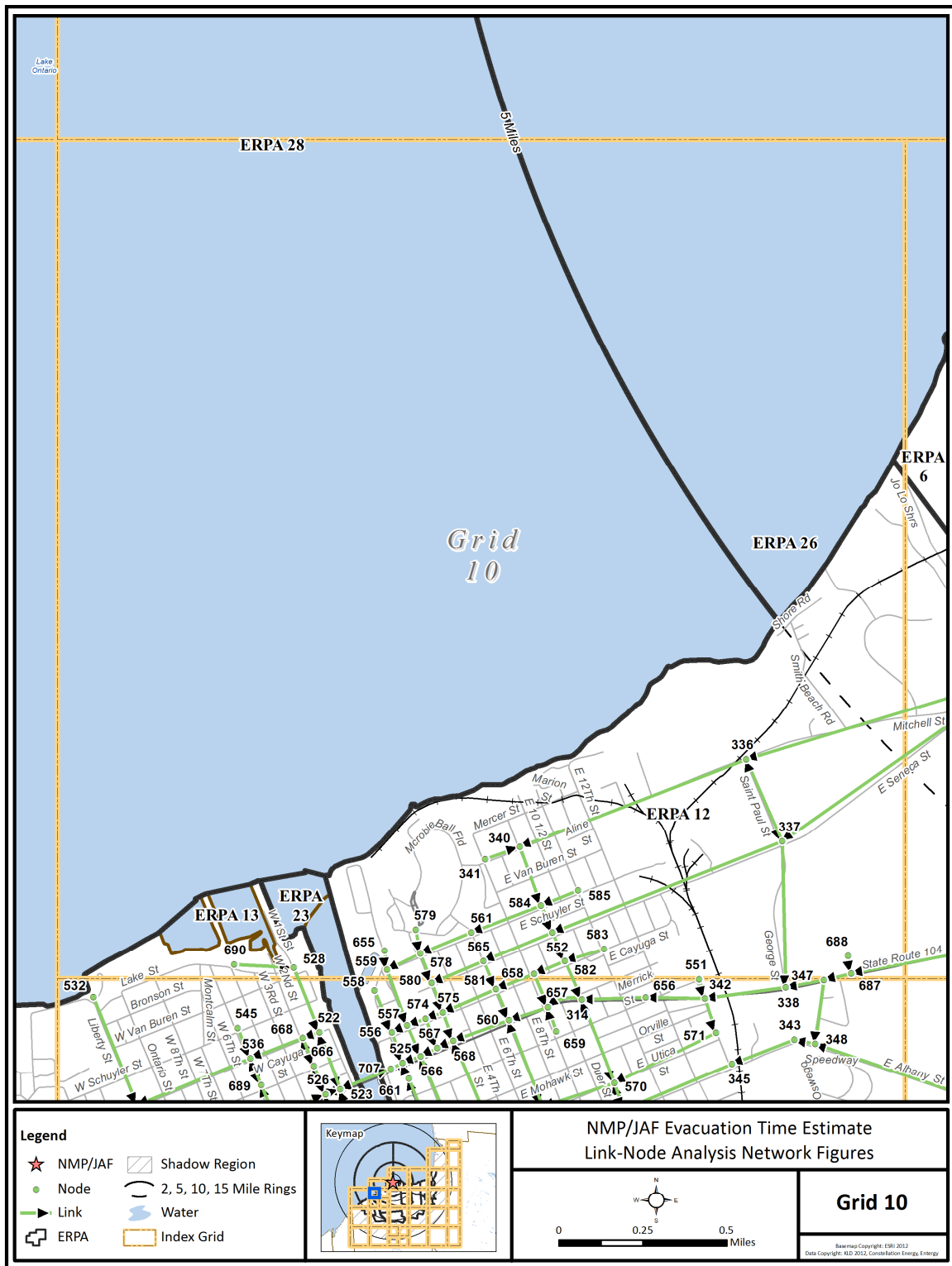


Figure K-11. Link-Node Analysis Network – Grid 10

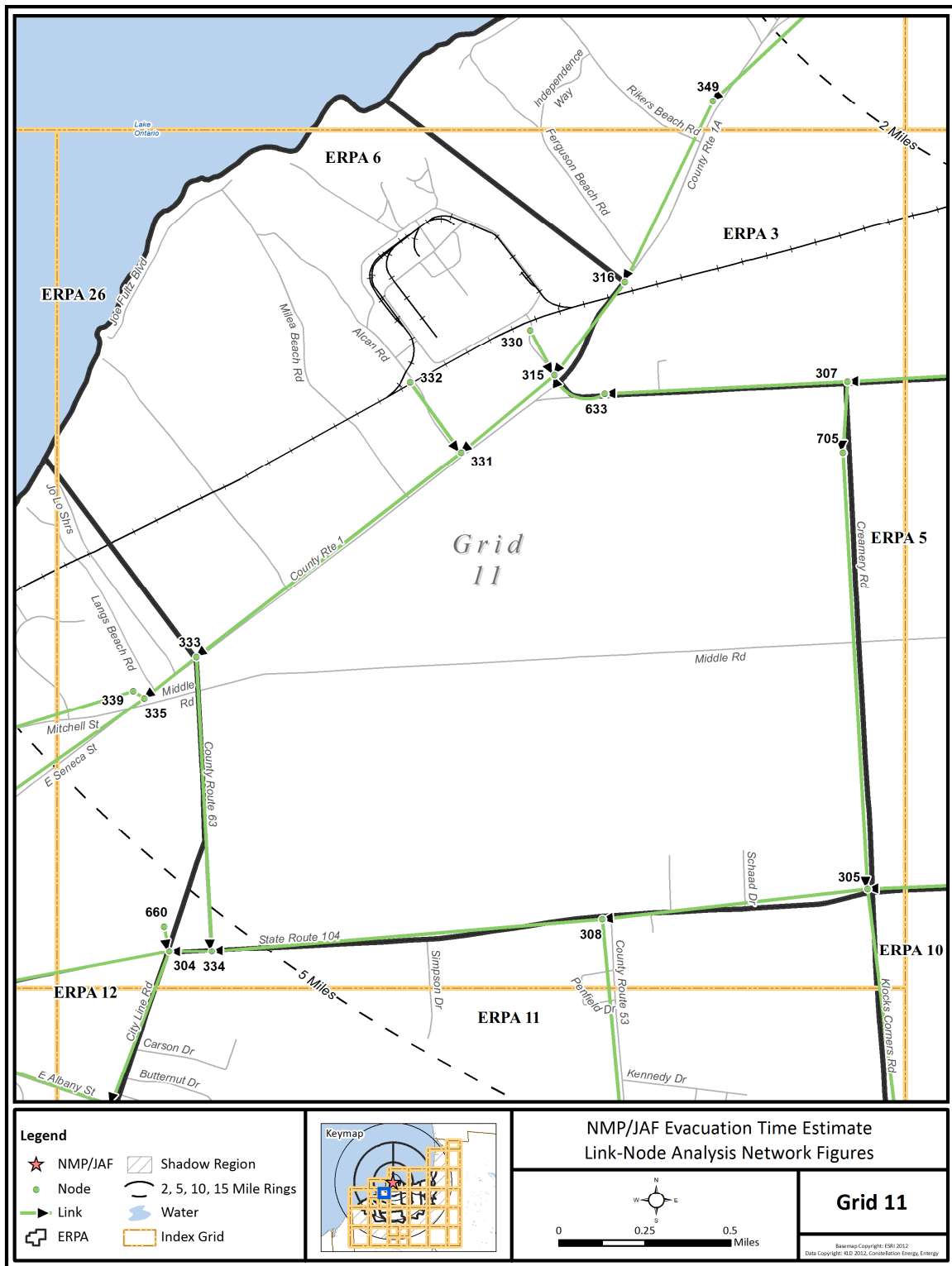


Figure K-12. Link-Node Analysis Network – Grid 11

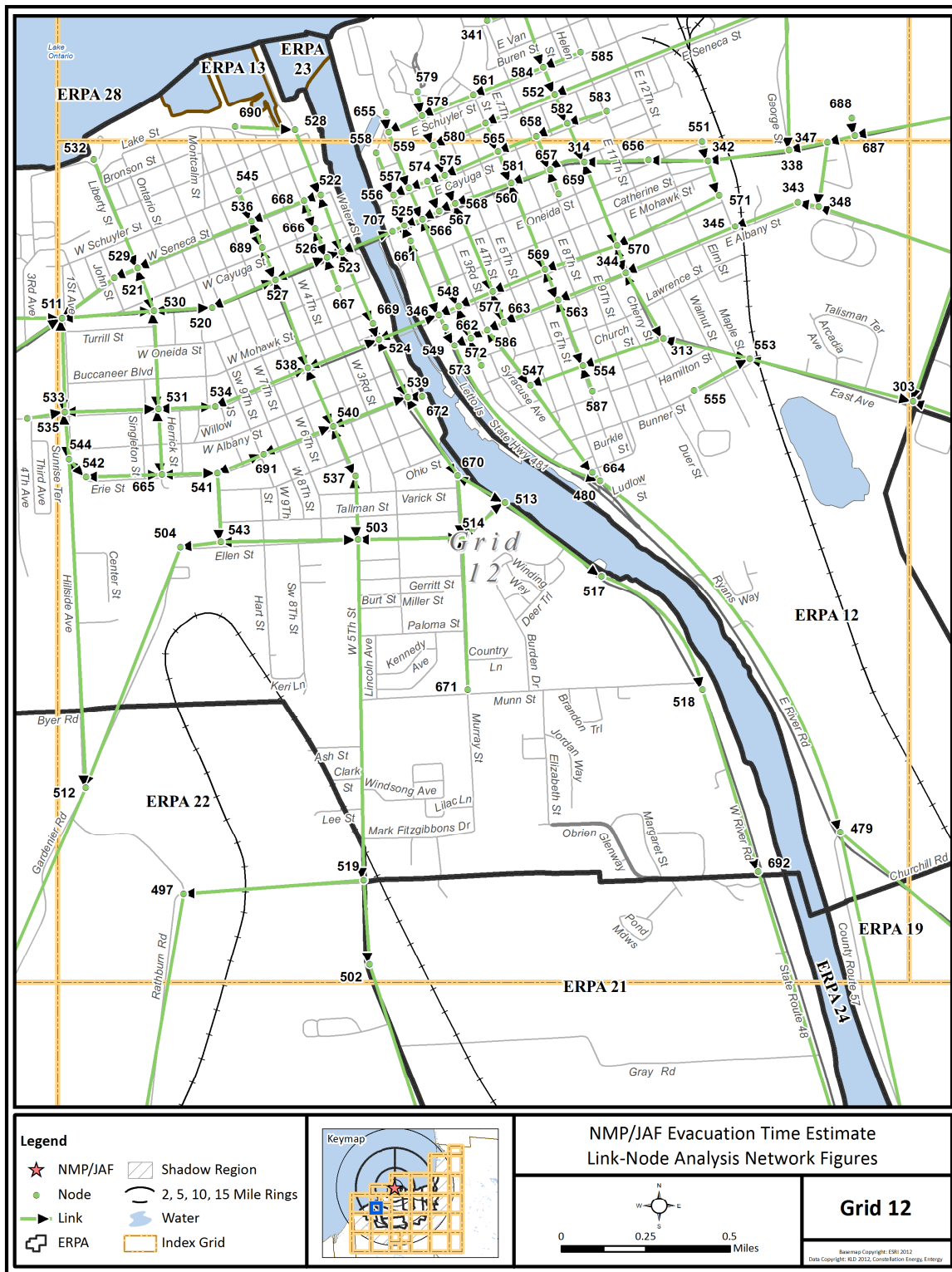


Figure K-13. Link-Node Analysis Network – Grid 12

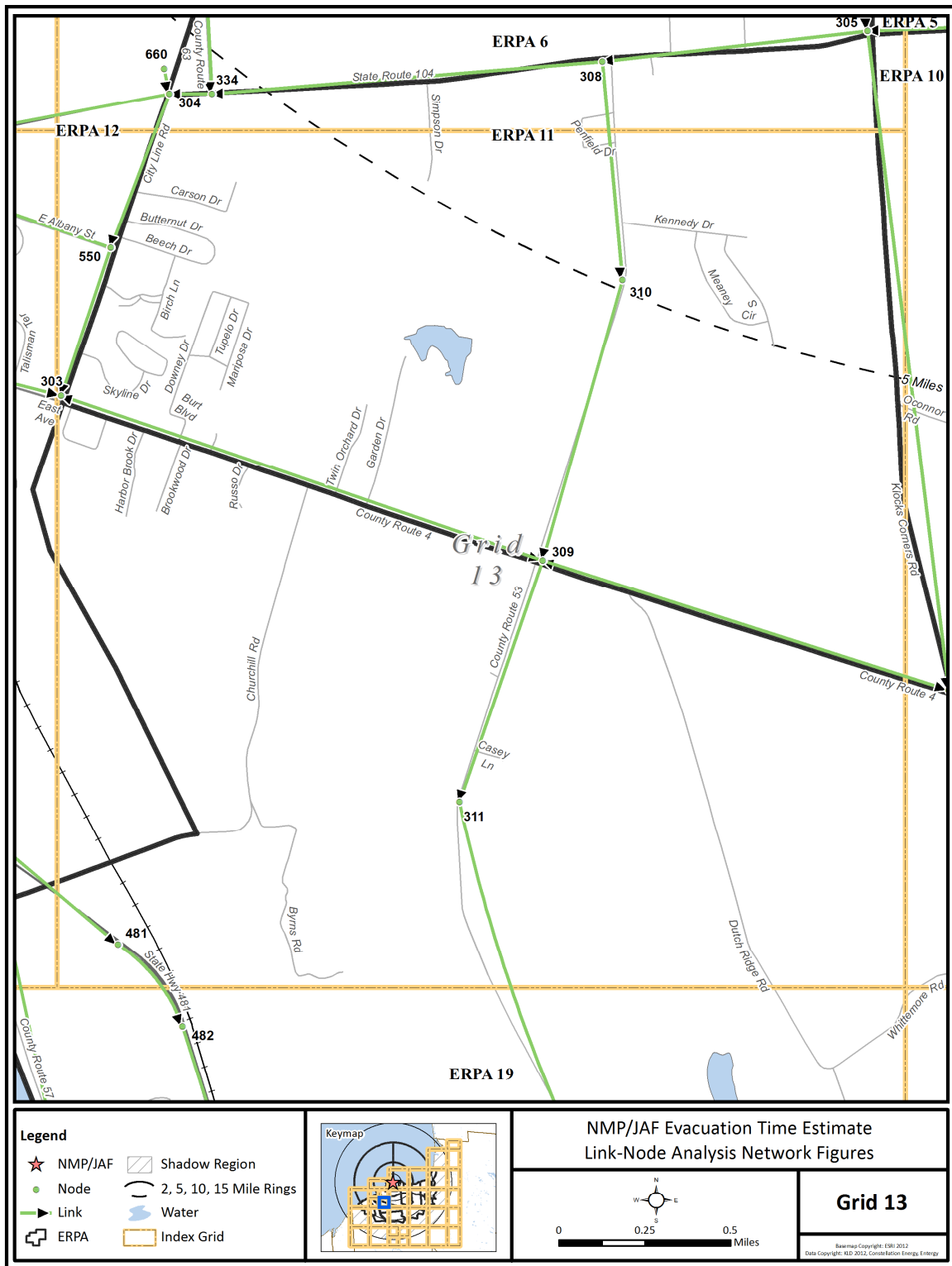


Figure K-14. Link-Node Analysis Network – Grid 13



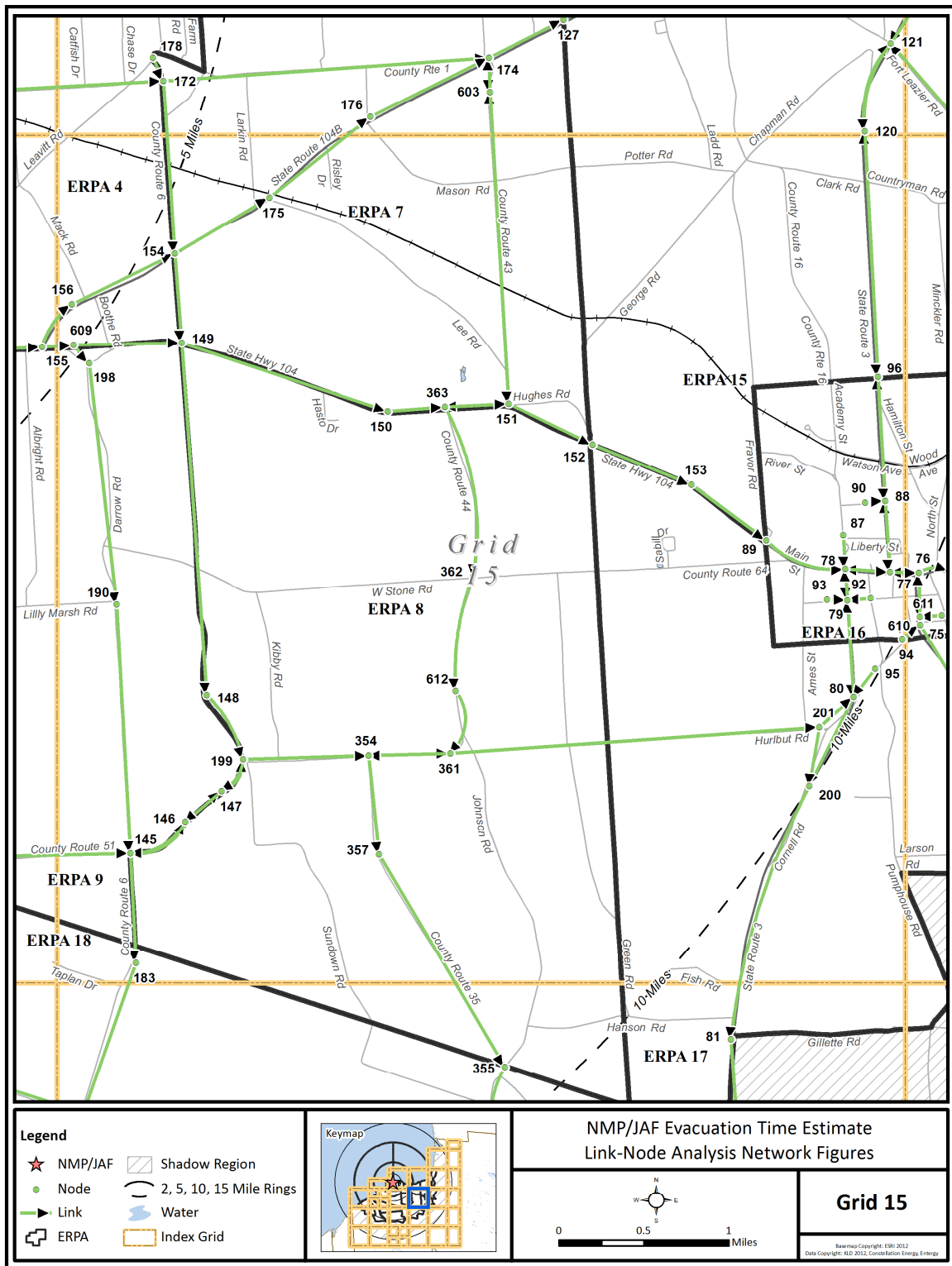


Figure K-16. Link-Node Analysis Network – Grid 15

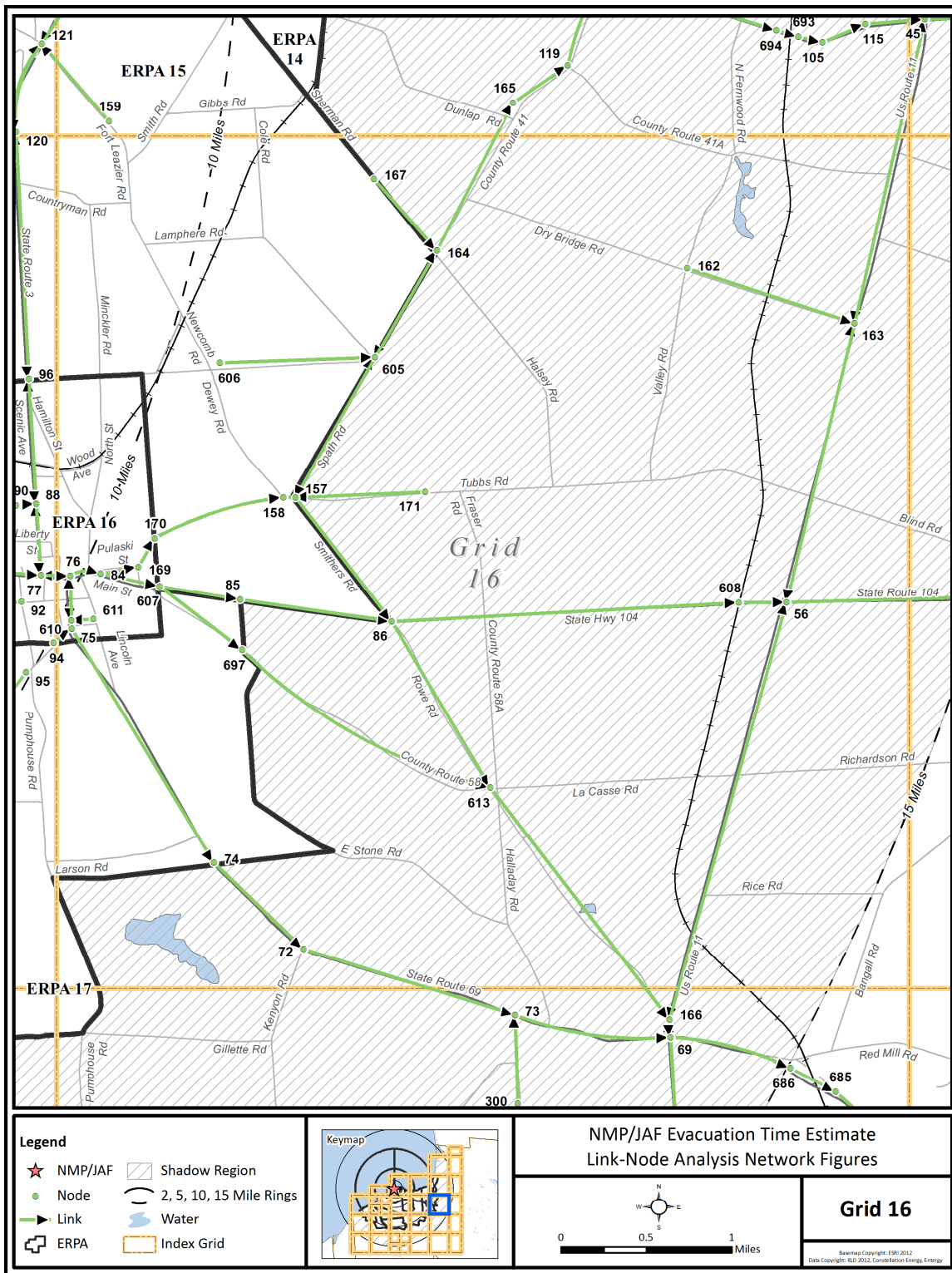


Figure K-17. Link-Node Analysis Network – Grid 16

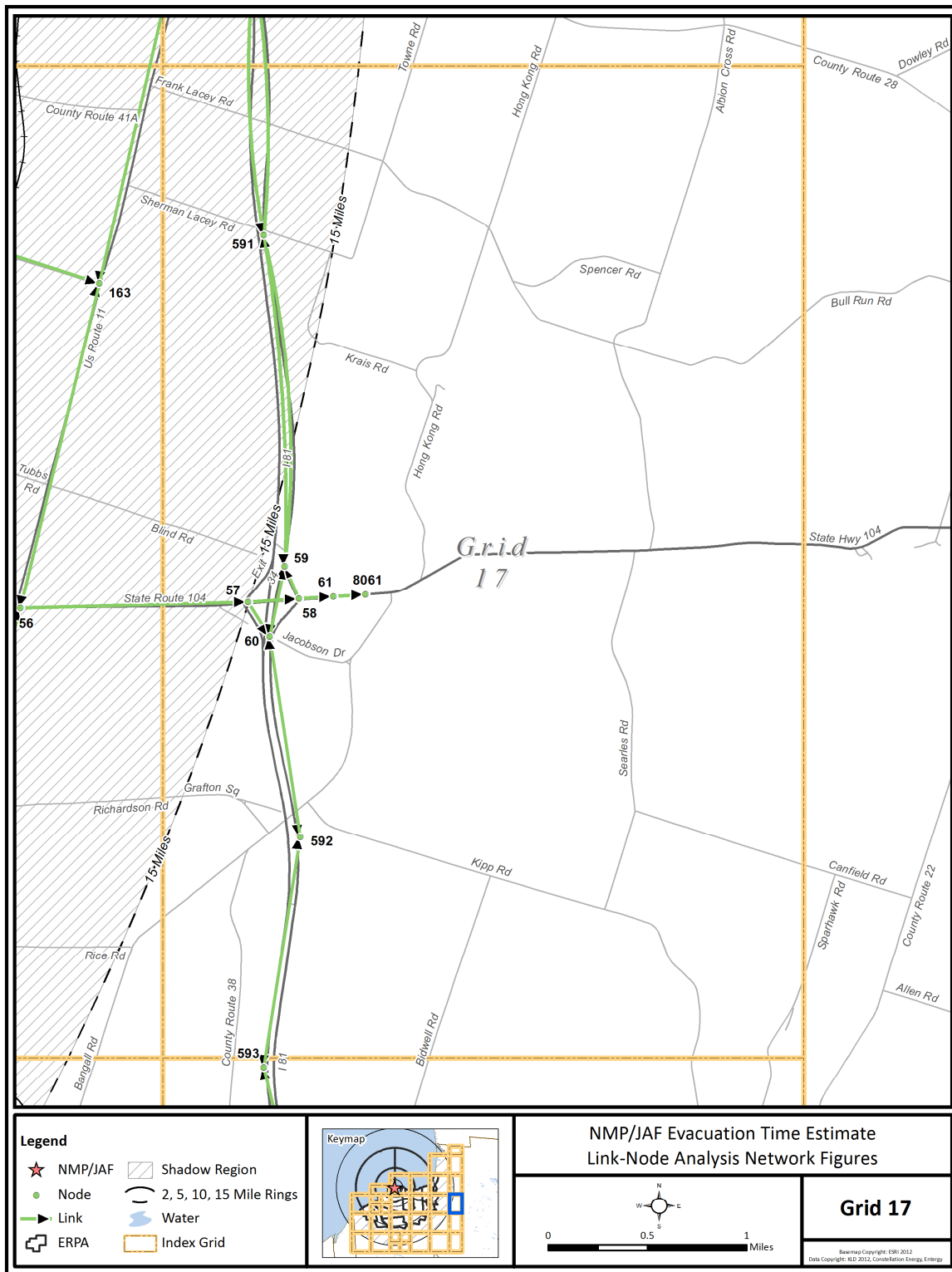


Figure K-18. Link-Node Analysis Network – Grid 17

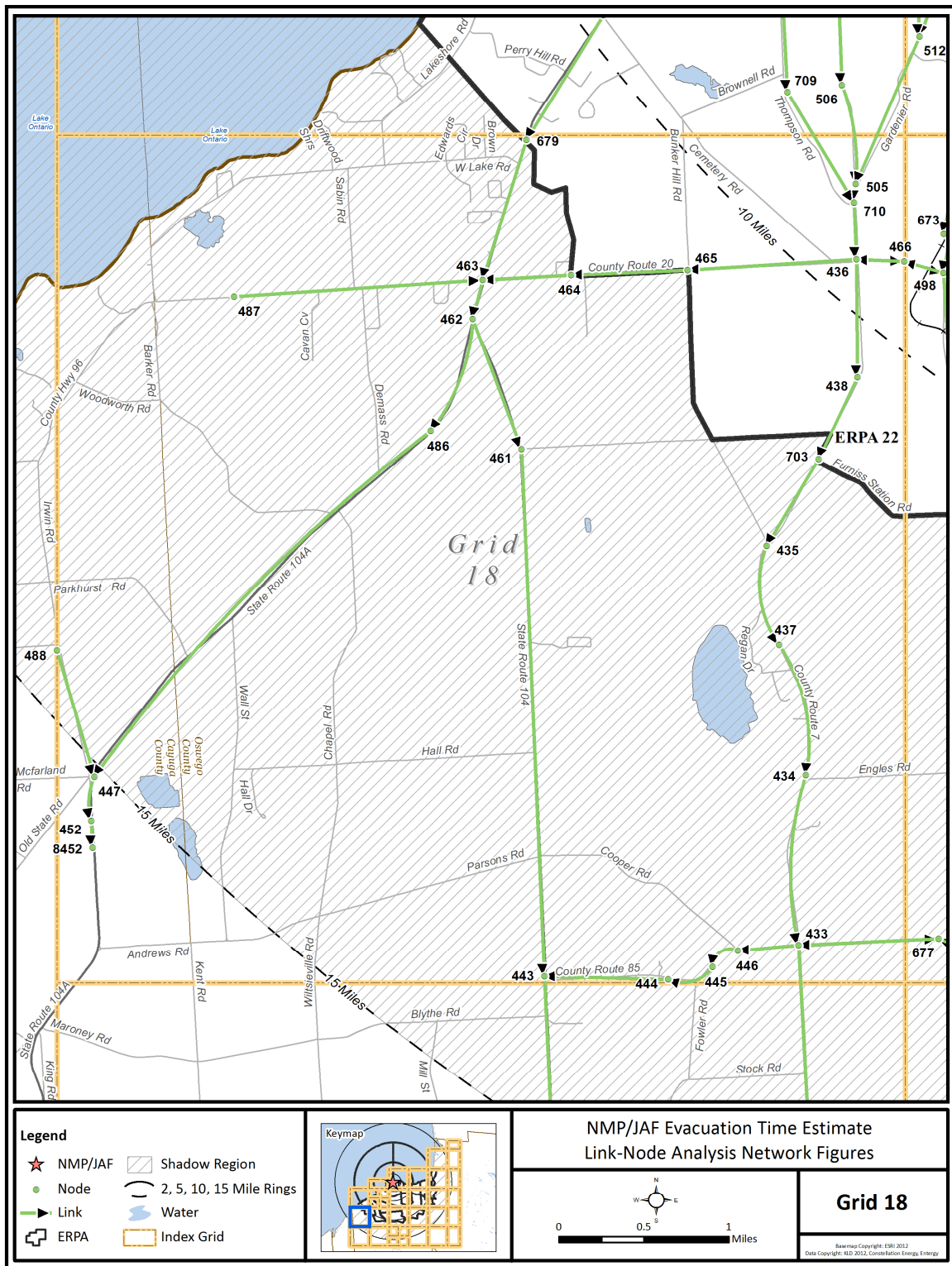


Figure K-19. Link-Node Analysis Network – Grid 18

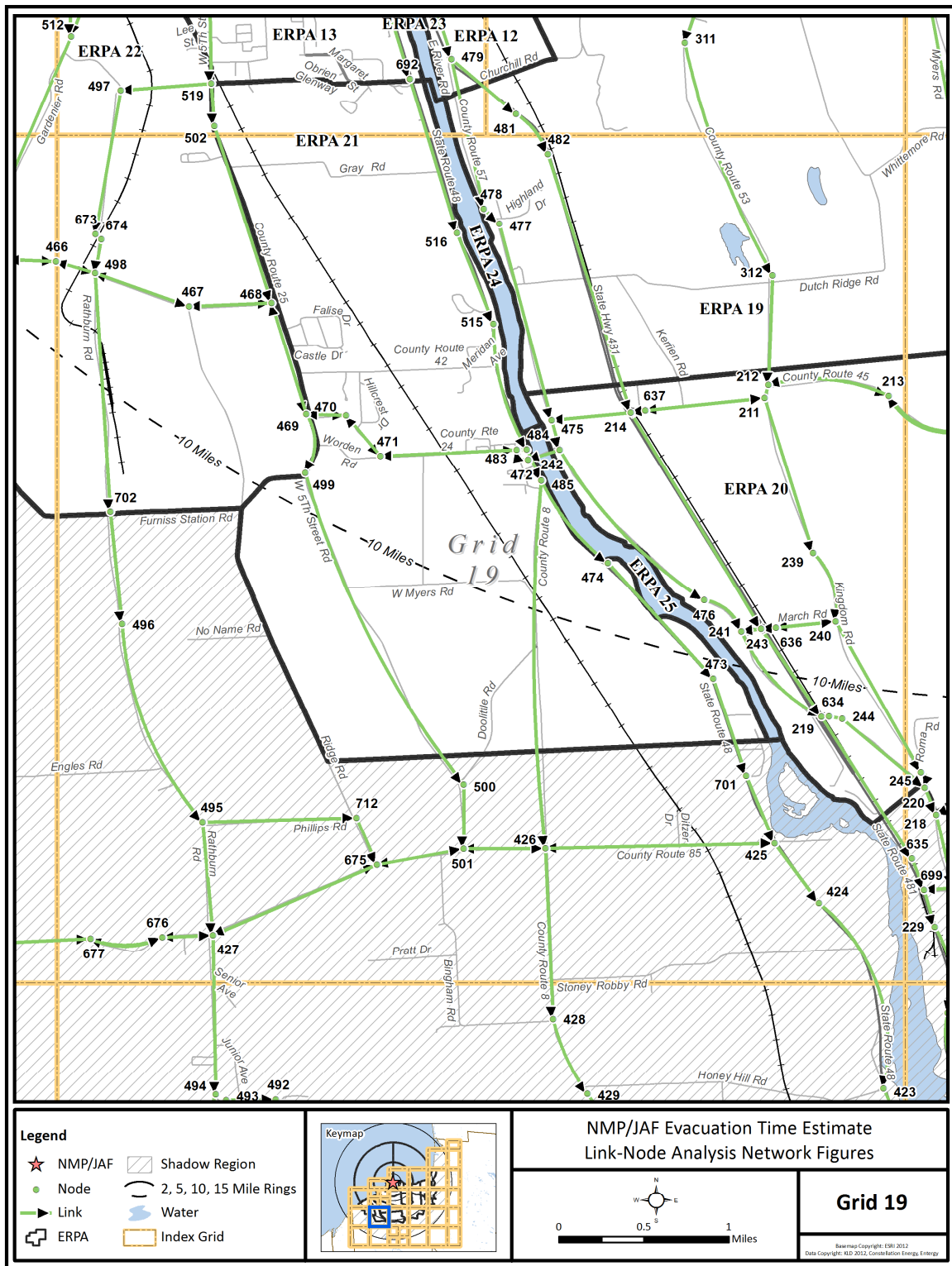


Figure K-20. Link-Node Analysis Network – Grid 19

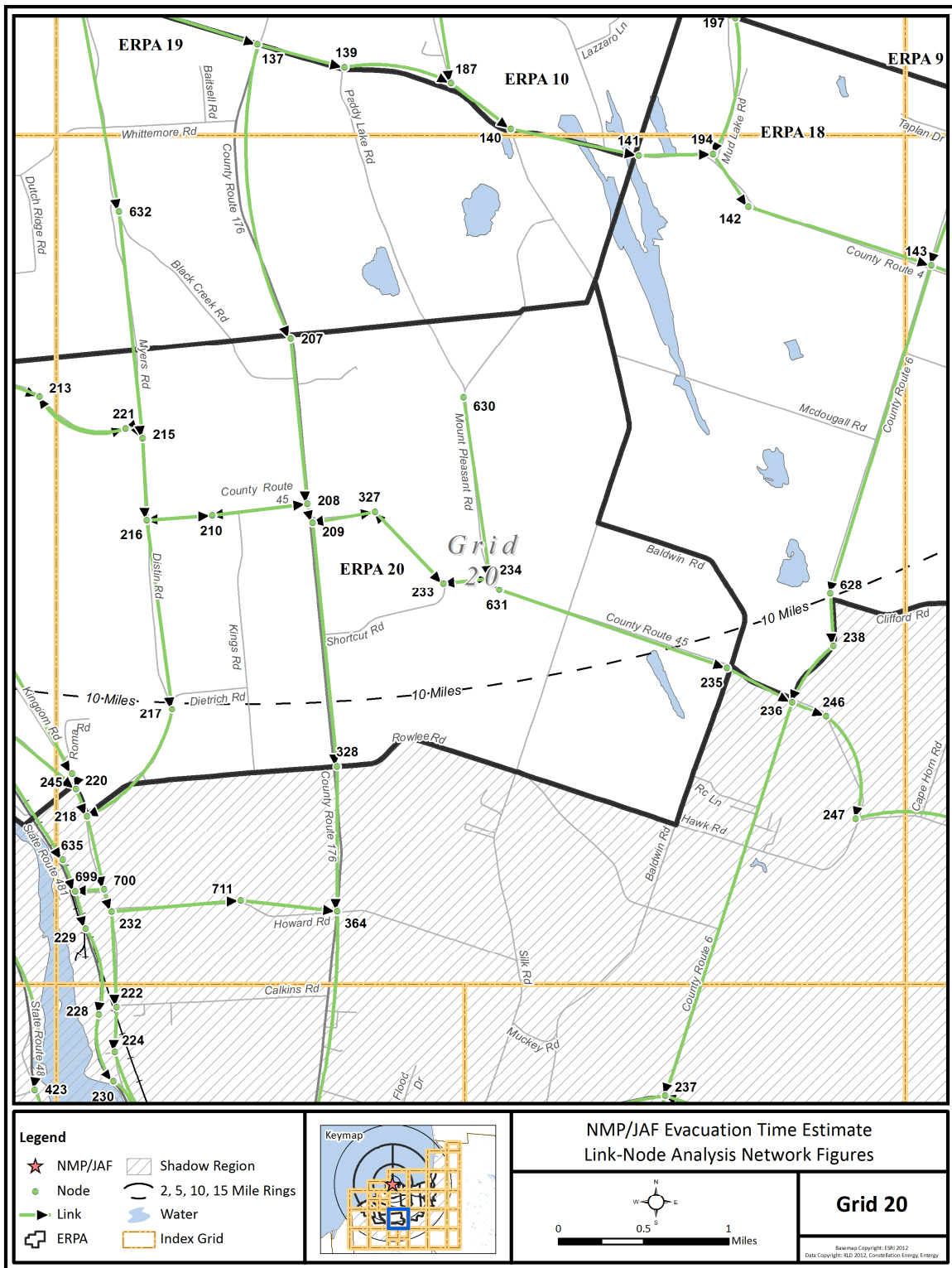


Figure K-21. Link-Node Analysis Network – Grid 20

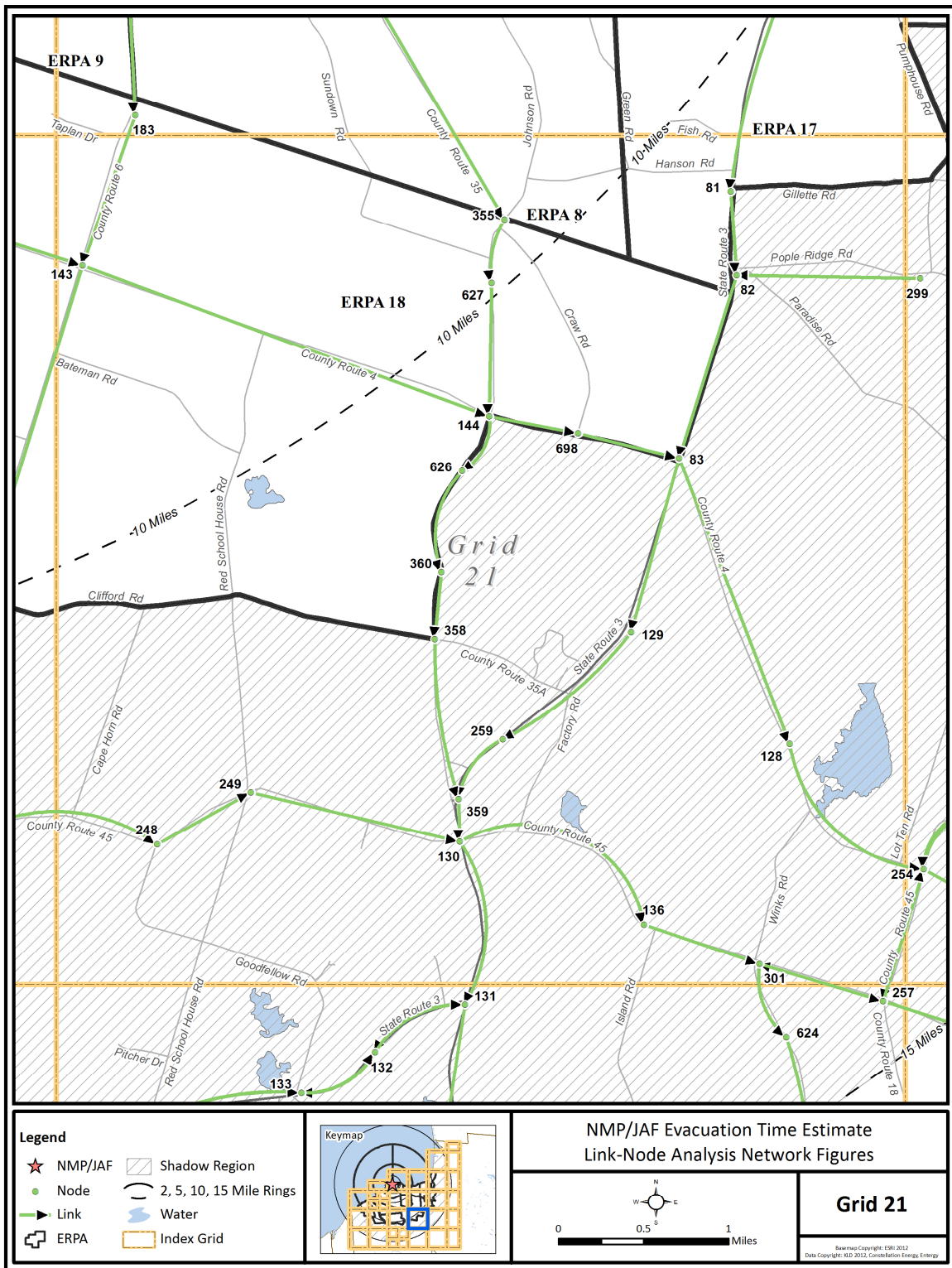


Figure K-22. Link-Node Analysis Network – Grid 21

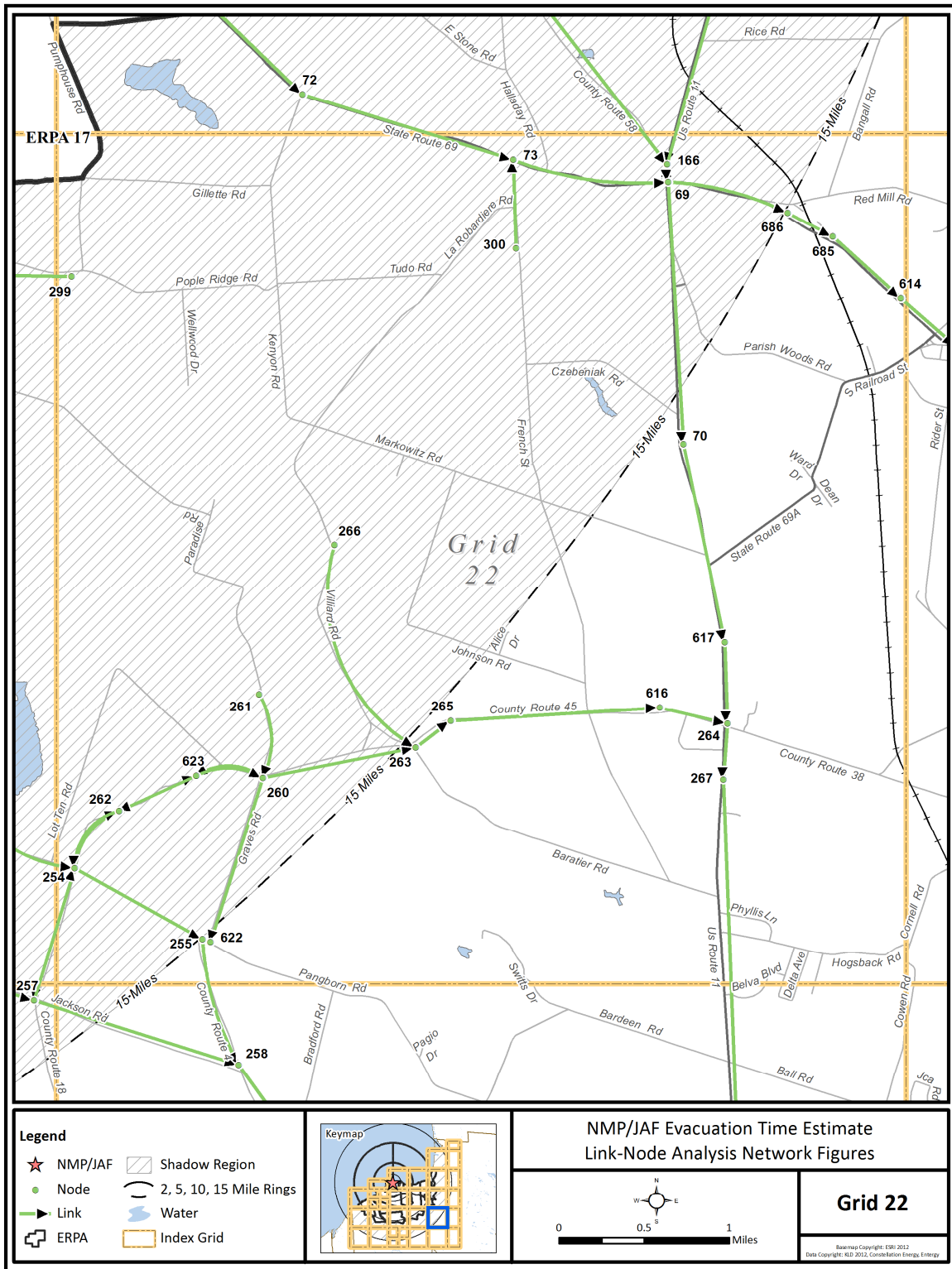
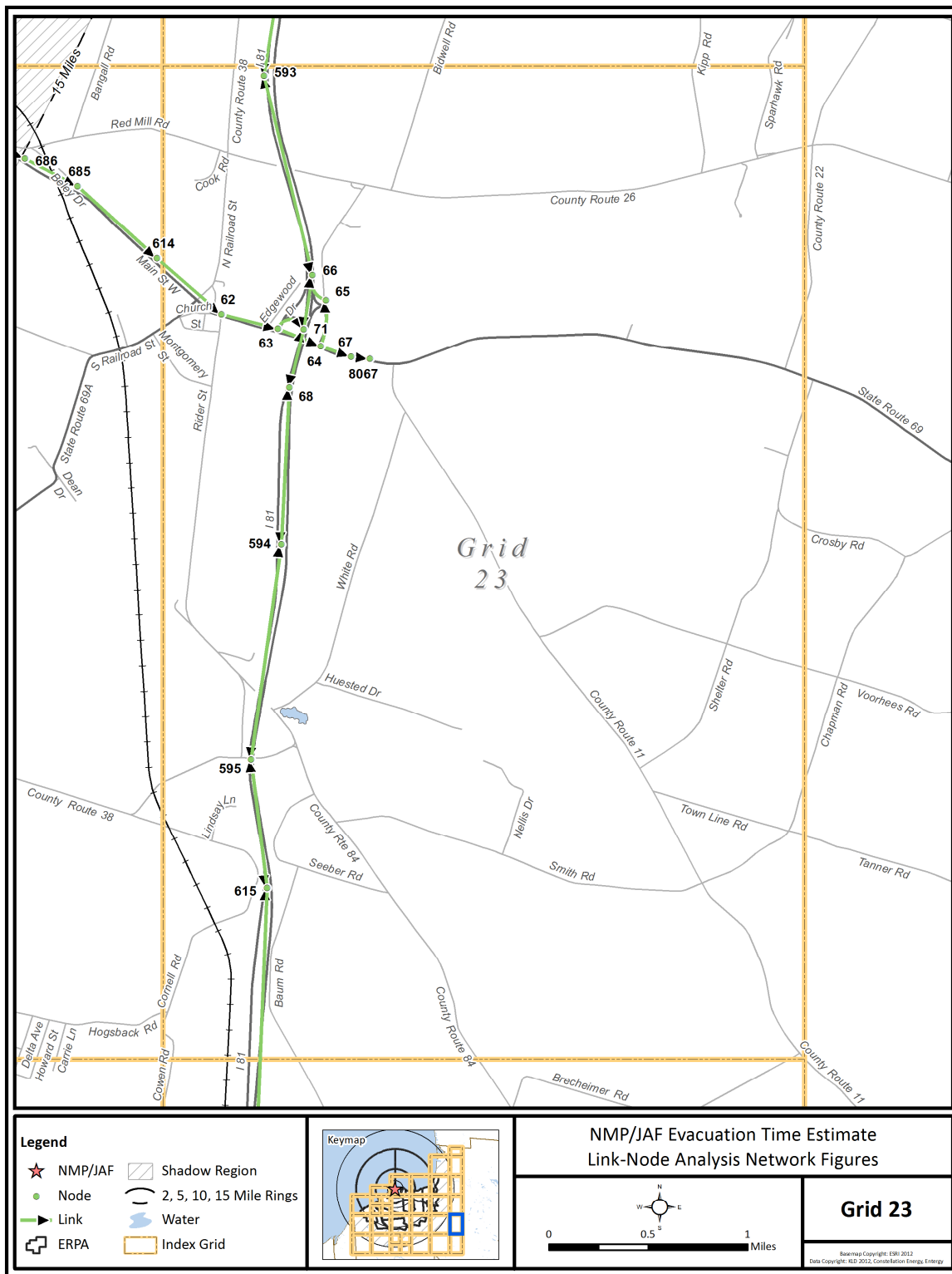
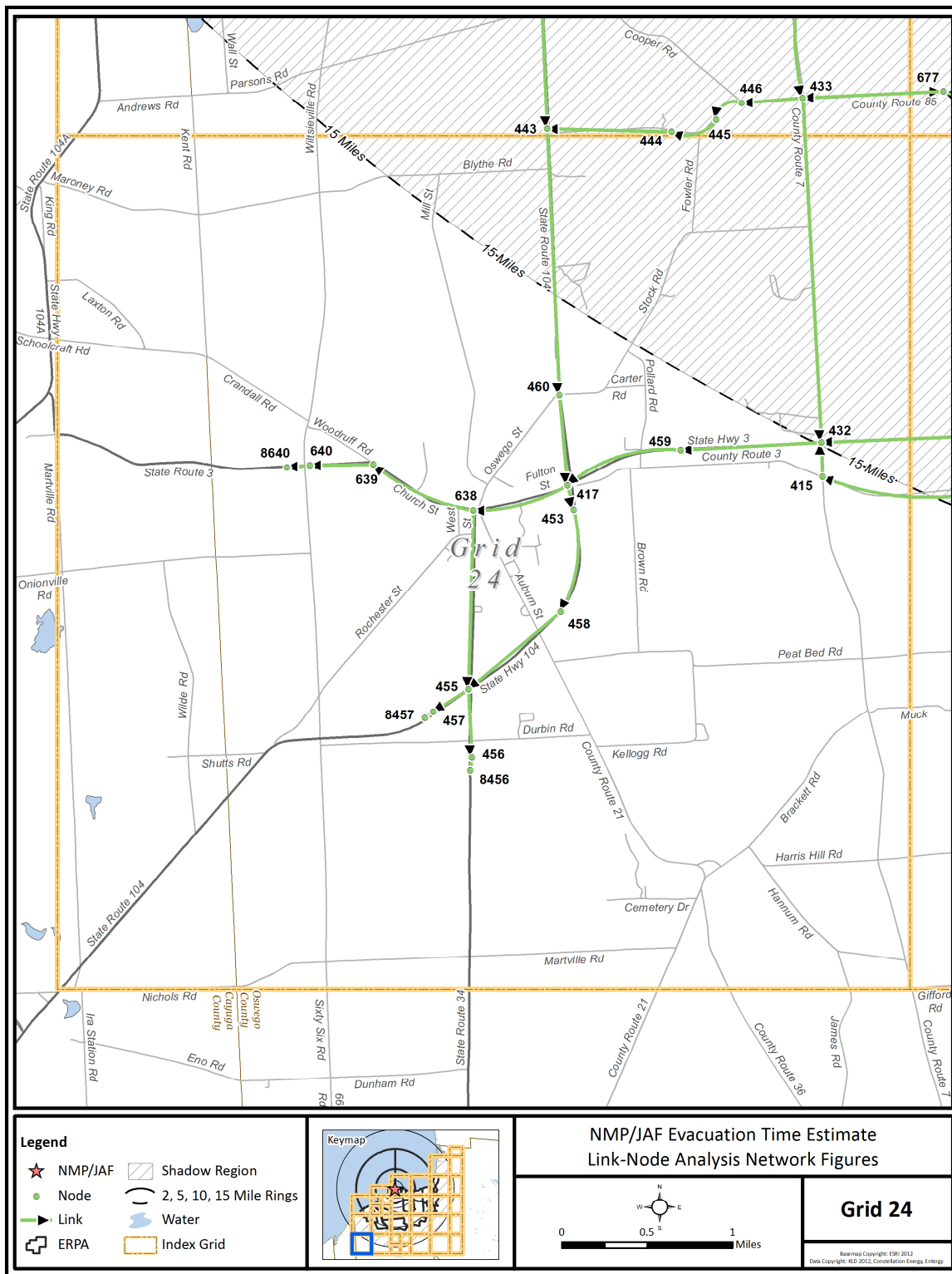


Figure K-23. Link-Node Analysis Network – Grid 22







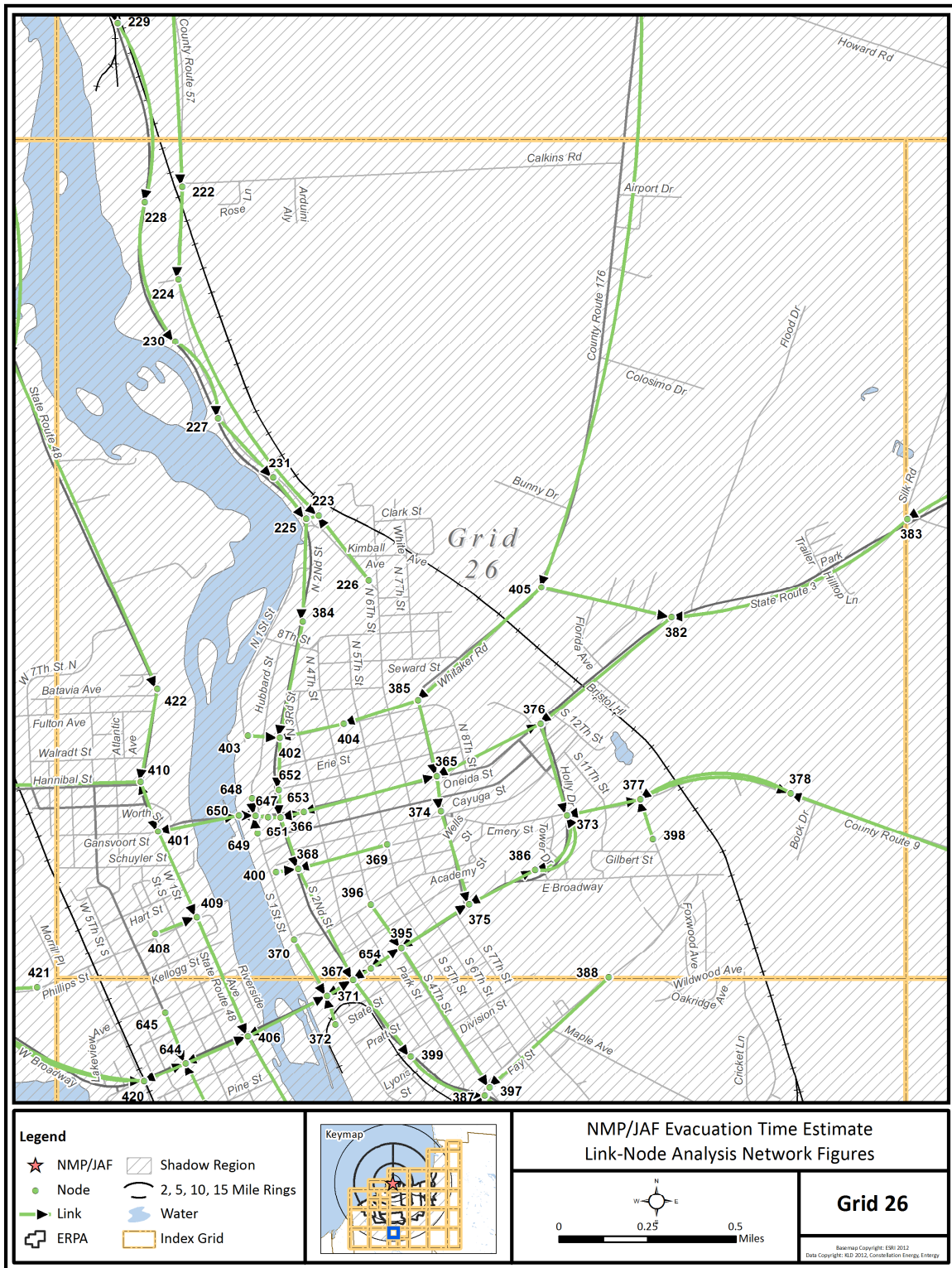
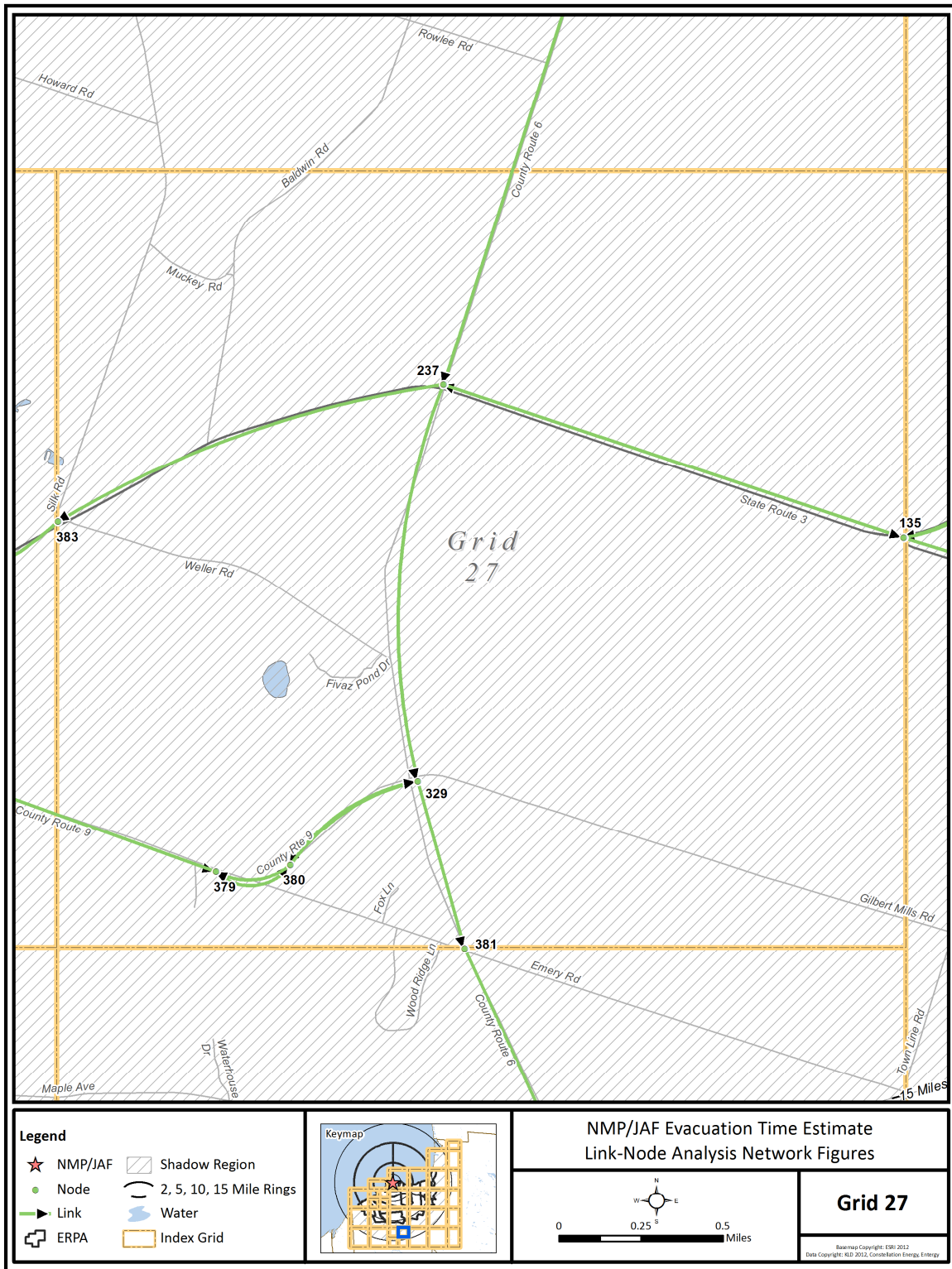


Figure K-27. Link-Node Analysis Network – Grid 26



**Figure K-28. Link-Node Analysis Network – Grid 27**

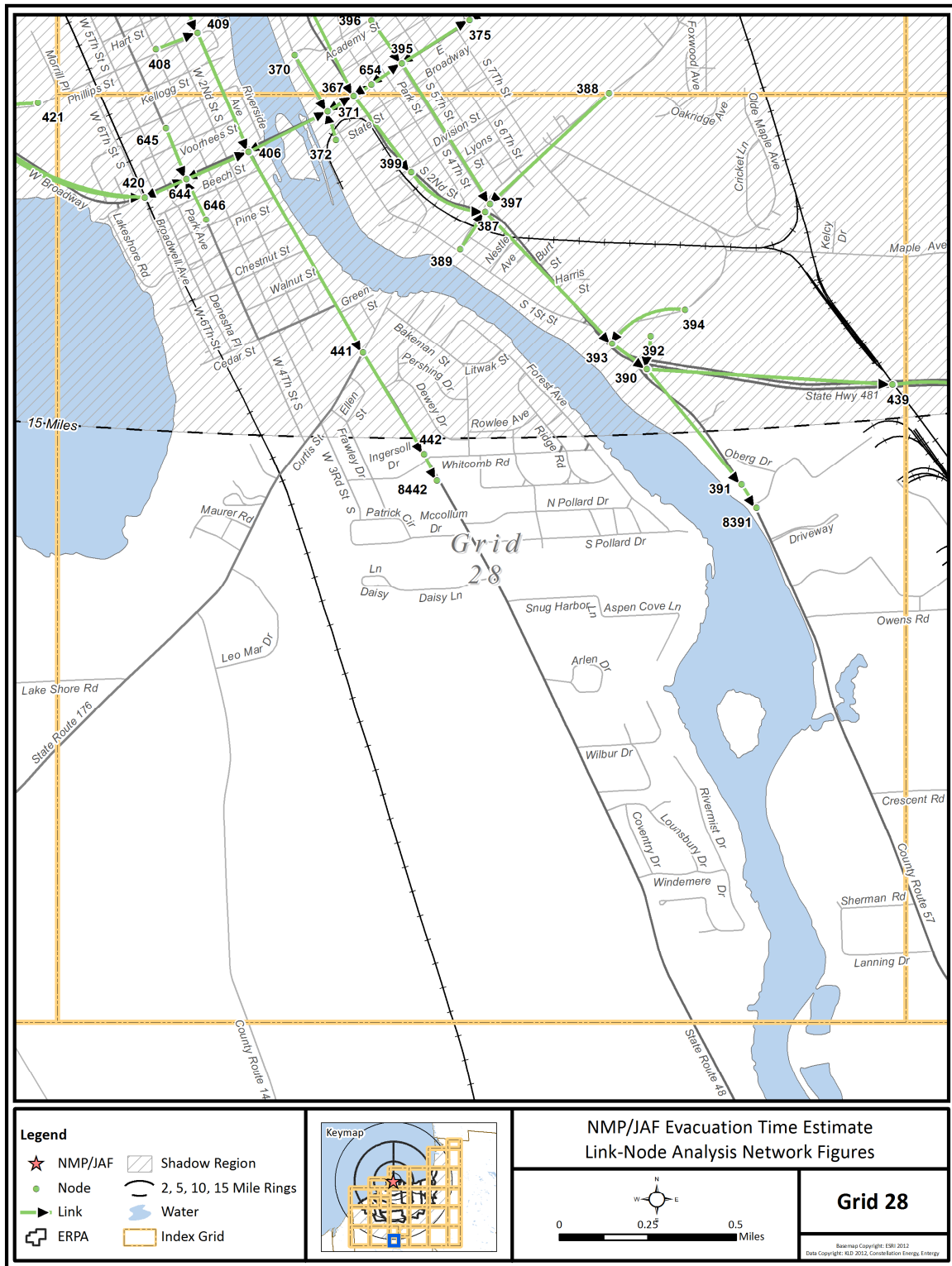
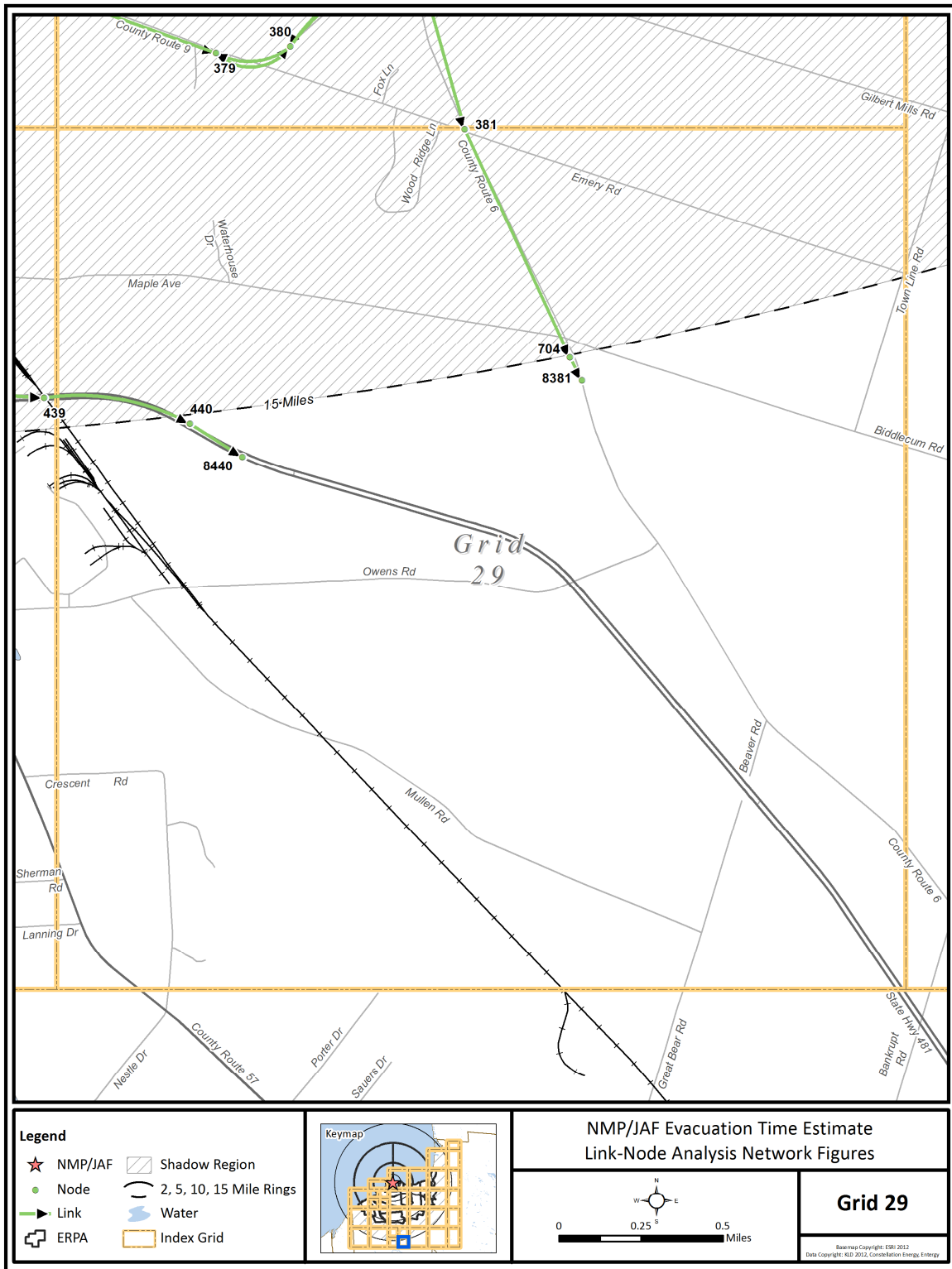
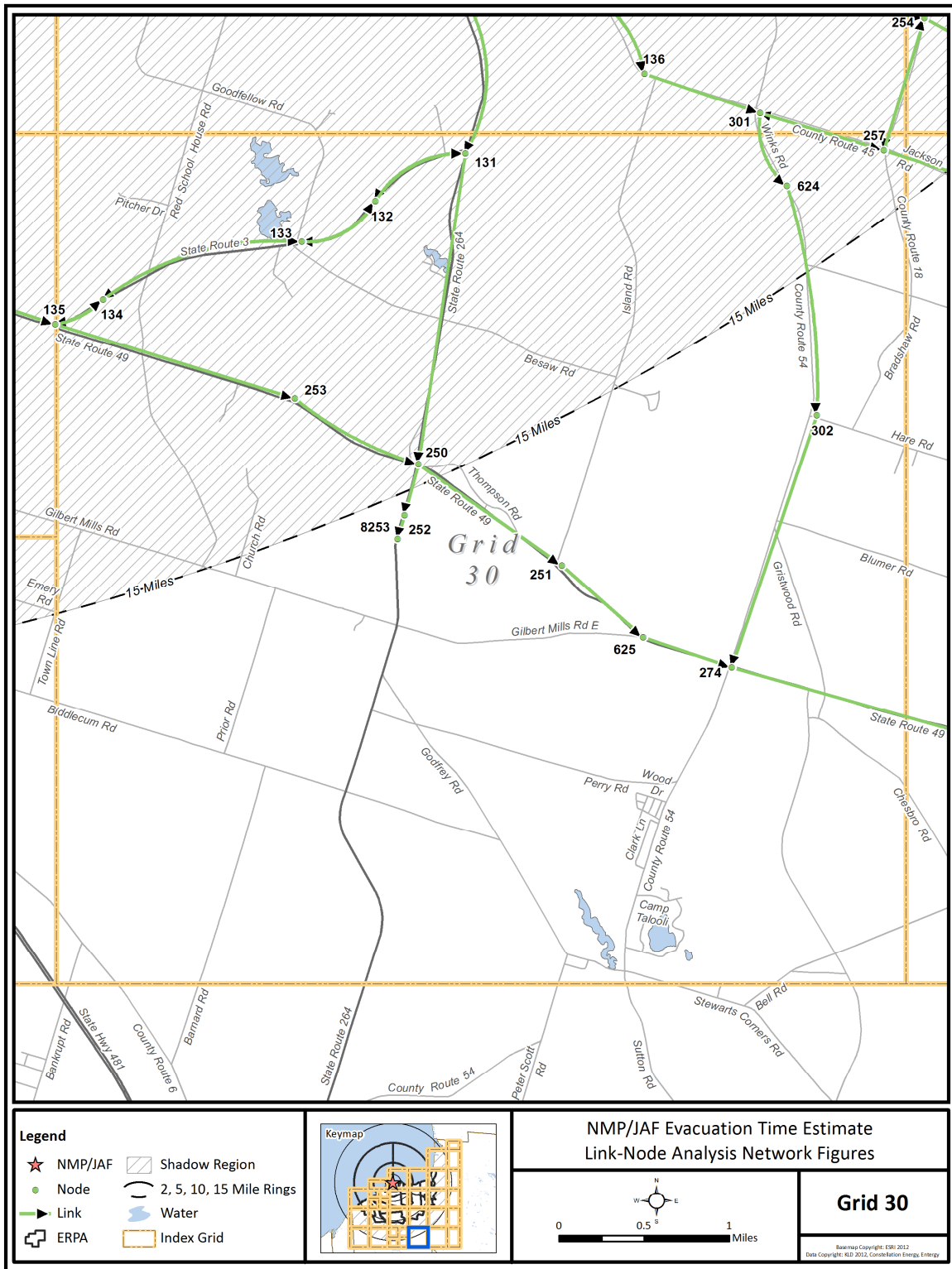


Figure K-29. Link-Node Analysis Network – Grid 28



**Figure K-30. Link-Node Analysis Network – Grid 29**



**Figure K-31. Link-Node Analysis Network – Grid 30**

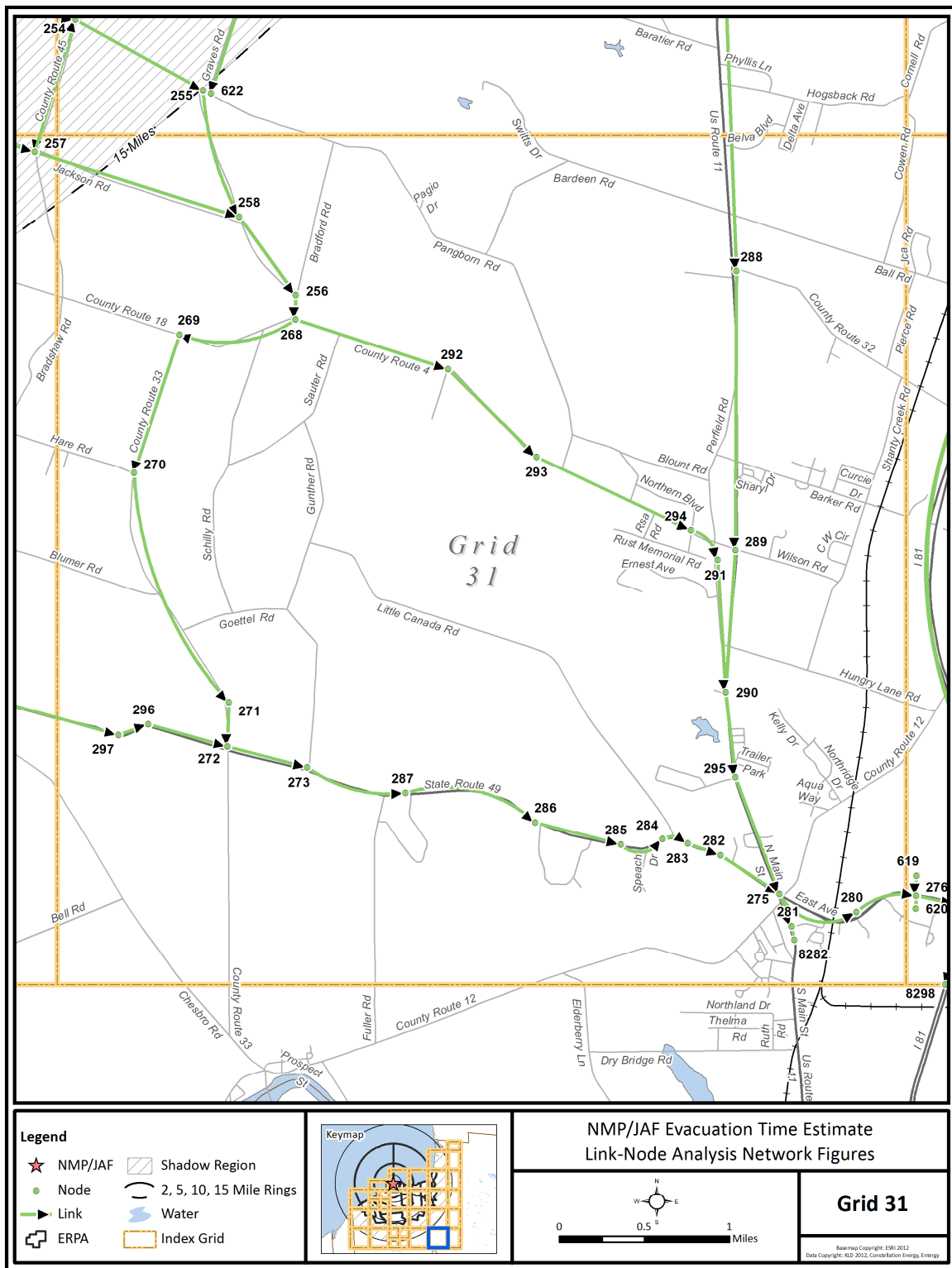
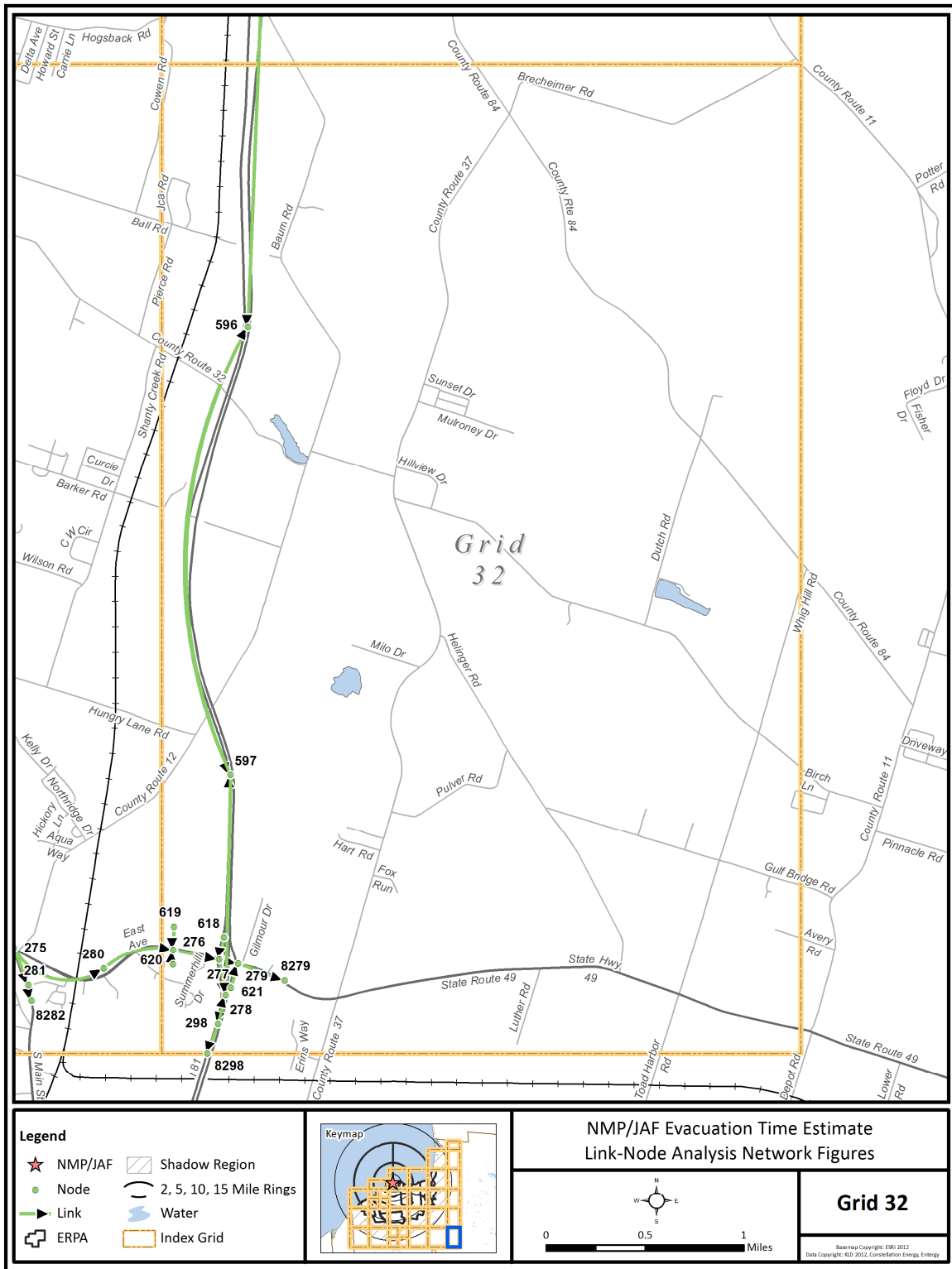


Figure K-32. Link-Node Analysis Network – Grid 31



**Figure K-33. Link-Node Analysis Network – Grid 32**

Table K-1. Evacuation Roadway Network Characteristics

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
1	2	3	US 11	COLLECTOR	1355	1	12	0	1350	30	8
2	2	599	US 11	COLLECTOR	1553	1	12	0	1575	35	8
3	2	683	SR 13	COLLECTOR	2433	1	12	0	1750	40	8
4	3	2	US 11	COLLECTOR	1355	1	12	0	1750	30	8
5	3	4	US 11	COLLECTOR	374	1	12	0	1125	25	8
6	4	3	US 11	COLLECTOR	374	1	12	0	1125	25	8
7	4	6	US 11	COLLECTOR	277	1	12	0	1750	30	8
8	5	2	SR 13	COLLECTOR	1204	1	12	0	1750	35	8
9	5	4	S JEFFERSON ST	LOCAL ROADWAY	1862	1	10	0	1350	30	7
10	6	4	US 11	COLLECTOR	277	1	12	0	1350	30	8
11	6	7	US 11	COLLECTOR	389	1	12	0	1750	30	8
12	7	6	US 11	COLLECTOR	389	1	12	0	1750	30	8
13	7	22	CR 2	COLLECTOR	1060	1	12	0	1575	35	8
14	7	27	US 11	COLLECTOR	5124	1	12	6	1575	35	3
15	7	29	PARK ST	COLLECTOR	254	1	12	0	1350	30	8
16	8	598	CR 5	COLLECTOR	4394	1	12	0	1700	50	2
17	9	8	CR 5	COLLECTOR	1979	1	12	0	1700	50	2
18	10	9	CR 5	COLLECTOR	2814	1	12	0	1700	50	2
19	11	10	CR 5	COLLECTOR	4508	1	12	0	1700	50	2
20	11	12	SR 3	COLLECTOR	2086	1	12	4	1750	55	2
21	11	21	SR 3	COLLECTOR	2967	1	12	4	1700	55	2
22	12	11	SR 3	COLLECTOR	2086	1	12	4	1750	55	2
23	12	13	SR 13	COLLECTOR	7048	1	12	3	1700	50	7

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
24	13	14	SR 13	COLLECTOR	4692	1	12	3	1700	50	7
25	14	15	SR 13	COLLECTOR	2230	1	12	3	1700	50	7
26	15	5	SR 13	COLLECTOR	1440	1	12	3	1700	40	7
27	16	17	SR 3	COLLECTOR	2215	1	12	4	1700	55	2
28	16	28	CR 15	COLLECTOR	5550	1	12	0	1700	50	2
EXIT LINK	17	8017	SR 3	COLLECTOR	520	1	12	4	1700	55	2
29	18	16	CR 15	COLLECTOR	1952	1	12	0	1700	45	2
30	19	16	SR 3	COLLECTOR	3886	1	12	4	1700	55	2
31	20	19	SR 3	COLLECTOR	12283	1	12	4	1700	55	2
32	21	11	SR 3	COLLECTOR	2969	1	12	4	1750	55	2
33	21	20	SR 3	COLLECTOR	4954	1	12	4	1700	55	2
34	22	23	CR 2	COLLECTOR	1092	1	12	0	1575	35	8
35	23	24	CR 2	COLLECTOR	2122	1	12	0	1700	45	8
36	24	25	I 81 - CR 2 RAMP	FREEWAY RAMP	908	1	12	6	1700	50	8
37	24	26	CR 2	COLLECTOR	461	1	12	0	1700	45	8
38	25	47	I 81	FREEWAY	6190	2	12	10	2250	75	8
39	25	589	I 81	FREEWAY	10141	2	12	10	2250	75	3
EXIT LINK	26	8026	CR 2	COLLECTOR	344	1	12	0	1700	45	8
40	27	42	US 11	COLLECTOR	15421	1	12	6	1700	55	3
41	28	16	CR 15	COLLECTOR	5550	1	12	0	1700	50	2
42	28	38	LAKE ST	COLLECTOR	2320	1	12	0	1700	45	2
43	29	7	PARK ST	COLLECTOR	254	1	12	0	1750	30	8
44	29	30	NORTH ST	COLLECTOR	1141	1	12	0	1575	35	3

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
45	30	29	NORTH ST	COLLECTOR	1141	1	12	0	1575	35	3
46	30	32	NORTH ST	COLLECTOR	5624	1	12	0	1700	45	3
47	31	30	LINCOLN AVE	LOCAL ROADWAY	438	1	12	4	1350	30	3
48	32	28	NORTH ST	COLLECTOR	15394	1	12	0	1700	50	2
49	33	34	I 81 - CR 22A RAMP	FREEWAY RAMP	1174	1	12	4	1700	50	1
50	34	43	I 81	FREEWAY	901	2	12	10	2250	75	1
51	34	588	I 81	FREEWAY	5999	2	12	10	2250	75	3
52	35	33	CR 22A	COLLECTOR	2080	1	12	0	1700	45	1
53	35	44	US 11	COLLECTOR	806	1	12	0	1575	35	1
54	36	35	US 11	COLLECTOR	649	1	12	0	1575	35	1
55	37	36	CR 15	COLLECTOR	912	1	12	0	1750	35	1
56	38	39	LAKE ST	COLLECTOR	3189	1	12	0	1700	50	3
57	39	40	LAKE ST	COLLECTOR	5796	1	12	0	1700	50	3
58	40	36	LAKE ST	COLLECTOR	2944	1	12	0	1750	45	1
59	41	36	US 11	COLLECTOR	2123	1	12	0	1750	35	1
60	42	41	US 11	COLLECTOR	7376	1	12	6	1700	55	3
61	43	34	I 81	FREEWAY	901	2	12	10	2250	75	1
EXIT LINK	43	8043	I 81	FREEWAY	451	2	12	10	2250	75	1
EXIT LINK	44	8044	US 11	COLLECTOR	352	1	12	6	1700	55	1
62	45	51	CR 28	COLLECTOR	1311	1	12	0	1700	55	8
63	45	116	US 11	COLLECTOR	16298	1	12	10	1700	55	8
64	45	163	US 11	COLLECTOR	9635	1	12	10	1700	55	16

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
65	46	47	I 81 - SR 13 RAMP	FREEWAY RAMP	1651	1	12	3	1700	50	8
66	46	48	SR 13	COLLECTOR	2821	1	12	0	1700	40	8
67	47	25	I 81	FREEWAY	6190	2	12	10	2250	75	8
68	47	590	I 81	FREEWAY	6689	2	12	10	2250	75	8
EXIT LINK	48	8048	SR 13	COLLECTOR	1423	1	12	0	1700	55	8
69	49	11	CR 5	LOCAL ROADWAY	1286	1	12	0	1750	35	2
70	50	21	BRENNAN BEACH RD	LOCAL ROADWAY	2072	1	12	0	1575	35	2
71	51	52	CR 28	COLLECTOR	1001	1	12	0	1700	55	8
72	51	54	I 81 - CR 28 RAMP	FREEWAY RAMP	1226	1	12	6	1700	50	8
73	52	53	I 81 - CR 28 RAMP	FREEWAY RAMP	1416	1	12	6	1700	50	8
74	52	55	CR 28	COLLECTOR	2790	1	12	0	1700	55	8
75	53	54	I 81	FREEWAY	2381	2	12	10	2250	75	8
76	53	590	I 81	FREEWAY	8912	2	12	10	2250	75	8
77	54	53	I 81	FREEWAY	2381	2	12	10	2250	75	8
78	54	591	I 81	FREEWAY	7143	2	12	10	2250	75	17
EXIT LINK	55	8056	CR 28	COLLECTOR	1157	1	12	0	1700	55	8
79	56	57	SR 104	COLLECTOR	6062	1	12	6	1700	55	16
80	56	163	US 11	COLLECTOR	8900	1	12	10	1700	55	16
81	56	166	US 11	COLLECTOR	13419	1	12	6	1700	55	16
82	57	58	SR 104	COLLECTOR	1354	1	12	6	1700	55	17

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
83	57	60	I 81 - SR 104 RAMP	FREEWAY RAMP	1084	1	12	6	1700	50	17
84	58	59	I 81 - SR 104 RAMP	FREEWAY RAMP	941	1	12	6	1700	50	17
85	58	61	SR 104	COLLECTOR	924	1	12	6	1700	55	17
86	59	60	I 81	FREEWAY	1914	2	12	10	2250	75	17
87	59	591	I 81	FREEWAY	8874	2	12	10	2250	75	17
88	60	59	I 81	FREEWAY	1914	2	12	10	2250	75	17
89	60	592	I 81	FREEWAY	5380	2	12	10	2250	75	17
EXIT LINK	61	8061	SR 104	COLLECTOR	852	1	12	6	1700	55	17
90	62	63	SR 69	COLLECTOR	1543	1	12	0	1575	35	23
91	63	64	SR 69	COLLECTOR	1231	1	12	8	1700	40	23
92	63	71	I 81 - SR 69 RAMPS	FREEWAY RAMP	997	1	12	4	1350	30	23
93	64	65	CR 26	COLLECTOR	1239	1	12	6	1700	60	23
94	64	67	SR 69	COLLECTOR	854	1	12	8	1700	40	23
95	65	66	I 81 - CR 26 RAMP	FREEWAY RAMP	810	1	12	4	1575	35	23
96	66	71	I 81	FREEWAY	1453	2	12	10	2250	75	23
97	66	593	I 81	FREEWAY	5464	2	12	10	2250	75	23
EXIT LINK	67	8067	SR 69	COLLECTOR	506	1	12	8	1700	45	23
98	68	71	I 81	FREEWAY	1592	2	12	10	2250	75	23
99	68	594	I 81	FREEWAY	4173	2	12	10	2250	75	23
100	69	70	US 11	COLLECTOR	8151	1	12	6	1700	55	22

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
101	69	166	US 11	COLLECTOR	550	1	12	6	1700	55	22
102	69	686	SR 69	COLLECTOR	3861	1	12	8	1700	55	22
103	70	617	US 11	COLLECTOR	6285	1	12	6	1700	55	22
104	71	66	I 81	FREEWAY	1453	2	12	10	2250	75	23
105	71	68	I 81	FREEWAY	1592	2	12	10	2250	75	23
106	72	73	SR 69	COLLECTOR	6861	1	12	8	1700	55	16
107	73	69	SR 69	COLLECTOR	4888	1	12	8	1700	55	22
108	74	72	SR 69	COLLECTOR	3860	1	12	8	1700	55	16
109	75	74	SR 69	COLLECTOR	8464	1	12	8	1700	55	16
110	75	610	SR 69	COLLECTOR	259	1	12	0	1350	30	16
111	76	77	SR 104	COLLECTOR	900	1	12	0	1750	30	15
112	76	84	SR 104	COLLECTOR	968	1	12	0	1575	35	16
113	76	610	SR 69	COLLECTOR	1380	1	12	0	1350	30	16
114	77	76	SR 104	COLLECTOR	900	1	12	0	1350	30	15
115	77	78	SR 104	COLLECTOR	1390	1	12	0	1750	30	15
116	77	88	SCENIC AVE	COLLECTOR	2212	1	12	8	1575	35	15
117	78	77	SR 104	COLLECTOR	1390	1	12	0	1750	30	15
118	78	79	SR 3	COLLECTOR	980	1	12	8	1700	40	15
119	79	78	SR 3	COLLECTOR	980	1	12	8	1750	40	15
120	79	80	SR 3	COLLECTOR	3000	1	12	8	1700	45	15
121	80	79	SR 3	COLLECTOR	3000	1	12	8	1700	45	15
122	80	200	SR 3	COLLECTOR	3091	1	12	8	1700	55	15
123	81	82	SR 3	COLLECTOR	2607	1	12	8	1750	55	21
124	82	83	SR 3	COLLECTOR	5972	1	12	8	1750	55	21
125	83	128	CR 4	COLLECTOR	9518	1	12	0	1700	50	21

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
126	83	129	SR 3	COLLECTOR	5604	1	12	8	1700	55	21
127	84	169	PULASKI DR	LOCAL ROADWAY	1184	1	12	0	1575	35	16
128	84	607	SR 104	COLLECTOR	1866	1	12	6	1700	40	16
129	85	86	SR 104	COLLECTOR	4748	1	12	6	1750	55	16
130	86	608	SR 104	COLLECTOR	10757	1	12	6	1700	60	16
131	86	613	ROWE RD	LOCAL ROADWAY	5965	1	12	0	1575	35	16
132	87	78	ACADEMY ST	COLLECTOR	1048	1	12	0	1750	40	15
133	88	77	SCENIC AVE	COLLECTOR	2212	1	12	8	1750	35	15
134	88	96	SCENIC AVE	COLLECTOR	3876	1	12	8	1700	45	15
135	89	78	SR 104	COLLECTOR	2674	1	12	6	1750	40	15
136	90	88	LIBERTY ST	LOCAL ROADWAY	630	1	12	0	1350	30	15
137	92	79	SPRING ST	LOCAL ROADWAY	719	1	12	0	1350	30	15
138	93	79	SPRING ST	LOCAL ROADWAY	637	1	12	0	1350	30	15
139	94	75	MUNGER HILL RD	LOCAL ROADWAY	704	1	12	0	1700	40	16
140	95	80	MUNGER HILL RD	LOCAL ROADWAY	1099	1	12	0	1700	40	15
141	96	88	SCENIC AVE	COLLECTOR	3876	1	12	8	1700	45	15
142	96	120	SR 3	COLLECTOR	7645	1	12	4	1700	55	15
143	97	98	SR 3	COLLECTOR	3882	1	12	4	1700	55	7
144	97	121	SR 3	COLLECTOR	3873	1	12	4	1700	55	7
145	98	99	SR 3	COLLECTOR	3761	1	12	4	1700	55	7

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
146	99	100	SR 3	COLLECTOR	5297	1	12	4	1700	55	7
147	100	102	SR 3	COLLECTOR	1767	1	12	4	1700	55	7
148	100	103	CR 28	COLLECTOR	1885	1	12	0	1700	45	7
149	101	12	SR 3	COLLECTOR	4835	1	12	4	1750	45	7
150	102	101	SR 3	COLLECTOR	2740	1	12	4	1700	55	7
151	103	104	CR 28	COLLECTOR	976	1	12	0	1700	45	7
152	104	161	CR 28	COLLECTOR	1977	1	12	0	1700	50	7
153	105	115	CR 28	COLLECTOR	1435	1	12	0	1700	55	7
154	106	694	CR 28	COLLECTOR	3016	1	12	0	1700	55	7
155	107	110	SALISBURY RD	COLLECTOR	873	1	12	0	1700	40	7
156	108	109	SALISBURY RD	COLLECTOR	2100	1	12	0	1700	40	7
157	109	111	CR 28	COLLECTOR	2779	1	12	0	1700	50	7
158	110	109	SALISBURY RD	COLLECTOR	194	1	12	0	1700	40	7
159	111	112	CR 28	COLLECTOR	2332	1	12	0	1700	50	7
160	112	113	CR 28	COLLECTOR	1224	1	12	0	1575	35	7
161	113	114	CR 28	COLLECTOR	1283	1	12	0	1700	45	7
162	113	118	CR 41	COLLECTOR	3988	1	12	0	1700	55	7
163	114	106	CR 28	COLLECTOR	1468	1	12	0	1700	45	7
164	115	45	CR 28	COLLECTOR	1855	1	12	0	1700	55	7
165	116	45	US 11	COLLECTOR	16298	1	12	10	1700	55	8
166	116	599	US 11	COLLECTOR	2352	1	12	6	1700	45	8
167	117	116	CR 41	COLLECTOR	1990	1	12	0	1700	50	7
168	118	602	CR 41	COLLECTOR	8746	1	12	0	1700	55	7
169	119	113	CR 41	COLLECTOR	4506	1	12	0	1700	55	7
170	120	96	SR 3	COLLECTOR	7645	1	12	4	1700	55	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
171	120	121	SR 3	COLLECTOR	2927	1	12	4	1700	55	6
172	121	97	SR 3	COLLECTOR	3873	1	12	4	1700	55	7
173	121	120	SR 3	COLLECTOR	2902	1	12	4	1700	55	6
174	122	97	SR 104B	COLLECTOR	5896	1	12	6	1700	60	6
175	123	122	SR 104B	COLLECTOR	1500	1	12	6	1700	50	6
176	124	123	MEIXCO POINT DR W	COLLECTOR	1892	1	12	0	1575	35	6
177	125	122	CR 40	COLLECTOR	2058	1	12	0	1575	35	6
178	126	123	SR 104B	COLLECTOR	2147	1	12	6	1700	50	6
179	127	126	SR 104B	COLLECTOR	3254	1	12	6	1700	55	6
180	128	254	CR 4	COLLECTOR	6035	1	12	0	1700	50	21
181	129	259	SR 3	COLLECTOR	5232	1	12	8	1700	55	21
182	130	131	SR 3	COLLECTOR	5310	1	12	8	1700	50	21
183	130	136	CR 45	COLLECTOR	7246	1	12	0	1700	50	21
184	131	132	SR 3	COLLECTOR	3272	1	12	8	1700	55	30
185	131	250	SR 264	COLLECTOR	9748	1	12	6	1700	55	30
186	132	131	SR 3	COLLECTOR	3277	1	12	8	1700	55	30
187	132	133	SR 3	COLLECTOR	2718	1	12	8	1700	55	30
188	133	132	SR 3	COLLECTOR	2709	1	12	8	1700	55	30
189	133	134	SR 3	COLLECTOR	6538	1	12	8	1700	55	30
190	134	133	SR 3	COLLECTOR	6539	1	12	8	1700	55	30
191	134	135	SR 3	COLLECTOR	1693	1	12	8	1700	55	30
192	135	134	SR 3	COLLECTOR	1695	1	12	8	1700	55	30
193	135	237	SR 3	COLLECTOR	7824	1	12	8	1700	55	27
194	135	253	SR 49	COLLECTOR	7796	1	12	6	1700	50	30
195	136	301	CR 45	COLLECTOR	3794	1	12	0	1700	45	21

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
196	137	139	CR 4	COLLECTOR	2792	1	12	0	1700	55	14
197	137	207	CR 176	COLLECTOR	9331	1	12	0	1700	55	20
198	138	137	CR 4	COLLECTOR	5862	1	12	0	1700	55	14
199	138	309	CR 4	COLLECTOR	6561	1	12	0	1700	55	13
200	138	632	MYERS RD	COLLECTOR	7063	1	12	0	1700	45	14
201	139	187	CR 4	COLLECTOR	3396	1	12	0	1700	45	14
202	140	141	CR 4	COLLECTOR	4062	1	12	0	1700	55	20
203	141	194	CR 4	COLLECTOR	2313	1	12	0	1700	50	20
204	142	143	CR 4	COLLECTOR	5978	1	12	0	1700	55	20
205	143	144	CR 4	COLLECTOR	13491	1	12	0	1750	55	21
206	143	628	CR 6	COLLECTOR	10681	1	12	0	1700	55	20
207	144	626	CR 35	COLLECTOR	1985	1	12	0	1700	50	21
208	144	698	CR 4	COLLECTOR	2817	1	12	0	1700	55	21
209	145	146	CR 6	COLLECTOR	2065	1	12	4	1700	50	15
210	145	183	CR 6	COLLECTOR	3428	1	12	0	1700	55	15
211	146	145	CR 6	COLLECTOR	2051	1	12	4	1700	50	15
212	146	147	CR 6	COLLECTOR	1480	1	12	4	1700	50	15
213	147	146	CR 6	COLLECTOR	1480	1	12	4	1700	50	15
214	147	199	CR 6	COLLECTOR	1222	1	12	4	1700	50	15
215	148	199	CR 6	COLLECTOR	2328	1	12	4	1700	50	15
216	149	148	CR 6	COLLECTOR	10992	1	12	4	1700	50	15
217	149	150	SR 104	COLLECTOR	6759	1	12	6	1700	55	15
218	150	363	SR 104	COLLECTOR	1791	1	12	6	1700	55	15
219	151	152	SR 104	COLLECTOR	2907	1	12	6	1700	55	15
220	151	363	SR 104	COLLECTOR	1988	1	12	6	1700	55	15

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
221	151	603	TOLLGATE RD	COLLECTOR	9722	1	12	6	1700	55	15
222	152	153	SR 104	COLLECTOR	3317	1	12	6	1700	55	15
223	153	89	SR 104	COLLECTOR	2905	1	12	6	1700	55	15
224	154	149	CR 6	COLLECTOR	2776	1	12	4	1700	45	15
225	154	175	SR 104B	COLLECTOR	3424	1	12	6	1700	60	15
226	155	156	SR 104B	COLLECTOR	1643	1	12	10	1700	55	14
227	155	609	SR 104	COLLECTOR	990	1	12	6	1700	40	15
228	156	154	SR 104B	COLLECTOR	3565	1	12	10	1700	55	15
229	157	86	SMITHERS RD	COLLECTOR	4855	1	10	0	1750	40	16
230	157	605	SPATH RD	LOCAL ROADWAY	4997	1	12	0	1700	45	16
231	158	157	TUBBS RD	COLLECTOR	377	1	12	0	1750	50	16
232	159	121	FORT LEAZIER RD	COLLECTOR	3173	1	12	0	1700	40	7
233	160	161	S DAYSVILLE RD	LOCAL ROADWAY	1726	1	12	0	1700	40	7
234	161	110	CR 28	COLLECTOR	2299	1	12	0	1700	50	7
235	162	163	DRYBRIDGE RD	COLLECTOR	5446	1	12	0	1700	40	16
236	163	45	US 11	COLLECTOR	9635	1	12	10	1700	55	16
237	163	56	US 11	COLLECTOR	8900	1	12	10	1750	55	16
238	164	165	CR 41	COLLECTOR	5136	1	12	4	1700	55	16
239	164	605	CR 41	COLLECTOR	3832	1	12	4	1700	55	16
240	165	119	CR 41	COLLECTOR	2048	1	12	0	1700	55	7
241	166	56	US 11	COLLECTOR	13419	1	12	6	1750	55	16
242	166	69	US 11	COLLECTOR	550	1	12	6	1700	55	22
243	167	164	SHERMAN RD	LOCAL ROADWAY	2949	1	12	0	1750	40	16

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
244	169	170	TUBBS RD	COLLECTOR	1017	1	12	0	1700	40	16
245	170	158	TUBBS RD	COLLECTOR	4203	1	12	0	1700	50	16
246	171	157	TUBBS RD	COLLECTOR	4014	1	12	0	1750	50	16
247	172	154	CR 6	COLLECTOR	5379	1	12	4	1700	50	15
248	172	174	CR 1	COLLECTOR	10160	1	12	0	1700	55	6
249	174	127	SR 104B	COLLECTOR	2600	1	12	6	1700	60	6
250	174	603	TOLLGATE RD	COLLECTOR	1067	1	12	6	1700	40	6
251	175	176	SR 104B	COLLECTOR	4018	1	12	6	1700	60	15
252	176	174	SR 104B	COLLECTOR	4129	1	12	6	1700	60	6
253	178	172	CR 6	LOCAL ROADWAY	794	1	12	10	1700	40	6
254	179	172	CR 1	COLLECTOR	7137	1	12	0	1700	55	5
255	180	179	CR 1	COLLECTOR	3057	1	12	0	1700	55	5
256	181	203	DENNIS RD	LOCAL ROADWAY	5630	1	12	0	1700	40	14
257	181	205	CR 1	COLLECTOR	411	1	12	0	1750	55	14
258	182	181	CR 1	COLLECTOR	4564	1	12	0	1700	45	14
259	182	706	CR 29	COLLECTOR	868	1	12	0	1700	55	14
260	183	143	CR 6	COLLECTOR	4945	1	12	0	1700	55	21
261	184	185	CR 29	COLLECTOR	3942	1	12	0	1700	50	14
262	185	186	CR 29	COLLECTOR	2720	1	12	0	1700	50	14
263	186	187	CR 29	COLLECTOR	4063	1	12	0	1700	55	14
264	187	140	CR 4	COLLECTOR	2348	1	12	0	1700	45	14
265	188	189	SR 104	COLLECTOR	1165	1	12	6	1700	55	14
266	188	604	SR 104	COLLECTOR	4497	1	12	6	1700	55	14

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
267	189	184	CR 29	COLLECTOR	4809	1	12	0	1700	50	14
268	189	188	SR 104	COLLECTOR	1165	1	12	6	1700	55	14
269	189	306	SR 104	COLLECTOR	3465	1	12	6	1700	55	14
270	190	145	DARROW RD	LOCAL ROADWAY	7742	1	12	0	1700	50	15
271	191	192	CR 51	COLLECTOR	7714	1	12	0	1700	55	14
272	191	202	SR 104	COLLECTOR	1118	1	12	6	1700	55	14
273	191	604	SR 104	COLLECTOR	1885	1	12	6	1700	55	14
274	192	193	CR 51	COLLECTOR	4494	1	12	0	1700	55	14
275	193	195	CR 51	COLLECTOR	1478	1	12	0	1700	45	14
276	193	197	MUD LAKE RD	COLLECTOR	3477	1	10	0	1700	45	14
277	194	142	CR 4	COLLECTOR	1955	1	12	0	1700	50	20
278	195	196	CR 51	COLLECTOR	4169	1	12	0	1700	45	14
279	196	145	CR 51	COLLECTOR	3789	1	12	0	1700	45	15
280	197	194	MUD LAKE RD	COLLECTOR	4359	1	10	0	1700	45	14
281	198	190	DARROW RD	LOCAL ROADWAY	7574	1	12	0	1700	45	15
282	199	147	CR 6	COLLECTOR	1213	1	12	4	1700	50	15
283	199	354	HURLBUT RD	LOCAL ROADWAY	3913	1	10	0	1700	50	15
284	200	81	SR 3	COLLECTOR	8301	1	12	8	1700	55	15
285	201	80	MUNGER HILL RD	LOCAL ROADWAY	1432	1	12	0	1700	40	15
286	201	200	MUNGER HILL RD	LOCAL ROADWAY	1843	1	12	0	1700	40	15
287	202	155	SR 104	COLLECTOR	6971	1	12	6	1700	55	14

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
288	202	191	SR 104	LOCAL ROADWAY	1118	1	12	6	1700	55	14
289	203	202	MIDDLE RD	COLLECTOR	1082	1	12	0	1350	30	14
290	205	180	CR 1	COLLECTOR	4078	1	12	0	1700	55	14
291	205	181	CR 1	COLLECTOR	411	1	12	0	1700	55	14
292	206	205	NINE MILE POINT RD	LOCAL ROADWAY	8925	1	12	0	1750	40	5
293	207	208	CR 176	COLLECTOR	5193	1	12	0	1700	55	20
294	208	209	CR 176	COLLECTOR	607	1	12	0	1700	55	20
295	208	210	CR 45	COLLECTOR	2980	1	12	0	1700	50	20
296	209	327	CR 45	COLLECTOR	1972	1	12	0	1700	50	20
297	209	328	CR 176	COLLECTOR	7600	1	12	0	1700	55	20
298	210	208	CR 45	COLLECTOR	2980	1	12	0	1700	50	20
299	210	216	CR 45	COLLECTOR	2040	1	12	0	1700	50	20
300	211	239	KINGDOM RD	LOCAL ROADWAY	5060	1	12	0	1700	40	19
301	211	637	CR 45	COLLECTOR	3731	1	12	0	1700	45	19
302	212	211	KINGDOM RD	LOCAL ROADWAY	427	1	12	0	1700	40	19
303	212	213	CR 45	COLLECTOR	3822	1	12	0	1700	50	19
304	213	212	CR 45	COLLECTOR	3821	1	12	0	1700	50	19
305	213	221	CR 45	COLLECTOR	3041	1	12	0	1700	50	20
306	214	243	SR 481	MINOR ARTERIAL	7866	2	12	12	1900	60	19
307	214	475	CR 45	COLLECTOR	2468	1	12	0	1700	45	19
308	214	637	CR 45	COLLECTOR	462	1	12	0	1700	45	19

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
309	215	216	MYERS RD	COLLECTOR	2558	1	12	0	1700	50	20
310	215	221	CR 45	COLLECTOR	648	1	12	0	1575	35	20
311	216	210	CR 45	COLLECTOR	2040	1	12	0	1700	50	20
312	216	217	MYERS RD	COLLECTOR	5918	1	12	0	1700	45	20
313	217	218	MYERS RD	COLLECTOR	4375	1	12	0	1700	45	20
314	218	700	CR 57	COLLECTOR	2339	1	12	0	1700	50	20
315	219	634	CR 57	COLLECTOR	240	1	12	0	1575	35	19
316	219	635	SR 481	MINOR ARTERIAL	5234	2	12	12	1900	60	19
317	220	218	CR 57	COLLECTOR	919	1	12	0	1700	50	20
318	221	213	CR 45	COLLECTOR	3031	1	12	0	1700	50	20
319	221	215	CR 45	COLLECTOR	649	1	12	0	1575	35	20
320	222	224	CR 57	COLLECTOR	1387	1	12	0	1700	45	26
321	223	225	CR 57	COLLECTOR	192	1	12	0	1700	50	26
322	224	223	CR 57	COLLECTOR	4140	1	12	0	1700	45	26
323	225	384	SR 481	COLLECTOR	1534	1	12	12	1700	45	26
324	226	223	VAN BUREN ST	LOCAL ROADWAY	1216	1	12	0	1350	30	26
325	227	231	SR 481	COLLECTOR	1218	1	12	12	1700	55	26
326	228	230	SR 481	COLLECTOR	2183	1	12	12	1700	55	26
327	229	228	SR 481	COLLECTOR	2760	1	12	12	1700	55	20
328	230	227	SR 481	COLLECTOR	1347	1	12	12	1700	55	26
329	231	225	SR 481	COLLECTOR	783	1	12	12	1700	55	26
330	232	222	CR 57	COLLECTOR	2984	1	12	0	1700	45	20
331	232	711	HOWARD RD	LOCAL ROADWAY	4027	1	12	0	1700	40	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
332	233	234	CR 45	COLLECTOR	1452	1	12	0	1700	50	20
333	233	327	CR 45	COLLECTOR	3067	1	12	0	1700	50	20
334	234	233	CR 45	COLLECTOR	1452	1	12	0	1700	50	20
335	234	631	CR 45	COLLECTOR	468	1	12	0	1575	35	20
336	235	236	CR 45	COLLECTOR	2280	1	12	0	1700	55	20
337	236	237	CR 6	COLLECTOR	12864	1	12	0	1700	55	20
338	236	246	CR 45	COLLECTOR	1158	1	12	0	1700	45	20
339	237	135	SR 3	COLLECTOR	7824	1	12	8	1700	55	27
340	237	329	CR 6	COLLECTOR	6487	1	12	0	1700	55	27
341	237	383	SR 3	COLLECTOR	6633	1	12	12	1700	55	27
342	238	236	CR 6	COLLECTOR	2183	1	12	0	1700	45	20
343	239	240	KINGDOM RD	LOCAL ROADWAY	2311	1	12	0	1700	40	19
344	240	245	KINGDOM RD	LOCAL ROADWAY	5379	1	12	0	1700	40	19
345	240	636	MARCH RD	LOCAL ROADWAY	1863	1	12	0	1700	40	19
346	241	219	CR 57	COLLECTOR	3695	1	12	0	1700	45	19
347	241	243	MARCH RD	LOCAL ROADWAY	616	1	12	0	1700	40	19
348	242	472	MINETTO BRIDGE RD	COLLECTOR	1033	1	12	0	1575	35	19
349	242	476	CR 57	COLLECTOR	6536	1	12	0	1700	50	19
350	243	219	SR 481	MINOR ARTERIAL	3313	2	12	12	1900	60	19
351	243	241	MARCH RD	LOCAL ROADWAY	616	1	12	0	1700	40	19

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
352	243	636	MARCH RD	LOCAL ROADWAY	467	1	12	0	1700	40	19
353	244	220	CR 57	COLLECTOR	3338	1	12	0	1700	50	19
354	245	220	KINGDOM RD	LOCAL ROADWAY	554	1	12	0	1350	30	20
355	246	247	CR 45	COLLECTOR	3473	1	12	0	1700	45	20
356	247	248	CR 45	COLLECTOR	4885	1	12	0	1700	50	21
357	248	249	CR 45	COLLECTOR	3336	1	12	0	1700	50	21
358	249	130	CR 45	COLLECTOR	6675	1	12	0	1700	50	21
359	250	251	SR 49	COLLECTOR	5452	1	12	6	1700	50	30
360	250	252	SR 264	COLLECTOR	1644	1	12	6	1700	55	30
361	251	625	SR 49	COLLECTOR	3380	1	12	6	1700	50	30
EXIT LINK	252	8253	SR 264	COLLECTOR	772	1	12	6	1700	55	30
362	253	250	SR 49	COLLECTOR	4368	1	12	6	1700	55	30
363	254	255	CR 4	COLLECTOR	4539	1	12	0	1700	50	22
364	254	257	CR 45	COLLECTOR	4304	1	12	0	1700	50	21
365	254	262	CR 45	COLLECTOR	2341	1	12	0	1700	45	22
366	255	258	CR 4	COLLECTOR	4110	1	12	0	1700	50	31
367	256	268	CR 4	COLLECTOR	760	1	12	0	1700	45	31
368	257	254	CR 45	COLLECTOR	4304	1	12	0	1700	50	21
369	257	258	CR 45	COLLECTOR	6663	1	12	0	1700	45	31
370	257	301	CR 45	COLLECTOR	4008	1	12	0	1700	45	21
371	258	256	CR 4	COLLECTOR	3002	1	12	0	1700	50	31
372	259	359	SR 3	COLLECTOR	2360	1	12	8	1700	55	21
373	260	263	CR 45	COLLECTOR	4839	1	12	0	1700	50	22

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
374	260	622	GRAVES RD	LOCAL ROADWAY	5355	1	12	0	1700	45	22
375	260	623	CR 45	COLLECTOR	2163	1	12	0	1700	45	22
376	261	260	PARADISE RD	LOCAL ROADWAY	2671	1	12	0	1700	40	22
377	262	254	CR 45	COLLECTOR	2361	1	12	0	1700	45	22
378	262	623	CR 45	COLLECTOR	2632	1	12	0	1700	45	22
379	263	265	CR 45	COLLECTOR	1371	1	12	0	1700	50	22
380	264	267	US 11	COLLECTOR	1744	1	12	12	1700	40	22
381	265	616	CR 45	COLLECTOR	6511	1	12	0	1700	50	22
382	266	263	VILLIARD RD	LOCAL ROADWAY	7199	1	12	0	1575	35	22
383	267	288	US 11	COLLECTOR	10575	1	12	10	1700	55	22
384	268	269	CR 18	COLLECTOR	3750	1	12	0	1700	50	31
385	268	292	CR 4	COLLECTOR	4993	1	12	0	1700	50	31
386	269	270	CR 33	COLLECTOR	4523	1	12	0	1700	50	31
387	270	271	CR 33	COLLECTOR	7832	1	12	0	1700	50	31
388	271	272	CR 33	COLLECTOR	1378	1	12	0	1700	50	31
389	272	273	SR 49	COLLECTOR	2565	1	12	6	1700	50	31
390	273	287	SR 49	COLLECTOR	3204	1	12	6	1700	50	31
391	274	297	SR 49	COLLECTOR	7604	1	12	6	1700	55	30
392	275	280	SR 49	COLLECTOR	2681	1	12	6	1700	40	31
393	275	281	US 11	COLLECTOR	1074	1	12	0	1575	35	31
394	276	277	SR 49	COLLECTOR	1247	1	12	6	1750	40	32
395	277	278	I 81 - SR 49 RAMPS	FREEWAY RAMP	973	1	12	4	1700	50	32

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
396	277	279	SR 49	COLLECTOR	524	1	12	6	1750	40	32
397	278	298	I 81	FREEWAY	798	3	12	10	2250	75	32
398	278	597	I 81	FREEWAY	5885	2	12	10	2250	75	32
EXIT LINK	279	8279	SR 49	COLLECTOR	1318	1	12	6	1700	45	32
399	280	276	SR 49	COLLECTOR	1978	1	12	6	1750	40	31
EXIT LINK	281	8282	US 11	COLLECTOR	429	1	12	0	1575	35	31
400	282	275	SR 49	COLLECTOR	2195	1	12	0	1750	35	31
401	283	282	SR 49	COLLECTOR	1075	1	12	6	1700	45	31
402	284	283	SR 49	COLLECTOR	832	1	12	6	1700	45	31
403	285	284	SR 49	COLLECTOR	1407	1	12	6	1700	50	31
404	286	285	SR 49	COLLECTOR	2748	1	12	6	1700	50	31
405	287	286	SR 49	COLLECTOR	4299	1	12	6	1700	50	31
406	288	289	US 11	COLLECTOR	8666	1	12	10	1700	55	31
407	289	290	US 11	COLLECTOR	4425	1	12	10	1700	55	31
408	290	295	US 11	COLLECTOR	2656	1	12	10	1700	55	31
409	291	290	CR 4	COLLECTOR	4121	1	12	0	1700	50	31
410	292	293	CR 4	COLLECTOR	3870	1	12	0	1700	50	31
411	293	294	CR 4	COLLECTOR	5308	1	12	0	1700	50	31
412	294	291	CR 4	COLLECTOR	1293	1	12	0	1700	40	31
413	295	275	US 11	COLLECTOR	3880	1	12	10	1750	40	31
414	296	272	SR 49	COLLECTOR	2555	1	12	6	1700	50	31
415	297	296	SR 49	COLLECTOR	988	1	12	6	1700	45	31
416	298	278	I 81	FREEWAY	798	3	12	10	2250	75	32

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
EXIT LINK	298	8298	I 81	FREEWAY	837	3	12	10	2250	75	32
417	299	82	POPLE RIDGE RD	LOCAL ROADWAY	5709	1	10	0	1750	40	21
418	300	73	FRENCH ST	LOCAL ROADWAY	2748	1	10	0	1700	40	22
419	301	257	CR 45	COLLECTOR	4006	1	12	0	1700	45	21
420	301	624	WINKS RD	COLLECTOR	2485	1	12	0	1700	45	30
421	302	274	WINKS RD	COLLECTOR	8256	1	12	0	1700	45	30
422	303	309	CR 4	COLLECTOR	7830	1	12	0	1700	55	13
423	303	553	EAST AVE	COLLECTOR	2646	1	12	0	1700	40	12
424	304	550	CITY LINE RD	LOCAL ROADWAY	2528	1	12	0	1575	35	13
425	304	687	SR 104	COLLECTOR	2616	1	12	0	1750	40	11
426	305	138	KLOCKS CORNERS RD	COLLECTOR	10212	1	12	0	1700	45	14
427	305	308	SR 104	COLLECTOR	4110	1	12	6	1700	50	11
428	306	189	SR 104	COLLECTOR	3465	1	12	6	1700	55	14
429	306	305	SR 104	COLLECTOR	8434	1	12	6	1700	50	14
430	307	633	CR 1	COLLECTOR	3737	1	12	0	1700	55	11
431	307	705	CREAMERY RD	COLLECTOR	1094	1	12	0	1700	45	11
432	308	310	CR 53	COLLECTOR	3371	1	12	0	1700	45	13
433	308	334	SR 104	COLLECTOR	6025	1	12	6	1700	50	11
434	309	138	CR 4	COLLECTOR	6561	1	12	0	1700	55	13
435	309	303	CR 4	COLLECTOR	7830	1	12	0	1700	55	13
436	309	311	CR 53	COLLECTOR	3928	1	12	0	1700	50	13
437	310	309	CR 53	COLLECTOR	4492	1	12	0	1700	55	13

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
438	311	312	CR 53	COLLECTOR	7750	1	12	0	1700	55	19
439	312	212	CR 53	COLLECTOR	3411	1	12	0	1700	55	19
440	313	344	E 10TH ST	COLLECTOR	1178	1	12	0	1350	30	12
441	313	553	EAST AVE	COLLECTOR	1392	1	12	0	1700	40	12
442	313	554	CHURCH ST	LOCAL ROADWAY	1334	1	12	0	1350	30	12
443	314	570	E 10TH ST	COLLECTOR	1407	1	12	0	1750	30	12
444	314	657	SR 104	MINOR ARTERIAL	554	2	12	0	1750	45	12
445	315	331	LAKE RD	COLLECTOR	1871	1	12	0	1700	50	11
446	316	315	LAKE RD	COLLECTOR	1795	1	12	0	1750	50	11
447	317	350	LAKE RD	COLLECTOR	1647	1	12	0	1700	50	4
448	318	317	LAKE RD	COLLECTOR	2027	1	12	0	1700	50	5
449	319	318	LAKE RD	COLLECTOR	3482	1	12	0	1700	50	5
450	320	695	LAKE RD	COLLECTOR	955	1	12	0	1700	40	5
451	321	206	LAKE RD	COLLECTOR	4453	1	12	0	1700	40	5
452	321	322	CR 29	COLLECTOR	6581	1	12	0	1700	55	5
453	322	182	CR 29	COLLECTOR	3956	1	12	0	1700	50	14
454	323	206	NINE MILE POINT RD	LOCAL ROADWAY	1590	1	12	0	1700	40	5
455	324	182	CR 1	COLLECTOR	3727	1	12	0	1700	55	14
456	324	325	CR 1	COLLECTOR	4247	1	12	0	1700	55	14
457	325	307	CR 1	COLLECTOR	4503	1	12	0	1700	55	14
458	327	209	CR 45	COLLECTOR	1972	1	12	0	1700	50	20
459	327	233	CR 45	COLLECTOR	3067	1	12	0	1700	50	20
460	328	364	CR 176	COLLECTOR	4496	1	12	0	1700	55	20

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
461	329	380	CR 9	COLLECTOR	2506	1	12	0	1700	55	27
462	329	381	CR 6	COLLECTOR	2800	1	12	0	1700	55	27
463	330	315	NOVELIS DRIVEWAY	COLLECTOR	785	1	12	0	1750	35	11
464	331	333	LAKE RD	COLLECTOR	5146	1	12	0	1700	50	11
465	332	331	NOVELIS DRIVEWAY	COLLECTOR	1339	1	12	0	1575	35	11
466	333	334	CR E 63	COLLECTOR	4542	1	12	0	1700	50	11
467	333	335	LAKE RD	COLLECTOR	1021	1	12	0	1700	50	11
468	334	304	SR 104	COLLECTOR	660	1	12	0	1750	45	11
469	335	337	E SENECA ST	COLLECTOR	4002	1	12	0	1750	50	10
470	335	339	MITCHELL ST	COLLECTOR	204	1	12	8	1700	50	11
471	336	337	ST PAUL	COLLECTOR	1405	1	12	0	1750	40	10
472	336	340	MITCHELL ST	COLLECTOR	3817	1	12	8	1700	40	10
473	337	336	ST PAUL	COLLECTOR	1405	1	12	0	1700	40	10
474	337	338	E 4TH ST	COLLECTOR	2313	1	12	0	1750	40	10
475	337	552	E SENECA ST	COLLECTOR	3892	1	12	0	1575	35	10
476	338	342	SR 104	COLLECTOR	1287	1	12	0	1750	40	12
477	339	336	MITCHELL ST	COLLECTOR	3843	1	12	8	1700	50	10
478	340	584	E 10TH ST	COLLECTOR	988	1	12	0	1350	30	10
479	341	340	MITCHELL ST	COLLECTOR	581	1	12	8	1350	30	10
480	342	571	E 13TH ST	LOCAL ROADWAY	560	1	12	0	1350	30	12
481	342	656	SR 104	COLLECTOR	930	1	12	0	1700	40	12
482	343	345	E ALBANY ST	COLLECTOR	1057	1	12	0	1575	35	12
483	344	313	E 10TH ST	COLLECTOR	1178	1	12	0	1350	30	12
484	344	563	E ALBANY ST	COLLECTOR	1138	1	12	0	1350	30	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
485	344	570	E 10TH ST	COLLECTOR	446	1	12	0	1750	30	12
486	345	344	E ALBANY ST	COLLECTOR	1858	1	12	0	1575	35	12
487	346	524	E UTICA ST	COLLECTOR	1014	2	12	0	1750	35	12
488	346	661	E 1ST ST	LOCAL ROADWAY	1237	2	12	0	1900	30	12
1035	8043	43	I 81	FREEWAY	451	2	12	10	2250	75	1
969	663	586	E ALBANY ST	COLLECTOR	290	1	12	0	1350	30	12
970	664	480	SYRACUSE ST	LOCAL ROADWAY	175	1	12	0	1350	30	12
971	665	531	LIBERTY ST	LOCAL ROADWAY	1042	1	12	0	1350	30	12
972	665	541	ERIE ST	LOCAL ROADWAY	870	1	12	0	1350	30	12
973	665	542	ERIE ST	LOCAL ROADWAY	1190	1	12	0	1575	35	12
974	666	526	W 2ND ST	LOCAL ROADWAY	484	1	12	0	1750	25	12
975	666	668	W 2ND ST	LOCAL ROADWAY	478	1	12	0	1125	25	12
976	667	526	W 2ND ST	LOCAL ROADWAY	519	1	12	0	1750	25	12
977	668	536	W SENECA ST	LOCAL ROADWAY	881	1	12	0	1350	30	12
978	668	666	W 2ND ST	LOCAL ROADWAY	478	1	12	0	1125	25	12
979	669	523	W 1ST ST	COLLECTOR	1213	1	12	0	1750	30	12
980	669	524	W 1ST ST	COLLECTOR	267	1	12	0	1750	30	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
981	670	513	W 1ST ST	COLLECTOR	852	1	12	0	1575	35	12
				LOCAL							
982	670	514	MURRAY ST	ROADWAY	967	1	12	0	1350	30	12
983	670	539	W 1ST ST	COLLECTOR	1466	2	12	0	1750	35	12
				LOCAL							
984	671	514	MURRAY ST	ROADWAY	2375	1	12	0	1350	30	12
				LOCAL							
985	672	539	BIRDIE CIR	ROADWAY	227	1	12	0	1750	30	12
986	673	674	RATHBURN RD	COLLECTOR	245	1	12	0	950	20	19
987	674	498	RATHBURN RD	COLLECTOR	1064	1	12	0	1700	45	19
988	675	427	CR 85	COLLECTOR	5560	1	12	0	1700	55	19
989	675	501	CR 85	COLLECTOR	2737	1	12	0	1700	55	19
990	676	427	CR 85	COLLECTOR	1578	1	12	0	1350	30	19
991	676	677	CR 85	COLLECTOR	2278	1	12	0	1700	40	19
992	677	433	CR 85	COLLECTOR	4367	1	12	0	1700	50	18
993	677	676	CR 85	COLLECTOR	2286	1	12	0	1700	40	19
				MINOR							
994	678	507	SR 104	ARTERIAL	621	2	12	0	1900	40	9
				MINOR							
995	678	509	SR 104	ARTERIAL	889	1	12	0	1750	45	9
996	679	463	SR 104	COLLECTOR	4562	1	12	4	1700	45	18
				MINOR							
997	680	507	SR 104	ARTERIAL	1571	2	12	0	1900	40	9
				MINOR							
998	680	511	SR 104	ARTERIAL	1278	2	12	0	1750	40	9
				LOCAL							
999	681	680	5TH AVE	ROADWAY	255	1	12	0	1750	30	9

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
1000	682	680	5TH AVE	LOCAL ROADWAY	372	1	12	0	1750	30	9
1001	683	46	SR 13	COLLECTOR	957	1	12	0	1700	40	8
1002	684	683	DRIVEWAY	LOCAL ROADWAY	256	1	12	0	1750	30	8
1003	685	614	SR 69	COLLECTOR	2851	1	12	8	1700	55	22
1004	686	685	SR 69	COLLECTOR	1585	1	12	8	1700	45	22
1005	687	347	SR 104	COLLECTOR	445	1	12	0	1700	40	10
1006	688	687	DRIVEWAY	LOCAL ROADWAY	280	1	12	0	1750	30	10
1007	689	527	W 5TH ST	LOCAL ROADWAY	541	1	12	0	1750	30	12
1008	689	536	W 5TH ST	LOCAL ROADWAY	456	1	12	0	1350	30	12
1009	690	528	LAKE	COLLECTOR	938	1	12	0	1350	30	10
1010	691	540	ERIE ST	LOCAL ROADWAY	1174	1	12	0	1350	30	12
1011	691	541	ERIE ST	LOCAL ROADWAY	785	1	12	0	1350	30	12
1012	692	516	SR 48	COLLECTOR	5011	1	12	3	1700	55	19
1013	693	105	CR 28	COLLECTOR	767	1	12	0	1700	55	7
1014	694	693	CR 28	COLLECTOR	710	1	12	0	1700	40	7
1015	695	321	LAKE RD	COLLECTOR	2280	1	12	0	1700	40	5
1016	696	695	JAF DRIVEWAY	LOCAL ROADWAY	596	1	12	0	1350	30	5
1017	697	613	SANDPIPE RD	COLLECTOR	8867	1	12	0	1700	45	16
1018	698	83	CR 4	COLLECTOR	3234	1	12	0	1750	55	21

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
1019	699	229	SR 481	COLLECTOR	1204	1	12	4	1700	60	20
1020	700	232	CR 57	COLLECTOR	729	1	12	0	1700	50	20
1021	700	699	VAN BRUEN	LOCAL ROADWAY	905	1	12	0	1700	40	20
1022	701	425	SR 48	COLLECTOR	2284	1	12	3	1700	50	19
1023	702	496	RATHBURN RD	COLLECTOR	3503	1	12	0	1700	45	19
1024	703	435	CR 7	COLLECTOR	3143	1	12	0	1700	50	18
EXIT LINK	704	8381	CR 6	COLLECTOR	421	1	12	0	1700	55	29
1025	705	305	CREAMERY RD	COLLECTOR	6719	1	12	0	1700	45	11
1026	706	188	CR 29	COLLECTOR	4946	1	12	0	1700	55	14
1027	707	523	SR 104	MINOR ARTERIAL	858	2	12	0	1750	35	12
1028	707	525	SR 104	MINOR ARTERIAL	205	1	12	0	1750	35	12
1029	708	508	SR 104	COLLECTOR	6598	1	12	4	1700	50	9
1030	708	709	THOMPSON RD	LOCAL ROADWAY	6186	1	12	0	1700	40	9
1031	709	710	THOMPSON RD	LOCAL ROADWAY	4007	1	12	0	1700	40	18
1032	710	436	CR 7	COLLECTOR	1773	1	12	0	1700	55	18
1033	711	364	HOWARD RD	LOCAL ROADWAY	3012	1	12	0	1700	40	20
489	346	662	E 1ST ST	LOCAL ROADWAY	213	2	12	0	1900	30	12
490	347	338	SR 104	COLLECTOR	611	1	12	0	1750	40	12
491	347	348	JIM SHAMPINE BLVD	LOCAL	1005	1	12	0	1700	40	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
				ROADWAY							
492	348	343	E ALBANY ST	COLLECTOR	334	1	12	0	1575	35	12
493	349	316	LAKE RD	COLLECTOR	3092	1	12	0	1700	50	11
494	350	349	LAKE RD	COLLECTOR	2643	1	12	0	1700	50	4
495	351	319	LAKE RD	COLLECTOR	2357	1	12	0	1700	50	5
496	352	351	NMP DRIVEWAY	LOCAL ROADWAY	698	1	12	0	1575	35	5
497	353	306	DUKE RD	LOCAL ROADWAY	3269	1	12	0	1700	45	14
498	354	357	CR 35	COLLECTOR	3083	1	12	0	1700	50	15
499	354	361	HURLBUT RD	LOCAL ROADWAY	2541	1	10	0	1700	50	15
500	355	627	CR 35	COLLECTOR	2038	1	12	0	1575	35	21
501	357	355	CR 35	COLLECTOR	7703	1	12	0	1700	55	15
502	358	359	CR 35	COLLECTOR	5034	1	12	0	1700	50	21
503	359	130	SR 3	COLLECTOR	1372	1	12	8	1700	45	21
504	360	358	CR 35	COLLECTOR	2098	1	12	0	1700	50	21
505	361	201	HURLBUT RD	LOCAL ROADWAY	11507	1	10	0	1700	45	15
506	361	354	HURLBUT RD	LOCAL ROADWAY	2541	1	10	0	1700	50	15
507	362	612	CR 44	COLLECTOR	3617	1	12	0	1700	50	15
508	363	151	SR 104	COLLECTOR	1988	1	12	6	1700	55	15
509	363	362	CR 44	COLLECTOR	5424	1	12	0	1700	50	15
510	364	405	CR 176	COLLECTOR	9141	1	12	0	1700	55	26
511	365	374	CR 176	LOCAL	522	1	12	0	1350	30	26

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
				ROADWAY							
512	365	376	ONEIDA ST	COLLECTOR	1736	1	12	0	1575	35	26
513	365	653	ONEIDA ST	COLLECTOR	2060	1	12	0	1575	35	26
514	366	368	SR 481	MINOR ARTERIAL	816	2	12	0	1750	35	26
515	366	651	ONEIDA ST	COLLECTOR	189	1	12	0	1575	35	26
516	366	653	ONEIDA ST	COLLECTOR	355	1	12	0	1575	35	26
517	367	371	SR 3	MINOR ARTERIAL	455	2	12	0	1750	35	28
518	367	399	SR 481	MINOR ARTERIAL	1433	2	12	0	1900	35	28
519	367	654	SR 3	MINOR ARTERIAL	313	1	12	0	1575	35	26
520	368	367	SR 481	MINOR ARTERIAL	1852	2	12	0	1750	35	26
521	369	368	ROCHESTER ST	COLLECTOR	1378	1	12	0	1750	30	26
522	370	371	1ST ST	COLLECTOR	983	1	12	0	1750	30	26
523	371	367	SR 3	MINOR ARTERIAL	455	2	12	0	1750	35	28
524	371	406	SR 3	MINOR ARTERIAL	1326	2	12	0	1750	35	28
525	372	371	1ST ST	COLLECTOR	443	1	12	0	1750	30	28
526	373	377	CR 9	COLLECTOR	1122	1	12	0	1575	35	26
527	373	386	SR 3	COLLECTOR	1067	1	12	0	1575	35	26
528	374	375	CR 176	LOCAL ROADWAY	1452	1	12	0	1350	30	26
529	375	386	SR 3	COLLECTOR	1107	1	12	0	1575	35	26

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
530	375	395	SR 3	COLLECTOR	1205	1	12	0	1750	35	26
531	376	365	ONEIDA ST	COLLECTOR	1736	1	12	0	1575	35	26
532	376	373	SR 3	COLLECTOR	1415	1	12	0	1750	35	26
533	377	373	CR 9	COLLECTOR	1122	1	12	0	1750	35	26
534	377	378	CR 9	COLLECTOR	2319	1	12	0	1700	50	26
535	378	377	CR 9	COLLECTOR	2336	1	12	0	1700	50	26
536	378	379	CR 9	COLLECTOR	4565	1	12	0	1700	55	27
537	379	378	CR 9	COLLECTOR	4565	1	12	0	1700	55	27
538	379	380	CR 9	COLLECTOR	1276	1	12	0	1700	50	27
539	380	329	CR 9	COLLECTOR	2503	1	12	0	1700	55	27
540	380	379	CR 9	COLLECTOR	1250	1	12	0	1700	50	27
541	381	704	CR 6	COLLECTOR	4049	1	12	0	1700	55	29
866	590	47	I 81	FREEWAY	6696	2	12	10	2250	75	8
867	590	53	I 81	FREEWAY	8881	2	12	10	2250	75	8
868	591	54	I 81	FREEWAY	7136	2	12	10	2250	75	17
869	591	59	I 81	FREEWAY	8849	2	12	10	2250	75	17
870	592	60	I 81	FREEWAY	5380	2	12	10	2250	75	17
871	592	593	I 81	FREEWAY	6219	2	12	10	2250	75	17
872	593	66	I 81	FREEWAY	5464	2	12	10	2250	75	23
873	593	592	I 81	FREEWAY	6219	2	12	10	2250	75	17
874	594	68	I 81	FREEWAY	4173	2	12	10	2250	75	23
875	594	595	I 81	FREEWAY	5778	2	12	10	2250	75	23
876	595	594	I 81	FREEWAY	5778	2	12	10	2250	75	23
877	595	615	I 81	FREEWAY	3431	2	12	10	2250	75	23
878	596	597	I 81	FREEWAY	12349	2	12	10	2250	75	32

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
879	596	615	I 81	FREEWAY	11582	2	12	10	2250	75	32
880	597	278	I 81	FREEWAY	5885	2	12	10	2250	75	32
881	597	596	I 81	FREEWAY	12339	2	12	10	2250	75	32
882	598	6	CR 5	COLLECTOR	2615	1	12	0	1750	35	7
883	599	2	US 11	COLLECTOR	1552	1	12	0	1750	35	8
884	599	116	US 11	COLLECTOR	2352	1	12	6	1700	45	8
885	600	12	SHAROUN DR	LOCAL ROADWAY	740	1	10	0	1750	30	7
886	601	117	CR 41	COLLECTOR	1230	1	12	0	1700	50	7
887	602	601	CR 41	COLLECTOR	1865	1	12	0	1700	55	7
888	603	151	TOLLGATE RD	COLLECTOR	9722	1	12	6	1700	55	15
889	603	174	TOLLGATE RD	COLLECTOR	1066	1	12	6	1700	40	6
890	604	188	SR 104	COLLECTOR	4495	1	12	6	1700	55	14
891	604	191	SR 104	COLLECTOR	1885	1	12	6	1700	55	14
892	605	157	SPATH RD	LOCAL ROADWAY	4997	1	12	0	1750	45	16
893	605	164	CR 41	COLLECTOR	3832	1	12	4	1750	55	16
894	606	605	CR 41	COLLECTOR	4799	1	12	0	1700	50	16
895	607	85	SR 104	COLLECTOR	2527	1	12	6	1700	50	16
896	607	697	SANDPIPE RD	COLLECTOR	3228	1	12	0	1700	45	16
897	608	56	SR 104	COLLECTOR	1485	1	12	6	1750	50	16
898	609	149	SR 104	COLLECTOR	3362	1	12	6	1700	40	15
899	609	198	SOPER MILLS RD	LOCAL ROADWAY	745	1	12	0	1350	30	15
900	610	75	SR 69	COLLECTOR	259	1	12	0	1350	30	16
901	610	76	SR 69	COLLECTOR	1380	1	12	0	1350	30	16

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
902	611	610	MADISON AVE	LOCAL ROADWAY	686	1	10	0	1350	30	16
903	612	361	CR 44	COLLECTOR	2106	1	12	0	1700	45	15
904	613	166	ROWE RD	LOCAL ROADWAY	9086	1	12	0	1700	50	16
542	382	376	SR 3	COLLECTOR	2522	1	12	12	1700	45	26
543	383	382	SR 3	COLLECTOR	3876	1	12	12	1700	55	26
544	384	402	SR 481	COLLECTOR	1769	1	12	12	1700	40	26
545	385	365	CR 176	LOCAL ROADWAY	1173	1	12	0	1350	30	26
546	385	404	ONTARIO ST	LOCAL ROADWAY	1163	1	12	0	1350	30	26
547	386	373	SR 3	COLLECTOR	1070	1	12	0	1750	35	26
548	386	375	SR 3	COLLECTOR	1107	1	12	0	1575	35	26
549	387	393	SR 481	MINOR ARTERIAL	2736	2	12	0	1900	40	28
550	388	397	FAY ST	COLLECTOR	2430	1	12	0	1700	40	28
551	389	387	FAY ST	COLLECTOR	680	1	12	0	1750	40	28
552	390	391	CR 57	COLLECTOR	2232	1	12	0	1575	35	28
553	390	439	SR 481	MINOR ARTERIAL	3684	2	12	12	1900	60	28
EXIT LINK	391	8391	CR 57	COLLECTOR	416	1	12	0	1700	55	28
554	392	390	DRIVEWAY	COLLECTOR	501	1	12	0	1750	30	28
555	393	390	SR 481	MINOR ARTERIAL	645	2	12	0	1750	35	28
556	394	393	PIERCE DR	COLLECTOR	1237	1	12	0	1575	35	28

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
557	395	375	SR 3	COLLECTOR	1205	1	12	0	1575	35	26
558	395	397	4TH ST	LOCAL ROADWAY	2481	1	12	0	1350	30	28
559	395	654	SR 3	COLLECTOR	558	1	12	0	1575	35	26
560	396	395	4TH ST	LOCAL ROADWAY	790	1	12	0	1750	30	26
561	397	387	FAY ST	COLLECTOR	138	1	12	0	1750	40	28
562	398	377	S 12TH ST	LOCAL ROADWAY	629	1	12	0	1350	30	26
563	399	387	SR 481	MINOR ARTERIAL	1274	2	12	0	1750	35	28
564	400	368	ROCHESTER ST	COLLECTOR	336	1	12	0	1750	30	26
565	401	409	SR 48	COLLECTOR	1397	1	12	0	1750	35	26
566	401	410	SR 48	COLLECTOR	790	1	12	0	1575	35	26
567	401	650	ONEIDA ST	COLLECTOR	1231	1	12	0	1575	35	26
568	402	652	SR 481	COLLECTOR	775	1	12	12	1700	45	26
569	403	402	ONTARIO ST	LOCAL ROADWAY	475	1	12	0	1350	30	26
570	404	402	ONTARIO ST	LOCAL ROADWAY	980	1	12	0	1350	30	26
571	405	382	GILLESPIE RD	LOCAL ROADWAY	1996	1	12	0	1575	35	26
572	405	385	CR 176	COLLECTOR	2495	1	12	0	1700	45	26
573	406	371	SR 3	MINOR ARTERIAL	1326	2	12	0	1750	35	28
574	406	441	SR 48	COLLECTOR	3454	1	12	0	1575	35	28
575	406	644	SR 3	COLLECTOR	1015	2	12	0	1750	35	28

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
576	407	420	SR 3	COLLECTOR	3178	1	12	10	1700	45	25
577	407	641	SR 3	COLLECTOR	3256	1	12	6	1750	45	25
578	408	409	PHILLIPS	LOCAL ROADWAY	669	1	12	0	1750	30	26
579	409	406	SR 48	COLLECTOR	1943	1	12	0	1750	35	26
580	410	401	SR 48	COLLECTOR	790	1	12	0	1750	35	26
581	410	411	HANNIBAL ST	COLLECTOR	5760	1	12	0	1750	35	25
582	411	419	SR 3	COLLECTOR	2559	1	12	12	1700	55	25
583	411	641	SR 3	COLLECTOR	990	1	12	6	1750	45	25
584	411	643	CR 3	COLLECTOR	1303	1	12	0	1700	45	25
585	412	413	CR 3	COLLECTOR	8608	1	12	0	1700	50	25
586	412	431	CR 8	COLLECTOR	6798	1	12	0	1700	55	25
587	413	414	CR 3	COLLECTOR	6523	1	12	0	1700	45	25
588	413	489	RATHBURN RD	COLLECTOR	1246	1	12	0	1575	35	25
589	414	415	CR 3	COLLECTOR	4742	1	12	0	1700	45	24
590	415	432	CR 7	COLLECTOR	1075	1	12	0	1700	45	24
591	417	453	SR 104	COLLECTOR	780	1	12	0	1700	55	24
592	417	638	SR 3	COLLECTOR	3036	1	12	4	1700	40	24
593	418	412	CR 8	COLLECTOR	910	1	12	0	1700	55	25
594	418	419	SR 3	COLLECTOR	3095	1	12	12	1700	55	25
595	418	489	SR 3	COLLECTOR	8613	1	12	12	1700	60	25
596	419	411	SR 3	COLLECTOR	2570	1	12	12	1750	55	25
597	419	418	SR 3	COLLECTOR	3095	1	12	12	1750	55	25
598	420	407	SR 3	COLLECTOR	3166	1	12	6	1700	45	25
599	420	644	SR 3	COLLECTOR	682	2	12	0	1750	35	28

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
600	421	407	PHILLIPS ST	COLLECTOR	1195	1	12	0	1575	35	25
601	422	410	SR 48	COLLECTOR	1414	1	12	0	1575	35	26
602	423	422	SR 48	COLLECTOR	5374	1	12	3	1700	50	26
603	424	423	SR 48	COLLECTOR	6377	1	12	3	1700	50	25
604	425	424	SR 48	COLLECTOR	2326	1	12	3	1700	50	19
605	425	426	CR 85	COLLECTOR	7134	1	12	0	1700	50	19
606	426	425	CR 85	COLLECTOR	7134	1	12	0	1700	50	19
607	426	428	CR 8	COLLECTOR	5326	1	12	0	1700	55	19
608	426	501	CR 85	COLLECTOR	2552	1	12	0	1700	55	19
609	427	494	RATHBURN RD	COLLECTOR	4952	1	12	0	1700	40	25
610	427	675	CR 85	COLLECTOR	5560	1	12	0	1700	55	19
611	427	676	CR 85	COLLECTOR	1578	1	12	0	1700	50	19
612	428	429	CR 8	COLLECTOR	2568	1	12	0	1700	55	25
613	429	430	CR 8	COLLECTOR	1808	1	12	0	1700	55	25
614	430	418	CR 8	COLLECTOR	3460	1	12	0	1750	55	25
EXIT LINK											
	431	8431	CR 8	COLLECTOR	511	1	12	0	1700	55	25
615	432	459	SR 3	COLLECTOR	4359	1	12	12	1700	60	24
616	432	489	SR 3	COLLECTOR	10771	1	12	12	1700	60	25
617	433	432	CR 7	COLLECTOR	10664	1	12	0	1700	55	24
618	433	446	CR 85	COLLECTOR	1890	1	12	0	1700	50	18
619	433	677	CR 85	COLLECTOR	4367	1	12	0	1700	50	18
620	434	433	CR 7	COLLECTOR	5364	1	12	0	1700	50	18
621	435	437	CR 7	COLLECTOR	3193	1	12	0	1700	50	18
622	436	438	CR 7	COLLECTOR	3670	1	12	0	1700	50	18

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
623	436	465	CR 20	COLLECTOR	5258	1	12	0	1700	50	18
624	436	466	CR 20	COLLECTOR	1490	1	12	0	1700	50	18
625	437	434	CR 7	COLLECTOR	4220	1	12	0	1700	50	18
626	438	703	CR 7	COLLECTOR	2831	1	12	0	1700	50	18
627	439	440	I 481	FREEWAY	2422	1	12	12	2250	75	29
EXIT LINK											
	440	8440	I 481	FREEWAY	1003	1	12	12	2250	75	29
628	441	442	SR 48	COLLECTOR	1773	1	12	0	1575	35	28
EXIT LINK											
	442	8442	SR 48	COLLECTOR	443	1	12	0	1700	40	28
629	443	460	SR 104	COLLECTOR	8243	1	12	8	1700	60	24
630	444	443	CR 85	COLLECTOR	3860	1	12	0	1700	50	18
631	445	444	CR 85	COLLECTOR	1517	1	12	0	1700	40	18
632	446	445	CR 85	COLLECTOR	1015	1	12	0	1700	40	18
633	447	452	SR 104A	COLLECTOR	1370	1	12	4	1700	55	18
EXIT LINK											
	452	8452	SR 104A	COLLECTOR	855	1	12	4	1700	55	18
634	453	458	SR 104	COLLECTOR	3235	1	12	0	1700	55	24
635	455	456	CR 34	COLLECTOR	2120	1	12	4	1700	55	24
636	455	457	SR 104	COLLECTOR	1299	1	12	0	1700	55	24
EXIT LINK											
	456	8456	CR 34	COLLECTOR	400	1	12	4	1700	55	24
EXIT LINK											
	457	8457	SR 104	COLLECTOR	321	1	12	4	1700	60	24
637	458	455	SR 104	COLLECTOR	3725	1	12	0	1700	55	24
638	459	417	SR 3	COLLECTOR	3758	1	12	12	1750	55	24

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
639	460	417	SR 104	COLLECTOR	2799	1	12	8	1750	55	24
640	461	443	SR 104	COLLECTOR	16428	1	12	8	1700	60	18
641	462	461	SR 104	COLLECTOR	4337	1	12	8	1700	55	18
642	462	486	SR 104A	COLLECTOR	3777	1	12	4	1700	50	18
643	463	462	SR 104	COLLECTOR	1245	1	12	0	1700	50	18
644	464	463	CR 20	COLLECTOR	2759	1	12	0	1700	50	18
645	465	464	CR 20	COLLECTOR	3632	1	12	0	1700	50	18
646	466	436	CR 20	COLLECTOR	1490	1	12	0	1700	50	18
647	466	498	CR 20	COLLECTOR	1276	1	12	0	1700	50	19
648	467	468	CR 20	COLLECTOR	2573	1	12	0	1700	50	19
649	467	498	CR 20	COLLECTOR	3096	1	12	0	1700	50	19
650	468	467	CR 20	COLLECTOR	2573	1	12	0	1700	50	19
651	468	469	CR 25	COLLECTOR	3626	1	12	0	1700	50	19
652	469	468	CR 25	COLLECTOR	3626	1	12	0	1700	50	19
653	469	470	CR 24	COLLECTOR	1245	1	12	0	1700	45	19
654	469	499	CR 25	COLLECTOR	1920	1	12	0	1700	45	19
655	470	469	CR 24	COLLECTOR	1245	1	12	0	1700	45	19
656	470	471	CR 24	COLLECTOR	1656	1	12	0	1700	45	19
657	471	470	CR 24	COLLECTOR	1656	1	12	0	1700	45	19
658	471	483	CR 24	COLLECTOR	4245	1	12	0	1700	50	19
659	472	483	MINETTO BRIDGE RD	COLLECTOR	520	1	12	0	1125	25	19
660	473	701	SR 48	COLLECTOR	3182	1	12	3	1700	50	19
661	474	473	SR 48	COLLECTOR	4866	1	12	3	1700	50	19
662	475	242	CR 57	COLLECTOR	957	1	12	0	1700	45	19
663	476	241	CR 57	COLLECTOR	1576	1	12	0	1700	45	19

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
664	477	475	CR 57	COLLECTOR	6337	1	12	0	1700	50	19
665	478	477	CR 57	COLLECTOR	671	1	12	0	1700	50	19
666	479	478	CR 57	COLLECTOR	4757	1	12	0	1700	50	12
667	479	481	SR 481	COLLECTOR	2639	1	12	12	1700	55	12
668	480	479	E RIVER RD	COLLECTOR	6776	1	12	12	1700	55	12
669	481	482	SR 481	MINOR ARTERIAL	1618	2	12	12	1900	60	13
670	482	214	SR 481	MINOR ARTERIAL	8439	2	12	12	1900	60	19
671	483	471	CR 24	COLLECTOR	4245	1	12	0	1700	50	19
672	483	484	CR 24	COLLECTOR	312	1	12	0	1575	35	19
673	484	483	CR 24	COLLECTOR	312	1	12	0	1575	35	19
674	484	485	SR 48	COLLECTOR	1072	1	12	12	1700	40	19
675	485	426	CR 8	COLLECTOR	11459	1	12	0	1700	50	19
676	485	474	SR 48	COLLECTOR	3321	1	12	3	1700	50	19
677	486	447	SR 104A	COLLECTOR	15063	1	12	4	1700	55	18
678	487	463	CR 20	COLLECTOR	7757	1	12	0	1700	50	18
679	488	447	CR 96	LOCAL ROADWAY	4098	1	12	0	1700	40	18
680	489	418	SR 3	COLLECTOR	8614	1	12	12	1750	60	25
681	489	432	SR 3	COLLECTOR	10771	1	12	12	1700	60	25
682	490	489	RATHBURN RD	COLLECTOR	3705	1	12	0	1700	40	25
683	491	490	RATHBURN RD	COLLECTOR	1390	1	12	0	1700	40	25
684	492	491	RATHBURN RD	COLLECTOR	574	1	12	0	1350	30	25
685	493	492	RATHBURN RD	COLLECTOR	1537	1	12	0	1700	40	25
686	494	493	RATHBURN RD	COLLECTOR	415	1	12	0	1350	30	25

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
687	495	427	RATHBURN RD	COLLECTOR	3556	1	12	0	1700	45	19
688	495	712	PHILLIPS RD	LOCAL ROADWAY	4796	1	12	0	1575	35	19
689	496	495	RATHBURN RD	COLLECTOR	6734	1	12	0	1700	45	19
690	497	673	RATHBURN RD	COLLECTOR	4538	1	12	0	1700	45	19
691	498	466	CR 20	COLLECTOR	1275	1	12	0	1700	50	19
692	498	467	CR 20	COLLECTOR	3095	1	12	0	1700	50	19
693	498	702	RATHBURN RD	COLLECTOR	7456	1	12	0	1700	45	19
694	499	500	CR 25	COLLECTOR	10919	1	12	0	1700	50	19
695	500	501	CR 25	COLLECTOR	2011	1	12	0	1700	50	19
696	501	426	CR 85	COLLECTOR	2553	1	12	0	1700	55	19
697	501	675	CR 85	COLLECTOR	2737	1	12	0	1700	55	19
698	502	468	CR 25	COLLECTOR	5777	1	12	0	1700	55	19
699	503	514	ELLEN ST	LOCAL ROADWAY	1631	1	12	0	1350	30	12
700	503	519	W 5TH ST	COLLECTOR	5339	1	12	0	1700	40	12
701	503	537	W 5TH ST	LOCAL ROADWAY	992	1	12	0	1350	30	12
702	503	543	ELLEN ST	LOCAL ROADWAY	2154	1	12	0	1350	30	12
703	504	512	LIBERTY ST	LOCAL ROADWAY	4045	1	12	0	1700	40	12
704	505	710	CR 7	COLLECTOR	586	1	12	0	1700	55	18
705	506	505	CR 7	COLLECTOR	3114	1	12	0	1700	55	9
706	507	506	CR 7	COLLECTOR	7214	1	12	0	1700	45	9
707	507	678	SR 104	MINOR	621	2	12	0	1900	40	9

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
				ARTERIAL							
708	507	680	SR 104	MINOR	1572	2	12	0	1750	40	9
709	508	679	SR 104	COLLECTOR	4551	1	12	4	1700	50	9
710	509	678	SR 104	MINOR	889	1	12	0	1700	45	9
711	509	708	SR 104	COLLECTOR	645	1	12	4	1700	50	9
712	510	509	SWEET RD	COLLECTOR	1282	2	12	0	1750	40	9
713	511	530	SR 104	MAJOR	1447	2	12	0	1750	35	12
714	511	533	HILLSIDE AVE	COLLECTOR	1476	1	12	0	1750	35	12
715	511	680	SR 104	MINOR	1278	2	12	0	1750	40	9
716	512	505	GARDENIER HILL RD	LOCAL	4984	1	12	0	1700	40	9
717	513	514	ELLEN ST	LOCAL	864	1	12	0	1350	30	12
718	513	517	SR 48	COLLECTOR	1901	1	12	3	1700	40	12
719	513	670	W 1ST ST	COLLECTOR	852	1	12	0	1575	35	12
720	514	503	ELLEN ST	LOCAL	1631	1	12	0	1350	30	12
721	514	513	ELLEN ST	LOCAL	864	1	12	0	1350	30	12
722	515	484	SR 48	COLLECTOR	4101	1	12	3	1700	45	19
723	516	515	SR 48	COLLECTOR	3027	1	12	3	1700	50	19
724	517	518	SR 48	COLLECTOR	2461	1	12	0	1700	45	12
725	518	692	SR 48	COLLECTOR	2986	1	12	3	1700	45	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
726	519	497	RATHBURN RD	COLLECTOR	2824	1	12	0	1700	45	12
727	519	502	CR 25	COLLECTOR	1327	1	12	0	1700	50	12
728	520	527	SR 104	MAJOR ARTERIAL	1087	2	12	0	1750	35	12
729	520	530	SR 104	MINOR ARTERIAL	909	2	12	0	1750	35	12
730	521	511	W SENECA ST	LOCAL ROADWAY	1031	1	12	0	1750	30	12
731	522	523	W 1ST ST	COLLECTOR	956	1	12	0	1750	30	12
732	522	668	W SENECA ST	LOCAL ROADWAY	276	1	12	0	1350	30	12
733	523	522	W 1ST ST	COLLECTOR	956	1	12	0	1350	30	12
734	523	526	SR 104	MINOR ARTERIAL	246	2	12	0	1750	35	12
735	523	669	W 1ST ST	COLLECTOR	1213	1	12	0	1350	30	12
736	523	707	SR 104	MINOR ARTERIAL	859	2	12	0	1900	35	12
737	524	346	E UTICA ST	COLLECTOR	1015	2	12	0	1750	35	12
738	524	538	W UTICA ST	COLLECTOR	1201	2	12	0	1750	35	12
739	524	539	W 1ST ST	COLLECTOR	1014	2	12	0	1750	35	12
740	524	669	W 1ST ST	COLLECTOR	268	2	12	0	1900	30	12
741	525	661	E 1ST ST	LOCAL ROADWAY	266	2	12	0	1900	30	12
742	525	707	SR 104	MINOR ARTERIAL	206	2	12	0	1900	35	12
743	526	523	SR 104	MINOR ARTERIAL	246	2	12	0	1750	35	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
744	526	527	SR 104	MINOR ARTERIAL	878	2	12	0	1750	35	12
745	526	666	W 2ND ST	LOCAL ROADWAY	484	1	12	0	1125	25	12
746	527	520	SR 104	MINOR ARTERIAL	1087	2	12	0	1900	35	12
747	527	526	SR 104	MINOR ARTERIAL	878	2	12	0	1750	35	12
748	527	538	W 5TH ST	LOCAL ROADWAY	1472	1	12	0	1750	35	12
749	527	689	W 5TH ST	LOCAL ROADWAY	541	1	12	0	1350	30	12
750	528	522	W 1ST ST	COLLECTOR	1094	1	12	0	1350	30	12
751	529	521	W SENECA ST	LOCAL ROADWAY	400	1	12	0	1350	30	12
752	529	530	LIBERTY ST	LOCAL ROADWAY	711	1	12	0	1750	30	12
753	530	511	SR 104	MINOR ARTERIAL	1447	2	12	0	1750	35	12
754	530	520	SR 104	MINOR ARTERIAL	909	2	12	0	1900	35	12
755	530	529	LIBERTY ST	LOCAL ROADWAY	711	1	12	0	1350	30	12
756	530	531	LIBERTY ST	LOCAL ROADWAY	1544	1	12	0	1350	30	12
757	531	530	LIBERTY ST	LOCAL ROADWAY	1544	1	12	0	1750	30	12
758	531	533	W UTICA ST	COLLECTOR	1469	1	12	0	1750	35	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
759	531	534	W UTICA ST	COLLECTOR	889	1	12	0	1575	35	12
760	531	665	LIBERTY ST	LOCAL	1042	1	12	0	1350	30	12
				ROADWAY							
761	532	529	LIBERTY ST	LOCAL	1832	1	12	0	1350	30	12
762	533	511	HILLSIDE AVE	COLLECTOR	1476	1	12	0	1750	35	12
763	533	531	W UTICA ST	COLLECTOR	1470	1	12	0	1575	35	12
764	533	544	HILLSIDE AVE	COLLECTOR	741	1	12	0	1575	35	12
765	534	531	W UTICA ST	COLLECTOR	889	1	12	0	1575	35	12
766	534	538	W UTICA ST	COLLECTOR	1575	2	12	0	1750	35	12
767	535	533	W UTICA ST	COLLECTOR	597	1	12	0	1750	35	9
768	536	529	W SENECA ST	LOCAL	1931	1	12	0	1350	30	12
769	536	689	W 5TH ST	LOCAL	455	1	12	0	1350	30	12
				ROADWAY							
770	537	503	W 5TH ST	LOCAL	992	1	12	0	1350	30	12
				ROADWAY							
771	537	540	W 5TH ST	LOCAL	860	1	12	0	1350	30	12
				ROADWAY							
772	538	524	W UTICA ST	COLLECTOR	1200	2	12	0	1750	35	12
773	538	527	W 5TH ST	LOCAL	1472	1	12	0	1750	35	12
				ROADWAY							
774	538	534	W UTICA ST	COLLECTOR	1574	2	12	0	1900	35	12
775	538	540	W 5TH ST	LOCAL	997	1	12	0	1350	30	12
				ROADWAY							
776	539	524	W 1ST ST	COLLECTOR	1014	2	12	0	1750	35	12
777	539	540	ERIE ST	LOCAL	1255	1	12	0	1350	30	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
				ROADWAY							
778	539	670	W 1ST ST	COLLECTOR	1466	2	12	0	1900	35	12
779	540	537	W 5TH ST	LOCAL ROADWAY	860	1	12	0	1350	30	12
780	540	538	W 5TH ST	LOCAL ROADWAY	997	1	12	0	1750	30	12
781	540	539	ERIE ST	LOCAL ROADWAY	1255	1	12	0	1750	30	12
782	540	691	ERIE ST	LOCAL ROADWAY	1174	1	12	0	1350	30	12
783	541	543	HAWLEY ST	LOCAL ROADWAY	1076	1	12	0	1350	30	12
784	541	665	ERIE ST	LOCAL ROADWAY	871	1	12	0	1350	30	12
785	541	691	ERIE ST	LOCAL ROADWAY	785	1	12	0	1350	30	12
786	542	544	ERIE ST	LOCAL ROADWAY	393	1	12	0	1350	30	12
787	542	665	ERIE ST	LOCAL ROADWAY	1191	1	12	0	1575	35	12
788	543	503	ELLEN ST	LOCAL ROADWAY	2153	1	12	0	1350	30	12
789	543	504	ELLEN ST	LOCAL ROADWAY	633	1	12	0	1350	30	12
790	544	512	HILLSIDE AVE	COLLECTOR	5150	1	12	0	1700	45	12
791	544	533	HILLSIDE AVE	COLLECTOR	741	1	12	0	1750	35	12
792	544	542	ERIE ST	LOCAL ROADWAY	394	1	12	0	1350	30	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
793	545	536	W 5TH ST	LOCAL ROADWAY	514	1	12	0	1350	30	12
794	546	511	WASHINGTON BLVD	COLLECTOR	1631	1	12	0	1750	35	9
795	547	586	SYRACUSE ST	LOCAL ROADWAY	1103	1	12	0	1350	30	12
796	547	664	SYRACUSE ST	LOCAL ROADWAY	1687	1	12	0	1350	30	12
797	548	346	E UTICA ST	COLLECTOR	339	2	12	0	1750	30	12
798	548	566	E 2ND ST	LOCAL ROADWAY	1479	1	12	0	1750	30	12
799	548	572	E 2ND ST	LOCAL ROADWAY	533	1	12	0	1350	30	12
800	549	480	SR 481	COLLECTOR	3202	1	12	4	1700	45	12
801	549	662	E 1ST ST	LOCAL ROADWAY	323	1	12	0	1350	30	12
802	550	303	CITY LINE RD	LOCAL ROADWAY	2405	1	12	0	1575	35	13
803	550	348	E ALBANY ST	COLLECTOR	2371	1	12	0	1575	35	12
804	551	342	E 13TH ST	LOCAL ROADWAY	315	1	12	0	1750	30	12
805	552	565	E SENECA ST	COLLECTOR	1178	1	12	0	1350	30	10
806	552	582	E 10TH ST	COLLECTOR	494	1	12	0	1350	30	10
807	553	303	EAST AVE	COLLECTOR	2646	1	12	0	1700	40	12
808	553	313	EAST AVE	COLLECTOR	1392	1	12	0	1700	40	12
809	554	547	CHURCH ST	LOCAL ROADWAY	878	1	12	0	1350	30	12
810	554	563	E 7TH ST	LOCAL	1107	1	12	0	1350	30	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
				ROADWAY							
811	555	553	BUNNER ST	LOCAL ROADWAY	1002	1	12	0	1350	30	12
812	556	525	E 1ST ST	LOCAL ROADWAY	506	1	12	0	1750	30	12
813	557	556	E CAYUGA ST	LOCAL ROADWAY	265	1	12	0	1750	30	12
814	557	566	E 2ND ST	LOCAL ROADWAY	526	1	12	0	1750	30	12
815	558	556	E 1ST ST	LOCAL ROADWAY	712	1	12	0	1750	30	12
816	559	557	E 2ND ST	LOCAL ROADWAY	929	1	12	0	1750	30	12
817	560	568	SR 104	MINOR ARTERIAL	932	2	12	0	1750	35	12
818	560	569	E 7TH ST	LOCAL ROADWAY	1457	1	12	0	1350	30	12
819	561	578	E SCHUYLER ST	LOCAL ROADWAY	871	1	12	0	1350	30	10
820	563	554	E 7TH ST	LOCAL ROADWAY	1107	1	12	0	1350	30	12
821	563	569	E 7TH ST	LOCAL ROADWAY	517	1	12	0	1350	30	12
822	563	663	E ALBANY ST	COLLECTOR	920	1	12	0	1350	30	12
823	565	580	E SENECA ST	COLLECTOR	885	1	12	0	1350	30	10
824	565	581	E 7TH ST	LOCAL ROADWAY	482	1	12	0	1350	30	10
825	566	525	SR 104	MINOR	303	2	12	0	1750	35	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
				ARTERIAL							
826	566	548	E 2ND ST	LOCAL ROADWAY	1479	1	12	0	1350	30	12
827	567	566	SR 104	MINOR ARTERIAL	291	2	12	0	1750	35	12
828	568	567	SR 104	MINOR ARTERIAL	276	2	12	0	1750	35	12
829	568	577	E 4TH ST	LOCAL ROADWAY	1499	1	12	0	1750	30	12
830	569	560	E 7TH ST	LOCAL ROADWAY	1457	1	12	0	1350	30	12
831	569	563	E 7TH ST	LOCAL ROADWAY	516	1	12	0	1350	30	12
832	569	577	E UTICA ST	COLLECTOR	888	1	12	0	1750	30	12
833	570	314	E 10TH ST	COLLECTOR	1407	1	12	0	1750	30	12
834	570	344	E 10TH ST	COLLECTOR	445	1	12	0	1350	30	12
835	570	569	E UTICA ST	COLLECTOR	1193	1	12	0	1350	30	12
836	571	570	E UTICA ST	COLLECTOR	1782	1	12	0	1750	30	12
837	572	548	E 2ND ST	LOCAL ROADWAY	533	1	12	0	1350	30	12
838	572	549	E ALBANY ST	COLLECTOR	281	1	12	0	1350	30	12
839	573	572	E 2ND ST	LOCAL ROADWAY	464	1	12	0	1350	30	12
840	574	557	E CAYUGA ST	LOCAL ROADWAY	304	1	12	0	1750	30	12
841	574	567	E 3RD ST	LOCAL ROADWAY	496	1	12	0	1750	30	12

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
842	575	568	E 4TH ST	LOCAL ROADWAY	472	1	12	0	1750	30	12
843	575	574	E CAYUGA ST	LOCAL ROADWAY	291	1	12	0	1350	30	12
844	577	548	E UTICA ST	COLLECTOR	579	1	12	0	1350	30	12
845	577	568	E 4TH ST	LOCAL ROADWAY	1499	1	12	0	1750	30	12
846	577	663	E 4TH ST	LOCAL ROADWAY	509	1	12	0	1350	30	12
847	578	559	E SCHUYLER ST	LOCAL ROADWAY	585	1	12	0	1750	30	10
848	578	580	E 4TH ST	LOCAL ROADWAY	496	1	12	0	1350	30	10
849	579	578	E 4TH ST	LOCAL ROADWAY	386	1	12	0	1350	30	10
850	580	575	E 4TH ST	LOCAL ROADWAY	496	1	12	0	1350	30	12
851	581	560	E 7TH ST	LOCAL ROADWAY	532	1	12	0	1350	30	12
852	581	575	E CAYUGA ST	LOCAL ROADWAY	911	1	12	0	1350	30	12
853	582	314	E 10TH ST	COLLECTOR	663	1	12	0	1750	30	12
854	582	658	E CAYUGA ST	LOCAL ROADWAY	525	1	12	0	1350	30	10
855	583	582	E CAYUGA ST	LOCAL ROADWAY	646	1	12	0	1350	30	10
856	584	552	E 10TH ST	COLLECTOR	463	1	12	0	1350	30	10
857	584	561	E SCHUYLER ST	LOCAL	1178	1	12	0	1350	30	10

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
				ROADWAY							
858	585	584	E SCHUYLER ST	LOCAL ROADWAY	630	1	12	0	1350	30	10
859	586	547	SYRACUSE ST	LOCAL ROADWAY	1103	1	12	0	1350	30	12
860	586	572	E ALBANY ST	COLLECTOR	283	1	12	0	1350	30	12
861	587	554	E 7TH ST	LOCAL ROADWAY	423	1	12	0	1350	30	12
862	588	34	I 81	FREEWAY	5999	2	12	10	2250	75	3
863	588	589	I 81	FREEWAY	14746	2	12	10	2250	75	3
864	589	25	I 81	FREEWAY	10128	2	12	10	2250	75	3
865	589	588	I 81	FREEWAY	14803	2	12	10	2250	75	3
905	614	62	SR 69	COLLECTOR	2274	1	12	8	1575	35	23
906	615	595	I 81	FREEWAY	3431	2	12	10	2250	75	23
907	615	596	I 81	FREEWAY	11582	2	12	10	2250	75	32
908	616	264	CR 45	COLLECTOR	2156	1	12	0	1700	40	22
909	617	264	US 11	COLLECTOR	2524	1	12	6	1700	40	22
910	618	277	I 81 - SR 49 RAMPS	FREEWAY RAMP	613	1	12	4	1750	50	32
911	619	276	DRIVEWAYS	LOCAL ROADWAY	621	1	12	0	1750	30	32
912	620	276	DRIVEWAYS	LOCAL ROADWAY	394	1	12	0	1750	30	32
913	621	279	I 81 - SR 49 RAMPS	FREEWAY RAMP	672	1	12	4	1750	50	32
914	622	255	PANGBORN RD	LOCAL ROADWAY	261	1	12	0	1700	40	22

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
915	623	260	CR 45	COLLECTOR	2142	1	12	0	1700	45	22
916	623	262	CR 45	COLLECTOR	2632	1	12	0	1700	45	22
917	624	302	WINKS RD	COLLECTOR	7208	1	12	0	1700	45	30
918	625	274	SR 49	COLLECTOR	2906	1	12	6	1700	50	30
919	626	360	CR 35	COLLECTOR	3325	1	12	0	1700	50	21
920	627	144	CR 35	COLLECTOR	4149	1	12	0	1750	50	21
921	628	238	CR 6	COLLECTOR	1623	1	12	0	1700	45	20
922	629	320	JAF DRIVEWAY	LOCAL ROADWAY	676	1	12	0	1575	35	5
923	630	234	MT PLEASANT RD	LOCAL ROADWAY	5678	1	12	0	1700	40	20
924	631	235	CR 45	COLLECTOR	7488	1	12	0	1700	55	20
925	632	215	MYERS RD	COLLECTOR	7090	1	12	0	1700	45	20
926	633	315	CR 1	COLLECTOR	919	1	12	0	1750	55	11
927	634	244	CR 57	COLLECTOR	418	1	12	0	1575	35	19
928	635	699	SR 481	COLLECTOR	1049	1	12	4	1700	60	20
929	636	240	MARCH RD	LOCAL ROADWAY	1863	1	12	0	1700	40	19
930	636	243	MARCH RD	LOCAL ROADWAY	467	1	12	0	1700	40	19
931	637	211	CR 45	COLLECTOR	3731	1	12	0	1700	45	19
932	637	214	CR 45	COLLECTOR	462	1	12	0	1700	45	19
933	638	455	CR 34	COLLECTOR	5517	1	12	4	1700	40	24
934	638	639	SR 3	COLLECTOR	3447	1	12	4	1700	45	24
935	639	640	SR 3	COLLECTOR	1964	1	12	4	1700	55	24
EXIT	640	8640	SR 3	COLLECTOR	722	1	12	4	1700	55	24

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
LINK											
936	641	407	SR 3	COLLECTOR	3256	1	12	6	1700	45	25
937	641	411	SR 3	COLLECTOR	990	1	12	6	1750	45	25
938	642	641	DRIVEWAY	COLLECTOR	454	1	12	0	1750	30	25
939	643	412	CR 3	COLLECTOR	4005	1	12	0	1700	45	25
940	644	406	SR 3	COLLECTOR	1015	2	12	0	1750	35	28
941	644	420	SR 3	COLLECTOR	682	2	12	0	1900	35	28
942	645	644	W 4TH ST	LOCAL ROADWAY	814	1	12	0	1750	30	28
943	646	644	W 4TH ST	LOCAL ROADWAY	674	1	12	0	1750	30	28
944	647	650	ONEIDA ST	COLLECTOR	250	1	12	0	1575	35	26
945	647	651	ONEIDA ST	COLLECTOR	189	2	12	0	1900	35	26
946	648	647	1ST ST	LOCAL ROADWAY	265	1	12	0	1750	30	26
947	649	647	1ST ST	LOCAL ROADWAY	272	1	12	0	1750	30	26
948	650	401	ONEIDA ST	COLLECTOR	1240	1	12	0	1750	35	26
949	650	647	ONEIDA ST	COLLECTOR	254	2	12	0	1750	35	26
950	651	366	ONEIDA ST	COLLECTOR	188	1	12	0	1750	35	26
951	651	647	ONEIDA ST	COLLECTOR	189	1	12	0	1750	35	26
952	652	366	SR 481	MINOR ARTERIAL	410	2	12	0	1750	35	26
953	653	365	ONEIDA ST	COLLECTOR	2060	1	12	0	1575	35	26
954	653	366	ONEIDA ST	COLLECTOR	355	1	12	0	1750	35	26
955	654	367	SR 3	MINOR	313	2	12	0	1750	35	26

Link #	Up-Stream Node	Down-Stream Node	Roadway Name	Roadway Type	Length (ft.)	No. of Lanes	Lane Width (ft.)	Shoulder Width (ft.)	Saturation Flow Rate (pcphpl)	Free Flow Speed (mph)	Grid Number
				ARTERIAL							
956	654	395	SR 3	COLLECTOR	558	1	12	0	1750	35	26
957	655	559	E 2ND ST	LOCAL ROADWAY	305	1	12	0	1750	30	10
958	656	314	SR 104	COLLECTOR	1004	2	12	0	1750	40	12
959	657	560	SR 104	MINOR ARTERIAL	645	2	12	0	1900	45	12
960	658	581	E CAYUGA ST	LOCAL ROADWAY	647	1	12	0	1350	30	12
961	658	657	E 9TH ST	LOCAL ROADWAY	565	1	12	0	1750	30	12
962	659	657	E 9TH ST	LOCAL ROADWAY	396	1	12	0	1750	30	12
963	660	304	DRIVEWAY	LOCAL ROADWAY	395	1	12	0	1750	30	11
964	661	346	E 1ST ST	LOCAL ROADWAY	1238	2	12	0	1750	30	12
965	661	525	E 1ST ST	LOCAL ROADWAY	266	1	12	0	1750	30	12
966	662	346	E 1ST ST	LOCAL ROADWAY	213	2	12	0	1750	30	12
967	662	549	E 1ST ST	LOCAL ROADWAY	323	1	12	0	1350	30	12
968	663	577	E 4TH ST	LOCAL ROADWAY	509	1	12	0	1750	30	12
1034	712	675	RIDGE ROAD	LOCAL ROADWAY	1604	1	12	0	1575	35	19

**Table K-2. Nodes in the Link-Node Analysis Network which are Controlled**

Node	X Coordinate	Y Coordinate	Control	Grid Map
2	941271	1298261	Actuated	8
4	940930	1299861	Stop	8
6	941048	1300112	Actuated	8
7	941255	1300442	Actuated	8
11	925344	1301924	TCP-Actuated	2
12	925125	1299850	Actuated	7
16	934094	1324086	Stop	2
21	926839	1304437	Stop	2
28	939456	1322649	Stop	2
29	941023	1300546	Stop	8
30	940891	1301680	Stop	3
36	951731	1328340	Actuated	1
45	940947	1278062	Stop	8
56	936666	1260028	Actuated	16
69	933064	1246560	Stop	22
73	928256	1247247	Stop	22
75	914525	1259199	Stop	16
76	914481	1260838	Stop	16
77	913582	1260863	Actuated	15
78	912195	1260959	TCP-Actuated	15
79	912262	1259982	Stop	15
80	912448	1256987	Stop	15
82	908817	1243723	TCP-Actuated	21
83	907028	1238025	TCP-Actuated	21
86	924440	1259431	TCP-Actuated	16
88	913432	1263070	Stop	15
97	915707	1280562	Stop	7
100	923651	1290773	TCP-No Control	7
109	928226	1285485	Stop	7
110	928072	1285367	Stop	7
113	931858	1280655	Stop	7
116	941293	1294356	Stop	8
121	913605	1277309	Stop	6
122	909823	1280195	Stop	6
123	908324	1280150	Stop	6
130	900208	1226118	Stop	21
131	900361	1221043	Stop	30
138	861928	1252649	Stop	14
143	888473	1244027	Stop	21

Node	X Coordinate	Y Coordinate	Control	Grid Map
144	901122	1239335	TCP-Actuated	21
145	889941	1252116	Stop	15
149	891534	1268011	Stop	15
151	901715	1266098	Stop	15
154	891321	1270778	Stop	15
157	921457	1263262	TCP-Actuated	16
161	926672	1287191	Stop	7
163	938764	1268677	Stop	16
164	925842	1270925	TCP-Actuated	16
165	928194	1275491	TCP-No Control	7
166	933037	1247109	Stop	22
172	890969	1276146	Stop	6
174	901103	1276869	Stop	6
182	872828	1271246	Stop	14
187	873533	1249694	Stop	14
188	873121	1265439	Stop	14
194	881683	1247475	Stop	20
200	911076	1254216	Stop	15
201	911379	1256034	Stop	15
202	880221	1267564	Stop	14
205	877259	1273111	TCP-Actuated	14
206	876741	1282021	Stop	5
208	869066	1236599	Stop	20
209	869228	1236014	Stop	20
211	856881	1239881	Stop	19
212	856997	1240291	Stop	19
214	852712	1239430	Stop	19
215	863943	1238651	Stop	20
216	864072	1236097	Stop	20
218	862216	1226917	Stop	20
219	858651	1229960	Stop	19
220	861864	1227765	Stop	20
223	865177	1216054	Stop	26
225	864990	1216007	Stop	26
234	874743	1234306	Stop	20
235	882118	1231515	TCP-No Control	20
236	884137	1230458	Stop	20
237	880195	1218213	Stop	27

Node	X Coordinate	Y Coordinate	Control	Grid Map
240	859087	1232917	Stop	19
241	856157	1232611	Stop	19
243	856768	1232691	Stop	19
250	898907	1211404	Stop	30
254	914627	1225262	Stop	22
255	918597	1223060	Stop	22
257	913366	1221146	Stop	30
258	919716	1219130	Stop	31
260	920477	1228066	Stop	22
263	925223	1229006	Stop	22
264	934909	1229749	Stop	22
268	921470	1215939	Stop	31
272	919353	1202669	Stop	31
274	908648	1205098	Stop	30
275	936517	1198091	Actuated	31
276	940772	1198035	Actuated	32
277	941992	1197777	Actuated	32
279	942503	1197658	Actuated	32
290	934852	1204362	Stop	31
303	848269	1257175	Stop	13
304	849930	1261818	Actuated	11
305	860678	1262784	Stop	11
306	869105	1263135	Stop	14
309	855677	1254640	Stop	13
313	844355	1258167	Stop	12
314	843118	1260922	Actuated	12
315	855859	1270694	TCP-Actuated	11
318	863061	1279014	TCP-No Control	5
321	872316	1281770	TCP-No Control	5
325	864864	1270844	TCP-No Control	14
328	869986	1228451	TCP-No Control	20
329	879785	1211823	Stop	27
331	854424	1269495	Stop	11
334	850590	1261818	Stop	11
336	845702	1264709	Stop	10
337	846269	1263423	Actuated	10

Node	X Coordinate	Y Coordinate	Control	Grid Map
338	846327	1261111	TCP-Actuated	12
342	845052	1260939	Actuated	12
344	843766	1259188	Stop	12
346	840837	1258531	Actuated	12
348	846790	1260232	Stop	12
351	868096	1281568	Yield	5
359	900177	1227447	Stop	21
364	869991	1223956	Stop	20
365	866945	1212165	Stop	26
366	864609	1211553	TCP-Actuated	26
367	865692	1209119	TCP-Actuated	28
368	864872	1210780	TCP-Actuated	26
371	865305	1208880	Actuated	28
373	868889	1211588	Actuated	26
374	867004	1211647	Stop	26
375	867428	1210258	Stop	26
377	869987	1211822	Stop	26
382	870451	1214539	Stop	26
387	867662	1207388	Actuated	28
390	870077	1205031	Actuated	28
393	869558	1205414	Stop	28
395	866414	1209608	Actuated	26
397	867733	1207507	Stop	28
401	862777	1211339	TCP-Actuated	26
402	864595	1212738	Stop	26
406	864122	1208281	TCP-Actuated	28
407	859777	1208944	Stop	25
409	863356	1210067	TCP-Actuated	26
411	856759	1211930	Actuated	25
412	851520	1212127	Stop	25
417	824249	1210851	Actuated	24
418	851481	1213036	Actuated	25
425	857193	1226028	Stop	19
426	850061	1225866	Stop	19
427	839710	1223155	Stop	19
432	832115	1212192	Stop	24
433	831535	1222840	Stop	18
436	833334	1244195	Stop	18
443	823622	1221874	Stop	18
447	809615	1228096	Yield	18

Node	X Coordinate	Y Coordinate	Control	Grid Map
455	821190	1204555	Stop	24
463	821704	1243558	Stop	18
465	828086	1243868	TCP-No Control	18
468	841538	1242849	Stop	19
469	842615	1239387	Stop	19
475	850256	1239192	Stop	19
480	843361	1255918	Yield	12
483	849168	1238265	Stop	19
484	849480	1238278	Stop	19
489	842877	1212630	Stop	25
498	836046	1243772	Stop	19
501	847508	1225854	Stop	19
503	839570	1255007	Stop	12
505	833318	1246553	Stop	18
509	831360	1255984	TCP-Actuated	9
511	834930	1258482	TCP-Actuated	12
512	835299	1251126	Stop	12
513	841870	1255583	Stop	12
514	841201	1255037	Stop	12
523	839315	1259512	TCP-Actuated	12
524	839896	1258151	Actuated	12
525	840293	1259932	Actuated	12
526	839083	1259431	TCP-Actuated	12
527	838278	1259080	TCP-Actuated	12
528	838580	1261426	Stop	10
529	836117	1259264	Stop	12
530	836372	1258600	Actuated	12
531	836443	1257057	Stop	12
533	834974	1257007	Actuated	12
536	837901	1260002	Stop	12
537	839530	1255998	Stop	12
538	838785	1257698	Actuated	12
539	840347	1257242	Actuated	12
540	839179	1256783	Stop	12
541	837366	1256042	Stop	12
543	837417	1254968	Stop	12
547	842271	1257428	Stop	12
548	841147	1258670	Stop	12
549	841083	1258055	Stop	12

Node	X Coordinate	Y Coordinate	Control	Grid Map
552	842654	1261981	Stop	10
553	845708	1257840	Stop	12
554	843094	1257731	Stop	12
556	840126	1260409	Actuated	12
557	840368	1260518	Actuated	12
559	840048	1261390	Actuated	10
560	841969	1260599	Stop	12
563	842708	1258769	Stop	12
565	841566	1261529	Stop	10
566	840578	1260035	Actuated	12
567	840841	1260162	Actuated	12
568	841094	1260278	Actuated	12
569	842498	1259241	Stop	12
570	843631	1259612	Actuated	12
572	841339	1258172	Stop	12
575	840928	1260719	Stop	12
577	841679	1258897	Actuated	12
578	840574	1261646	Stop	10
580	840751	1261182	Stop	12
581	841761	1261089	Stop	12
582	842848	1261527	Stop	10
584	842475	1262408	Stop	10
586	841593	1258298	Stop	12
605	923915	1267613	Stop	16
610	914514	1259458	Stop	16
613	927486	1254302	Stop	16
622	918841	1222967	Stop	22
628	885332	1233819	TCP-No Control	20
634	858890	1229979	Stop	19
636	857234	1232726	Stop	19
637	853170	1239492	Stop	19
641	857444	1211215	Actuated	25
644	863191	1207876	Actuated	28
647	864233	1211581	Actuated	26
657	842581	1260802	Actuated	12
658	842364	1261324	Stop	10
663	841857	1258420	Stop	12
664	843244	1256050	Stop	12
665	836496	1256016	Stop	12

Node	X Coordinate	Y Coordinate	Control	Grid Map
666	838897	1259878	Stop	12
668	838722	1260323	Stop	12
675	844817	1225354	Stop	19
679	823063	1247913	TCP-No Control	18
680	833865	1257776	Actuated	9
683	943294	1296923	Actuated	8
687	847359	1261333	Actuated	10
689	838068	1259579	Stop	12
691	838089	1256348	Stop	12
695	870037	1281825	Stop	5
697	919801	1258551	TCP-No Control	16
698	903888	1238801	TCP-No Control	21
699	861844	1224569	Stop	20
701	856309	1228134	TCP-No Control	19
702	836516	1236331	TCP-No Control	19
703	832160	1237968	TCP-No Control	18
710	833267	1245970	Stop	18
712	844181	1226826	Stop	19

<sup>1</sup>Coordinates are in the North American Datum of 1983 New York Central Plane Zone

## **APPENDIX L**

### ERPA Boundaries

## L. ERPA BOUNDARIES

- ERPA 1 Lake Ontario on the North; Nine Mile Point, and Parkhurst Rds. to the East; Miner Rd. to the South; Bayshore, and Lakeview Rds. to the West.
- ERPA 2 Lake Ontario on the North; Shore Oaks Drive to the East; County Rte. 1 on the South; and to just west of County Rte. 29 between Miner and North Rds. to the West.
- ERPA 3 Lake View and Miner Rds. on the North; just east of County Rte. 29 to the East; to County Rte. 1 on the South; corner of County Rtes. 1 and 1A to the West.
- ERPA 4 Lake Ontario on the North; Dempster Beach Drive, County Rte 6 and 6A to the East; US Rte 104 on the South; Shore Oaks Dr., County Rte. 1, and to just west of Woolson and Dennis Rds. to the West.
- ERPA 5 County Rte. 1 on the North; just west of Woolson and Dennis Rds. to the East; U.S. Rte. 104 on the South; and Creamery Rd. to the West.
- ERPA 6 The road just east of the Alcan Plant and Co. Rte. 1A on the North; Creamery Rd. to the East; U.S. Rte. 104 on the South; and County Rte. 63 to the West.
- ERPA 7 Lake Ontario on the North; just west of Mexico Pt. between County Rte. 43 and Ladd Rd. to the East; U.S. Rte. 104 on the South; and County Rte. 6 and Dempster Beach Drive to the West.
- ERPA 8 U.S. Rte. 104 on the North; just east of and Green Rd. to the East; the intersection of Johnson and Craw Rds. in Vermillion on the South; and County Rte. 6 to the West.
- ERPA 9 U.S. Rte. 104 on the North; County Rte. 6 to the East; just North of Taplan Drive on the South; and to just west of Co. Rte. 51 to the West.
- ERPA 10 U.S. Rte. 104 on the North; just east of Co. Rte. 51 to the East; County Rte. 4 on the South; and Klocks Corners Rd. to the West.
- ERPA 11 U.S. Rte. 104 on the North; Klocks Corners Rd. to the East; County Rte. 4 on the South; and City Line Rd. to the West.
- ERPA 12 The City of Oswego, east of the Oswego River.
- ERPA 13 The City of Oswego, west of the Oswego River.
- ERPA 14 County Rte. 5 (just past the bridge in Port Ontario) on the North; N.Y. Rte. 3, Manwaring Rd. and just east of S. Daysville Rd. to the East; Sherman Rd. on the South; and Lake Ontario to the West.
- ERPA 15 Just north of the intersections of N.Y. 104B, N.Y. Rte. 3 and Sherman Rd. on the North; Sherman, Spath and Smithers Rds. to the East; U.S. Rte. 104, excluding the Village of Mexico on the South; the intersection of George Rd. and U. S. Rte. 104, just west of Mexico Pt., and between County Rte. 43 and Ladd Rd. to the West.
- ERPA 16 The Village of Mexico.

- ERPA 17 U.S. Rte. 104 and the southern boundary of Village of Mexico, on the North; Emery, Stone, Larson and Pumphouse Rds. to the East; Gillette Rd. on the South; and just east of and Green Rd. to the West.
- ERPA 18 Just below County Rte. 51, just above Taplan Dr and the intersections of Johnson and Craw Rds. on the North; N.Y. Rte. 3, County Rte. 4, and County Rte. 35 to the East; Clifford Rd. on the South; Baldwin, Silk, and just east of O'Connor Rds. to
- ERPA 19 County Rte. 4 on the North; just east of Silk Rd. to the East; just above County Rte. 45 (intersecting with County Rte. 53), Myers, Black Creek, and Paddy Lake Rds. on the South; the Oswego River to the West.
- ERPA 20 Just above Co. Rte. 45 (intersecting with County Rte. 53), Myers, Black Creek, and Paddy Lake Rds. on the North; Silk, and Baldwin Rds. to the East; Hawk and Rowlee Rds. on the South; the Oswego River to the West.
- ERPA 21 Oswego City Line on the North; the Oswego River to the East, Hickory Grove Rd.
- ERPA 22 Lake Ontario on the North; County Rte. 7, Byer Rd., and County Rte. 25 to the East; Furniss and Tug Hill Rds. on the South; Bunker Hill Rd. and Maple Ave. to just west of Crestwood Dr. to the West.
- ERPA 23 Oswego River within the Oswego City limits.
- ERPA 24 Oswego River south of the Oswego City limits to Lock #5 in Minetto.
- ERPA 25 Oswego River south of Lock #5 in Minetto north to Hickory Grove Rd.
- ERPA 26 Portion of Lake Ontario within 5 miles and west of the plants.
- ERPA 27 Portion of Lake Ontario within 5 miles and west of the plants.
- ERPA 28 Portion of Lake Ontario between 5 and 10 miles west of the plants.
- ERPA 29 Portion of Lake Ontario between 5 and 10 miles east of the plants.

## **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 Times

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 Advisory to Evacuate, could be persuaded to respond much more rapidly), how would the ETE be affected? The case considered was Scenario 6, Region 3; a winter, midweek, midday, good weather evacuation of the entire EPZ. Table M-1 presents the results of this study.

**Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study**

Trip Generation Period	Evacuation Time Estimate for Entire EPZ	
	90 <sup>th</sup> Percentile	100 <sup>th</sup> Percentile
2 Hours 30 Minutes	2:55	4:00
3 Hours	2:55	4:00
3 Hours 30 Minutes (Base)	2:55	4:00

As discussed in Section 7.3, for Region 3 cases, traffic congestion persists within the EPZ for about 4 hours. As such, the ETE for the 100<sup>th</sup> percentile are not affected by the trip generation time, but by the time needed to clear the congestion within the EPZ. The 90<sup>th</sup> percentile, Region 3 ETE are also not sensitive to truncating the tail of the mobilization time distribution.

## 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 6, Region 3; a winter, midweek, midday, good weather evacuation for 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 evacuation time estimates for each of the cases considered. The results show that the ETE is not impacted by shadow evacuation from 0% to 20%. Tripling the shadow percentage increases the ETE by 5 minutes for the 90<sup>th</sup> and 100<sup>th</sup> percentiles, respectively – not a significant change. Note, the telephone survey results presented in Appendix F indicate that 21% of households would elect to evacuate if advised to shelter. Thus, the base assumption of 20% non-compliance suggested in NUREG/CR-7002 is valid.

**Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study**

Percent Shadow Evacuation	Evacuating Shadow Vehicles	Evacuation Time Estimate for Entire EPZ	
		90 <sup>th</sup> Percentile	100 <sup>th</sup> Percentile
0	0	2:55	4:00
15	2,328	2:55	4:00
20 (Base)	3,103	2:55	4:00
60	9,310	3:00	4:05

### 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. The sensitivity study was conducted using the following planning assumptions:

1. The percent increase in population within the study area was varied between 10% and 30%. Increases in population were applied to permanent residents only (as per federal guidance), in both the EPZ area and in the Shadow Region.
2. The transportation infrastructure remained fixed; the presence of new roads or highway capacity improvements were not considered.
3. The study was performed for the 2-Mile Region (R01), the 5-Mile Region (R02) and the entire EPZ (R03).
4. The good weather scenario which yielded the highest ETE values was selected as the case to be considered in this sensitivity study (Scenario 6).

Table M-3 presents the results of the sensitivity study. Section IV of Appendix E to 10 CFR Part 50, and NUREG/CR-7002, Section 5.4, require licensees to provide an updated ETE analysis to the NRC when a population increase within the EPZ causes ETE values (for the 2-Mile Region, 5-Mile Region or entire EPZ) to increase by 25 percent or 30 minutes, whichever is less. Note that the base ETE values for the 100<sup>th</sup> percentile cases as well as the 90<sup>th</sup> percentile for the full EPZ are greater than 2 hours; therefore, 30 minutes is the lesser and is the criterion for updating these cases. Twenty five percent of the 90<sup>th</sup> percentile ETE for the 2-Mile and 5-Mile region are 22 and 27 minutes respectively. Both are less than 30 minutes and are the criteria for updating these cases.

Those percent population increases which result in ETE changes are highlighted in red below – a 30% increase in the EPZ population. Constellation Energy/Entergy will have to estimate the EPZ population on an annual basis. If the EPZ population increases by 30% or more, or decreases by 30% or more, an updated ETE analysis will be needed.

**Table M-3. ETE Variation with Population Change**

Resident Population	Base	Population Change		
		4,189	8,377	12,566
ETE for 90 <sup>th</sup> Percentile				
Region		Population Change		
	Base	10%	20%	30%
2-Mile	1:30	1:30	1:30	1:30
5-MILE	1:50	1:55	1:55	1:55
FULL EPZ	2:55	3:05	3:15	3:25
ETE for 100 <sup>th</sup> Percentile				
Region	Base	Population Change		
		10%	20%	30%
2-Mile	3:30	3:30	3:30	3:30
5-MILE	3:35	3:35	3:35	3:35
FULL EPZ	4:00	4:10	4:20	4:35

## **APPENDIX N**

### **ETE Criteria Checklist**

## N. ETE CRITERIA CHECKLIST

Table N-1. ETE Review Criteria Checklist

NRC Review Criteria		Criterion Addressed in ETE Analysis	Comments
<b>1.0 Introduction</b>			
a.	The emergency planning zone (EPZ) and surrounding area should be described.	Yes	Section 1
b.	A map should be included that identifies primary features of the site, including major roadways, significant topographical features, boundaries of counties, and population centers within the EPZ.	Yes	Figure 1-1
c.	A comparison of the current and previous ETE should be provided and includes similar information as identified in Table 1-1, "ETE Comparison," of NUREG/CR-7002.	Yes	Table 1-3
<b>1.1 Approach</b>			
a.	A discussion of the approach and level of detail obtained during the field survey of the roadway network should be provided.	Yes	Section 1.3
b.	Sources of demographic data for schools, special facilities, large employers, and special events should be identified.	Yes	Section 2.1 Section 3
c.	Discussion should be presented on use of traffic control plans in the analysis.	Yes	Section 1.3, Section 2.3, Section 9, Appendix G
d.	Traffic simulation models used for the analyses should be identified by name and version.	Yes	Section 1.3, Table 1-3, Appendix B, C and D

NRC Review Criteria		Criterion Addressed in ETE Analysis	Comments
e.	Methods used to address data uncertainties should be described.	Yes	Section 3 – avoid double counting Section 5, Appendix F – 4.5% sampling error at 95% confidence interval for telephone survey
<b>1.2 Assumptions</b>			
a.	The planning basis for the ETE includes the assumption that the evacuation should be ordered promptly and no early protective actions have been implemented.	Yes	Section 2.3 – Assumption 1 Section 5.1
b.	Assumptions consistent with Table 1-2, “General Assumptions,” of NUREG/CR-7002 should be provided and include the basis to support their use.	Yes	Sections 2.2, 2.3
<b>1.3 Scenario Development</b>			
a.	The ten scenarios in Table 1-3, Evacuation Scenarios, should be developed for the ETE analysis, or a reason should be provided for use of other scenarios.	Yes	Tables 2-1, 6-4
<b>1.3.1 Staged Evacuation</b>			
a.	A discussion should be provided on the approach used in development of a staged evacuation.	Yes	Sections 5.4.2, 7.2
<b>1.4 Evacuation Planning Areas</b>			
a.	A map of EPZ with emergency response planning areas (ERPAs) should be included.	Yes	Figure 6-1
b.	A table should be provided identifying the ERPAs considered for each ETE calculation by downwind direction in each sector.	Yes	Table 6-1

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
c. A table similar to Table 1-4, "Evacuation Areas for a Staged Evacuation Keyhole," of NUREG/CR-7002 should be provided and includes the complete evacuation of the 2, 5, and 10 mile areas and for the 2 mile area/5 mile keyhole evacuations.	Yes	Table 7-5
<b>2.0 Demand Estimation</b>		
a. Demand estimation should be developed for the four population groups, including permanent residents of the EPZ, transients, special facilities, and schools.	Yes	Permanent residents, employees, transients – Section 3, Appendix E Special facilities, schools – Section 8, Appendix E
<b>2.1 Permanent Residents and Transient Population</b>		
a. The US Census should be the source of the population values, or another credible source should be provided.	Yes	Section 3.1
b. Population values should be adjusted as necessary for growth to reflect population estimates to the year of the ETE.	Yes	2010 used as the base year for analysis. No growth of population necessary.
c. A sector diagram should be included, similar to Figure 2-1, "Population by Sector," of NUREG/CR-7002, showing the population distribution for permanent residents.	Yes	Figure 3-2
<b>2.1.1 Permanent Residents with Vehicles</b>		
a. The persons per vehicle value should be between 1 and 2 or justification should be provided for other values.	Yes	1.93 persons per vehicle – Table 1-3
b. Major employers should be listed.	Yes	Appendix E – Table E-3
<b>2.1.2 Transient Population</b>		

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
a. A list of facilities which attract transient populations should be included, and peak and average attendance for these facilities should be listed. The source of information used to develop attendance values should be provided.	Yes	Sections 3.3, 3.4, Appendix E
b. The average population during the season should be used, itemized and totaled for each scenario.	Yes	Tables 3-4, 3-5 and Appendix E itemize the transient population and employee estimates. These estimates are multiplied by the scenario specific percentages provided in Table 6-5 to estimate transient population by scenario.
c. The percent of permanent residents assumed to be at facilities should be estimated.	Yes	Sections 3.3, 3.4
d. The number of people per vehicle should be provided. Numbers may vary by scenario, and if so, discussion on why values vary should be provided.	Yes	Sections 3.3, 3.4
e. A sector diagram should be included, similar to Figure 2-1 of NUREG/CR-7002, showing the population distribution for the transient population.	Yes	Figure 3-6 – transients Figure 3-8 – employees
<b>2.2 Transit Dependent Permanent Residents</b>		
a. The methodology used to determine the number of transit dependent residents should be discussed.	Yes	Section 8.1, Table 8-1
b. Transportation resources needed to evacuate this group should be quantified.	Yes	Section 8.1, Tables 8-5, 8-10
c. The county/local evacuation plans for transit dependent residents should be used in the analysis.	Yes	Sections 8.1, 8.4, Table 8-6

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
d. 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 should be provided. Data from local/county registration programs should be used in the estimate, but should not be the only set of data.	Yes	Section 8.5
e. Capacities should be provided for all types of transportation resources. Bus seating capacity of 50% should be used or justification should be provided for higher values.	Yes	Section 2.3 – Assumption 10 Sections 3.5, 8.1, 8.2, 8.3
f. An estimate of this population should be provided and information should be provided that the existing registration programs were used in developing the estimate.	Yes	Table 8-1 – transit dependents Sections 8-1, 8.4
g. A summary table of the total number of buses, ambulances, or other transport needed to support evacuation should be provided and the quantification of resources should be detailed enough to assure double counting has not occurred.	Yes	Section 8.3, 8.4 Table 8-5
<b>2.3 Special Facility Residents</b>		
a. A list of special facilities, including the type of facility, location, and average population should be provided. Special facility staff should be included in the total special facility population.	Yes	Appendix E, Tables E-2, E-6 – list facilities, type, location, and population
b. A discussion should be provided on how special facility data was obtained.	Yes	Sections 3.5, 8.3

NRC Review Criteria		Criterion Addressed in ETE Analysis	Comments
c.	The number of wheelchair and bed-bound individuals should be provided.	Yes	Section 3.5
d.	An estimate of the number and capacity of vehicles needed to support the evacuation of the facility should be provided.	Yes	Section 8.3 Tables 8-4, 8-6
e.	The logistics for mobilizing specially trained staff (e.g., medical support or security support for prisons, jails, and other correctional facilities) should be discussed when appropriate.	Yes	Section 3.5
<b>2.4 Schools</b>			
a.	A list of schools including name, location, student population, and transportation resources required to support the evacuation, should be provided. The source of this information should be provided.	Yes	Table 8-2, E-1 Section 8.2
b.	Transportation resources for elementary and middle schools should be based on 100% of the school capacity.	Yes	Table 8-2
c.	The estimate of high school students who will use their personal vehicle to evacuate should be provided and a basis for the values used should be discussed.	Yes	Section 8.2
d.	The need for return trips should be identified if necessary.	Yes	There are sufficient resources to evacuate schools in a single wave. However, Section 8.3 and Figure 8-1 discuss the potential for a multiple wave evacuation

NRC Review Criteria		Criterion Addressed in ETE Analysis	Comments
<b>2.5.1 Special Events</b>			
a.	A complete list of special events should be provided and includes information on the population, estimated duration, and season of the event.	Yes	Section 3.7
b.	The special event that encompasses the peak transient population should be analyzed in the ETE.	Yes	Section 3.7
c.	The percent of permanent residents attending the event should be estimated.	Yes	Section 3.7
<b>2.5.2 Shadow Evacuation</b>			
a.	A shadow evacuation of 20 percent should be included for areas outside the evacuation area extending to 15 miles from the NPP.	Yes	Section 2.2 – Assumption 5 Figure 2-1 Section 3.2
b.	Population estimates for the shadow evacuation in the 10 to 15 mile area beyond the EPZ are provided by sector.	Yes	Section 3.2 Figure 3-4 Table 3-3
c.	The loading of the shadow evacuation onto the roadway network should be consistent with the trip generation time generated for the permanent resident population.	Yes	Section 5 – Table 5-9 footnote
<b>2.5.3 Background and Pass Through Traffic</b>			

NRC Review Criteria		Criterion Addressed in ETE Analysis	Comments
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 3.6 Table 3-6 Section 6 Table 6-5, 6-6
b.	Pass through traffic is assumed to have stopped entering the EPZ about two hours after the initial notification.	Yes	Section 2.3 – Assumption 5 Section 3.6
<b>2.6 Summary of Demand Estimation</b>			
a.	A summary table should be provided that identifies the total populations and total vehicles used in analysis for permanent residents, transients, transit dependent residents, special facilities, schools, shadow population, and pass-through demand used in each scenario.	Yes	Section 3.8 Tables 3-7, 3-8
<b>3.0 Roadway Capacity</b>			
a.	The method(s) used to assess roadway capacity should be discussed.	Yes	Section 4
<b>3.1 Roadway Characteristics</b>			
a.	A field survey of key routes within the EPZ has been conducted.	Yes	Section 1.3
b.	Information should be provided describing the extent of the survey, and types of information gathered and used in the analysis.	Yes	Section 1.3
c.	A table similar to that in Appendix A, “Roadway Characteristics,” of NUREG/CR-7002 should be provided.	Yes	Appendix K, Table K-1

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
d. Calculations for a representative roadway segment should be provided.	Yes	Section 4
e. A legible map of the roadway system that identifies node numbers and segments used to develop the ETE should be provided and should be similar to Figure 3-1, "Roadway Network Identifying Nodes and Segments," of NUREG/CR-7002.	Yes	Appendix K, Figures K-1 through K-33 present the entire link-node analysis network at a scale suitable to identify all links and nodes
<b>3.2 Capacity Analysis</b>		
a. The approach used to calculate the roadway capacity for the transportation network should be described in detail and identifies factors that should be expressly used in the modeling.	Yes	Section 4
b. The capacity analysis identifies where field information should be used in the ETE calculation.	Yes	Section 1.3, Section 4
<b>3.3 Intersection Control</b>		
a. A list of intersections should be provided that includes the total number of intersections modeled that are unsignalized, signalized, or manned by response personnel.	Yes	Appendix K, Table K-2
b. Characteristics for the 10 highest volume intersections within the EPZ are provided including the location, signal cycle length, and turn lane queue capacity.	Yes	Table J-1
c. Discussion should be provided on how signal cycle time is used in the calculations.	Yes	Section 4.1, Appendix C.
<b>3.4 Adverse Weather</b>		

NRC Review Criteria		Criterion Addressed in ETE Analysis	Comments
a.	The adverse weather condition should be identified and the effects of adverse weather on mobilization time should be considered.	Yes	Table 2-1, Section 2.3 – Assumption 9 Mobilization time – Table 2-2, Section 5.3 (page 5-10)
b.	The speed and capacity reduction factors identified in Table 3-1, “Weather Capacity Factors,” of NUREG/CR-7002 should be used or a basis should be provided for other values.	Yes	Table 2-2 – based on HCM 2010. The factors provided in Table 3-1 of NUREG/CR-7002 are from HCM 2000.
c.	The study identifies assumptions for snow removal on streets and driveways, when applicable.	Yes	Section 2.3 – Assumption 9 Section 5.3 – page 5-10 Appendix F – Section F.3.3
<b>4.0 Development of Evacuation Times</b>			
<b>4.1 Trip Generation Time</b>			
a.	The process used to develop trip generation times should be identified.	Yes	Section 5
b.	When telephone surveys are used, the scope of the survey, area of survey, number of participants, and statistical relevance should be provided.	Yes	Appendix F
c.	Data obtained from telephone surveys should be summarized.	Yes	Appendix F
d.	The trip generation time for each population group should be developed from site specific information.	Yes	Section 5, Appendix F
<b>4.1.1 Permanent Residents and Transient Population</b>			

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
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 prior to evacuating.	Yes	Section 5 discusses trip generation for households with and without returning commuters. Table 6-5 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.
b. Discussion should be provided on the time and method used to notify transients. The trip generation time discusses any difficulties notifying persons in hard to reach areas such as on lakes or in campgrounds.	Yes	Section 5.4.3
c. The trip generation time accounts for transients potentially returning to hotels prior to evacuating.	Yes	Section 5, Figure 5-1
d. Effect of public transportation resources used during special events where a large number of transients should be expected should be considered.	Yes	Section 3.7
e. The trip generation time for the transient population should be integrated and loaded onto the transportation network with the general public.	Yes	Section 5, Table 5-9, Figure 5-4
<b>4.1.2 Transit Dependent Residents</b>		

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
a. If available, existing plans and bus routes should be used in the ETE analysis. If new plans should be developed with the ETE, they have been agreed upon by the responsible authorities.	Yes	Section 8.4. 76 pre-established bus routes were used in the ETE analysis – see Table 8-6.
b. Discussion should be included on the means of evacuating ambulatory and non-ambulatory residents.	Yes	Section 8.4, 8.5
c. The number, location, and availability of buses, and other resources needed to support the demand estimation should be provided.	Yes	Section 8.4 Table 8-5
d. Logistical details, such as the time to obtain buses, brief drivers, and initiate the bus route should be provided.	Yes	Section 8.4, 8.5, 8.6 Figure 8-1
e. Discussion should identify the time estimated for transit dependent residents to prepare and travel to a bus pickup point, and describes the expected means of travel to the pickup point.	Yes	Section 8.4,8.5
f. The number of bus stops and time needed to load passengers should be discussed.	Yes	Section 8.4, 8.5
g. A map of bus routes should be included.	Yes	Maps of the bus pick-up routes in each ERPA are contained in the EMO calendar.
h. The trip generation time for non-ambulatory persons includes the time to mobilize ambulances or special vehicles, time to drive to the home of residents, loading time, and time to drive out of the EPZ should be provided.	Yes	Section 8.5

NRC Review Criteria		Criterion Addressed in ETE Analysis	Comments
i.	Information should be provided to supports analysis of return trips, if necessary.	Yes	Sections 8.4 Figure 8-1 Tables 8-11 through 8-13
<b>4.1.3 Special Facilities</b>			
a.	Information on evacuation logistics and mobilization times should be provided.	Yes	Section 8.3, 8.4, 8.6, Tables 8-4, 8-14 through 8-16, Table 8-17
b.	Discussion should be provided on the inbound and outbound speeds.	Yes	Sections 8.4 8.6
c.	The number of wheelchair and bed-bound individuals should be provided, and the logistics of evacuating these residents should be discussed.	Yes	Section 8.3 Tables 8-4, 8-14, 8-15, 8-16
d.	Time for loading of residents should be provided	Yes	Section 8.4, 8.6
e.	Information should be provided that indicates whether the evacuation can be completed in a single trip or if additional trips should be needed.	Yes	Section 8.4, Table 8-4, 8-5
f.	If return trips should be needed, the destination of vehicles should be provided.	Yes	Section 8.4 Figure 10-1
g.	Discussion should be provided on whether special facility residents are expected to pass through the reception center prior to being evacuated to their final destination.	Yes	Section 8.4
h.	Supporting information should be provided to quantify the time elements for the return trips.	Yes	Section 8.4.
<b>4.1.4 Schools</b>			

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
a. Information on evacuation logistics and mobilization time should be provided.	Yes	Section 8.4 Table 8-7, 8-8, 8-9
b. Discussion should be provided on the inbound and outbound speeds.	Yes	School bus routes are presented in Table 8-6.  School bus speeds are presented in Tables 8-7 (good weather), 8-8 (rain) and 8-9 (snow). Outbound speeds are defined as the minimum of the evacuation route speed and the State school bus speed limit.  Inbound speeds are limited to the State school bus speed limit.
c. Time for loading of students should be provided.	Yes	Tables 8-7 through 8-9, Discussion in Section 8.4
d. Information should be provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed.	Yes	Section 8.4 – page 8-8 Table 8-5
e. If return trips are needed, the destination of school buses should be provided.	Yes	Return trips are not needed
f. If used, reception centers should be identified. Discussion should be provided on whether students are expected to pass through the reception center prior to being evacuated to their final destination.	Yes	Table 8-3. Students are evacuated to reception center where they will be picked up by parents or guardians.

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
g. Supporting information should be provided to quantify the time elements for the return trips.	Yes	Return trips are not needed. Tables 8-7 through 8-9 provide time needed to arrive at reception center, which could be used to compute a second wave evacuation if necessary
<b>4.2 ETE Modeling</b>		
a. General information about the model should be provided and demonstrates its use in ETE studies.	Yes	DYNEV II (Ver. 4.0.8.0). Section 1.3, Table 1-3, Appendix B, Appendix C.
b. If a traffic simulation model is not used to conduct the ETE calculation, sufficient detail should be provided to validate the analytical approach used. All criteria elements should have been met, as appropriate.	No	Not applicable as a traffic simulation model was used.
<b>4.2.1 Traffic Simulation Model Input</b>		
a. Traffic simulation model assumptions and a representative set of model inputs should be provided.	Yes	Appendices B and C describe the simulation model assumptions and algorithms Table J-2
b. A glossary of terms should be provided for the key performance measures and parameters used in the analysis.	Yes	Appendix A Tables C-1, C-2
<b>4.2.2 Traffic Simulation Model Output</b>		

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
a. A discussion regarding whether the traffic simulation model used must be in equilibration prior to calculating the ETE should be provided.	Yes	Appendix B
b. The minimum following model outputs should be provided to support review: <ol style="list-style-type: none"> <li>1. Total volume and percent by hour at each EPZ exit node.</li> <li>2. Network wide average travel time.</li> <li>3. Longest queue length for the 10 intersections with the highest traffic volume.</li> <li>4. Total vehicles exiting the network.</li> <li>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.</li> <li>6. Average speed for each major evacuation route that exits the EPZ.</li> </ol>	Yes	<ol style="list-style-type: none"> <li>1. Table J-5.</li> <li>2. Table J-3.</li> <li>3. Table J-1.</li> <li>4. Table J-3.</li> <li>5. Figures J-1 through J-14 (one plot for each scenario considered).</li> <li>6. Table J-4. Network wide average speed also provided in Table J-3.</li> </ol>
c. Color coded roadway maps should be provided for various times (i.e., at 2, 4, 6 hrs., etc.) during a full EPZ evacuation scenario, identifying areas where long queues exist including level of service (LOS) "E" and LOS "F" conditions, if they occur.	Yes	Figures 7-3 through 7-7
<b>4.3 Evacuation Time Estimates for the General Public</b>		
a. The ETE should include the time to evacuate 90% and 100% of the total permanent resident and transient population	Yes	Tables 7-1, 7-2

NRC Review Criteria	Criterion Addressed in ETE Analysis	Comments
b. The ETE for 100% of the general public should include all members of the general public. Any reductions or truncated data should be explained.	Yes	Section 5.4 – truncating survey data to eliminate statistical outliers Table 7-2 – 100 <sup>th</sup> percentile ETE for general public
c. Tables should be provided for the 90 and 100 percent ETEs similar to Table 4-3, “ETEs for Staged Evacuation Keyhole,” of NUREG/CR-7002.	Yes	Tables 7-3, 7-4
d. ETEs should be provided for the 100 percent evacuation of special facilities, transit dependent, and school populations.	Yes	Section 8.4, 8.5, 8.6 Tables 8-7 through 8-9 Tables 8-11 through 8-18
<b>5.0 Other Considerations</b>		
<b>5.1 Development of Traffic Control Plans</b>		
a. Information that responsible authorities have approved the traffic control plan used in the analysis should be provided.	Yes	Section 9, Appendix G
b. A discussion of adjustments or additions to the traffic control plan that affect the ETE should be provided.	Yes	Appendix G
<b>5.2 Enhancements in Evacuation Time</b>		
a. The results of assessments for improvement of evacuation time should be provided.	Yes	Appendix M
b. A statement or discussion regarding presentation of enhancements to local authorities should be provided.	Yes	Results of the ETE study were formally presented to local authorities at the final project meeting. Recommended enhancements were discussed.

NRC Review Criteria		Criterion Addressed in ETE Analysis	Comments
<b>5.3 State and Local Review</b>			
a.	A list of agencies contacted and the extent of interaction with these agencies should be discussed.	Yes	Table 1-1
b.	Information should be provided on any unresolved issues that may affect the ETE.	Yes	There are no outstanding issues.
<b>5.4 Reviews and Updates</b>			
a.	A discussion of when an updated ETE analysis is required to be performed and submitted to the NRC.	Yes	Appendix M, Section M.3
<b>5.5 Reception Centers and Congregate Care Center</b>			
a.	A map of congregate care centers and reception centers should be provided.	Yes	Figure 10-1
b.	If return trips are required, assumptions used to estimate return times for buses should be provided.	Yes	Section 8.4 discusses a multi-wave evacuation procedure. Figure 8-1
c.	It should be clearly stated if it is assumed that passengers are left at the reception center and are taken by separate buses to the congregate care center.	Yes	Section 2.3 – Assumption 7h Section 10

Technical Reviewer \_\_\_\_\_

Date \_\_\_\_\_

Supervisory Review \_\_\_\_\_

Date \_\_\_\_\_