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10 CFR 50, Appendix E, Section IV.4

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Diablo Canyon Power Plant Evacuation Time Estimate Analysis Using Most Recent Decennial Census Data

Dear Commissioners and Staff:

In accordance with 10 CFR 50, Appendix E, Section IV.4, Pacific Gas and Electric Company (PG&E) hereby submits the Evacuation Time Estimate analysis for the Diablo Canyon Power Plant Emergency Planning Zone using the most recent decennial census data.

PG&E makes no regulatory commitments (as described by NEI 99-04) in this letter. If you have any questions, please contact me at (805) 545-3865.

Sincerely,

Andrew M. Warwick

9/12/2022
(date)

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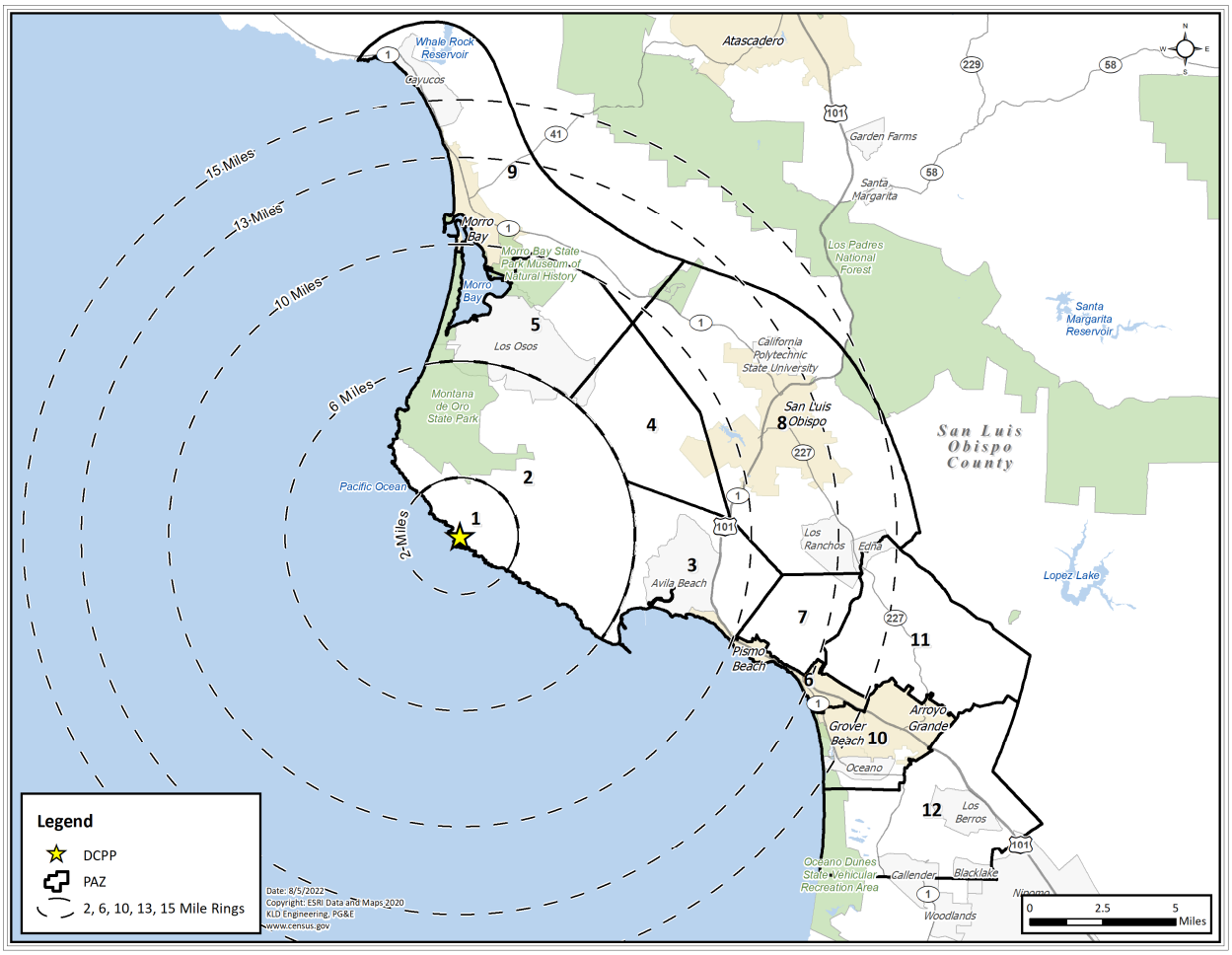
Diablo Canyon Power Plant

Development of Evacuation Time Estimates

KLD ENGINEERING, P.C.

Diablo Canyon Power Plant

Development of Evacuation Time Estimates



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September 6, 2022 **Final Report, Rev. 0** **KLD TR – 1235**

Table of Contents

1 INTRODUCTION 1-1

1.1 Overview of the ETE Process 1-1
1.2 The Diablo Canyon Power Plant Location 1-3
1.3 Preliminary Activities 1-3
1.4 Comparison with Prior ETE Study 1-6

2 STUDY ESTIMATES AND ASSUMPTIONS 2-1

2.1 Data Estimate Assumptions 2-1
2.2 Methodological Assumptions 2-1
2.3 Assumptions on Mobilization Times 2-3
2.4 Transit Dependent Assumptions 2-3
2.5 Traffic and Access Control Assumptions 2-5
2.6 Scenarios and Regions 2-5

3 DEMAND ESTIMATION 3-1

3.1 Permanent Residents 3-2
3.1.1 Colleges and Universities 3-3
3.2 Shadow Population 3-4
3.3 Transient Population 3-5
3.4 Employees 3-6
3.5 Medical Facilities 3-7
3.6 Transit Dependent Population 3-7
3.7 School Population Demand 3-9
3.8 Special Event 3-10
3.9 Access and/or Functional Needs Population 3-10
3.10 Correctional Facilities 3-11
3.11 External Traffic 3-11
3.12 Background Traffic 3-11
3.13 Summary of Demand 3-12

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 Diablo Canyon Power Plant Study Area 4-6
4.3.1 Two-Lane Roads 4-6
4.3.2 Multilane Highway 4-7
4.3.3 Freeways 4-7
4.3.4 Intersections 4-8
4.4 Simulation and Capacity Estimation 4-8
4.5 Boundary Conditions 4-9

5 ESTIMATION OF TRIP GENERATION TIME 5-1

5.1 Background 5-1
5.2 Fundamental Considerations 5-2
5.3 Estimated Time Distributions of Activities Preceding Event 5 5-4

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

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-2
C.1.1 The Fundamental Diagram C-2
C.1.2 The Simulation Model C-2
C.1.3 Lane Assignment C-6
C.2 Implementation C-6
C.2.1 Computational Procedure C-6
C.2.2 Interfacing with Dynamic Traffic Assignment (DTRAD) C-7
D. DETAILED DESCRIPTION OF STUDY PROCEDURE D-1
E. SPECIAL FACILITY DATA E-1
F. DEMOGRAPHIC SURVEY F-1
F.1 Introduction F-1

F.2 Survey Instrument and Sampling Plan F-1
F.3 Survey Results F-2
F.3.1 Household Demographic Results F-2
F.3.2 Evacuation Response F-3
F.3.3 Time Distribution Results F-5
G. TRAFFIC MANAGEMENT PLAN G-1
G.1 Traffic Control Points G-1
G.2 Access Control Points (ACPs) G-1
G.3 Analysis of Key TCP Locations G-1
H. EVACUATION REGIONS H-1
J. REPRESENTATIVE INPUTS TO AND OUTPUTS FROM THE DYNEV II SYSTEM J-1
K. EVACUATION ROADWAY NETWORK K-1
L. PAZ 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-1
M.3 Effect of Changes in Resident Population M-2
M.4 Event at Avila Beach Golf Resort M-3
M.5 Enhancements in Evacuation Time M-3
N. ETE CRITERIA CHECKLIST N-1

Note: Appendix I intentionally skipped

List of Figures

Figure 1-1. DCPP Location 1-11
Figure 1-2. DCPP Link-Node Analysis Network 1-12
Figure 2-1. Voluntary Evacuation Methodology 2-8
Figure 2-2. Voluntary Evacuation Methodology Continued 2-9
Figure 3-1. PAZs Comprising the DCPP EPZ 3-25
Figure 3-2. Permanent Resident Population by Sector 3-26
Figure 3-3. Permanent Resident Vehicles by Sector 3-27
Figure 3-4. Shadow Population by Sector 3-28
Figure 3-5. Shadow Vehicles by Sector 3-29
Figure 3-6. Transient Population by Sector 3-30
Figure 3-7. Transient Vehicles by Sector 3-31
Figure 3-8. Employee Population by Sector 3-32
Figure 3-9. Employee Vehicles by Sector 3-33
Figure 4-1. Fundamental Diagrams 4-10
Figure 5-1. Events and Activities Preceding the Evacuation Trip 5-17
Figure 5-2. Evacuation Mobilization Activities 5-18
Figure 5-3. Comparison of Data Distribution and Normal Distribution 5-19
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 6 Mile Region and the 6 to 10 Mile Region 5-21
Figure 6-1. DCPP EPZ 6-11
Figure 7-1. Voluntary Evacuation Methodology 7-18
Figure 7-2. Voluntary Evacuation Methodology Including Staged Evacuation 7-19
Figure 7-3. DCPP Shadow Region 7-20
Figure 7-4. Congestion Patterns at 30 Minutes after the Evacuation Order 7-21
Figure 7-5. Congestion Patterns at 1 Hour, 30 Minutes after the Evacuation Order 7-22
Figure 7-6. Congestion Patterns at 4 Hours, 45 Minutes after the Evacuation Order 7-23
Figure 7-7. Congestion Patterns at 6 Hours, 45 Minutes after the Evacuation Order 7-24
Figure 7-8. Congestion Patterns at 7 Hours, 30 Minutes after the Evacuation Order 7-25
Figure 7-9. Congestion Patterns at 8 Hours, 30 Minutes after the Evacuation Order 7-26
Figure 7-10. Congestion Patterns at 10 Hours after the Evacuation Order 7-27
Figure 7-11. Congestion Patterns at 11 Hours, 5 Minutes after the Evacuation Order 7-28
Figure 7-12. Evacuation Time Estimates - Scenario 1 for Region R04 7-29
Figure 7-13. Evacuation Time Estimates - Scenario 2 for Region R04 7-29
Figure 7-14. Evacuation Time Estimates - Scenario 3 for Region R04 7-30
Figure 7-15. Evacuation Time Estimates - Scenario 4 for Region R04 7-30
Figure 7-16. Evacuation Time Estimates - Scenario 5 for Region R04 7-31
Figure 7-17. Evacuation Time Estimates - Scenario 6 for Region R04 7-31
Figure 7-18. Evacuation Time Estimates - Scenario 7 for Region R04 7-32
Figure 7-19. Evacuation Time Estimates - Scenario 8 for Region R04 7-32
Figure 7-20. Evacuation Time Estimates - Scenario 9 for Region R04 7-33
Figure 7-21. Evacuation Time Estimates - Scenario 10 for Region R04 7-33
Figure 7-22. Evacuation Time Estimates - Scenario 11 for Region R04 7-34
Figure 7-23. Evacuation Time Estimates - Scenario 12 for Region R04 7-34
Figure 8-1. Chronology of Transit Evacuation Operations 8-28

Figure 10-1. Evacuation Route Map 10-9
Figure 10-2. Transit-Dependent Bus Routes and Careless Collection Points 10-10
Figure 10-3. General Population Reception Centers and Public School Relocation Centers 10-11
Figure B-1. Flow Diagram of Simulation-DTRAD Interface B-4
Figure C-1. Representative Analysis Network C-13
Figure C-2. Fundamental Diagrams C-14
Figure C-3. A UNIT Problem Configuration with $t_1 > 0$ C-14
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. Overview of Schools within the DCPP Full EPZ E-17
Figure E-2. Schools within the North of the DCPP Full EPZ E-18
Figure E-3. Schools within the South of the DCPP Full EPZ E-19
Figure E-4. Overview of Medical Facilities within the DCPP Full EPZ E-20
Figure E-5. Medical Facilities within the DCPP Full EPZ – PAZs 5 and 9 ..... E-21
Figure E-6. Medical Facilities within the DCPP Full EPZ – PAZ 8 ..... E-22
Figure E-7. Medical Facilities within the DCPP Full EPZ – PAZs 10 and 11 ..... E-23
Figure E-8. Major Employers within the Full EPZ E-24
Figure E-9. Beaches, Golf Courses and Marinas within the Full EPZ E-25
Figure E-10. Campgrounds within the DCPP Full EPZ E-26
Figure E-11. Parks and Other Recreational Areas within the DCPP Full EPZ E-27
Figure E-12. Overview of Lodging Facilities within the DCPP Full EPZ E-28
Figure E-13. Lodging Facilities within the DCPP Full EPZ – PAZs 5 and 9 ..... E-29
Figure E-14. Lodging Facilities within the DCPP Full EPZ – PAZ 8 ..... E-30
Figure E-15. Lodging Facilities within the DCPP Full EPZ – PAZs 3, 6, 10 and 11 ..... E-31
Figure E-16. Correctional Facilities within the DCPP Full EPZ E-32
Figure F-1. Household Size in the Study Area F-8
Figure F-2. Household Vehicle Availability F-8
Figure F-3. Vehicle Availability - 1 to 6 Person Households F-9
Figure F-4. Household Ridesharing Preference F-9
Figure F-5. Commuters in Households in the Study Area F-10
Figure F-6. Modes of Travel in the Study Area F-10
Figure F-7. Impact to Commuters due to the COVID-19 Pandemic F-11
Figure F-8. Households with Functional or Transpiration Needs F-11
Figure F-9. Number of Vehicles Used for Evacuation F-12
Figure F-10. Households Evacuating with Pets/Animals to Shelters F-12
Figure F-11. Shelter Locations F-13
Figure F-12. Time Required to Prepare to Leave Work/School F-13
Figure F-13. Work to Home Travel Time F-14
Figure F-14. Time to Prepare Home for Evacuation F-14
Figure F-15. Time to Prepare Pets for Evacuation F-15
Figure G-1. Traffic Control Points for the DCPP Study Area G-4
Figure H-1. Region R01 ..... H-5
Figure H-2. Region R02 ..... H-6
Figure H-3. Region R03 ..... H-7
Figure H-4. Region R04 ..... H-8
Figure H-5. Region R05 ..... H-9
Figure H-6. Region R06 ..... H-10

Figure H-7. Region R07 ..... H-11
Figure H-8. Region R08 ..... H-12
Figure H-9. Region R09 ..... H-13
Figure H-10. Region R10 ..... H-14
Figure H-11. Region R11 ..... H-15
Figure H-12. Region R12 ..... H-16
Figure H-13. Region R13 ..... H-17
Figure H-14. Region R14 ..... H-18
Figure H-15. Region R15 ..... H-19
Figure H-16. Region R16 ..... H-20
Figure H-17. Region R17 ..... H-21
Figure H-18. Region R18 ..... H-22
Figure H-19. Region R19 ..... H-23
Figure H-20. Region R20 ..... H-24
Figure H-21. Region R21 ..... H-25
Figure H-22. Region R22 ..... H-26
Figure H-23. Region R23 ..... H-27
Figure H-24. Region R24 ..... H-28
Figure H-25. Region R25 ..... H-29
Figure J-1. Network Source/Origins J-6
Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1) J-7
Figure J-3. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2) J-7
Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3) J-8
Figure J-5. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4) J-8
Figure J-6. ETE and Trip Generation: Summer, Midweek, Weekend, Evening,
Good Weather (Scenario 5) J-9
Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6) J-9
Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Rain (Scenario 7) J-10
Figure J-9. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 8) J-10
Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Rain (Scenario 9) J-11
Figure J-11. ETE and Trip Generation: Winter, Midweek, Weekend, Evening,
Good Weather (Scenario 10) J-11
Figure J-12. ETE and Trip Generation: Summer, Midweek, Weekend, Evening,
Special Event (Scenario 11) J-12
Figure J-13. ETE and Trip Generation: Summer, Midweek, Midday, Roadway Impact (Scenario 12) J-12
Figure K-1. DCPP Link-Node Analysis Network K-2
Figure K-2. Link-Node Analysis Network – Grid 1 ..... K-3
Figure K-3. Link-Node Analysis Network – Grid 2 ..... K-4
Figure K-4. Link-Node Analysis Network – Grid 3 ..... K-5
Figure K-5. Link-Node Analysis Network – Grid 4 ..... K-6
Figure K-6. Link-Node Analysis Network – Grid 5 ..... K-7
Figure K-7. Link-Node Analysis Network – Grid 6 ..... K-8
Figure K-8. Link-Node Analysis Network – Grid 7 ..... K-9
Figure K-9. Link-Node Analysis Network – Grid 8 ..... K-10
Figure K-10. Link-Node Analysis Network – Grid 9 ..... K-11
Figure K-11. Link-Node Analysis Network – Grid 10 ..... K-12
Figure K-12. Link-Node Analysis Network – Grid 11 ..... K-13

Figure K-13. Link-Node Analysis Network – Grid 12 ..... K-14
Figure K-14. Link-Node Analysis Network – Grid 13 ..... K-15
Figure K-15. Link-Node Analysis Network – Grid 14 ..... K-16
Figure K-16. Link-Node Analysis Network – Grid 15 ..... K-17
Figure K-17. Link-Node Analysis Network – Grid 16 ..... K-18
Figure K-18. Link-Node Analysis Network – Grid 17 ..... K-19
Figure K-19. Link-Node Analysis Network – Grid 18 ..... K-20
Figure K-20. Link-Node Analysis Network – Grid 19 ..... K-21
Figure K-21. Link-Node Analysis Network – Grid 20 ..... K-22
Figure K-22. Link-Node Analysis Network – Grid 21 ..... K-23
Figure K-23. Link-Node Analysis Network – Grid 22 ..... K-24
Figure K-24. Link-Node Analysis Network – Grid 23 ..... K-25
Figure K-25. Link-Node Analysis Network – Grid 24 ..... K-26
Figure K-26. Link-Node Analysis Network – Grid 25 ..... K-27
Figure K-27. Link-Node Analysis Network – Grid 26 ..... K-28
Figure K-28. Link-Node Analysis Network – Grid 27 ..... K-29
Figure K-29. Link-Node Analysis Network – Grid 28 ..... K-30
Figure K-30. Link-Node Analysis Network – Grid 29 ..... K-31
Figure K-31. Link-Node Analysis Network – Grid 30 ..... K-32
Figure K-32. Link-Node Analysis Network – Grid 31 ..... K-33
Figure K-33. Link-Node Analysis Network – Grid 32 ..... K-34
Figure K-34. Link-Node Analysis Network – Grid 33 ..... K-35
Figure K-35. Link-Node Analysis Network – Grid 34 ..... K-36
Figure K-36. Link-Node Analysis Network – Grid 35 ..... K-37
Figure K-37. Link-Node Analysis Network – Grid 36 ..... K-38
Figure K-38. Link-Node Analysis Network – Grid 37 ..... K-39
Figure K-39. Link-Node Analysis Network – Grid 38 ..... K-40
Figure K-40. Link-Node Analysis Network – Grid 39 ..... K-41
Figure K-41. Link-Node Analysis Network – Grid 40 ..... K-42
Figure K-42. Link-Node Analysis Network – Grid 41 ..... K-43
Figure K-43. Link-Node Analysis Network – Grid 42 ..... K-44
Figure K-44. Link-Node Analysis Network – Grid 43 ..... K-45
Figure K-45. Link-Node Analysis Network – Grid 44 ..... K-46
Figure K-46. Link-Node Analysis Network – Grid 45 ..... K-47
Figure K-47. Link-Node Analysis Network – Grid 46 ..... K-48
Figure K-48. Link-Node Analysis Network – Grid 47 ..... K-49
Figure K-49. Link-Node Analysis Network – Grid 48 ..... K-50
Figure K-50. Link-Node Analysis Network – Grid 49 ..... K-51
Figure K-51. Link-Node Analysis Network – Grid 50 ..... K-52
Figure K-52. Link-Node Analysis Network – Grid 51 ..... K-53
Figure K-53. Link-Node Analysis Network – Grid 52 ..... K-54
Figure K-54. Link-Node Analysis Network – Grid 53 ..... K-55
Figure K-55. Link-Node Analysis Network – Grid 54 ..... K-56
Figure K-56. Link-Node Analysis Network – Grid 55 ..... K-57
Figure K-57. Link-Node Analysis Network – Grid 56 ..... K-58
Figure K-58. Link-Node Analysis Network – Grid 57 ..... K-59
Figure K-59. Link-Node Analysis Network – Grid 58 ..... K-60

Figure K-60. Link-Node Analysis Network – Grid 59 ..... K-61
Figure K-61. Link-Node Analysis Network – Grid 60 ..... K-62
Figure K-62. Link-Node Analysis Network – Grid 61 ..... K-63
Figure K-63. Link-Node Analysis Network – Grid 62 ..... K-64
Figure K-64. Link-Node Analysis Network – Grid 63 ..... K-65
Figure K-65. Link-Node Analysis Network – Grid 64 ..... K-66
Figure K-66. Link-Node Analysis Network – Grid 65 ..... K-67

List of Tables

Table 1-1. Stakeholder Interaction 1-7
Table 1-2. Highway Characteristics 1-7
Table 1-3. ETE Study Comparisons 1-8
Table 2-1. Evacuation Scenario Definitions 2-7
Table 2-2. Model Adjustment for Adverse Weather 2-7
Table 3-1. EPZ Permanent Resident Population 3-13
Table 3-2. Permanent Resident Population and Vehicles by PAZ 3-13
Table 3-3. Shadow Population and Vehicles by Sector 3-14
Table 3-4. Summary of Transients and Transient Vehicles 3-14
Table 3-5. Summary of Employees and Employee Vehicles Commuting into the Full EPZ 3-15
Table 3-6. Medical Facility Transit Demand 3-16
Table 3-7. Transit-Dependent Population Estimates 3-19
Table 3-8. School Population Demand Estimates 3-20
Table 3-9. DCPP EPZ External Traffic 3-22
Table 3-10. Summary of Population Demand 3-23
Table 3-11. Summary of Vehicle Demand 3-24
Table 5-1. Event Sequence for Evacuation Activities 5-10
Table 5-2. Time Distribution for Notifying the Public 5-10
Table 5-3. Time Distribution for Employees to Prepare to Leave Work 5-11
Table 5-4. Time Distribution for Commuters to Travel Home 5-12
Table 5-5. Time Distribution for Population to Prepare to Evacuate 5-13
Table 5-6. Mapping Distributions to Events 5-13
Table 5-7. Description of the Distributions 5-14
Table 5-8. Trip Generation Histograms for the EPZ Population for Unstaged Evacuation 5-15
Table 5-9. Trip Generation Histograms for the EPZ Population for Staged Evacuations 5-16
Table 6-1. Description of Evacuation Regions 6-6
Table 6-2. Evacuation Scenario Definitions 6-8
Table 6-3. Percent of Population Groups Evacuating for Various Scenarios 6-9
Table 6-4. Vehicle Estimates by Scenario 6-10
Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population 7-10
Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population 7-12
Table 7-3. Time to Clear *90* Percent of the 2-Mile and 6-Mile Areas within the Indicated Region 7-14
Table 7-4. Time to Clear *100* Percent of the 2-Mile and 6-Mile Areas within the Indicated Region 7-15
Table 7-5. Description of Evacuation Regions 7-16
Table 8-1. Summary of Transportation Resources 8-12
Table 8-2. School Evacuation Time Estimates - Good Weather 8-14
Table 8-3. School Evacuation Time Estimates – Rain 8-17
Table 8-4. Transit-Dependent Evacuation Time Estimates - Good Weather 8-20
Table 8-5. Transit-Dependent Evacuation Time Estimates – Rain 8-21
Table 8-6. Medical Facilities Evacuation Time Estimates - Good Weather 8-22
Table 8-7. Medical Facilities Evacuation Time Estimates – Rain 8-25
Table 8-8. Access and/or Functional Needs Population Evacuation Time Estimates 8-27
Table 10-1. Summary of Transit-Dependent Bus Routes 10-2
Table 10-2. Bus Route Descriptions 10-3
Table 10-3. School Relocation Centers 10-7

Table A-1. Glossary of Traffic Engineering Terms A-1
Table C-1. Selected Measures of Effectiveness Output by DYNEV II C-9
Table C-2. Input Requirements for the DYNEV II Model C-10
Table C-3. Glossary C-11
Table E-1. Schools within the Full EPZ E-2
Table E-2. Medical Facilities within the Full EPZ E-4
Table E-3. Major Employers within the Full EPZ E-7
Table E-4. Beaches, Golf Courses and Marinas within the Full EPZ E-8
Table E-5. Campgrounds within the Full EPZ E-9
Table E-6. Parks and Other Recreational Areas within the Full EPZ E-10
Table E-7. Lodging Facilities within the Full EPZ E-11
Table E-8. Correctional Facilities within the Full EPZ E-16
Table F-1. DCPP Demographic Survey Sampling Plan F-7
Table G-1. List of Key TCP Locations G-3
Table G-2. ETE with No MTC G-3
Table H-1. Percent of PAZ Population Evacuating for Each Region H-2
Table J-1. Sample Simulation Model Input J-2
Table J-2. Selected Model Outputs for the Evacuation of the Full EPZ (Region R04) J-3
Table J-3. Average Speed (mph) and Travel Time (min) for Major Evacuation Routes (Region R04, Scenario 1) J-4
Table J-4. Simulation Model Outputs at Network Exit Links for Region R04, Scenario 1 ..... J-5
Table K-1. Summary of Nodes by the Type of Control K-1
Table M-1. Evacuation Time Estimates for Trip Generation Sensitivity Study M-4
Table M-2. Evacuation Time Estimates for Shadow Sensitivity Study M-4
Table M-3. ETE Variation with Population Change M-5
Table M-4. Event at Avila Beach Golf Resort M-5
Table N-1. ETE Review Criteria Checklist N-1

ACRONYM LIST

Table 1. Acronym List

ACRONYM	DEFINITION
AADT	Average Annual Daily Traffic
ACP	Access Control Point
ASLB	Atomic Safety and Licensing Board
ATIS	Automated Traveler Information Systems
BFFS	Base Free Flow Speed
COVID-19	Coronavirus Disease 2019
D	Destination
DCPP	Diablo Canyon Power Plant
DDHV	Directional Design Hourly Volume
DHV	Design Hour Volume
DMS	Dynamic Message Sign
DTA	Dynamic Traffic Assignment
DTRAD	Dynamic Traffic Assignment and Distribution
DYNEV	Dynamic Network Evacuation
EPZ	Emergency Planning Zone
EPFAQ	Emergency Planning Frequently Asked Questions
ETE	Evacuation Time Estimate
EVAN	Evacuation Animator
FEMA	Federal Emergency Management Agency
FFS	Free Flow Speed
FHWA	Federal Highway Administration
GIS	Geographical Information System
HAR	Highway Advisory Radio
HCM	Highway Capacity Manual
HH	Household
ITS	Intelligent Transportation Systems
LOS	Level of Service
MOE	Measures of Effectiveness
mph	Miles Per Hour
MUTCD	Manual of Uniform Traffic Control Devices
MTC	Manual Traffic Control
NRC	United States Nuclear Regulatory Commission
O	Origin
O-D	Origin-Destination
PAZ	Protective Action Zone
pcphpl	passenger car per hour per lane

PEZ	Public Education Zone
PG&E	Pacific Gas & Electric
PSL	Path-Size-Logit
QDF	Queue Discharge Flow
R.C.	Reception Center
S.R.C.	School Relocation Center
SH	State Highway
SLO	San Luis Obispo
SLOCOES	San Luis Obispo County Office of Emergency Services
SV	Service Volume
TA	Traffic Assignment
TCP	Traffic Control Point
TD	Trip Distribution
TI	Time Interval
TMP	Traffic Management Plan
UNITES	Unified Transportation Engineering System
USDOT	United States Department of Transportation
vph	Vehicles Per Hour
vpm	Vehicles Per Minute

EXECUTIVE SUMMARY

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Diablo Canyon Power Plant (DCPP) located in San Luis Obispo County, California. ETE are part of the required planning basis and provide Pacific Gas and Electric Company and State and local governments with site-specific information needed for emergency planning.

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

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

Overview of Project Activities

This project began in October 2020 and extended over a period of one and a half years. The major activities performed are briefly described in chronological sequence:

- Attended "kick-off" meetings with Pacific Gas and Electric Company personnel and San Luis Obispo County Office of Emergency Services (SLOCOES).
- Accessed the 2020 U.S. Census Bureau data files.
- Obtained the estimates of employees who reside outside the EPZ and commute to work within the EPZ from San Luis Obispo (SLO) County.
- Studied Geographic Information Systems (GIS) maps of the area in the vicinity of the DCPP, then conducted a detailed field survey of the highway network to observe any roadway changes relative to the previous ETE study done in 2012.
- Updated the analysis network representing the highway system topology and capacities within the Full Emergency Planning Zone (EPZ), plus a Shadow Region covering the Public Education Zone (PEZ).
- Conducted an online demographic survey of residents within the study area, to gather focused data needed for this ETE study that were not contained within the census database.
- Special facility data was requested from the SLO County at the kickoff meeting. If updated information was not provided and data could not be obtained from online sources, the data gathered in the 2012 ETE study was utilized, supplemented by internet searches and aerial imagery.

- The traffic demand and trip-generation rates of evacuating vehicles were estimated from the gathered data. The trip generation rates reflected the estimated mobilization time (i.e., the time required by evacuees to prepare for the evacuation trip) computed using the results of the demographic survey.
- Following federal guidelines, the EPZ is subdivided into 12 Protective Action Zones (PAZs). These PAZs are then grouped within circular areas or "keyhole" configurations (circles plus radial sectors) that define a total of 25 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 or Rain). One special event scenario involving a firework show in Morro Bay Harbor, Avila Beach, Cayucos Beach and Pismo Beach was considered. One roadway impact scenario was considered wherein a single lane was closed on US 101 southbound for the duration of the evacuation.
- Staged evacuation was considered for those regions wherein the 2-mile radius and sectors downwind to 6-miles were evacuated and 6-mile radius and sectors downwind to 10-Mile/FEMA EPZ were evacuated.
- As per NUREG/CR-7002, Rev. 1, the Planning Basis for the calculation of ETE is:
    - A rapidly escalating accident at the DCPP that quickly assumes the status of a general emergency wherein evacuation is ordered promptly, and no early protective actions or emergency action levels have been implemented such that the Evacuation Order is virtually coincident with the siren alert.
    - While an unlikely accident scenario, this planning basis will yield ETE, measured as the elapsed time from the Evacuation Order until the stated percentage of the population exits the impacted Region that represent "upper bound" estimates. This conservative Planning Basis is applicable for all initiating events.
- If the emergency occurs while schools are in session, the ETE study assumes that the children will be evacuated by bus directly to school relocation centers located outside the EPZ. Parents, relatives, and neighbors are advised to not pick up their children at school prior to the arrival of the buses dispatched for that purpose. The ETE for schoolchildren are calculated separately.
- 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 access and/or functional needs population, and for those evacuated from special facilities.
- Attended "final" meeting with PG&E personnel and SLO County to present results from the study.

Computation of ETE

A total of 300 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 25 Evacuation Regions to evacuate from that Region, under the circumstances defined for one of the 12 Evacuation Scenarios (25 x 12 = 300). Separate ETE are calculated for transit-dependent evacuees, including schoolchildren for applicable scenarios.

Except for Region R04, which is the evacuation of the Full EPZ, only a portion of the people within the EPZ would be advised to evacuate. That is, the Evacuation Order 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 monitor and prepare.

The computation of ETE assumes that 20 percent of the population within the EPZ but outside the impacted region, will elect to "voluntarily" evacuate. In addition, 20 percent 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 6 miles, 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.

Additionally, a second staged evacuation is considered wherein those people within the 6-mile region evacuate immediately, while those beyond 6 miles, but within 10 miles (the FEMA EPZ), shelter-in-place. Once 90% of the 6-mile region is evacuated, those people beyond 6 miles begin to evacuate. As per federal guidance, 20% of people beyond 6 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 plant), 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 90th percentile ETE have been identified as the values that should be considered when making protective action decisions or planning for emergencies because the 100th percentile ETE are prolonged by those relatively few people who take longer to mobilize. This is referred to as the "evacuation tail" in Section 4.0 of NUREG/CR-7002, Rev. 1. The 100th percentile ETE is when the last vehicle to evacuate crosses the EPZ boundary.

Traffic Management

This study used the comprehensive existing traffic management plan for SLO County. Refer to Section 9 and Appendix G.

Selected Results

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

- Table 3-1 presents the estimates of permanent resident population in each PAZ based on the 2020 Census data.
- Table 6-1 defines each of the 25 Evacuation Regions in terms of their respective groups of PAZ.
- Table 6-2 lists the 12 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.
- Table 7-3 and 7-4 present ETE for the 2-mile and 6-mile region for un-staged and staged evacuations for the 90th and 100th percentiles, respectively.
- Table 8-2 presents ETE for the schoolchildren in good weather.
- Table 8-4 presents ETE for the transit-dependent population in good weather.
- Figure 6-1 displays a map of the DCPP EPZ showing the layout of the 12 PAZs that comprise, in aggregate, the EPZ.
- Figure H-8 presents an example of an Evacuation Region (Region R08) to be evacuated under the circumstances defined in Table 6-1. Maps of all regions are provided in Appendix H.

Conclusions

- General population ETE were computed for 300 unique cases – a combination of 25 unique Evacuation Regions and 12 unique Evacuation Scenarios. Table 7-1 and Table 7-2

document these ETE for the 90th and 100th percentiles. These ETE range from 1:00 (hr:min) to 14:30 at the 90th percentile. The 100th percentile ETE range from 1:30 to 20:10.

- Inspection of Table 7-1 and Table 7-2 indicates that the ETE for the 100th percentile are significantly longer than those for the 90th percentile. This is the result of the 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 Section 7.5 and Figures 7-12 through 7-23.
- 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 (compare Regions R01 with Region R20, respectively, in Tables 7-1 and 7-2). These tables also indicate that a staged evacuation of the 10-mile region provides no benefits to evacuees from within the 6-mile region (compare Regions R21 through R25 with Regions R05, R06, R03, R07 and R08 respectively). In addition, a staged evacuation adversely impacts those beyond 2 miles and 6 miles. See Section 7.6 for additional discussion.
- Comparison of Scenarios 5 (summer, midweek/weekend, evening) and 11 (summer, weekend, evening) in Table 7-2 indicates that the special event has a material affect on the ETE for PAZs evacuating to the south. See Section 7.5 for additional discussion.
- Comparison of Scenarios 1 and 12 in Table 7-1 indicates that the roadway closure – one lane southbound on US 101 from the interchange with Los Osos Valley Rd to the interchange with State Highway 166 – has a material impact on 90th percentile ETE for keyhole regions with wind from the south-southwest to north-northwest (Regions R04, R07, R08, and Regions R10 through R15) with increases of up to 3 hours and 35 minutes. See Section 7.5 for additional discussion.
- Arroyo Grande and Grover Beach are the two most congested areas during an evacuation. The last locations in the EPZ to exhibit traffic congestion are in Arroyo Grande to the east and US-101 southbound; this is the result of limited evacuation routes and a high evacuation demand in this area. All congestion within the Full EPZ clears by 11 hours and 5 minutes after the Evacuation Order. See Section 7.3 and Figures 7-4 through 7-11.
- Separate ETE were computed for schools, medical facilities, transit-dependent persons, and access and/or functional needs persons. The average single-wave ETE for these facilities are within a similar range or lower as the general population ETE at the 90th percentile. Correctional facilities shelter in place. See Section 8.
- Table 8-1 indicates that there are not enough transportation resources available to evacuate the schools, medical facilities, transit-dependent persons, and access and/or functional needs persons within the EPZ in a single wave. Second-wave ETE were calculated for these population groups. See Sections 8.1 and 8.2.
- An hour reduction in the base trip generation time of 4 hours and 45 minutes reduces the general population ETE at the 100th percentile by 15 minutes and has no effect on

the 90th percentile. An increase in mobilization time by one hour has no impact on the 90th or 100th percentile ETE. See Table M-1.

- The general population 90th and 100th percentile ETE is sensitive to increases in the number of voluntary evacuees in the Shadow Region. When the shadow percent is increased to 100 percent, the ETE increases by 1 hour and 25 minutes. See Table M-2.
- An increase in permanent resident population (EPZ plus Shadow Region) of 7% or greater results in an increase in the longest 90th percentile ETE of 30 minutes, which meets the federal criterion for performing a fully updated ETE study between decennial Censuses. See Section M.3.
- An event at the Avila Beach Golf Resort that would attract about 1,000 visitors has no impact on the 90th or 100th percentile ETE. When the event attracts more than 3,000 people (up to 5,000 visitors), the 90th and the 100th percentile ETE for the Full EPZ (R04) increases by 5 and 25 minutes, respectively. See Section M.4.

Table 3-1. EPZ Permanent Resident Population

PAZ	2010 Population	2020 Population
1	0	0
2	168	160
3	2,736	2,846
4	713	521
5	14,217	14,485
6	6,562	7,170
7	281	85
8	60,962	63,286
9	13,126	13,733
10	37,476	38,380
11	4,205	4,454
12	6,775	7,029
EPZ TOTAL:	**147,221**	**152,149**
EPZ Population Growth (2010-2020):		**3.35%**

Table 6-1. Description of Evacuation Regions

Region	Description	PAZ											
		1	2	3	4	5	6	7	8	9	10	11	12
R01	2-Mile Ring	X											
R02	6-Mile Ring (similar to the FEMA 5-mile ring)	X	X										
R03	FEMA EPZ	X	X	X	X	X							
R04	Full EPZ	X	X	X	X	X	X	X	X	X	X	X	X
Evacuate 2-Mile Radius and Downwind to 6 Miles													
Region	Wind Direction From:	PAZ											
		1	2	3	4	5	6	7	8	9	10	11	12
-	ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW	Refer to Region R02											
-	N, NNE, NE, ENE, E	Refer to Region R01											
Evacuate 6-Mile Radius and Downwind to 10 miles[1]													
Region	Wind Direction From:	PAZ											
		1	2	3	4	5	6	7	8	9	10	11	12
R05	SE, SSE, S	X	X			X							
R06	SSW	X	X		X	X							
-	SW, WSW	Refer to Region R03											
R07	W, WNW	X	X	X	X								
R08	NW, NNW	X	X	X									
-	N, NNE, NE, ENE, E, ESE	Refer to Region R02											
Evacuate 6-Mile Radius and Downwind to EPZ Boundary													
Region	Wind Direction From:	PAZ											
		1	2	3	4	5	6	7	8	9	10	11	12
R09	SE, SSE, S	X	X			X				X			
R10	SSW	X	X		X	X			X	X			
R11	SW	X	X	X	X	X			X	X			
R12	WSW	X	X	X	X	X		X	X	X		X	
R13	W, WNW	X	X	X	X		X	X	X		X	X	X
R14	NW	X	X	X			X	X			X	X	X
R15	NNW	X	X	X							X		X
-	N, NNE, NE, ENE, E, ESE	Refer to Region R02											

[1] The land based portions of the DCPP EPZ are divided into 12 Protective Action Zones (PAZs) defined by local geographic boundaries. For the purposes of computing ETE's, PAZs 1-5 represent the FEMA 10-mile EPZ. The local geographic boundaries for PAZs 1-5 encompass the majority of land-based regions within approximately 10 miles of DCPP, excluding portions of PAZs 8 and 9 that are within 10 miles of DCPP. PAZs 6-12 cover the areas beyond 10 miles from DCPP. ETEs are computed for all regions within the EPZ boundary.

Site Specific Regions													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R16	-	X	X		X								
R17	-	X	X	X			X						
R18	-	X	X	X	X								
R19	-	X	X		X	X							
Advanced Emergency Classification, 100% of the PAZ(s) already evacuated					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 6 Miles													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R20	ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW	X	X										
-	N, NNE, NE, ENE, E	**Refer to Region R01**											
Shelter-in-Place until 90% ETE for **R01**, then Evacuate					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

Staged Evacuation - 6-Mile Radius Evacuates, then Evacuate Downwind to 10 Miles													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R21	SE, SSE, S	X	X			X							
R22	SSW	X	X		X	X							
R23	SW, WSW (& FEMA EPZ)	X	X	X	X	X							
R24	W, WNW	X	X	X	X								
R25	NW, NNW	X	X	X									
-	N, NNE, NE, ENE, E, ESE	**Refer to Region R02**											
Shelter-in-Place until 90% ETE for **R02**, then Evacuate					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

Table 6-2. Evacuation Scenario Definitions

Scenarios	Season[2]	Day of Week	Time of Day	Weather	Special
1	Summer	Midweek	Midday	Good	None
2	Summer	Midweek	Midday	Rain	None
3	Summer	Weekend	Midday	Good	None
4	Summer	Weekend	Midday	Rain	None
5	Summer	Midweek, Weekend	Evening	Good	None
6	Winter	Midweek	Midday	Good	None
7	Winter	Midweek	Midday	Rain	None
8	Winter	Weekend	Midday	Good	None
9	Winter	Weekend	Midday	Rain	None
10	Winter	Midweek, Weekend	Evening	Good	None
11	Summer	Midweek	Evening	Good	Firework Shows at Avila Beach[3], Pismo Beach, and Morro Bay Harbor
12	Summer	Midweek	Midday	Good	Lane Closure southbound on US 101

[2] Winter assumes that school is in session (also applies to spring and autumn). Summer assumes that school is not in session.
[3] Transients present at Avila Beach to observe the fireworks at Pismo Beach

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

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

	Summer		Summer		Summer	Winter		Winter		Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek		Weekend		Midweek Weekend	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 6 Miles												
R20 (PAZ 1, 2)	1:15	1:15	1:30	1:30	1:30	1:15	1:15	1:45	1:45	1:30	1:30	1:15
Staged Evacuation - 6-Mile Radius Evacuates, then Evacuate Downwind to FEMA EPZ												
R21 (PAZ 1, 2, 5)	3:40	4:10	3:35	3:50	3:35	3:40	4:00	3:35	3:55	3:35	3:40	3:45
R22 (PAZ 1, 2, 4, 5)	3:45	4:00	3:40	3:55	3:40	3:45	4:05	3:40	4:05	3:40	3:40	3:45
R23 (PAZ 1, 2, 3, 4, 5)	3:25	3:40	3:25	3:35	3:30	3:30	3:40	3:25	3:40	3:30	3:30	4:00
R24 (PAZ 1, 2, 3, 4)	2:05	2:10	1:55	2:00	2:05	2:05	2:05	2:00	2:00	2:10	3:05	3:35
R25 (PAZ 1, 2, 3)	2:00	2:05	1:55	2:00	2:00	2:00	2:05	2:00	2:00	2:05	3:10	3:35

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	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
Entire 2-Mile Region, 6-Mile Region, FEMA EPZ and Full EPZ												
R01 (PAZ 1)	1:35	1:35	1:30	1:30	1:30	1:35	1:35	1:30	1:30	1:30	1:30	1:35
R02 (PAZ 1, 2)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R03 (PAZ 1, 2, 3, 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R04 (PAZ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)	10:50	12:10	10:50	11:55	11:45	11:05	12:10	10:05	10:50	10:35	20:10	15:00
6-Mile Ring and Keyhole to FEMA EPZ												
R05 (PAZ 1, 2, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R06 (PAZ 1, 2, 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R07 (PAZ 1, 2, 3, 4)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R08 (PAZ 1, 2, 3)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
Evacuate 6-Mile Radius and Downwind to Full EPZ Boundary												
R09 (PAZ 1, 2, 5, 9)	5:10	5:35	5:15	5:40	5:10	5:10	5:45	5:00	5:10	5:10	7:00	5:15
R10 (PAZ 1, 2, 4, 5, 8, 9)	8:10	9:10	7:05	8:20	7:10	9:00	10:10	7:15	8:00	7:10	9:40	9:25
R11 (PAZ 1, 2, 3, 4, 5, 8, 9)	8:30	9:20	8:50	9:30	9:05	7:50	8:50	7:45	8:25	8:10	10:10	11:00
R12 (PAZ 1, 2, 3, 4, 5, 7, 8, 9, 11)	8:25	9:15	7:45	8:25	7:20	9:20	10:35	7:50	8:25	7:25	10:05	9:20
R13 (PAZ 1, 2, 3, 4, 6, 7, 8, 10, 11, 12)	10:50	11:45	10:35	11:50	11:20	10:20	11:30	9:20	10:05	9:50	18:55	15:15
R14 (PAZ 1, 2, 3, 6, 7, 10, 11, 12)	9:00	9:55	9:40	10:05	9:45	8:45	9:35	8:15	9:10	8:55	18:35	12:40
R15 (PAZ 1, 2, 3, 10, 12)	8:15	9:10	7:35	8:05	7:10	9:15	10:05	7:25	8:05	7:05	12:30	9:20
Site Specific Regions												
R16 (PAZ 1, 2, 4)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R17 (PAZ 1, 2, 3, 6)	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	13:40	6:15
R18 (PAZ 3, 4)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R19 (PAZ 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55

	Summer		Summer		Summer	Winter		Winter		Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek		Weekend		Midweek Weekend	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 6 Miles												
R20 (PAZ 1, 2)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
Staged Evacuation - 6-Mile Radius Evacuates, then Evacuate Downwind to FEMA EPZ												
R21 (PAZ 1, 2, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R22 (PAZ 1, 2, 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R23 (PAZ 1, 2, 3, 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R24 (PAZ 1, 2, 3, 4)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R25 (PAZ 1, 2, 3)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55

Table 7-3. Time to Clear *90* Percent of the 2-Mile and 6-Mile Areas within the Indicated Region

	Summer		Summer		Summer	Winter		Winter		Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek		Weekend		Midweek Weekend	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
2-Mile ETE												
Entire 2-Mile Region												
R01 (PAZ 1)	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00
Entire 6-Mile Region												
R02 (PAZ 1, 2)	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00
Staged Evacuation - Entire 6-Mile Region												
R20 (PAZ 1, 2)	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00
6-Mile ETE												
Entire 6-Mile Region												
R02 (PAZ 1, 2)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
Unstaged Evacuation - FEMA EPZ and Keyhole to 10 Miles												
R03 (PAZ 1, 2, 3, 4, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R05 (PAZ 1, 2, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R06 (PAZ 1, 2, 4, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R07 (PAZ 1, 2, 3, 4)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R08 (PAZ 1, 2, 3)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
Staged Evacuation -FEMA EPZ and Keyhole to 10 Miles												
R21 (PAZ 1, 2, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R22 (PAZ 1, 2, 4, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R23 (PAZ 1, 2, 3, 4, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R24 (PAZ 1, 2, 3, 4)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R25 (PAZ 1, 2, 3)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15

Table 7-4. Time to Clear *100* Percent of the 2-Mile and 6-Mile Areas within the Indicated Region

	Summer		Summer		Summer	Winter		Winter		Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek		Weekend		Midweek Weekend	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
2-Mile ETE												
Entire 2-Mile Region												
R01 (PAZ 1)	1:35	1:35	1:30	1:30	1:30	1:35	1:35	1:30	1:30	1:30	1:30	1:35
Entire 6-Mile Region												
R02 (PAZ 1, 2)	1:35	1:35	1:30	1:30	1:30	1:35	1:35	1:30	1:30	1:30	1:30	1:35
Staged Evacuation - Entire 6-Mile Region												
R20 (PAZ 1, 2)	1:35	1:35	1:30	1:30	1:30	1:35	1:35	1:30	1:30	1:30	1:30	1:35
6-Mile ETE												
Entire 6-Mile Region												
R02 (PAZ 1, 2)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
Unstaged Evacuation - FEMA EPZ and Keyhole to 10 Miles												
R03 (PAZ 1, 2, 3, 4, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R05 (PAZ 1, 2, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R06 (PAZ 1, 2, 4, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R07 (PAZ 1, 2, 3, 4)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R08 (PAZ 1, 2, 3)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
Staged Evacuation -FEMA EPZ and Keyhole to 10 Miles												
R21 (PAZ 1, 2, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R22 (PAZ 1, 2, 4, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R23 (PAZ 1, 2, 3, 4, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R24 (PAZ 1, 2, 3, 4)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R25 (PAZ 1, 2, 3)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50

Table 8-2. School Evacuation Time Estimates – Good Weather

School	Driver Mobilization Time	Loading Time (min)	Dist. To EPZ Bdry (mi.)	Average Speed (mph)	Travel Time to EPZ Bdry (min.)	ETE (hr:min)	Dist. EPZ bdry to S.R.C. (mi.)	Travel Time from EPZ Bdry to S.R.C. (min)	ETA to S.R.C. (hr:min)
SAN LUIS OBISPO SCHOOLS									
Bellevue-Santa Fe Charter School	120	15	8.0	2.08	231	**6:10**	26.0	28	**6:40**
Heartland Christian Academy	120	15	10.9	2.39	274	**6:50**	25.4	28	**7:20**
Monarch Grove Elementary School	120	15	11.1	2.44	273	**6:50**	25.4	28	**7:20**
Manzanita School	120	15	8.9	2.87	187	**5:25**	25.4	28	**5:55**
Baywood Elementary School	120	15	8.9	2.87	185	**5:20**	25.4	28	**5:50**
Los Osos Middle School	120	15	8.4	2.55	198	**5:35**	25.4	28	**6:05**
Shell Beach Elementary School	120	15	13.1	3.46	228	**6:05**	1.9	2	**6:10**
Judkins Middle School	120	15	9.6	4.36	133	**4:30**	1.9	2	**4:35**
Discovery House Montessori	120	15	6.4	2.79	139	**4:35**	26.0	28	**5:05**
Laguna Middle School	120	15	6.6	2.72	145	**4:40**	26.0	28	**5:10**
Christ Classical School	120	15	19.2	3.33	345	**8:00**	25.4	28	**8:30**
Pacific Beach High School	120	15	6.3	2.83	135	**4:30**	26.0	28	**5:00**
San Luis Community School	120	15	6.2	2.80	132	**4:30**	26.0	28	**5:00**
C. L. Smith Elementary School	120	15	6.9	2.81	147	**4:45**	26.0	28	**5:15**
Montessori Children's School	120	15	6.9	3.22	128	**4:25**	26.0	28	**4:55**
Grizzly Challenge Charter School	120	15	12.8	3.44	223	**6:00**	25.4	28	**6:30**
Bishop's Peak Elementary School	120	15	16.3	3.15	310	**7:25**	25.4	28	**7:55**
Old Mission School	120	15	3.8	6.67	34	**2:50**	26.0	28	**3:20**
Pacheco Elementary School	120	15	16.0	3.14	305	**7:20**	25.4	28	**7:50**
Mission College Preparatory Catholic High School	120	15	3.8	6.67	34	**2:50**	26.0	28	**3:20**

School	Driver Mobilization Time	Loading Time (min)	Dist. To EPZ Bdry (mi.)	Average Speed (mph)	Travel Time to EPZ Bdry (min.)	ETE (hr:min)	Dist. EPZ bdry to S.R.C. (mi.)	Travel Time from EPZ Bdry to S.R.C. (min)	ETA to S.R.C. (hr:min)
Hawthorne Elementary School	120	15	4.7	4.41	64	**3:20**	26.0	28	**3:50**
Christian Day School	120	15	5.2	4.49	69	**3:25**	26.0	28	**3:55**
San Luis Obispo Christian School	120	15	3.7	3.67	60	**3:15**	26.0	28	**3:45**
Sinsheimer Elementary School	120	15	4.4	3.44	76	**3:35**	26.0	28	**4:05**
California Polytechnic State University	120	15	3.9	4.11	57	**3:15**	26.0	28	**3:45**
San Luis Obispo High School	120	15	3.2	4.26	45	**3:00**	26.0	28	**3:30**
Charles E. Teach Elementary School	120	15	3.1	4.14	44	**3:00**	26.0	28	**3:30**
Chris Jespersen	120	15	3.1	4.14	44	**3:00**	26.0	28	**3:30**
Olive Grove Charter School	120	15	3.1	4.14	44	**3:00**	26.0	28	**3:30**
San Luis Obispo Classical Academy	120	15	3.1	4.14	44	**3:00**	26.0	28	**3:30**
Los Ranchos Elementary School	120	15	8.8	4.48	118	**4:15**	26.0	28	**4:45**
Rancho El Chorro Outdoor School	120	15	11.5	3.76	183	**5:20**	25.4	28	**5:50**
Loma Vista Community School	120	15	11.5	3.76	183	**5:20**	25.4	28	**5:50**
Morro Bay High School	120	15	3.6	17.70	12	**2:30**	25.4	28	**3:00**
Del Mar Elementary School	120	15	4.5	45.30	6	**2:25**	25.4	28	**2:55**
Cayucos Elementary School	120	15	1.5	14.55	6	**2:25**	11.9	13	**2:40**
Grover Heights Elementary School	120	15	8.1	5.62	86	**3:45**	1.9	2	**3:50**
Grover Beach Elementary School	120	15	7.9	3.54	133	**4:30**	1.9	2	**4:35**
Dandy Lion Montessori School	120	15	8.3	4.66	108	**4:05**	3.0	3	**4:10**
Highland Preparatory School	120	15	6.9	3.67	114	**4:10**	1.9	2	**4:15**
Oceano Elementary School	120	15	9.2	4.88	114	**4:10**	1.9	2	**4:15**
Ocean View Elementary School	120	15	6.8	6.45	63	**3:20**	1.9	2	**3:25**

School	Driver Mobilization Time	Loading Time (min)	Dist. To EPZ Bdry (mi.)	Average Speed (mph)	Travel Time to EPZ Bdry (min.)	ETE (hr:min)	Dist. EPZ bdry to S.R.C. (mi.)	Travel Time from EPZ Bdry to S.R.C. (min)	ETA to S.R.C. (hr:min)
Lopez Continuation High School	120	15	7.4	4.95	90	**3:45**	3.0	3	**3:50**
Coastal Christian High School	120	15	6.5	4.02	97	**3:55**	3.0	3	**4:00**
Fairgrove Elementary School	120	15	7.9	3.91	121	**4:20**	1.9	2	**4:25**
Saint Patrick's School	120	15	6.6	6.12	65	**3:20**	3.0	3	**3:25**
Arroyo Grande Montessori	120	15	6.0	6.99	52	**3:10**	3.0	3	**3:15**
Harloe Elementary School	120	15	6.7	4.92	81	**3:40**	1.9	2	**3:45**
Valley View Adventist Academy	120	15	6.2	5.98	62	**3:20**	3.0	3	**3:25**
Lighthouse Christian School	120	15	6.6	3.67	108	**4:05**	3.0	3	**4:10**
Arroyo Grande High School	120	15	6.6	3.67	108	**4:05**	1.9	2	**4:10**
Paulding Middle School	120	15	6.6	5.10	78	**3:35**	1.9	2	**3:40**
Coastal Christian School	120	15	7.5	3.29	137	**4:35**	1.9	2	**4:40**
Branch Elementary School	120	15	8.8	3.44	154	**4:50**	1.9	2	**4:55**
Lopez High School	120	15	5.3	15.16	21	**2:40**	4.6	5	**2:45**
Pacific View Academy	120	15	5.3	15.16	21	**2:40**	4.6	5	**2:45**
Mesa Middle School	120	15	6.9	11.03	37	**2:55**	4.6	5	**3:00**
					Maximum for EPZ:	**8:00**		**Maximum:**	**8:30**
					Average for EPZ:	**4:15**		**Average:**	**4:35**

Table 8-4. Transit-Dependent Evacuation Time Estimates – Good Weather

Route Number	Number of Buses	Number of Stops	One-Wave						Two-Wave						
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to Rec. Ctr (miles)	Travel Time to Rec. Ctr (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
48	8	20	120	16	2.64	364	30	**8:35**	36	39	5	10	74	30	**11:15**
	7	20	140	16	2.71	355	30	**8:45**	36	39	5	10	74	30	**11:25**
49	8	20	120	18	3.55	304	30	**7:35**	12	13	5	10	52	30	**9:30**
50	11	20	120	13	5.59	140	30	**4:50**	26	28	5	10	57	30	**7:05**
	11	20	140	13	5.62	139	30	**5:10**	26	28	5	10	57	30	**7:25**
51	10	20	120	9	1.97	274	30	**7:05**	26	28	5	10	48	30	**9:10**
52	12	20	120	22	5.83	226	30	**6:20**	15	16	5	10	64	30	**8:30**
	11	20	140	22	6.15	215	30	**6:25**	15	16	5	10	64	30	**8:35**
							Maximum ETE:	**8:45**						**Maximum ETE:**	**11:25**
							Average ETE:	**6:50**						**Average ETE:**	**9:10**

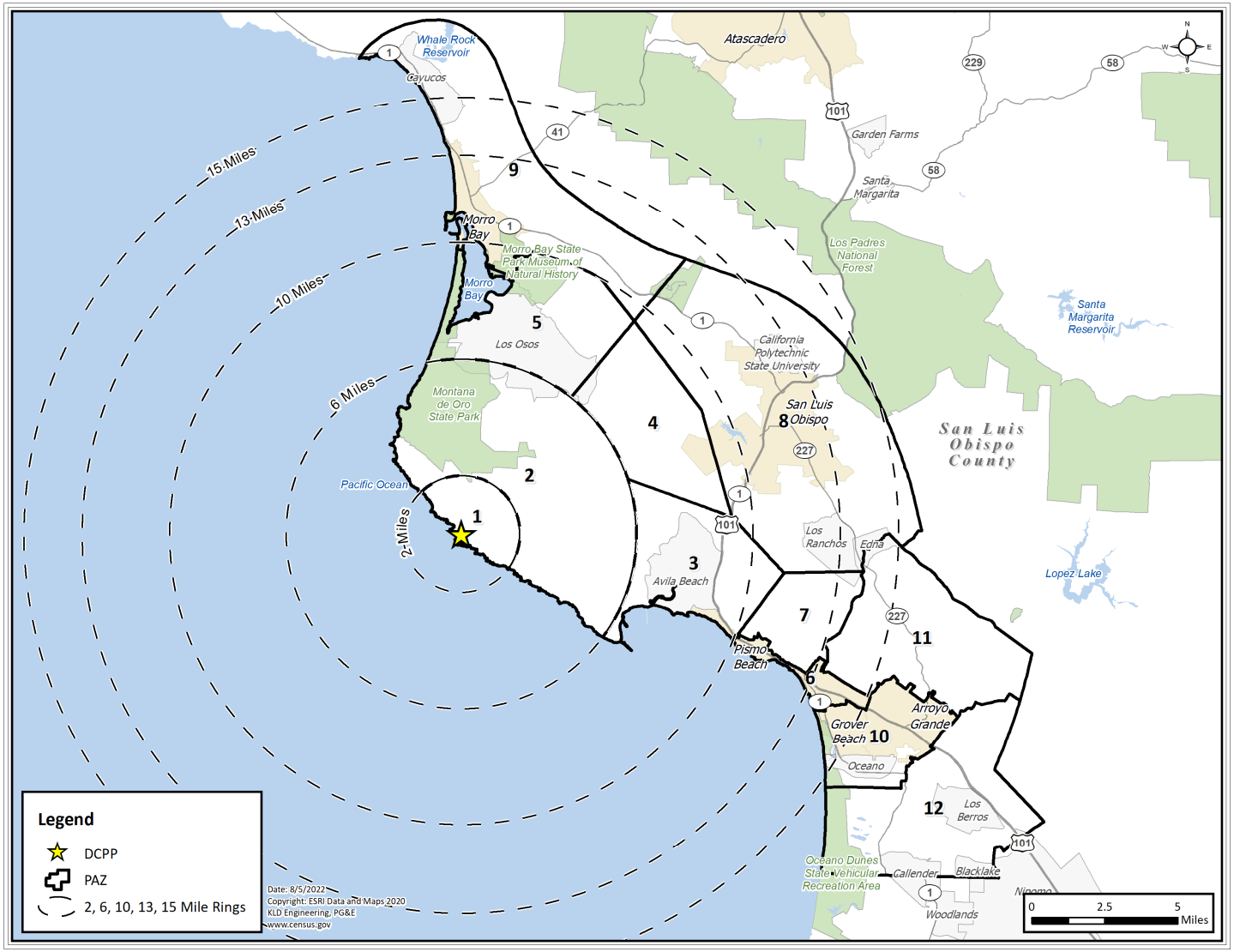


Figure 6-1. DCPP EPZ PAZs

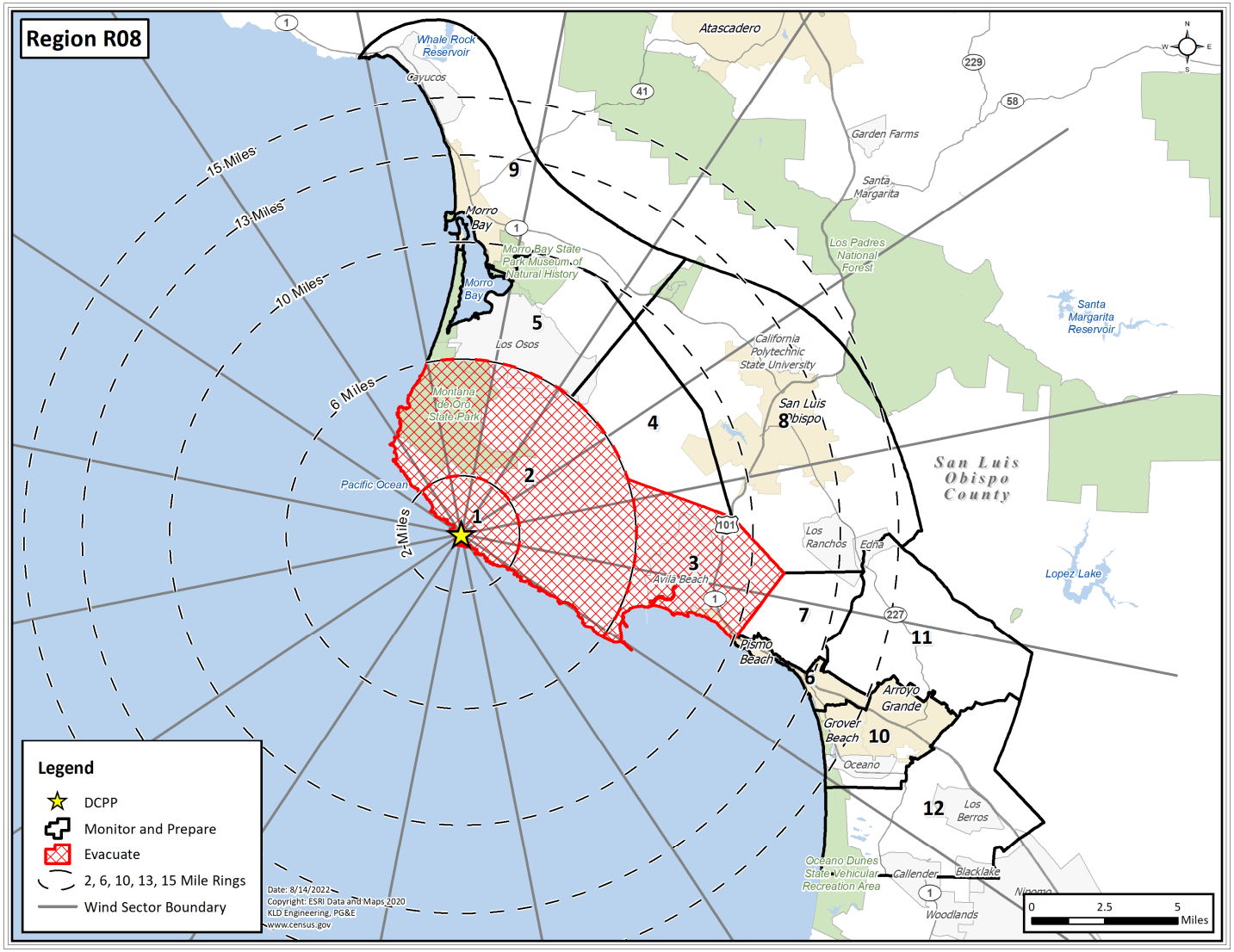


Figure H-8. Region R08

1 INTRODUCTION

This report describes the analyses undertaken and the results obtained by a study to develop Evacuation Time Estimates (ETE) for the Diablo Canyon Power Plant (DCPP), located in San Luis Obispo, California. ETE provide State and local governments with site-specific information needed for emergency planning.

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

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

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

1.1 Overview of the ETE Process

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

1. Information Gathering:
    a. Defined the scope of work in discussions with representatives from Pacific Gas and Electric Company (PG&E).
    b. Attended meetings with emergency planners from San Luis Obispo County Office of Emergency Services 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 (Public Education Zone [PEZ]).
    d. Obtained demographic data from the 2020 Census (See Section 3.1).
    e. Conducted an online demographic survey of study area 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 online demographic 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 the plant. Traffic control is applied at specified Traffic Control Points (TCP) located within and near the EPZ.
5. Used existing PAZs to define Evacuation Regions. The EPZ is partitioned into 12 Protective Action Zones (PAZs) along jurisdictional and geographic boundaries. "Regions" are groups of contiguous PAZs for which ETE are calculated. The configurations of these Regions reflect wind direction and the radial extent of the impacted area. Each Region, other than those that approximate circular areas, approximates a "key-hole section" within the EPZ as recommended by NUREG/CR-7002, Rev 1.
6. Estimated demand for transit services for persons at "Special Facilities" and for transit-dependent and access and/or functional needs 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, PG&E and from the demographic survey.
    b. Applied the procedures specified in the 2016 Highway Capacity Manual (HCM[1]) to the data acquired during the field survey, to estimate the capacity of all 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 the plant.
8. Executed the DYNEV II model to provide the estimates of evacuation routing and ETE for all residents, transients and employees ("general population") with access to private vehicles. Generated a complete set of ETE for all specified Regions and Scenarios.
9. Documented ETE in formats in accordance with NUREG/CR-7002, Rev 1.

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

10. Calculated the ETE for all transit activities including those for special facilities (schools, medical facilities, etc.), for the transit-dependent population and for access and/or functional needs population.

1.2 The Diablo Canyon Power Plant Location

The Diablo Canyon Power Plant is located along the shores of the Pacific Ocean in San Luis Obispo County, CA. The site is approximately 150 miles northwest of Los Angeles, CA and 200 miles south of San Francisco, CA. The Emergency Planning Zone (EPZ) consists of Morro Bay, Baywood-Los Osos, Arroyo Grande, Grover Beach, and San Luis Obispo. Figure 1-1 displays the area surrounding the plant. This map identifies the major cities in the area and the major roads.

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 Public Education Zone. The characteristics of each section of highway were recorded. These characteristics are shown in Table 1-2.

Video and audio recording equipment were used to capture a permanent record of the highway infrastructure. No attempt was made to meticulously measure such attributes as lane width and shoulder width; estimates of these measures based on visual observation and recorded images were considered appropriate for the purpose of estimating the capacity of highway sections. For example, Exhibit 15-7 in the HCM indicates that a reduction in lane width from 12 feet (the "base" value) to 10 feet can reduce free flow speed (FFS) by 1.1 mph – not a material difference – for two-lane highways. Exhibit 15-46 in the HCM 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. Roadway types were assigned based on the following criteria:

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

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

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

Traffic signals are either pre-timed (signal timings are fixed over time and do not change with the traffic volume on competing approaches) or are actuated (signal timings vary over time based on the changing traffic volumes on competing approaches). Actuated signals require detectors to provide the traffic data used by the signal controller to adjust the signal timings. These detectors are typically magnetic loops in the roadway, or video cameras mounted on the signal masts and pointed toward the intersection approaches. If detectors were observed on the approaches to a signalized intersection during the road survey, detailed signal timings were not collected as the timings vary with traffic volume. TCPs 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 requested from City of San Luis Obispo. These signal timings were input to the DYNEV II system used to compute ETE, as per NUREG/CR-7002 Rev 1. guidance.

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

Demographic Survey

An online demographic survey was 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.

Developing the Evacuation Time Estimates

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

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

Analytical Tools

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

DYNEV II consists of four sub-models:

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

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

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

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

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

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

The evacuation analysis procedures are based upon the need to:

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

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

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

1.4 Comparison with Prior ETE Study

Table 1-3 presents a comparison of the present ETE study with the previous ETE study (KLD TR-498, dated November 2012). The 90th percentile ETE for the Full EPZ increased by 1 hour and 5 minutes for a winter midweek midday scenario and by 45 minutes for a summer weekend midday scenario when compared with the 2012 study. The 100th percentile ETE increases by 50 minutes for a winter midweek midday scenario and 35 minutes for a summer weekend midday scenario. 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:

- The permanent resident population increased compared to the previous ETE and the number of people per vehicle stayed nearly the same. The increase in population results in more evacuating vehicles, which can increase ETE.
- The number of employees commuting into the EPZ decreased significantly (49%) due to the updated NRC criteria for major employers from 50 or more employees per shift to 200 or more employees per shift. A decrease in this quickly mobilizing population group can cause the 90th percentile ETE to increase as it will take longer to reach an evacuation of 90% of all vehicles. A decrease in the number of employee vehicles can decrease the 100th percentile ETE.
- Total transient population increased by 33%. While this can help to decrease the 90th percentile ETE, it ultimately can increase the 100th percentile ETE as there are more evacuating vehicles for this population group.
- Access control is established 30 minutes later than indicated in 2012. As a result, external traffic/through traffic increases by 62%. This increase in through traffic takes up some of the available roadway capacity on the two major evacuation routes – SH-1 and US-101. The reduction of available capacity to evacuees can increase both the 90th and 100th percentile ETEs.
- Residents without commuters take 30 minutes longer to mobilize and residents with commuters take 15 minutes longer to mobilize. This delay in trip generation will increase the 100th percentile ETE for cases wherein trip generation times dictate ETE.

The various factors that can increase the ETE explain why the 90th and 100th percentile ETE for the Full EPZ are longer in this study relative to the 2012 ETE study.

Table 1-1. Stakeholder Interaction

Stakeholder	Nature of Stakeholder Interaction
Pacific Gas and Electric emergency planning personnel	Meetings to define data requirements and set up contacts with local government agencies. Review and approval of demographic survey instrument and of key project assumptions.
San Luis Obispo County Office of Emergency Services (SLOCOES)	Meetings to define data requirements and set up contacts with local government agencies. Provided local emergency plans, special facility data. Review and approval of demographic survey instrument and of key project assumptions.

Table 1-2. Highway Characteristics

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

Table 1-3. ETE Study Comparisons

Topic	Previous ETE Study	Current ETE Study
Resident Population Basis	ArcGIS Software using 2010 US Census blocks; area ratio method used.	ArcGIS Software using 2020 US Census blocks; area ratio method used.
	Population = 147,221	Population = 152,149
Resident Population Vehicle Occupancy	2.3 persons/household, 1.3 evacuating vehicles/household yielding: 1.77 persons/vehicle.	2.7 persons/household, 1.51 evacuating vehicles/household yielding: 1.79 persons/vehicle.
Employee Population	Employee estimates based on information obtained from the US Census Bureau Longitudinal Employer-Household Dynamics, and data provided by PG&E. 1.08 employees per vehicle based on telephone survey results.	Employee estimates based on information obtained from San Luis Obispo County. 1.06 employees per vehicle based on demographic survey results.
	Employees = 18,054	Employees = 8,898
Transit-Dependent Population	Estimates based upon U.S. Census data and the results of the telephone survey. A total of 3,402 people who do not have access to a vehicle, requiring 114 buses to evacuate. An additional 553 homebound special needs persons needed special transportation to evacuate (426 required a bus, 117 required a wheelchair-accessible vehicle, and 10 required an ambulance).	Estimates based upon U.S. Census data and the results of the demographic survey. A total of 1,512 people who do not have access to a vehicle, requiring 78 buses to evacuate. An additional 554 access and functional needs population need special transportation to evacuate (444 required a bus, 100 required a wheelchair-accessible vehicle, and 10 required an ambulance).
Transient Population	Transient estimates based upon information provided about transient attractions in EPZ.	Transient estimates based upon information provided by San Luis Obispo County and the previous ETE study, supplemented by internet searches and aerial imagery where data was missing.
	Transients = 30,935	Transients = 41,056
School Population	School population based on information provided by the county and California Polytechnic State University.	School population based on information provided by San Luis Obispo County and the previous ETE study, supplemented by internet searches and aerial imagery where data was missing.
	School enrollment = 50,863	School enrollment = 52,804
	Buses required = 412	Buses required = 410

Topic	Previous ETE Study	Current ETE Study
Special Facilities Population	Special facility population based on information provided by county and local agencies within the EPZ. Correctional Facilities shelter in place.	Special facility population was based upon information provided by San Luis Obispo County and the previous ETE study, supplemented by internet searches and aerial imagery where data was missing. Correctional Facilities shelter in place.
	Current census = Correctional Facilities = 7,085 Medical Facilities = 1,692	Current census = Correctional Facilities = 7,135 Medical Facilities = 1,692
	Buses Required = 98	Buses Required = 36
	Wheelchair Bus Required = 83	Wheelchair Bus Required = 25
	Ambulances Required = 17	Ambulances Required = 20
Voluntary evacuation from within EPZ in areas outside region to be evacuated	20 percent of the population within the EPZ, but not within the Evacuation Region (see Figure 2-1)	20 percent of the population within the EPZ, but not within the Evacuation Region (see Figure 2-1)
Shadow Population/Evacuation	20% of people outside of the EPZ within the Shadow Region (see Figure 7-2)	20% of people outside of the EPZ within the Shadow Region (see Figure 7-2)
	Population = 23,613	Population = 26,765
Network Size	1,429 links; 1,035 nodes	1,771 links; 1,254 nodes
Roadway Geometric Data	Field surveys conducted in November 2010. Roads and intersections were video archived.	Field surveys conducted in October 2020. Roads and intersections were video archived.
	Road capacities based on 2010 HCM.	Road capacities based on 2016 HCM.
School Evacuation	Direct evacuation to designated Public School Relocation Center.	Direct evacuation to designated Public School Relocation Center.
Ridesharing	50 percent of transit-dependent persons will evacuate with a neighbor or friend as per NUREG/CR-7002.	50 percent of transit-dependent persons will evacuate with a neighbor or friend as per NUREG/CR-7002, Rev 1 and discussions with SLOCOES.
Trip Generation for Evacuation	Based on residential telephone survey of specific pre-trip mobilization activities:	Based on residential demographic survey of specific pre-trip mobilization activities:
	Residents with commuters returning leave between 30 and 270 minutes.	Residents with commuters returning leave between 60 and 285 minutes.
	Residents without commuters returning leave between 15 and 210 minutes.	Residents without commuters returning leave between 30 and 240 minutes.
	Employees and transients leave between 15 and 120 minutes.	Employees and transients leave between 15 and 90 minutes.

Topic	Previous ETE Study	Current ETE Study
External Traffic	Access control is established 30 minutes after the Evacuation Order.	Access control is established 60 minutes after the Evacuation Order.
	3,276 external traffic vehicles	5,318 external traffic vehicles.
Weather	Normal or Rain. The capacity and free flow speed of all links in the network are reduced by 10% in the event of rain.	Normal or Rain. The capacity and free flow speed of all links in the network are reduced by 10% in the event of rain.
Modeling	DYNEV II System – Version 4.0.4.0	DYNEV II System – Version 4.0.20.0
Special Events	July 4th Fireworks Show, occurs once a year at Avila Beach, Pismo Beach Pier, and Morro Bay Harbor.	July 4th Fireworks Show, occurs once a year at Avila Beach, Pismo Beach Pier, and Morro Bay Harbor.
	Special Event Population = 134,130 additional transients	Special Event Population = 140,725 additional transients
Evacuation Cases	26 Regions (central sector wind direction and each adjacent sector technique used) and 12 Scenarios producing 312 unique cases.	25 Regions (central sector wind direction and each adjacent sector technique used) and 12 Scenarios producing 300 unique cases.
Evacuation Time Estimates Reporting	ETE reported for 90th and 100th percentile population. Results presented by Region and Scenario.	ETE reported for 90th and 100th percentile population. Results presented by Region and Scenario.
Evacuation Time Estimates for the Full EPZ (90th percentile)	Winter Midweek Midday Good Weather: 8:05 Summer Weekend Midday Good Weather: 7:30	Winter Midweek Midday Good Weather: 9:10 Summer Weekend Midday Good Weather: 8:15
Evacuation Time Estimates for the Full EPZ (100th percentile)	Winter Midweek Midday Good Weather: 10:15 Summer Weekend Midday Good Weather: 10:15	Winter Midweek Midday Good Weather: 11:05 Summer Weekend Midday Good Weather: 10:50

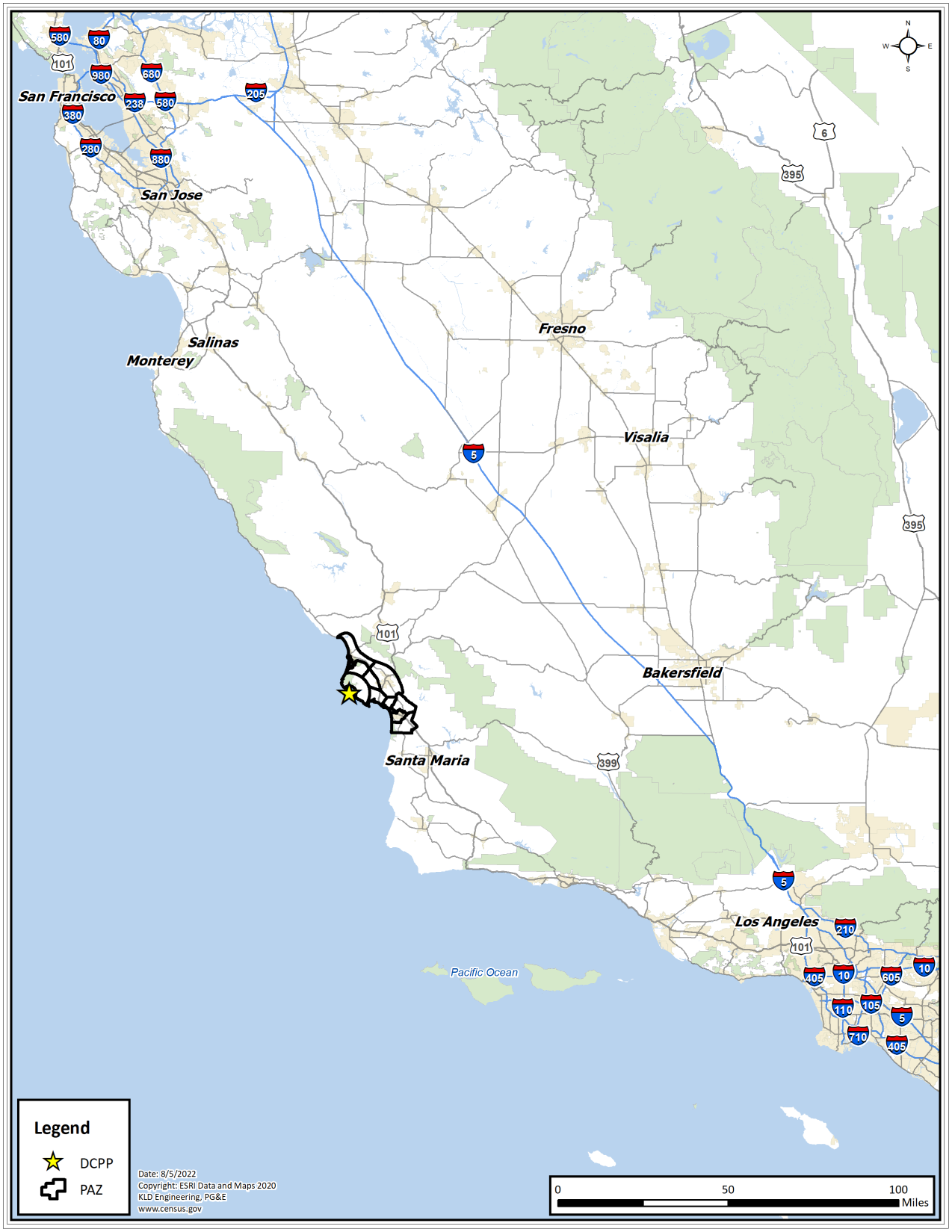


Figure 1-1. DCPP Location

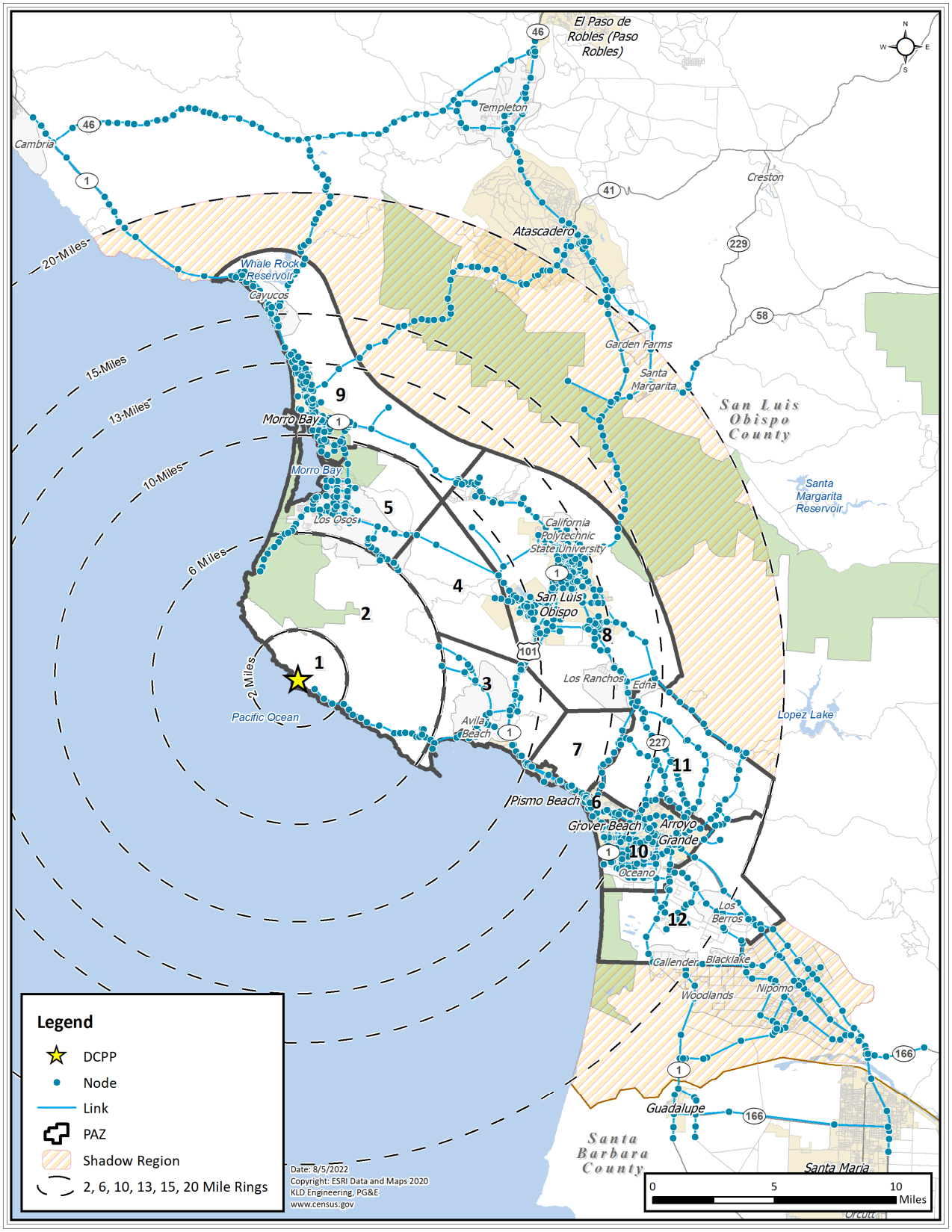


Figure 1-2. DCPP Link-Node Analysis Network

2 STUDY ESTIMATES AND ASSUMPTIONS

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

2.1 Data Estimate Assumptions

1. The permanent resident population are based on the 2020 U.S. Census population from the Census Bureau website[1]. (See Section 3.1.)
2. Estimates of employees who reside outside the Emergency Planning Zone (EPZ) and commute to work within the EPZ are based upon the data provided by San Luis Obispo County. Plant employment data is based on data provided by PG&E. (See Section 3.4.)
3. Population estimates at transient and special facilities are based on the data received from San Luis Obispo County, the previous ETE study, supplemented by internet searches and aerial imagery where data was missing.
4. The relationship between permanent resident population and evacuating vehicles was based on the results of the recent, random-sample demographic survey. Values of 2.70 persons per household and 1.51 evacuating vehicles per household was used for the permanent resident population.
5. Where data was not provided, the average household size was assumed to be the vehicle occupancy rate for transient facilities and the special event.
6. Employee vehicle occupancies are based on the results of the demographic survey; 1.06 employees per vehicle is used in the study. (See Figure F-7.) In addition, it is assumed there are two people per carpool, on average.
7. The maximum bus speed assumed within the EPZ is 55 mph based on California state laws for buses.
8. Roadway capacity estimates are based on field surveys performed in 2020 (verified by aerial imagery), and the application of the Highway Capacity Manual 2016.

2.2 Methodological Assumptions

1. The Planning Basis Assumption for the calculation of ETE is a rapidly escalating accident that requires evacuation, and includes the following[2] (as per NRC guidance):
    a. Evacuation Order is announced coincident with the siren notification.

[1] www.census.gov

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

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

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

b. Mobilization of the general population will commence within 15 minutes after siren notification.
c. ETE are measured relative to the Evacuation Order.

2. The center-point of the plant is 35° 12' 42.1" N, 120° 51' 17.9" W.
3. The DYNEV II[3] system is used to compute ETE in this study.
4. Evacuees will drive safely, travel radially away from the plant to the extent practicable given the highway network, and obey all control devices and traffic guides. All major evacuation routes are used in the analysis.
5. The existing EPZ and Protective Action Zone (PAZ) boundaries are used. See Figure 3-1.
6. The Shadow Region extends to about 20 miles to the north and northeast and 25 miles to the southeast radially from the plant or approximately 5 miles radially from the EPZ boundary, as per NRC guidance. See Figure 7-2.
7. One hundred percent (100%) of the people within the impacted keyhole will evacuate. Twenty percent (20%) of the population within the Shadow Region and within PAZ of the EPZ not advised to evacuate will voluntarily evacuate, as shown in Figure 2-1 and Figure 2-2, as per NRC guidance. Sensitivity studies explore the effect on ETE of increasing the percentage of voluntary evacuees in the Shadow Region (see Appendix M).
8. ETE are presented at the 90th and 100th percentiles, as well as in graphical and tabular format, as per NRC guidance. The percentile ETE is defined as the elapsed time from the Evacuation Order issued to a specific Region of the EPZ, to the time that Region is clear of the indicated percentile of evacuees.
9. This study does not assume that roadways are empty at the start of the first time period. Rather, there is a 60-minute initialization period (often referred to as "fill time in traffic simulation) wherein the traffic volumes from the first time period are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of the first time period depends on the scenario and the region being evacuated. See Section 3.12.
10. To account for boundary conditions beyond the study area, this study assumes a 25% reduction in capacity on two-lane roads and multi-lane highways for roadways that have traffic signals downstream. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the study area and the fact that the evacuating traffic volume is more significant than the competing traffic volume at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time. There is no reduction in capacity for freeways due to boundary conditions.

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

2.3 Assumptions on Mobilization Times

1. Trip generation time (also known as mobilization time, or the time required by evacuees to prepare for the evacuation) are based upon the results of the demographic survey.
2. One hundred percent (100%) of the EPZ population can be notified within 45 minutes, in accordance with the 2019 Federal Emergency Management Agency (FEMA) Radiological Emergency Preparedness Program Manual.
3. Commuter percentages (and percentage of residents awaiting the return of a commuter) are based on the results of the demographic survey. According to the survey results, 69% of the households in the EPZ have at least 1 commuter (see Section F.3.1.); 54% of those households with commuters will await the return of a commuter before beginning their evacuation trip (see Section F.3.2.). Therefore, 37 percent (69% x 54% = 37%) of EPZ households will await the return of a commuter, prior to beginning their evacuation trip.

2.4 Transit Dependent Assumptions

1. The percentage of transit-dependent people who will rideshare with a neighbor or friend are based on the results of the demographic survey. According to the survey results, approximately 50 percent of the transit-dependent population will rideshare to account for the homeless population based on discussions with emergency management personnel at San Luis Obispo County.
2. Transit vehicles are used to transport those without access to private vehicles:
    a. Schools and daycare centers
        i. If schools are in session, transport (buses) will evacuate students directly to the designated school relocation centers.
        ii. It is assumed that parents will pick up children at daycare facilities prior to evacuation and the time needed to perform this activity is included in the responses to the demographic survey.
        iii. For the schools that are evacuated via buses, it is assumed no school children will be picked up by their parents prior to the arrival of the buses.
        iv. Schoolchildren, if school is in session, are given priority in assigning transit vehicles.
        v. No allowance will be made for student absenteeism, typically 3 percent daily, for a conservative estimate of buses needed.
    b. Medical Facilities
        i. Buses, passenger cars, wheelchair buses, wheelchair vans and ambulances will evacuate patients at medical facilities and at any senior facilities within the EPZ, as needed.
        ii. Staff will transport medical facility patients at small medical facilities.
        iii. The percent breakdown of ambulatory, wheelchair bound, and bedridden patients was based on the data provided from San Luis Obispo County. For facilities wherein the breakdown cannot be obtained, the average

breakdowns from the facilities with data was used on the remaining medical facilities.

c. Transit-dependent permanent residents:
   i. Transit-dependent general population are evacuated from Carless Collection Points to reception center.
   ii. Access and/or functional needs population may require county assistance (ambulance, bus or wheelchair transport) to evacuate. This is considered separately from the general population ETE, as per NRC guidance.
   iii. Households with 3 or more vehicles were assumed to have no need for transit vehicles.
d. Buses are used to evacuate the inmate population at correctional facilities.
e. Analysis of the number of required round-trips ("waves") of evacuating transit vehicles is presented.
f. Transport of transit-dependent evacuees from reception centers to congregate care centers is not considered in this study.

3. Transit vehicle capacities:
   a. School buses = 70 students per bus for elementary schools and 50 students per bus for middle/high schools, based on the previous ETE study.
   b. Transit-dependent persons = 20 persons per bus, utilizing the results of the demographic survey. Pets and service animals will be accommodated in these buses, and they will occupy 0.5[4] seats on average.
   c. Ambulatory medical facility patients = 30 persons per bus.
   d. Ambulances = 2 bedridden persons (includes advanced and basic life support). This includes pets for bedridden access and/or functional needs people.
   e. Wheelchair vans = 4 wheelchair bound persons.
   f. Wheelchair buses = 15 wheelchair bound persons.
   g. Correctional facility buses = 30 inmates per bus.

4. Transit vehicles mobilization times:
   a. School and transit buses will arrive at schools and facilities to be evacuated within 120 minutes of the Evacuation Order.
   b. Transit dependent buses are mobilized when approximately 80% of residents with no commuters have completed their mobilization at 120 minutes of the Evacuation Order. Multiple waves of buses will be utilized to gather transit dependent people who mobilize more slowly.
   c. Vehicles will arrive at hospitals, medical facilities, senior living facilities, and correctional facilities to be evacuated within 90 minutes of the Evacuation Order.

5. Transit Vehicle loading times:
   a. Buses for schools and inmates are loaded in 15 minutes.

[4] It is assumed that only large pets will occupy a seat. It is assumed small pets in carriages will not occupy a full seat and can either be kept on a passengers lap or on the floor.

b. Transit Dependent buses require 1 minute of loading time per passenger.
c. Buses for hospitals and medical facilities require 1 minute of loading time per ambulatory passenger.
d. Wheelchair transport vehicles require 5 minutes of loading time per passenger.
e. Ambulances are loaded in 15 minutes per bedridden passenger.

6. It is assumed that drivers for all transit vehicles are available.

2.5 Traffic and Access Control Assumptions

1. Traffic Control Points (TCP) and Access Control Points (ACP) as defined in the approved county and state emergency plans are considered in the ETE analysis, as per NRC guidance. See Appendix G.
2. TCP and ACP are assumed to be staffed approximately 120 minutes and 60 minutes after the Evacuation Order, respectively. Earlier activation of ACP locations could delay returning commuters. It is assumed that no through traffic will enter the EPZ after this 60-minute time period.
3. It assumed that all transit vehicles and other responders entering the EPZ to support the evacuation are unhindered by personnel manning TCPs and ACPs.

2.6 Scenarios and Regions

1. A total of 12 "Scenarios" representing different temporal variations (season, time of day, day of week) and weather conditions are considered. Scenarios to be considered are defined in Table 2-1. A description of each scenario can be found in Section 6.
    a. Fourth of July Firework Shows at Avila Beach, Pismo Beach, and Morro Bay Harbor are considered as the special event (single or multi-day event that attracts a significant population into the EPZ; recommended by NRC guidance) for Scenario 11.
    b. As per NRC guidance, one segment of one of the highest volume roadways will be out of service or one lane outbound on a freeway must be closed for a roadway impact scenario. This study considers the closure of one lane on US-101 southbound for the roadway impact scenario – Scenario 12.
2. One type of adverse weather scenarios is considered. Rain may occur for either winter or summer scenarios. It is assumed that the rain begins earlier or at about the same time the Evacuation Order is issued. No weather-related reduction in the number of transients who may be present in the EPZ is assumed.

3. Adverse weather scenarios affect roadway capacity and the free flow speeds. In accordance with Table 3-1 of Revision 1 to NUREG/CR-7002 Rev. 1, this study assumes a 10% reduction in speed and capacity for rain. The factors are shown in Table 2-2.
4. It is assumed that employment is reduced slightly in the summer for vacation.
5. It is also assumed that mobilization and loading times for transit vehicles are slightly longer in adverse weather. It is assumed that mobilization times are 10 minutes longer in rain. It is assumed that loading times are 5 minutes longer for school buses and 10 minutes longer for transit buses in rain. Refer to Table 2-2.
6. Regions are defined by the underlying "keyhole" or circular configurations as specified in Section 1.4 of NUREG/CR-7002, Rev 1. These Regions, as defined, display irregular boundaries reflecting the geography of the PAZ included within these underlying configurations. All 16 cardinal and intercardinal wind direction keyhole configurations are considered. Regions to be considered are defined in Table 6-1. It is assumed that everyone within the group of PAZ forming a Region that is issued an Evacuation Order will, in fact, respond and evacuate in general accord with the planned routes. It should be noted that for Regions R18 and R19, it is assumed that PAZs 1 and 2 have already completely evacuated and there will be no evacuating vehicles from these PAZs for these regions.
7. Staged evacuation is considered as defined in NUREG/CR-7002, Rev. 1 – those people between 2 and 6 miles will shelter-in-place until 90% of the 2-Mile Region has evacuated, then they will evacuate. Additionally, staged evacuation was considered for those people between 6 and 10 miles. People between 6 and 10 miles will shelter-in-place until 90% of the 6-Mile Region has evacuated, then they will evacuate. See Regions R20 through R25 in Table 6-1.

Table 2-1. Evacuation Scenario Definitions

Scenarios	Season[5]	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	Weekend	Midday	Good	None
9	Winter	Weekend	Midday	Rain	None
10	Winter	Midweek, Weekend	Evening	Good	None
11	Summer	Midweek	Evening	Good	July 4th Firework Shows at Avila Beach, Pismo Beach, and Morro Bay Harbor
12	Summer	Midweek	Midday	Good	Lane Closure southbound on US 101

Table 2-2. Model Adjustment for Adverse Weather

Scenario	Highway Capacity*	Free Flow Speed*	Mobilization Time for General Population	Mobilization Time for Transit Vehicles	Loading Time for School Buses	Loading Time for Transit Buses[6]
Rain	90%	90%	No Effect	10-minute increase	5-minute increase	10-minute increase
*Adverse weather capacity and speed values are given as a percentage of good weather conditions. Roads are assumed to be passable.						

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

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

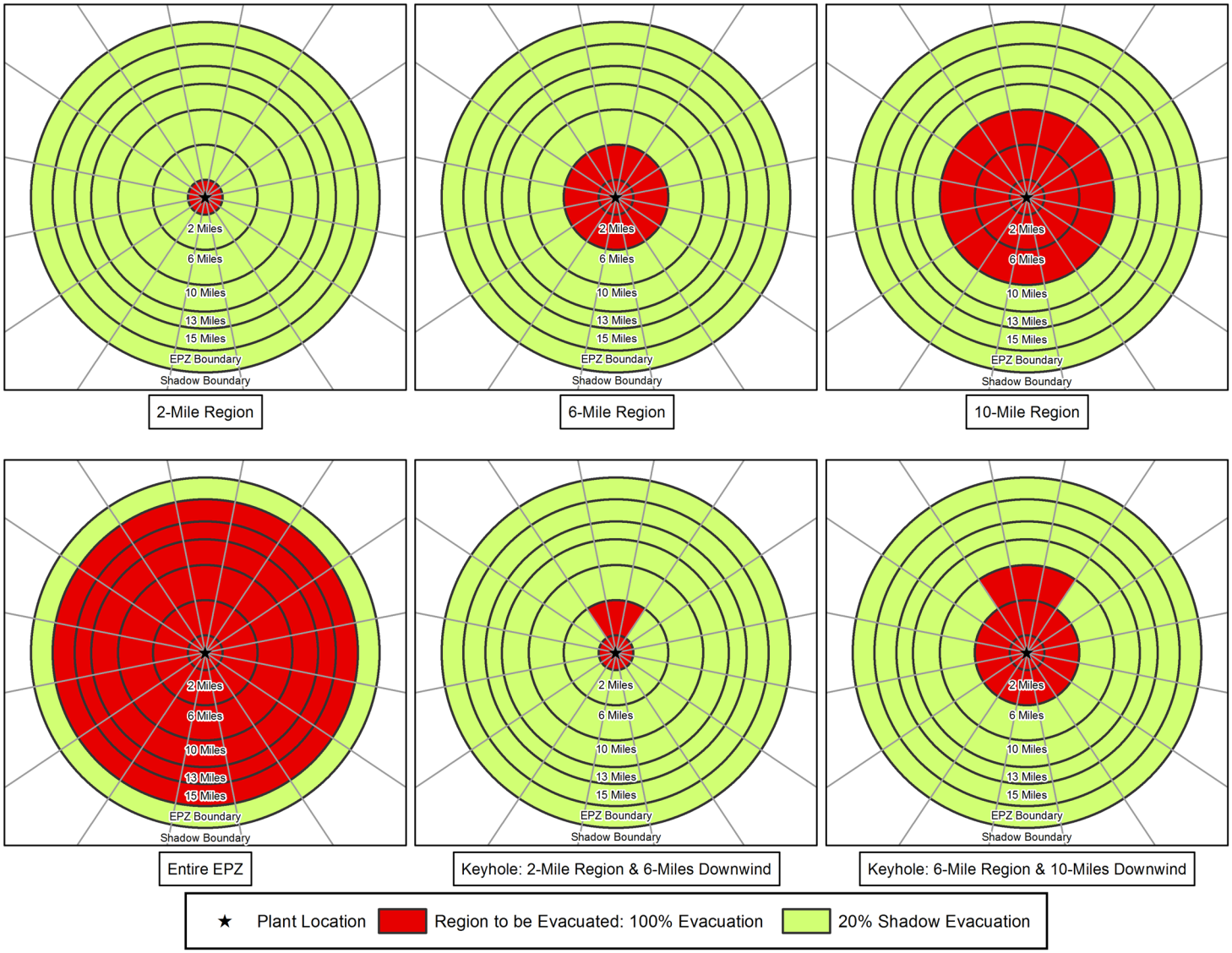


Figure 2-1. Voluntary Evacuation Methodology

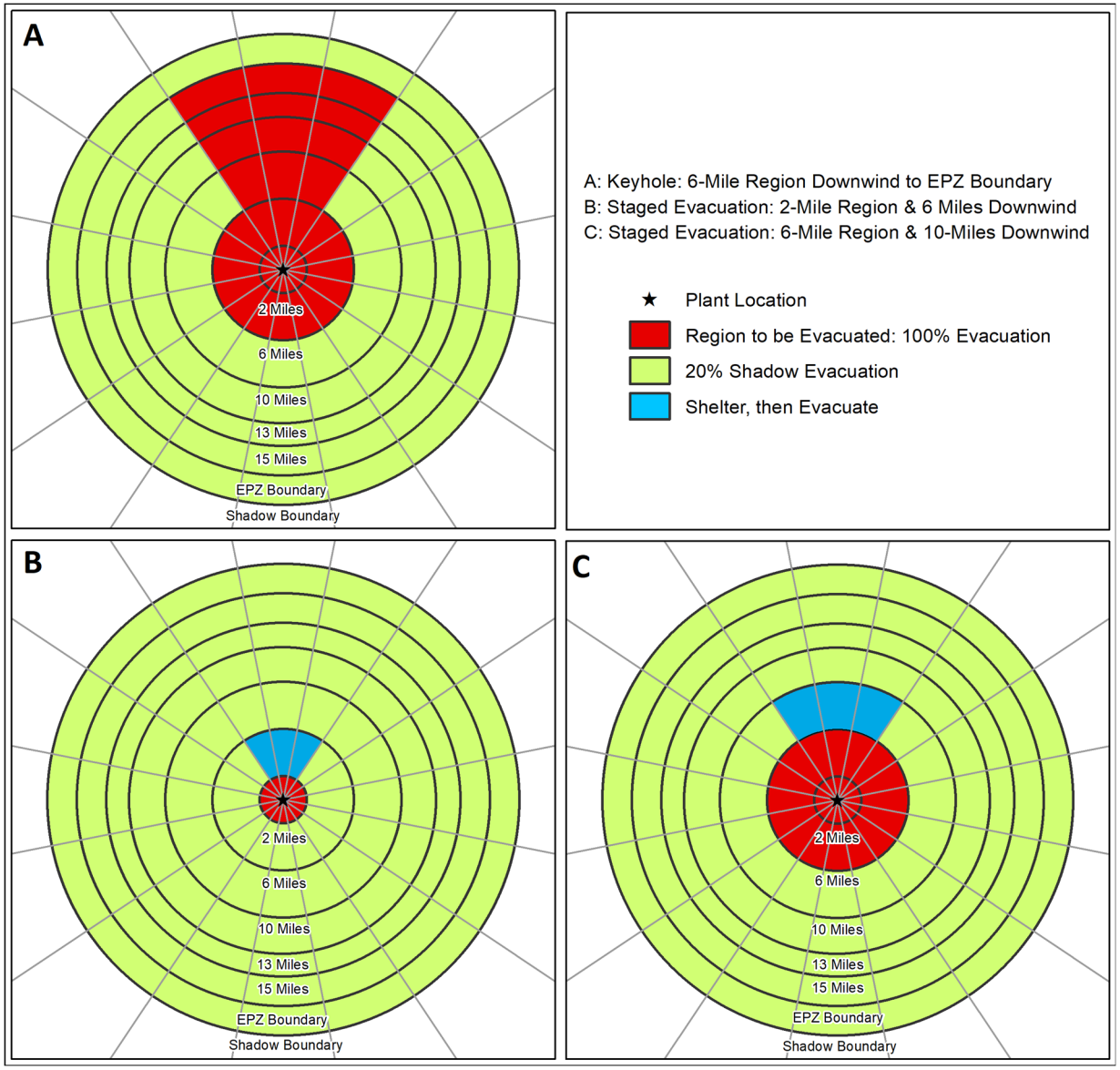


Figure 2-2. Voluntary Evacuation Methodology Continued

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

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

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

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

- A resident who works and 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 DCPP 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 work within the EPZ on a daily basis.

Estimates of the population and number of evacuating vehicles for each of the population groups are presented for each PAZ and by polar coordinate representation (population rose). The Full DCPP EPZ is subdivided into 12 PAZs. The PAZs comprising the Full EPZ are shown in Figure 3-1.

3.1 Permanent Residents

The primary source for estimating permanent population is the latest U.S. Census data with an availability date of September 16, 2021. The average household size (2.70 persons/household – See Appendix F, Sub-section F.3.1) and the number of evacuating vehicles per household (1.51 vehicles/household – See Appendix F, Sub-section F.3.2) were adapted from the demographic survey.

The permanent resident population is estimated by cutting the census block polygons by the PAZ 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 (referred to as the "area ratio method") assumes that the population is evenly distributed across a census block. Table 3-1 provides the permanent resident population within the EPZ, by PAZ for 2010 and for 2020 (based on the methodology above). As indicated, the permanent resident population within the Full EPZ has increased by 3.35% since the 2010 Census.

To estimate the number of vehicles, the 2020 permanent resident population is divided by the average household size and then multiplied by the average number of evacuating vehicles per household. Permanent resident population and vehicle estimates are presented in Table 3-2. Figure 3-2 and Figure 3-3 present the permanent resident population and permanent resident vehicle estimates by sector and distance from the plant. This "rose" was constructed using GIS software. Note, the 2020 Census includes residents living in group quarters, such as skilled nursing facilities, group homes, prisons, college/university student housing, etc. These people are either transit dependent (will not evacuate in personal vehicles) and are included in the special facility evacuation demand estimates or are included as a separate vehicle group due to their differing vehicle occupancies. To avoid double counting vehicles, the vehicle estimates for these people have been removed. The resident vehicles in Table 3-2 and Figure 3-3 have been adjusted accordingly.

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 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.

3.1.1 Colleges and Universities

There are four college/university campuses within the DCPP Full EPZ. The enrollment data for these facilities were provided by SLO County and supplemented by internet search searches and aerial imagery where the data was missing. The data/information is summarized as follows:

Cuesta College:

- Located in PAZ 8, 10.4 miles northeast of DCPP.
- According to SLO County, Cuesta College has a total enrollment of 13,000 students. Since this college does not have on-campus housing, all the students are considered commuter students.
- Based on the data obtained from the college website[1], approximately 62% of the students live within the Full EPZ and are already included in the Census data. The remaining 38% of the students live outside of the Full EPZ. As such, 4,940 (13,000 x 38%) students live outside of the Full EPZ and will evacuate in personal vehicles. The remaining students are assumed to return home and evacuate from there. Applying the commuter vehicle occupancy rate (1.06 – see Appendix F), there are 4,660 (4,940 ÷ 1.06) commuter vehicles at this college.

Laurus College:

- Located in PAZ 8, 11.1 miles east-northeast of DCPP.
- Based on the data obtained from the National Center for Education Statistics (NCES)[2], there are 88 full-time students at Laurus College. Laurus College is also a commuter college where all the students are commuter students.
- It is conservatively assumed that all the 88 students live outside of the DCPP Full EPZ. Applying the same commuter vehicle occupancy rate above, there are 83 (88 ÷ 1.06) commuter vehicles at this college.

The University of San Luis Obispo School of Law

- Located in PAZ 8, 12.2 miles east of DCPP.
- Based on the data obtained from internet[3], there are 235 students at this campus. Similar to Cuesta College and Laurus College, the University of San Luis Obispo School of Law does not provide on-campus student housing for their students. Therefore, all the students will evacuate in personal vehicles.
- Conservatively assuming all the students live outside of the Full EPZ. Applying the same commuter vehicle occupancy rate above, resulting in 222 (235 ÷ 1.06) commuter vehicles.

California Polytechnic State University:

- Located in PAZ 8, 12.6 miles east-northeast of DCPP.

[1] https://www.cuesta.edu/about/info/collegefacts.html
[2] https://nces.ed.gov/
[3] https://en.wikipedia.org/wiki/Monterey_College_of_Law

- According to SLO County, California Polytechnic State University has a total enrollment of 20,944 students.
- Based on the National Application Center (NAC)[4] database (as of December 2019), 32% of the students live on campus and 23% of the on-campus students own private vehicles. As such, there are 6,702 (20,944 x 32%) on-campus students and 14,242 (20,944 – 6,702) off-campus students. Of the 6,702 on-campus students, 1,541 (6,702 x 23%) students own private vehicles.
- The remaining 5,161 (6,702 – 1,541) on-campus students without vehicles are considered transit dependent who would rideshare with a fellow classmate or evacuate in buses. According to the demographic survey, approximately 76.5% of the transit-dependent people would rideshare with a neighbor or friend (see Appendix F, Sub-section F.3.1). As such, 3,948 (5,161 x 76.5%) students would rideshare with a fellow classmate, leaving 1,213 (5,161 – 3,948) students to be evacuated by buses. Using a capacity of 22 people per transit-dependent bus to account for luggage and pets, the total number of buses needed for this university is 56 (1,213 ÷ 22 = 56, rounded up) or 112 vehicles (1 bus equivalent to 2 passenger vehicles).
- According to SLO County, approximately 65% of the off-campus students live within the Full EPZ, which have been included as permanent residents in the Census data. As a result, 4,985 (14,242 x (1 – 65%)) commuter students travel from outside of the Full EPZ. Applying the commuter vehicle occupancy rate (1.06 – see Appendix F), there are 4,703 (4,985 ÷ 1.06) commuter vehicles.
- In summary, 6,244 (1,541 + 4,703) private vehicles and 112 buses are assigned to California Polytechnic State University.

3.2 Shadow Population

A portion of the population living outside the evacuation area in the Public Education Zone (PEZ) – identified as the Shadow Region (see Section 7.1 for additional discussion) in this study – may elect to evacuate without having been instructed to do so. Based upon NUREG/CR-7002, Rev. 1 guidance, it is assumed that 20 percent of the permanent resident population, based on U.S. Census Bureau data, in the Shadow Region will elect to evacuate.

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

[4] https://www.nationalapplicationcenter.com/,

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 transient data was provided by SLO County, supplemented by data obtained from the previous study, internet searches and aerial imagery where the data was not provided. It is assumed that transients will travel to the transient facilities as a family/household. As such, the average household size of 2.70 persons per household (see Section 3.1) was used. Overall, the average transient vehicle occupancy rates vary by facility from 1.0 person per vehicle to 6.7 persons per vehicle. Note, recreational vehicles (RVs) at campgrounds are treated as 2 passenger car equivalents due to their larger size and more sluggish operating characteristics. The DCPP Full EPZ has a number of areas and facilities that attract transients, including:

- Beaches
- Campgrounds
- Golf Courses
- Marinas
- Parks and Other Recreational Areas
- Lodging Facilities

There are four beaches within the Full EPZ. Beach data was provided by SLO County. This data includes the number of beachgoers and vehicles for each beach. A total of 2,888 transients and 746 vehicles were assigned to beaches in the Full EPZ – an average of 3.87 transients per vehicle.

There are a number of campgrounds within the Full EPZ. The number of transients and vehicles at each campground was provided by SLO County or estimated based on the number of camp sites and the average household size when the data was not provided. Note, the 2020 Census indicates the residents at Blue Heron Terrace MHP, Bay Pines Travel Trailer Park and Bay Pines Mobile Home Park are permanent residents that are included in Section 3.1; the transients at Morro Bay State Park Campground are part of the transients visiting Morro Bay State Park and are already included at the park. Therefore, no transient or transient vehicle was assigned to these four campgrounds/mobile home parks. In total, there are 12,620 transients and 6,479 vehicles for campgrounds within the Full EPZ – an average of 1.95 transients per vehicle.

There are several golf courses within the Full EPZ. The number of golfers and vehicles at each golf course was provided by SLO County or estimated based on the parking lot capacity and average household size when the data was not provided. A total of 1,506 transients and 770 vehicles were assigned to golf courses within the Full EPZ – an average of 1.96 transients per vehicle.

There are four marinas within the Full EPZ. The data for marinas was not provided. As such, the number of transients and vehicles for each marina was estimated based on the parking lot capacity and average household size when the data was not provided. Note, the transients at Morro Bay State Park Marina are part of the transients visiting Morro Bay State Park and are

already included at the park. Thus, no transient or vehicle was assigned to Morro Bay State Park Marina. In total, there are 95 transients and 35 vehicles for marinas within the Full EPZ – an average of 2.71 transients per vehicle.

There are parks and recreational areas within the Full EPZ as well. The number of transients and vehicles at each facility was provided by SLO County or estimated based on parking lot capacity and average household size when the data was not provided. A total of 4,162 transients and 1,536 vehicles have been assigned to parks and recreational areas within the Full EPZ – an average of 2.71 transients per vehicle.

There are a large number of lodging facilities within the Full EPZ. The number of transients and vehicles at each lodging facility was provided by SLO County or estimated based on the number of rooms and average household size when the data was not provided. A total of 19,785 transients in 8,223 vehicles are assigned to lodging facilities in the Full EPZ – an average of 2.41 transients per vehicle.

Appendix E summarizes the transient data that was gathered for the Full EPZ. Table E-4 through Table E-6 present the number of transients visiting recreational areas, while Table E-7 presents the number of transients at lodging facilities within the Full EPZ.

In total, there are 41,506 transients evacuating in 17,789 vehicles (an average of 2.31 transients per vehicle) in the Full EPZ. Table 3-4 presents transient population and transient vehicle estimates by PAZ. Figure 3-6 and Figure 3-7 present these data by sector and distance from the plant.

3.4 Employees

As per the NUREG/CR-7002, Rev. 1 guidance, employers with 200 or more employees working during a single shift are considered as the major employers. The employment data of the major employers was provided by SLO County. This data includes the total number of employees, the maximum number of employees per shift and the percentage of employees living outside of the Full EPZ. Note, the total number of employees is available for all the major employers, while the maximum number of employees per shift is not available for some major employers. For those employers, it is conservative to use the total number of employees as the maximum number of employees per shift.

Employees who work within the Full EPZ fall into two categories:

- Those who live and work in the Full EPZ
- Those who live outside of the Full EPZ and commute to jobs within the Full 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 Full EPZ who will evacuate along with the permanent resident population. The percentage of employees living outside of the Full EPZ was provided by SLO County and supplemented by data from the previous study where the data was not available.

To estimate the evacuating employee vehicles, a vehicle occupancy of 1.06 employees per vehicle obtained from the demographic survey (See Appendix F, Sub-section F.3.1) was used for all major employers within the Full EPZ. Table E-3 presents the employment data for each major employer. Table 3-5 summaries the employee and employee vehicle estimates commuting into the Full EPZ by PAZ. Figure 3-8 and Figure 3-9 present these data by sector.

3.5 Medical Facilities

The data was provided by San Luis Obispo County for the majority of the medical facilities within the EPZ. Where no data was provided, the data was gathered from online sources and the previous ETE study. Facilities with 8 or fewer patients were considered small-scale facilities where the residents will be evacuated with staff vehicles and thus, no transportation resources were allocated for them (see Section 2.4). Table E-2 in Appendix E summarizes the data gathered. Table 3-6 presents the census of medical facilities in the EPZ. A total of 1,342 people have been identified as living in, or being treated in, these facilities. From the medical facility data San Luis Obispo County provided, the average breakdown of ambulatory, wheelchair bound, and bedridden patients were 77%, 20% and 3%, respectively. For the facilities where no data was provided, these percent breakdowns were utilized.

The transportation requirements for the medical facility population are also presented in Table 3-6. The number of ambulance runs is determined by assuming that 2 patients can be accommodated per ambulance trip; the number of wheelchair bus runs assumes 15 wheelchairs per trip and the number of bus runs estimated assumes 30 ambulatory patients per trip.

3.6 Transit Dependent Population

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

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

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

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

- Estimates of persons requiring transit vehicles include schoolchildren. For those evacuation scenarios where children are at school when an evacuation is ordered, separate transportation is provided for the schoolchildren. The actual need for transit vehicles by residents is thereby less than the given estimates. However, estimates of transit vehicles are not reduced when schools are in session.
- It is reasonable and appropriate to consider that many transit-dependent persons will evacuate by 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. **Based on the conversations with San Luis Obispo Office of Emergency Services, we will adopt a conservative estimate that 50 percent of transit dependent persons will ride share, in accordance with NUREG/CR-7002, Rev. 1.**

- The EPZ homeless population is transit-dependent.

The estimated number of bus trips needed to service transit-dependent persons is based on an estimate of average bus occupancy of 20 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). Based on discussions with SLOCOES staff, it was determined that pets would also likely accompany passengers on the bus. The results of the demographic survey indicate approximately 64% of the EPZ population have pets (see Section F.3.2) and 96% of those people would evacuate with their pet. Hence, 61.4% (64% x 96% = 61.4%) of the transit dependent population would have pets with them. As discussed in item 3 of Section 2.4, it was assumed that pets occupy half of a (0.5) seat, on average. For a bus that normally holds 40 adults, the equivalent number of seats taken by adults, children (40/60 adult equivalents) and pets (40/80 adult equivalents x 61.4% of households with pets that would evacuate) is 20. Thus, it is estimated that the buses transporting the transit dependent population (with and without pets) can accommodate 20 passengers.

A total of 76 buses are required from a capacity standpoint. In order to service all of the transit dependent population and have at least one bus drive through each of the PAZ to pick up transit dependent people, **78 buses** are used in the ETE calculations, see Section 10 for further discussion.

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

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

Where,

A = Percent of households with commuters

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

$$P = 56{,}351 \times [0.163 \times (1.41 - 1) \times 0.6914 \times 0.4634 + 0.455 \times (2.69 - 2) \times (0.6914 \times 0.4634)^2] = 56{,}399 \times 0.0536 = 3{,}023$$

$$B = ((1 - 0.50) \times P) \div 20 = 76$$

These calculations are explained as follows:

- An EPZ population of 152,149 and average household size of 2.7 people per household gives an average number of households of 56,351.
- There were no households with 0 vehicles.

- The members of HH with 1 vehicle (16.3%) away, who are at home, equal (1.41-1). The number of HH where the commuter will not return home is equal to (56,351 x 0.163 x 0.41 x 0.6914 x 0.4634), as 69.14% of EPZ households have a commuter, 46.34% 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 (45.5%) that are away, who are at home, equal (2.69 – 2). The number of HH where neither commuter will return home is equal to 56,399 x 0.455 x 0.69 x $(0.6914 \times 0.4634)^2$. The number of persons who will evacuate by public transit or ride-share is equal to the product of these two terms (the last term is squared to represent the probability that neither commuter will return).
- Households with 3 or more vehicles are assumed to have no need for transit vehicles.
- The 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 3-7 far exceeds the number of registered transit-dependent persons in the EPZ as provided by San Luis Obispo County (discussed in Section 3.9). 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. Since there is no reliable data on the number of homeless people within the EPZ, the homeless population is assumed to be included in the estimate of transit-dependent people in Table 3-7 due to the conservative nature of the calculation.

As shown in Table 3-7 it is estimated that about 1% of the EPZ population is transit dependent. The computations contained within this section, based on the results of the demographic survey of the EPZ population, provide the basis for using a lower percentage than the suggested range (1.5 to 5 percent) discussed in NUREG/CR-7002, Rev. 1.

3.7 School Population Demand

Table 3-8 presents the school population and transportation requirements for the direct evacuation of all schools within the EPZ for the 2020-2021 school year. The majority of the information was provided by San Luis Obispo County. Online sources and the previous ETE were utilized where data was missing. The column in Table 3-8 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, Rev. 1), the estimate of buses required for school evacuation do not consider the use of these private vehicles, since the intent of schools is to evacuate all students by bus.

- 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 San Luis Obispo County introduce 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. 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.

As previously mentioned, there are four universities within the EPZ. Out of theses universities, only California Polytechnic State University provide on-campus housing. Hence, it is assumed that only California Polytechnic State University has on-campus students that might require transportation assistance during an evacuation. It is assumed that out of 5,161 on-campus students, 1,213 students would require transportation assistance.

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

3.8 Special Event

One special event is considered for the ETE study – 4th of July fireworks shows at Avila Beach (transient present at Avila Beach to observe Pismo Beach fireworks), Pismo Beach Pier, Cayucos Beach and Morro Bay Harbor. The event occurs after sundown for a couple of hours. The source of the data is San Luis Obispo County Office of Emergency Services. Avila Beach attracts 10,000 people, approximately 10% of which are local residents. Pismo Beach Pier attracts 100,000 people, of which about 9% are local residents. Morro Bay Harbor attracts 15,000 people and on average 9.5% of these visitors are local residents. Cayucos attracts 30,000 people and on average 9.5% of these visitors are local residents. The percent of local residents within each city were preserved from the previous ETE study. It was assumed that families travel to the event as a household unit in a single vehicle; therefore, the average household size of 2.7 was used for vehicle occupancy. A total of 140,725 non-local residents evacuating in about 52,120 vehicles were incorporated at various parking areas within these cities. The special event vehicle trips were generated utilizing the same mobilization distributions for transients. Public transportation is not provided for the special event and was therefore not considered.

3.9 Access and/or Functional Needs Population

SLOCOES has a combined registration for transit-dependent and access and/or functional needs population. Based on data provided, there are 554 access and/or functional needs people

within the EPZ who require transportation assistance to evacuate. There are 444 ambulatory persons, 100 wheelchair-bound persons and 10 bedridden persons.

3.10 Correctional Facilities

As detailed in Table E-5, there are three correctional facilities in the EPZ – San Luis Obispo County Jail, San Luis Obispo County Juvenile Hall and California Men's Colony. The total inmate population at these facilities is 7,135 people. During an emergency all correctional facilities will shelter in place, see Section 8.

3.11 External Traffic

Vehicles will be traveling through the EPZ (external-external trips) at the time of an accident. After the Evacuation Order is announced, these through-travelers will also evacuate. These through vehicles are assumed to travel on the major routes traversing the EPZ – US 101 and State Highway 1. It is assumed that this traffic will continue to enter the EPZ during the first 60 minutes following the Evacuation Order, while access control is being established.

Average Annual Daily Traffic (AADT) data was obtained from California State Geoportal[5] 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 30th highest hourly traffic volume of the year, measured in vehicles per hour (vph). The DHV is then multiplied by the D-Factor, which is the proportion of the DHV occurring in the peak direction of travel (also known as the directional split). A directional factor of 0.5 was used for all roads. The resulting values are the directional design hourly volumes (DDHV) and are presented in Table 3-9, for each of the routes considered. The DDHV is then multiplied by 1 hour (access control points – ACP – are assumed to be activated at 60 minutes after the Evacuation Order) to estimate the total number of external vehicles loaded on the analysis network. As indicated, there are 5,318 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 and 10) as discussed in Section 6.

3.12 Background Traffic

Section 5 discusses the time needed for the people in the EPZ to mobilize and begin their evacuation trips. As shown in Table 5-8, there are 14 time periods during which traffic is loaded on to roadways in the study area to model the mobilization time of people in the EPZ. Note, there is no traffic generated during the 15th time period, as this time period is intended to allow traffic that has already begun evacuating to clear the study area.

This study does not assume that roadways are empty at the start of Time Period 1. Rather, there is a 60-minute initialization time period (often referred to as "fill time" in traffic

[5] https://gis.data.ca.gov/

simulation) wherein the traffic volumes from Time Period 1 are loaded onto roadways in the study area. The amount of initialization/fill traffic that is on the roadways in the study area at the start of Time Period 1 depends on the scenario and the region being evacuated (see Section 6). There are 5,618 vehicles on the roadways in the study area at the end of fill time for an evacuation of the Full EPZ (Region R04) under Scenario 6 (winter, midweek, midday, good weather) conditions.

3.13 Summary of Demand

A summary of population and vehicle demand is summarized in Table 3-10 and Table 3-11, respectively. This summary includes all population groups described in this section. Additional population groups – transit-dependent, medical facility and school population – are described in greater detail in Section 8. A total of 411,512 people and 175,979 vehicles are considered in this study.

Table 3-1. EPZ Permanent Resident Population

PAZ	2010 Population	2020 Population
1	0	0
2	168	160
3	2,736	2,846
4	713	521
5	14,217	14,485
6	6,562	7,170
7	281	85
8	60,962	63,286
9	13,126	13,733
10	37,476	38,380
11	4,205	4,454
12	6,775	7,029
EPZ TOTAL:	**147,221**	**152,149**
EPZ Population Growth (2010-2020):		**3.35%**

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

PAZ	2020 Population	2020 Resident Vehicles
1	0	0
2	160	89
3	2,846	1,588
4	521	291
5	14,485	8,061
6	7,170	4,000
7	85	49
8	63,286	27,338
9	13,733	7,485
10	38,380	21,255
11	4,454	2,482
12	7,029	3,909
EPZ TOTAL:	**152,149**	**76,547**

Table 3-3. Shadow Population and Vehicles by Sector

Sector	2020 Population	Evacuating Vehicles
N	135	75
NNE	2,059	1,155
NE	2,432	1,347
ENE	132	53
E	426	209
ESE	12,644	7,057
SE	8,877	4,958
SSE	0	0
S	0	0
SSW	0	0
SW	0	0
WSW	0	0
W	0	0
WNW	0	0
NW	0	0
NNW	60	34
TOTAL:	**26,765**	**14,888**

Table 3-4. Summary of Transients and Transient Vehicles

PAZ	Transients	Transient Vehicles
1	0	0
2	870	324
3	6,164	2,524
4	0	0
5	688	305
6	8,279	3,351
7	0	0
8	7,638	3,559
9	6,512	2,455
10	10,423	5,081
11	18	7
12	464	183
EPZ TOTAL:	**41,056**	**17,789**

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

PAZ	Employees	Employee Vehicles
1	575	542
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	0	0
8	8,096	7,635
9	612	577
10	153	144
11	0	0
12	0	0
EPZ TOTAL:	**9,436**	**8,898**

Table 3-6. Medical Facility Transit Demand

PAZ	Facility Name	Municipality	Capacity	Current Census	Ambu-latory	Wheel-chair Bound	Bed-ridden	Bus Runs	Wheel-chair Bus Runs	Ambulance Runs
San Luis Obispo County										
5	Sea Gardens	Baywood-Los Osos	6	6	5	1	0	0	0	0
5	Rose Garden II	Los Osos	5	5	4	1	0	0	0	0
5	Pacific Heights Residential	Los Osos	5	4	3	1	0	0	0	0
5	Sunrise Terrace RCFE VI	Los Osos	6	4	3	1	0	0	0	0
5	Bay Osos RCFE III	Los Osos	6	6	5	1	0	0	0	0
5	Los Osos Residential Care II	Los Osos	6	4	3	1	0	0	0	0
5	Jaj Residential Care	Los Osos	6	4	3	1	0	0	0	0
5	Sunrise Terrace RCFE V	Los Osos	6	4	3	1	0	0	0	0
5	Sachele Senior Guest Home III LLC	Los Osos	6	4	3	1	0	0	0	0
5	M&L South Bay MaxiCare	Los Osos	6	4	3	1	0	0	0	0
5	Bay Osos RCFE II	Los Osos	6	4	3	1	0	0	0	0
5	Bay Osos RCFE I	Baywood-Los Osos	6	4	3	1	0	0	0	0
5	Los Osos Residential Care I	Los Osos	6	4	3	1	0	0	0	0
5	Jaj Residential Care II	Los Osos	6	6	5	1	0	0	0	0
5	Sunrise Terrace RCFE VII	Los Osos	6	4	3	1	0	0	0	0
5	Welcome Home II	Baywood-Los Osos	6	4	3	1	0	0	0	0
5	Baywood Manor RCFE II	Los Osos	6	4	3	1	0	0	0	0
5	Baywood Manor RCFE	Los Osos	6	4	3	1	0	0	0	0
5	Orchid Garden Residential Care	Los Osos	4	3	2	1	0	0	0	0
5	Southbay Maxi Care	Los Osos	6	4	3	1	0	0	0	0
5	Caluya's Residential Care	Los Osos	4	4	3	1	0	0	0	0
5	Caluya's Residential Care II	Los Osos	4	3	2	1	0	0	0	0
8	Sunrise Terrace RCFE IV	San Luis Obispo	6	4	3	1	0	0	0	0
8	Greenbrook Elderly Care	San Luis Obispo	5	5	4	1	0	0	0	0

PAZ	Facility Name	Municipality	Capacity	Current Census	Ambu-latory	Wheel-chair Bound	Bed-ridden	Bus Runs	Wheel-chair Bus Runs	Ambulance Runs
8	Valley Vista Residential Care	San Luis Obispo	6	4	3	1	0	0	0	0
8	Sunrise Terrace RCFE III	San Luis Obispo	6	4	3	1	0	0	0	0
8	Miriam's Place	San Luis Obispo	6	4	3	1	0	0	0	0
8	Singletree Caring Hands	San Luis Obispo	6	4	3	1	0	0	0	0
8	Sunrise Terrace RCFE I	San Luis Obispo	6	4	3	1	0	0	0	0
8	Sunrise Terrace RCFE II	San Luis Obispo	6	4	3	1	0	0	0	0
8	Valley Vista Residential Care III	San Luis Obispo	6	4	3	1	0	0	0	0
8	Valley Vista Residential Care II	San Luis Obispo	6	4	3	1	0	0	0	0
8	Madonna Cottage	San Luis Obispo	6	6	5	1	0	0	0	0
8	The Residence	San Luis Obispo	6	4	3	1	0	0	0	0
8	The Park Grove	San Luis Obispo	6	4	3	1	0	0	0	0
8	The Residence IV	San Luis Obispo	6	4	3	1	0	0	0	0
8	Avila Senior Living SLO	San Luis Obispo	11	8	6	2	0	1	1	0
8	Welcome Home Residential	San Luis Obispo	6	4	3	1	0	0	0	0
8	Vista Rosita Elder Care	San Luis Obispo	6	4	3	1	0	0	0	0
8	San Luis Residential Care	San Luis Obispo	6	6	5	1	0	0	0	0
8	Vista Rosa	San Luis Obispo	25	19	14	4	1	1	1	1
8	Foothills Residential Care	San Luis Obispo	6	4	3	1	0	0	0	0
8	Garden Creek Assisted Living	San Luis Obispo	72	54	41	11	2	2	1	1
8	Casa de Vida	San Luis Obispo	59	36	28	7	1	1	1	1
8	Sierra Vista Regional Medical Center	San Luis Obispo	162	100	77	21	2	3	2	1
8	Bob and Corky's Care Home III	San Luis Obispo	6	4	3	1	0	0	0	0
8	French Hospital Medical Center	San Luis Obispo	98	35	27	7	1	1	1	1
8	Bob and Corky's Care Home IV	San Luis Obispo	6	4	3	1	0	0	0	0
8	Bob and Corky's Care Home	San Luis Obispo	6	4	3	1	0	0	0	0
8	San Luis Obispo Mental Health	San Luis Obispo	16	10	8	2	0	1	1	0
8	The Village at Sydney Creek	San Luis Obispo	84	63	48	13	2	2	1	1

PAZ	Facility Name	Municipality	Capacity	Current Census	Ambu-latory	Wheel-chair Bound	Bed-ridden	Bus Runs	Wheel-chair Bus Runs	Ambulance Runs
8	Bella Vista Transitional Care	San Luis Obispo	162	122	94	24	4	4	2	2
8	Mission View Health Center	San Luis Obispo	161	121	93	24	4	4	2	2
8	Anna's Gardens	San Luis Obispo	8	6	5	1	0	0	0	0
8	Chateau Rose	San Luis Obispo	6	4	3	1	0	0	0	0
8	Bob and Corky's Care Home V	San Luis Obispo	6	4	3	1	0	0	0	0
9	Garden House	Morro Bay	15	11	9	2	0	1	1	0
9	Casa De Flores	Morro Bay	120	90	69	18	3	3	2	2
9	Bayside Care Center	Morro Bay	145	109	84	22	3	3	2	2
10	Anna's Gardens	Grover Beach	6	6	5	1	0	0	0	0
10	Get Total TLC	Grover Beach	6	6	5	1	0	0	0	0
10	Family Care Home	Grover Beach	6	6	5	1	0	0	0	0
10	Full Circle Residence I	Grover Beach	4	4	3	1	0	0	0	0
10	Golden Sunrise	Grover Beach	5	5	4	1	0	0	0	0
10	Family Home Care II	Grover Beach	6	6	5	1	0	0	0	0
10	Parkview Village II	Grover Beach	6	6	5	1	0	0	0	0
10	La Serena Residence	Grover Beach	4	4	3	1	0	0	0	0
10	Heritage Residence	Grover Beach	4	4	3	1	0	0	0	0
10	Full Circle Residence II	Arroyo Grande	6	4	3	1	0	0	0	0
10	Five Cities Residence	Arroyo Grande	6	4	3	1	0	0	0	0
10	Parkview Village	Arroyo Grande	5	4	3	1	0	0	0	0
10	Bella Vita Senior Living	Arroyo Grande	6	4	3	1	0	0	0	0
10	Wyndham Residence	Arroyo Grande	72	54	41	11	2	2	1	1
10	Arroyo Grande Care Center	Arroyo Grande	99	74	57	15	2	2	1	1
10	Sacred Heart Residential Care Facility	Arroyo Grande	6	6	5	1	0	0	0	0
10	Alder House	Arroyo Grande	32	24	18	5	1	1	1	1
10	Graceful Living 2	Arroyo Grande	6	4	3	1	0	0	0	0
10	Arroyo Grande Community Hospital	Arroyo Grande	84	76	58	16	2	2	2	1

PAZ	Facility Name	Municipality	Capacity	Current Census	Ambu-latory	Wheel-chair Bound	Bed-ridden	Bus Runs	Wheel-chair Bus Runs	Ambulance Runs
10	Graceful Living	Arroyo Grande	6	4	3	1	0	0	0	0
10	Hillside Villa Retirement Home	Arroyo Grande	6	4	3	1	0	0	0	0
10	Hillside Villa Retirement Home II	Arroyo Grande	6	4	3	1	0	0	0	0
11	Edna Rose Residence	San Luis Obispo	6	6	5	1	0	0	0	0
11	Oak Park Manor Assisted Living	Arroyo Grande	32	24	18	5	1	1	1	1
12	Cypress Ridge Home Care	Arroyo Grande	6	4	3	1	0	0	0	0
12	Cypress Garden Home Care	Arroyo Grande	6	4	3	1	0	0	0	0
12	Casa Rosa Elder Care	Arroyo Grande	22	17	13	3	1	1	1	1
		EPZ TOTAL:	**1,858**	**1,342**	**1,031**	**279**	**32**	**36**	**25**	**20**

Table 3-7. Transit-Dependent Population Estimates

2020 Study Area 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						
152,149	0	1.41	2.69	56,351	0.0%	16.3%	45.5%	69.14%	46.34%	3,023	50.0%	1,512	1.0%

Table 3-8. School Population Demand Estimates

PAZ	School Name	Enrollment	Buses Required
3	Bellevue-Santa Fe Charter School	156	3
5	Heartland Christian Academy	20	1
5	Monarch Grove Elementary School	278	4
5	Manzanita School	24	1
5	Baywood Elementary School	358	6
5	Los Osos Middle School	536	11
6	Shell Beach Elementary School	309	5
6	Judkins Middle School	460	10
8	Discovery House Montessori	16	1
8	Laguna Middle School	678	14
8	Christ Classical School	120	3
8	Pacific Beach High School	71	2
8	San Luis Community School	50	1
8	C. L. Smith Elementary School	410	6
8	Montessori Children's School	57	1
8	Cuesta College	13,000	0
8	Grizzly Challenge Charter School	225	5
8	Laurus College	88	0
8	Bishop's Peak Elementary School	380	6
8	Old Mission School	263	6
8	Pacheco Elementary School	505	8
8	Mission College Preparatory Catholic High School	350	7
8	Hawthorne Elementary School	347	5
8	Christian Day School	45	1
8	The University of San Luis Obispo School of Law	235	0
8	San Luis Obispo Christian School	43	1
8	Sinsheimer Elementary School	380	6
8	California Polytechnic State University	20,944	56
8	San Luis Obispo High School	1447	29

PAZ	School Name	Enrollment	Buses Required
8	Charles E. Teach Elementary School	176	3
8	Chris Jespersen	15	1
8	Olive Grove Charter School	75	2
8	San Luis Obispo Classical Academy	260	6
8	Los Ranchos Elementary School	452	7
9	Rancho El Chorro Outdoor School	160	4
9	Loma Vista Community School	90	2
9	Morro Bay High School	848	17
9	Del Mar Elementary School	315	5
9	Cayucos Elementary School	220	4
10	Grover Heights Elementary School	439	7
10	Grover Beach Elementary School	506	8
10	Dandy Lion Montessori School	15	1
10	Highland Preparatory School	10	1
10	Oceano Elementary School	465	7
10	Ocean View Elementary School	558	8
10	Lucia Mar Adult School	-	0
10	Lopez Continuation High School	105	3
10	Coastal Christian High School	274	6
10	Fairgrove Elementary School	462	7
10	Saint Patrick's School	275	6
10	Arroyo Grande Montessori	23	1
10	Harloe Elementary School	632	10
10	Valley View Adventist Academy	66	2
10	Lighthouse Christian School	38	1
10	Arroyo Grande High School	2174	44
10	Paulding Middle School	656	14
11	Coastal Christian School	196	4
11	Branch Elementary School	330	5
12	Lopez High School	137	3

PAZ	School Name	Enrollment	Buses Required
12	Pacific View Academy	517	11
12	Mesa Middle School	520	11
	TOTAL:	**52,804**	**410**

Table 3-9. DCPP EPZ External Traffic

Up Node	Down Node	Road Name	Direction	AADT[5]	K-Factor[6]	D-Factor[6]	Hourly Volume	External Traffic
8005	5	US 101	Southbound	46,500	0.107	0.5	2,488	2,488
8046	46	US 101	Northbound	46,500	0.107	0.5	2,488	2,488
8074	74	SH-1	Southbound	5,800	0.118	0.5	342	342
							TOTAL:	5,318

[6] HCM 2016

Table 3-10. Summary of Population Demand[7]

PAZ	Residents	Transit-Dependent	Transients	Employees	Special Facilities[8]	Universities	Schools	Special Event	Shadow Population[9]	External Traffic	Total
1	0	0	0	575	0	0	0	0	0	0	575
2	160	2	870	0	0	0	0	0	0	0	1,032
3	2,846	28	6,164	0	0	0	156	9,000	0	0	18,194
4	521	5	0	0	0	0	0	0	0	0	526
5	14,485	144	688	0	93	0	1,216	0	0	0	16,626
6	7,170	71	8,279	0	0	0	769	91,000	0	0	107,289
7	85	1	0	0	0	0	0	0	0	0	86
8	63,286	630	7,638	8,096	7,806[10]	34,267	6,365	0	0	0	128,088
9	13,733	136	6,512	612	210	0	1,633	40,725	0	0	63,561
10	38,380	381	10,423	153	313	0	6,698	0	0	0	56,348
11	4,454	44	18	0	30	0	526	0	0	0	5,072
12	7,029	70	464	0	25	0	1,174	0	0	0	8,762
Shadow Region	0	0	0	0	0	0	0	0	5,353	0	5,353
TOTAL:	**152,149**	**1,512**	**41,056**	**9,436**	**8,477**	**34,267**	**18,537**	**140,725**	**5,353**	**0**	**411,512**

[7] Since the spatial distribution of the access and/or functional needs population is unknown, they are not included in this table.
[8] Special Facilities includes both medical facilities and correctional facilities.
[9] Shadow Population has been reduced to 20%. Refer to Figure 2-1 for additional information.
[10] Includes 7,135 inmates at correctional facilities.

Table 3-11. Summary of Vehicle Demand[11]

PAZ	Residents	Transit-Dependent[12]	Transients	Employees	Medical Facilities[13]	Universities	Schools	Special Event	Shadow Population	External Traffic	Total
1	0	0	0	542	0	0	0	0	0	0	542
2	89	0	324	0	0	0	0	0	0	0	413
3	1,588	16	2,524	0	0	0	6	3,334	0	0	7,468
4	291	0	0	0	0	0	0	0	0	0	291
5	8,061	28	305	0	0	0	46	0	0	0	8,440
6	4,000	0	3,351	0	0	0	30	33,704	0	0	41,085
7	49	0	0	0	0	0	0	0	0	0	49
8	27,338	66	3,559	7,635	76	11,209	354	0	0	0	50,237
9	7,485	0	2,455	577	28	0	64	15,084	0	0	25,693
10	21,255	46	5,081	144	28	0	252	0	0	0	26,806
11	2,482	0	7	0	5	0	18	0	0	0	2,512
12	3,909	0	183	0	5	0	50	0	0	0	4,147
Shadow Region	0	0	0	0	0	0	0	0	2,978	5,318	8,296
TOTAL:	**76,547**	**156**	**17,789**	**8,898**	**142**	**11,209**	**820**	**52,122**	**2,978**	**5,318**	**175,979**

[11] Since the spatial distribution of the access and/or functional needs population is unknown, they are not included in this table.
[12] Buses evacuating transit-dependent residents are represented as two passenger vehicles. Refer to Section 3.6 and Section 8 for additional information.
[13] Buses and wheelchair buses are represented as two passenger vehicles. Refer to Section 3.5 and Section 8 for additional information. Note that correctional facilities are not included here as they shelter in place. See Section 3.10.

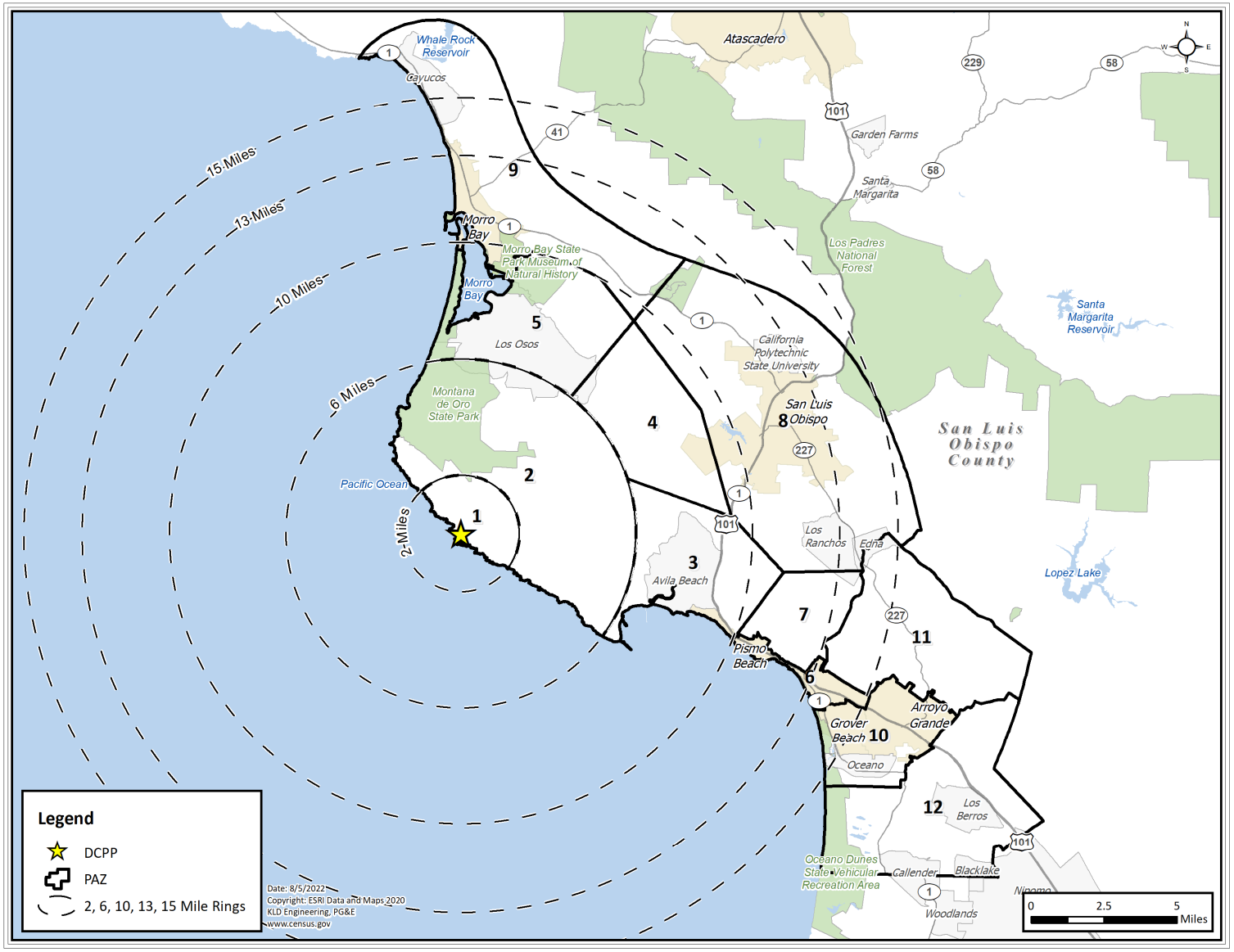
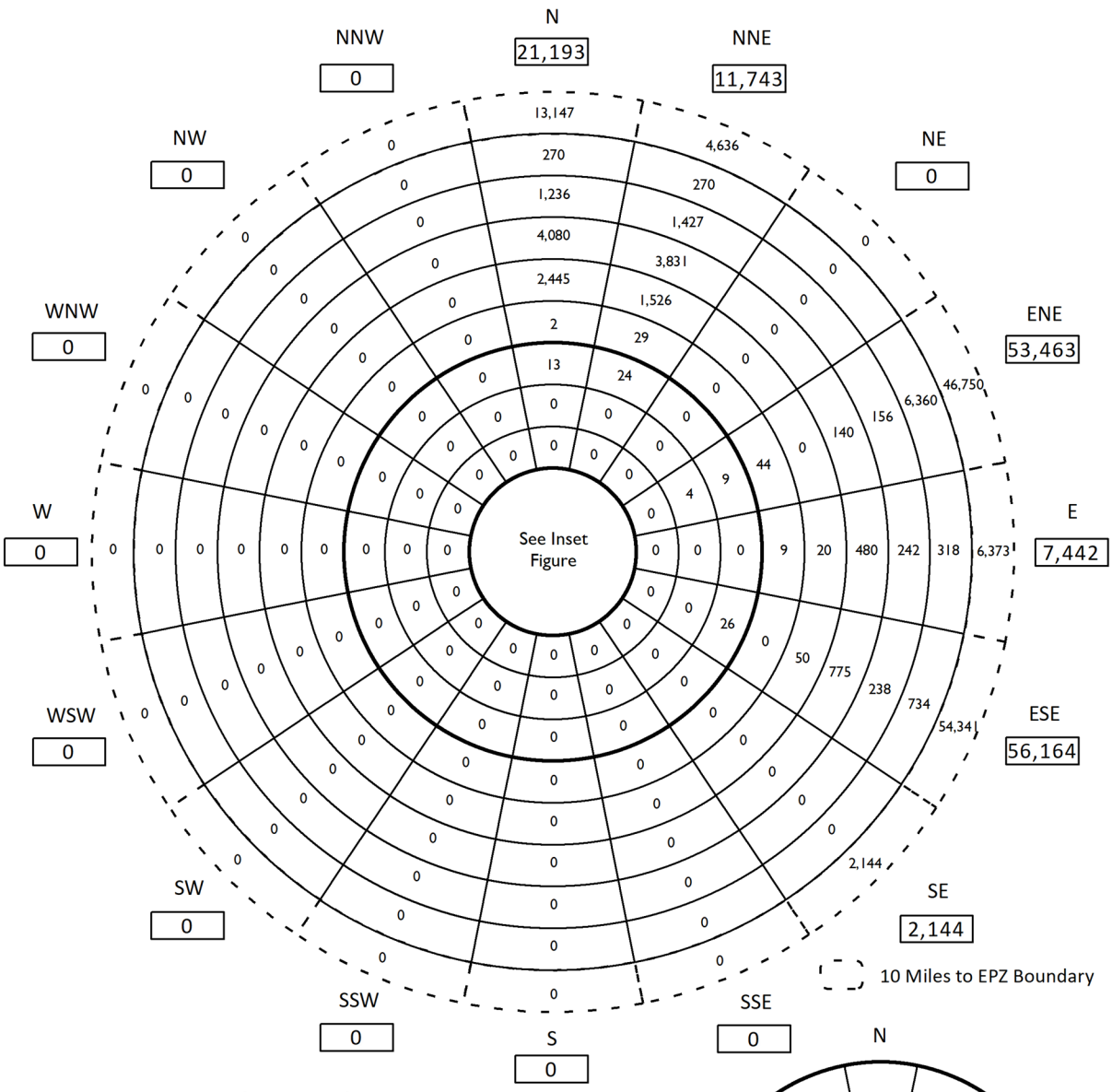


Figure 3-1. PAZs Comprising the DCPP EPZ



2020 Permanent Resident Population

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	0	0
2 - 3	0	0
3 - 4	4	4
4 - 5	72	76
5 - 6	84	160
6 - 7	4,041	4,201
7 - 8	9,306	13,507
8 - 9	3,299	16,806
9 - 10	7,952	24,758
10 - EPZ	127,391	152,149
	Total:	152,149

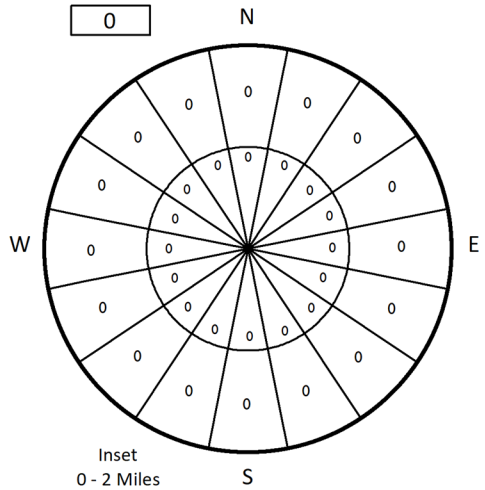
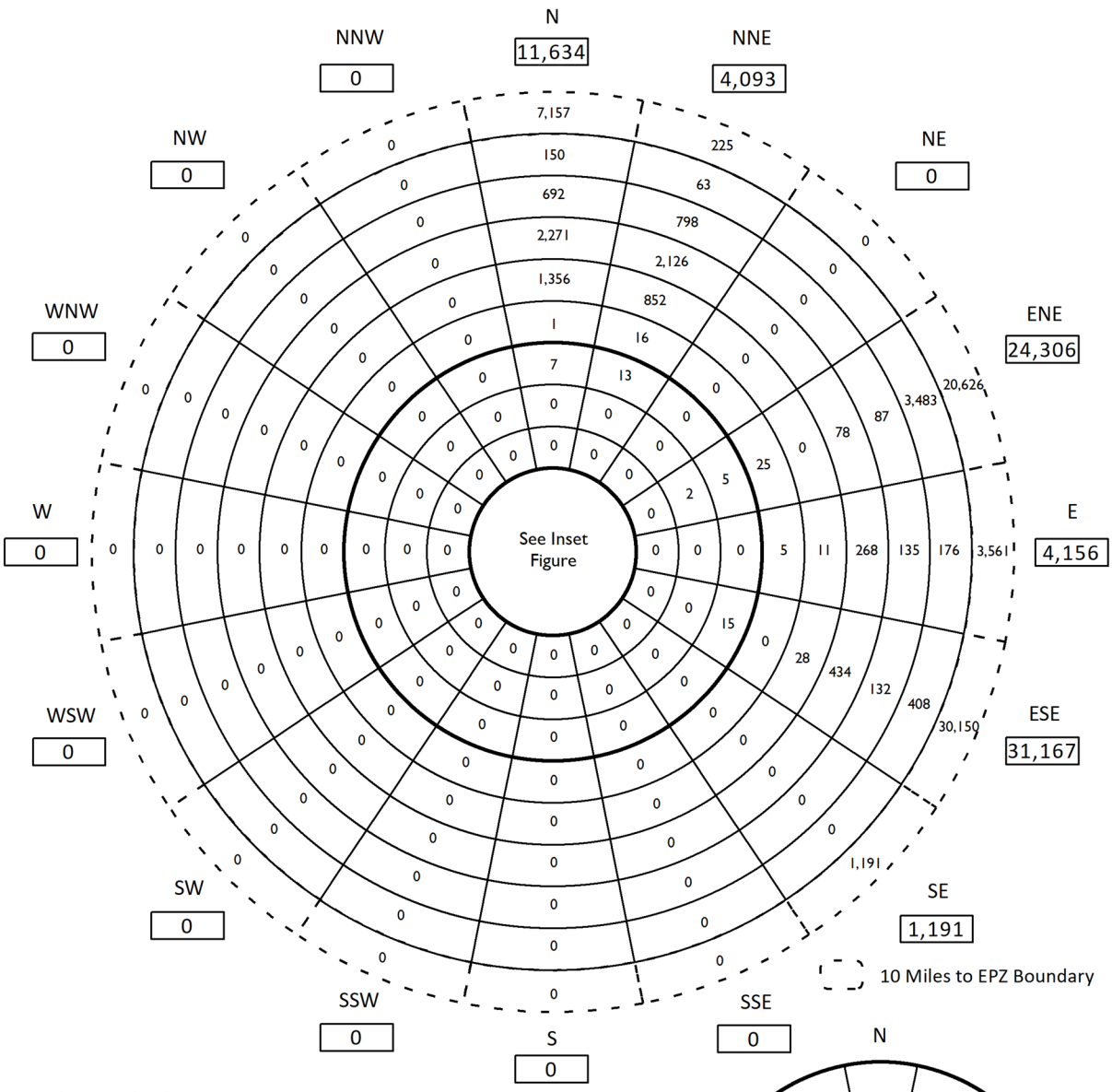


Figure 3-2. Permanent Resident Population by Sector



Resident Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	0	0
2 - 3	0	0
3 - 4	2	2
4 - 5	40	42
5 - 6	47	89
6 - 7	2,247	2,336
7 - 8	5,177	7,513
8 - 9	1,844	9,357
9 - 10	4,280	13,637
10 - EPZ	62,910	76,547
	Total:	76,547

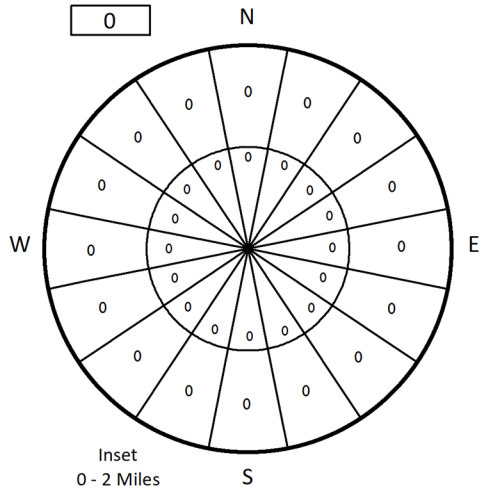
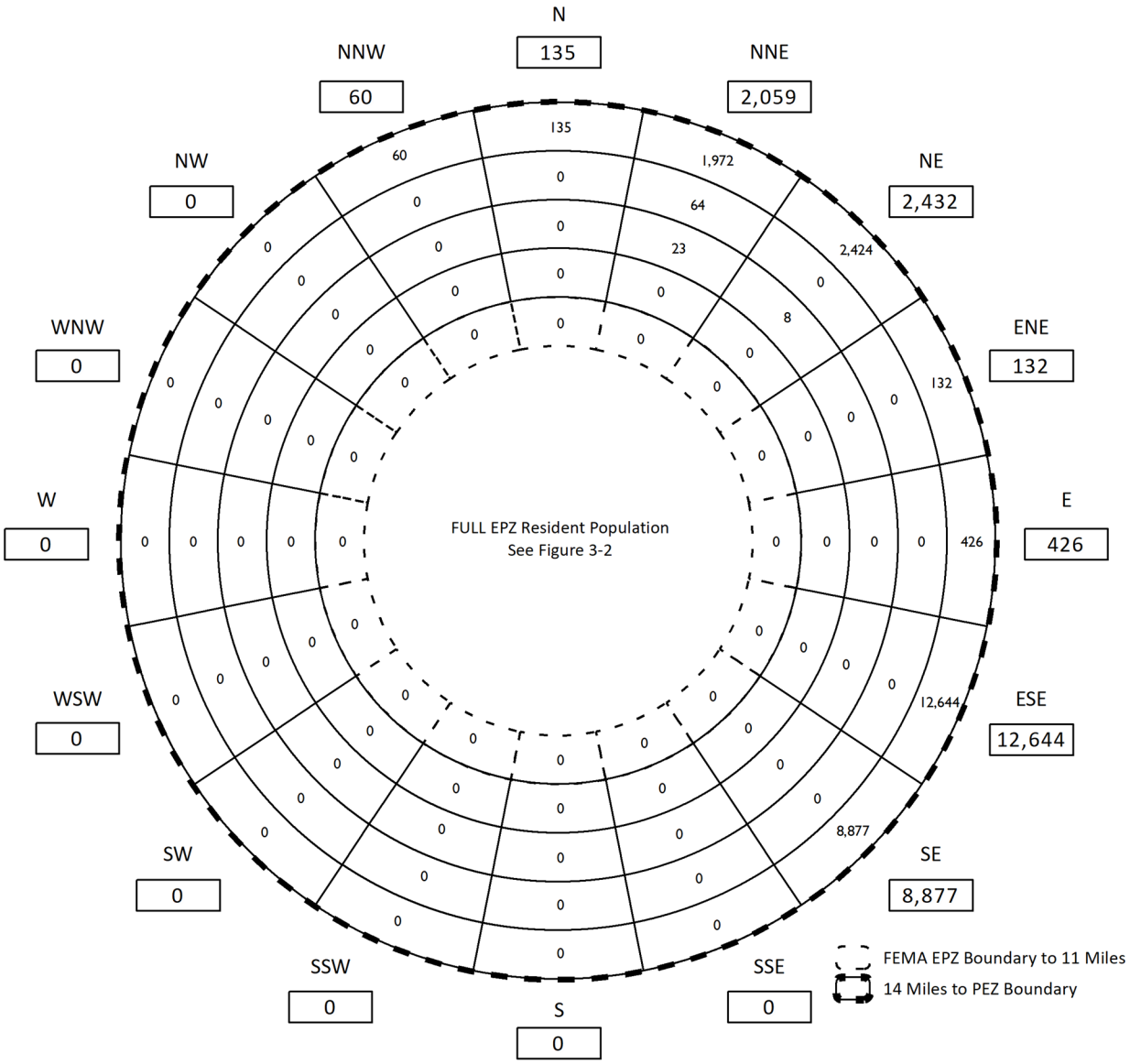


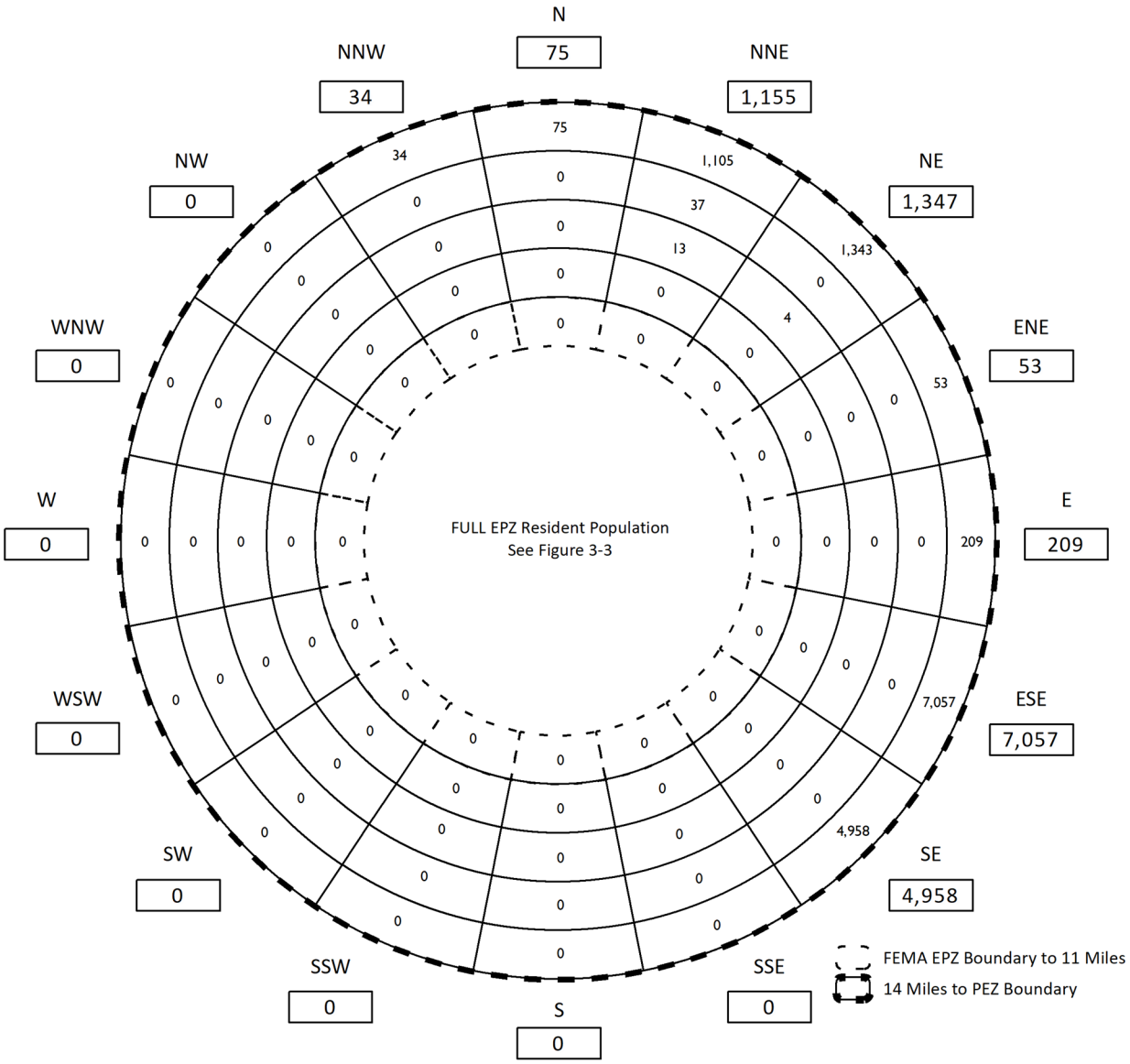
Figure 3-3. Permanent Resident Vehicles by Sector



2020 Shadow Population

Miles	Subtotal by Ring	Cumulative Total
EPZ - 11	0	0
11 - 12	0	0
12 - 13	31	31
13 - 14	64	95
14 - PEZ	26,670	26,765
	Total:	26,765

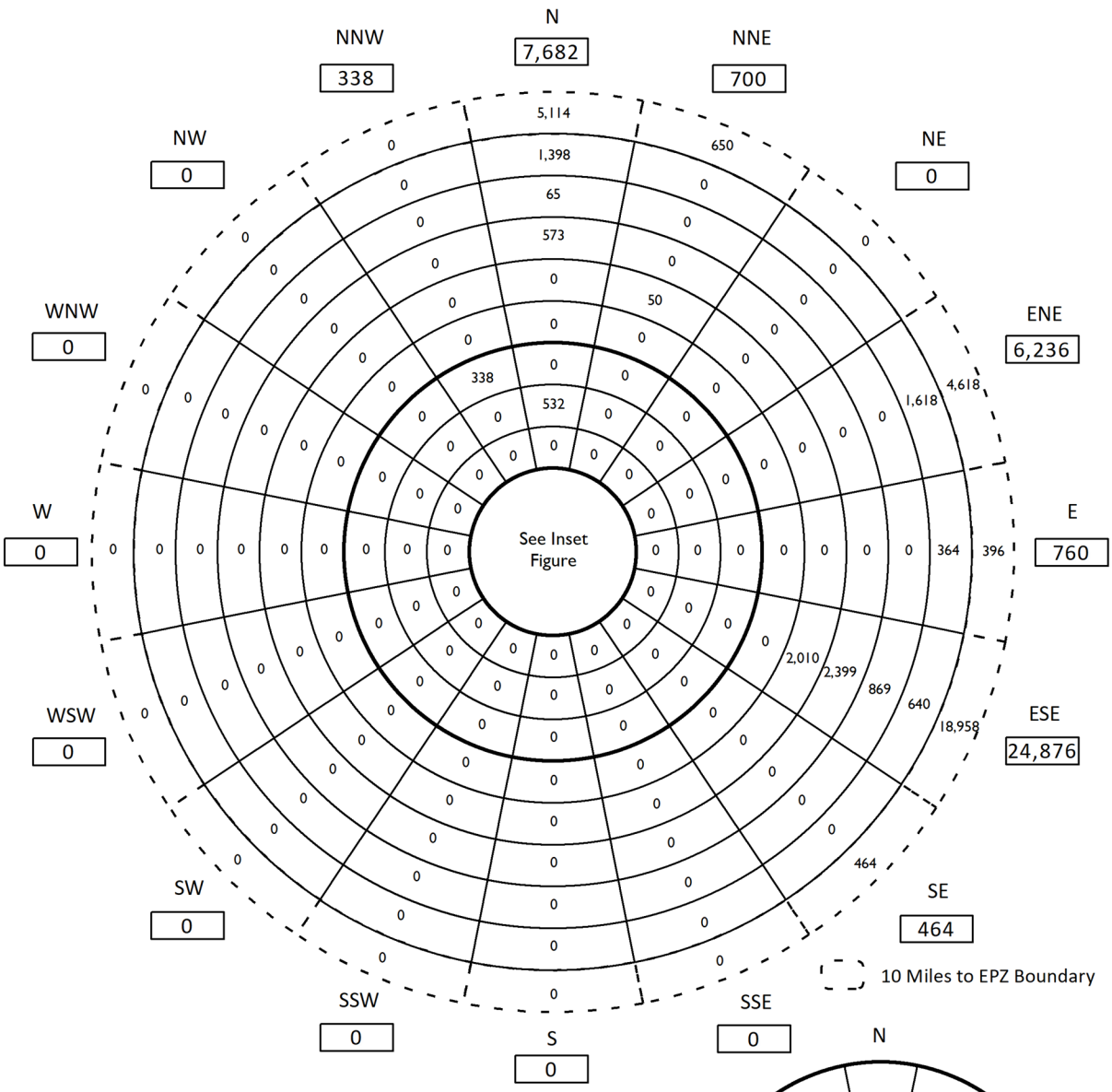
Figure 3-4. Shadow Population by Sector



Shadow Vehicles

Miles	Subtotal by Ring	Cumulative Total
EPZ - 11	0	0
11 - 12	0	0
12 - 13	17	17
13 - 14	37	54
14 - PEZ	14,834	14,888
	Total:	14,888

Figure 3-5. Shadow Vehicles by Sector



Transients

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	0	0
2 - 3	0	0
3 - 4	532	532
4 - 5	338	870
5 - 6	0	870
6 - 7	2,060	2,930
7 - 8	2,972	5,902
8 - 9	934	6,836
9 - 10	4,020	10,856
10 - EPZ	30,200	41,056
	Total:	41,056

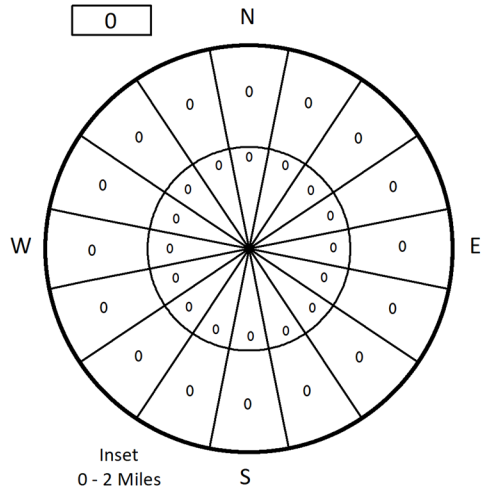
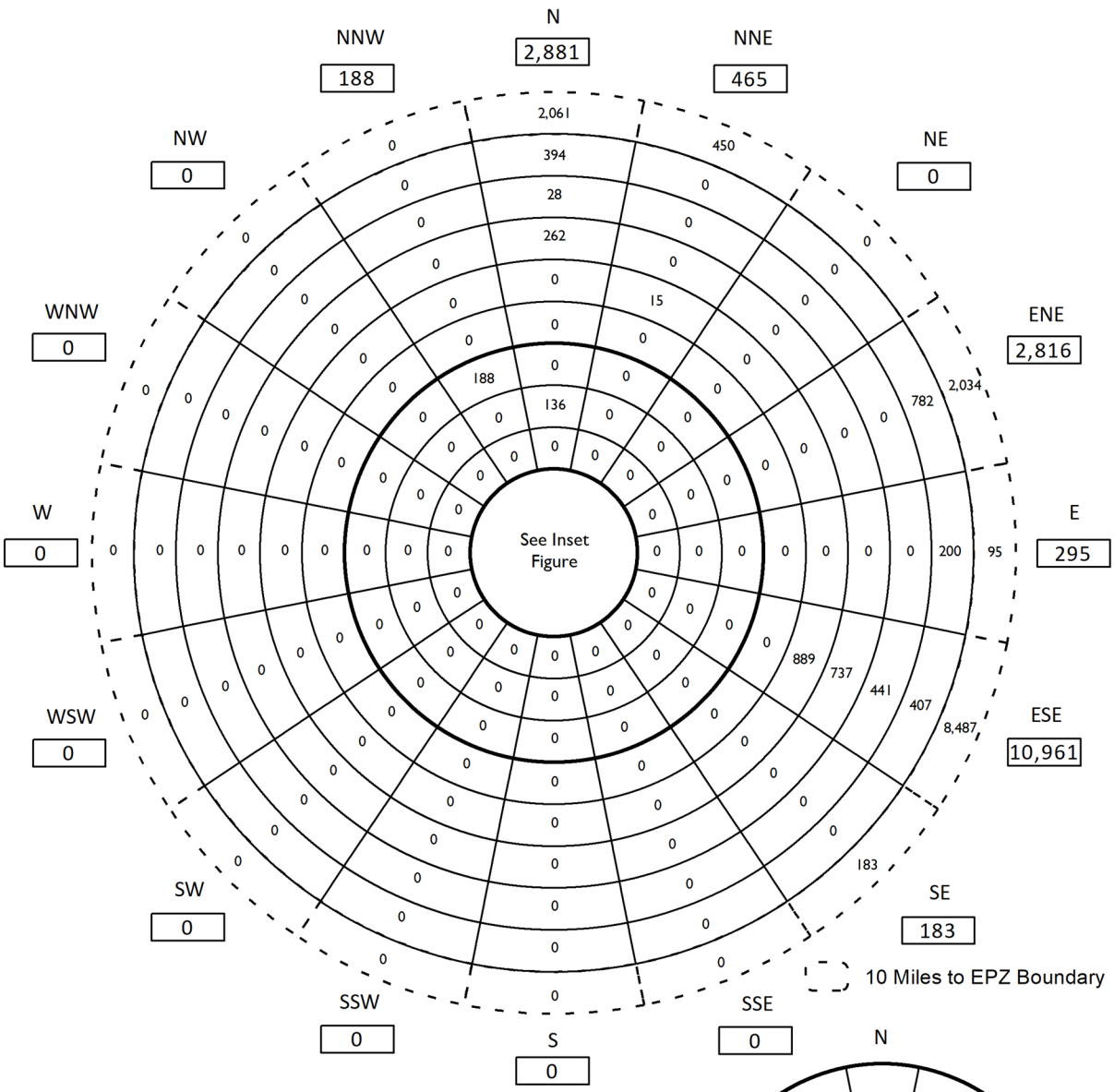


Figure 3-6. Transient Population by Sector



Transient Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	0	0
1 - 2	0	0
2 - 3	0	0
3 - 4	136	136
4 - 5	188	324
5 - 6	0	324
6 - 7	904	1,228
7 - 8	999	2,227
8 - 9	469	2,696
9 - 10	1,783	4,479
10 - EPZ	13,310	17,789
	Total:	17,789

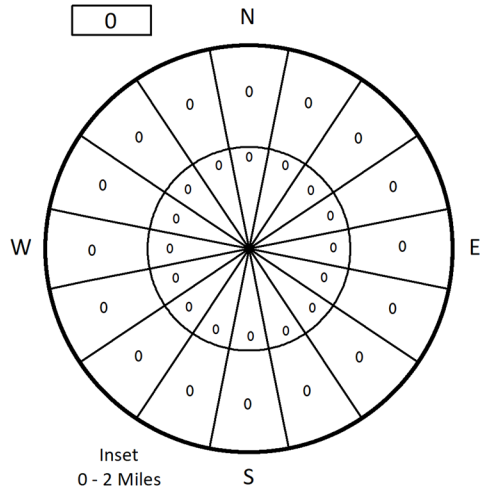
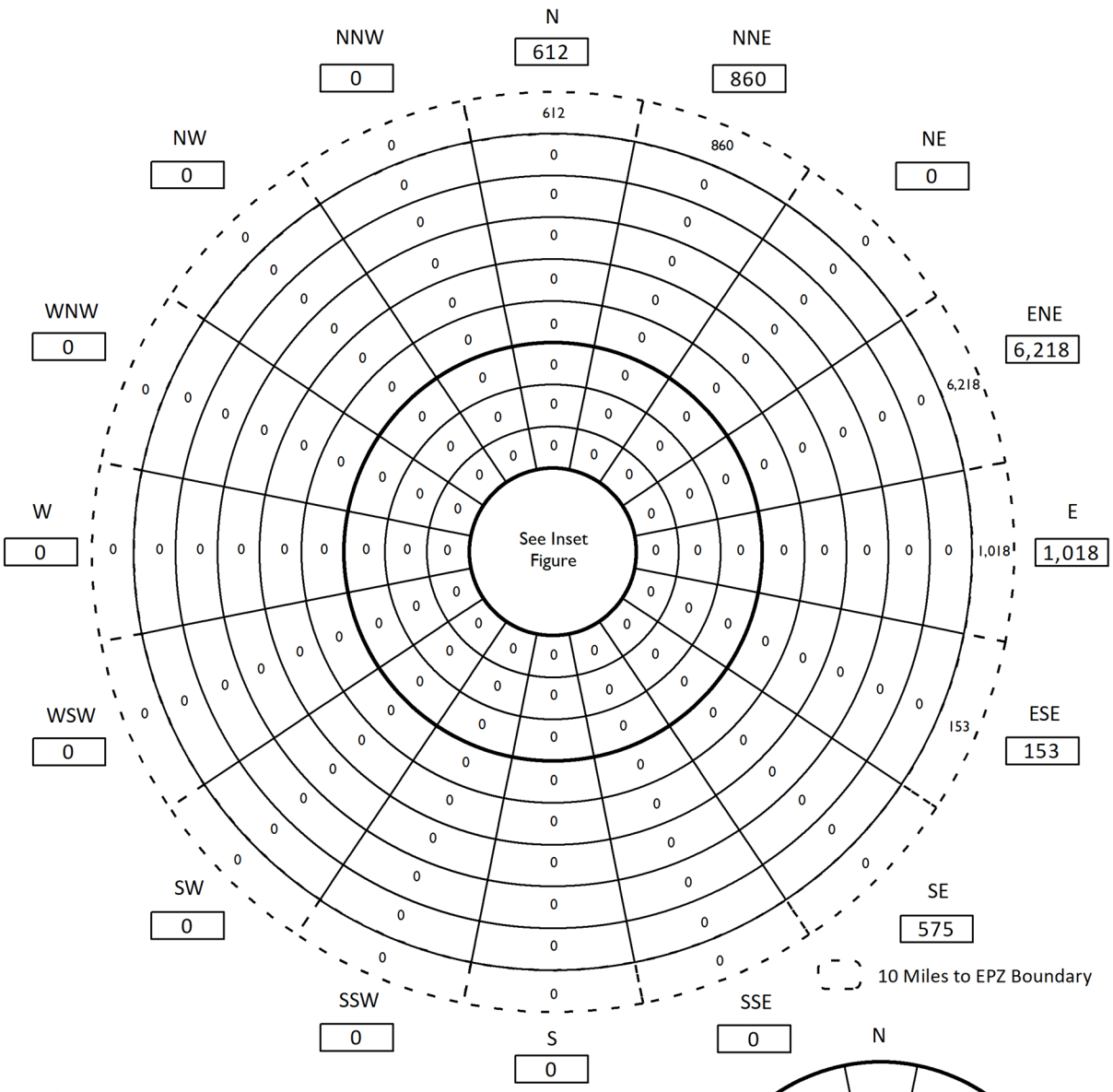


Figure 3-7. Transient Vehicles by Sector



Employees

Miles	Subtotal by Ring	Cumulative Total
0 - 1	575	575
1 - 2	0	575
2 - 3	0	575
3 - 4	0	575
4 - 5	0	575
5 - 6	0	575
6 - 7	0	575
7 - 8	0	575
8 - 9	0	575
9 - 10	0	575
10 - EPZ	8,861	9,436
	Total:	9,436

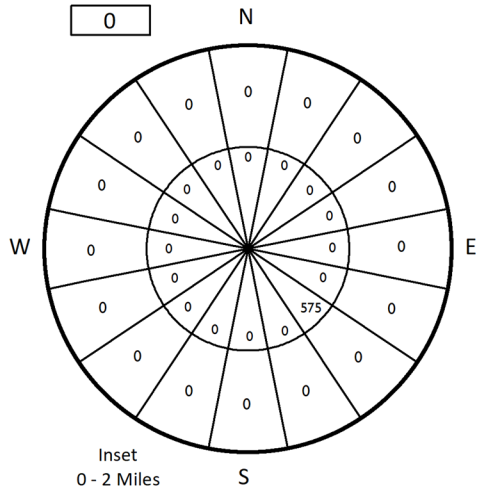
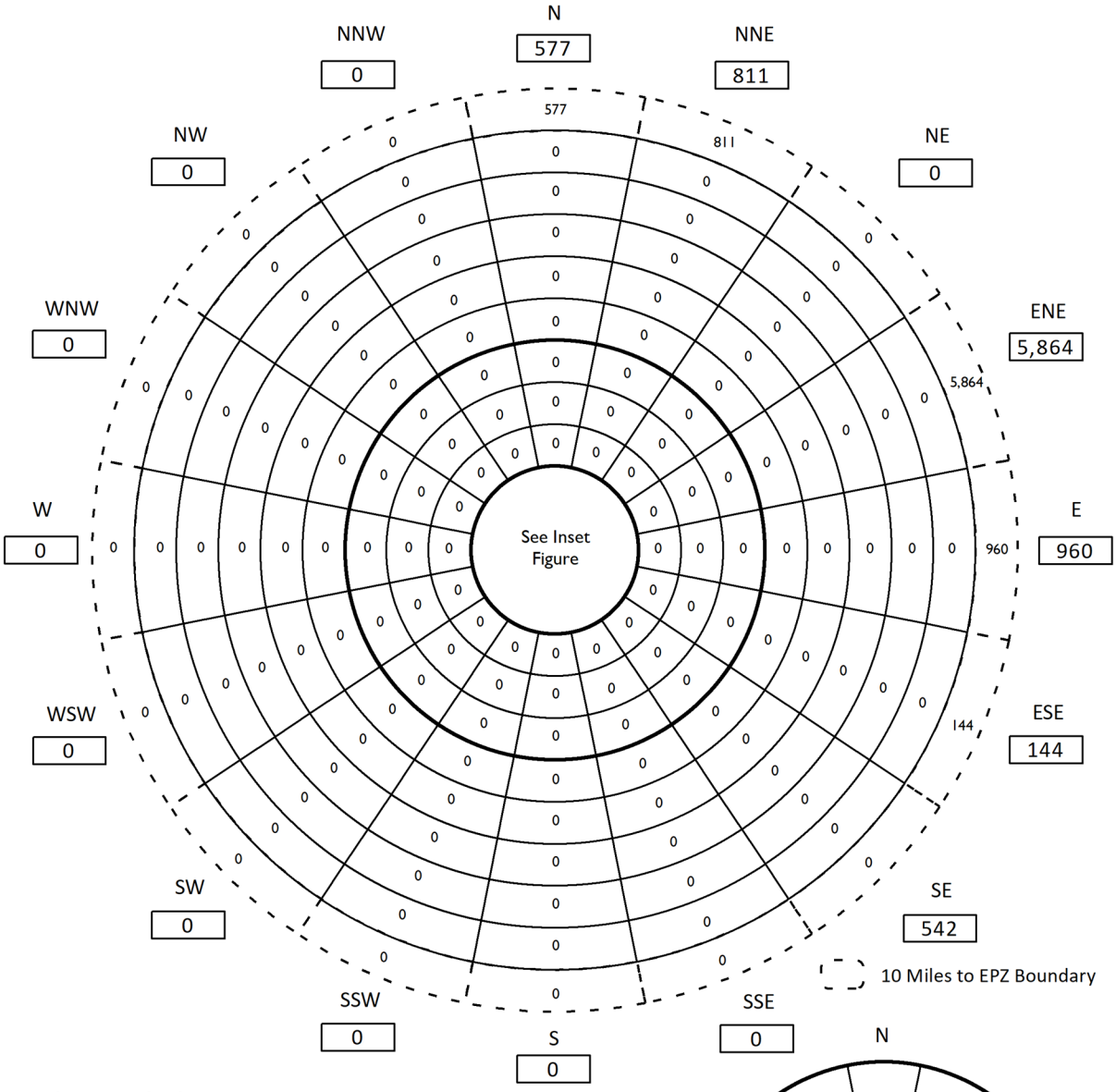


Figure 3-8. Employee Population by Sector



Employee Vehicles

Miles	Subtotal by Ring	Cumulative Total
0 - 1	542	542
1 - 2	0	542
2 - 3	0	542
3 - 4	0	542
4 - 5	0	542
5 - 6	0	542
6 - 7	0	542
7 - 8	0	542
8 - 9	0	542
9 - 10	0	542
10 - EPZ	8,356	8,898
	Total:	8,898

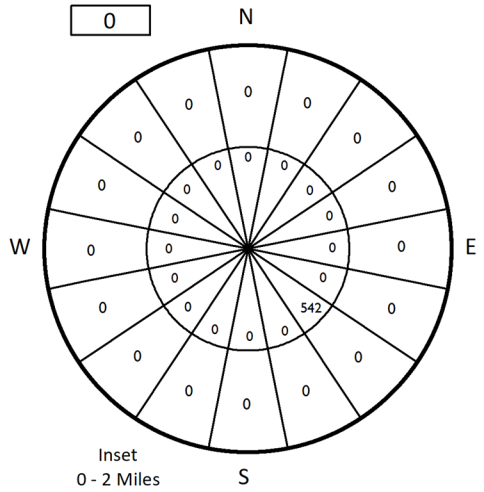


Figure 3-9. Employee Vehicles by Sector

4 ESTIMATION OF HIGHWAY CAPACITY

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

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

Another concept, closely associated with capacity, is “Service Volume” (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.

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

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

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

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

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[1]) according to Exhibit 15-7 of the HCM. Consequently, lane and shoulder widths at the narrowest points were observed

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

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 the 2016 HCM. For example, HCM Exhibit 7-1(b) shows the sensitivity of SV at the upper bound of LOS D to grade (capacity is the SV at the upper bound of LOS E).

The amount of traffic that can flow on a roadway is effectively governed by vehicle speed and spacing. The faster that vehicles can travel when closely spaced, the higher the amount of flow. As discussed in Section 2.6, it is necessary to adjust capacity figures to represent the prevailing conditions. Adverse conditions like inclement weather, construction, and other incidents tend to slow traffic down and often, also increase vehicle-to-vehicle separation, thus decreasing the amount of traffic flow. Based on limited empirical data, weather conditions such as rain reduce the values of free 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 2.6, we employ a reduction in free speed and in highway capacity of 10 percent for rain.

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 San Luis Obispo County/Cities Nuclear Power Plant Emergency Response Plan, dated August 2018, is extensive and was 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,

$$h_m = f_m(h_{sat}, F, F_2, \ldots)$$

where:

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

The estimation of h_m for specified values of h_{sat}, F_1, F_2, ... is undertaken within the DYNEV II simulation model by a mathematical model[2]. The resulting values for h_m always satisfy the condition:

$$h_m \geq h_{sat}$$

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

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

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

4.2 Capacity Estimation along Sections of Highway

The capacity of highway sections -- as distinct from approaches to intersections -- is a function of roadway geometrics, traffic composition (e.g. percent heavy trucks and buses in the traffic stream) and, of course, motorist behavior. There is a fundamental relationship which relates 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

[2]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

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[3] describe a research program that collected data from a computer-based surveillance system (loop detectors) installed on the Interstate Highway System, at 27 active bottlenecks in the twin cities metro area in Minnesota over a 7-week period. When flow breakdown occurs, queues are formed which discharge at lower flow rates than the maximum capacity prior to observed breakdown. These queue discharge flow (QDF) rates vary from one location to the next and also vary by day of week and time of day based upon local circumstances. The cited reference presents a mean QDF of 2,016 passenger cars per hour per lane (pcphpl). This figure compares with the nominal capacity estimate of 2,250 pcphpl estimated for the ETE for freeway links. The ratio of these two numbers is 0.896 which translates into a capacity reduction factor of 0.90.

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

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

The estimated value of capacity is based primarily upon the type of facility and on roadway geometrics. Sections of roadway with adverse geometrics are characterized by lower free-flow speeds and lane capacity. Exhibit 15-46 in the Highway Capacity Manual was referenced to

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

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 2016 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.

4.3 Application to the Diablo Canyon Power Plant Study Area

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

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

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

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

Each of these classifications will be discussed.

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 Multilane Highway

Ref: HCM Chapter 12

Exhibit 12-8 of the HCM 2016 presents a set of curves that indicate a per-lane capacity ranging from approximately 1900 to 2200 pc/h, for free-speeds of 45 to 60 mph, respectively. Based on observation, the multilane 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 multilane highways outside of urban areas.

4.3.3 Freeways

Ref: HCM Chapters 10, 12, 13, 14

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

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

Free Speed (mph):	55	60	65	70+
Per-Lane Capacity (pc/h):	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.

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

Chapter 14 of the HCM 2016 presents procedures for estimating capacities of ramps and of "merge" areas. There are three significant factors to the determination of capacity of a ramp-freeway junction: The capacity of the freeway immediately downstream of an on-ramp or immediately upstream of an off-ramp; the capacity of the ramp roadway; and the maximum

flow rate entering the ramp influence area. In most cases, the freeway capacity is the controlling factor. Values of this merge area capacity are presented in Exhibit 14-10 of the HCM 2016, and depend on the number of freeway lanes and on the freeway free speed. Ramp capacity is presented in Exhibit 14-12 and is a function of the ramp 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 14 of the HCM 2016. If congestion results from an excess of demand relative to capacity, then the model allocates service appropriately to the two entering traffic streams and produces LOS F conditions (The HCM does not address LOS F explicitly).

4.3.4 Intersections

Ref: HCM Chapters 19, 20, 21, 22

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

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

The model is also capable of modeling the presence of manned traffic control. At specific locations where it is advisable or where existing plans call for overriding existing traffic control to implement manned control, the model will use actuated signal timings that reflect the presence of traffic guides. At locations where a special traffic control strategy (continuous left-turns, contra-flow lanes) is used, the strategy is modeled explicitly. Where applicable, the location and type of traffic control for nodes in the evacuation network are noted in Appendix K.

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 involving several HCM chapters. Alternative tools are able to analyze these facilities as a single system."*

This statement succinctly describes the analyses required to determine traffic operations across an area encompassing 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 2016 procedures only for the purpose of estimating capacity.

All simulation models must be calibrated properly with field observations that quantify the performance parameters applicable to the analysis network. Two of the most important of these are: (1) 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 2016, as described earlier.

4.5 Boundary Conditions

As illustrated in Figure 1-2 and in Appendix K, the link-node analysis network used for this study is finite. The analysis network does extend well beyond the 20-mile to the north and northeast and 25-miles to the southeast in order to model intersections with other major evacuation routes beyond the study area. However, the network does have an end at the destination (exit) nodes as discussed in Appendix C. Beyond these destination nodes, there may be signalized intersections or merge points that impact the capacity of the evacuation routes leaving the study area. Rather than neglect these "boundary conditions", this study assumes a 25% reduction in capacity on two lane roads (Section 4.3.1 above) and multilane highways (Section 4.3.2 above). There is no reduction in capacity for freeways due to boundary conditions. The 25% reduction in capacity is based on the prevalence of actuated traffic signals in the study area and the fact that the evacuating traffic volume will be more significant than the competing traffic volume at any downstream signalized intersections, thereby warranting a more significant percentage (75% in this case) of the signal green time.

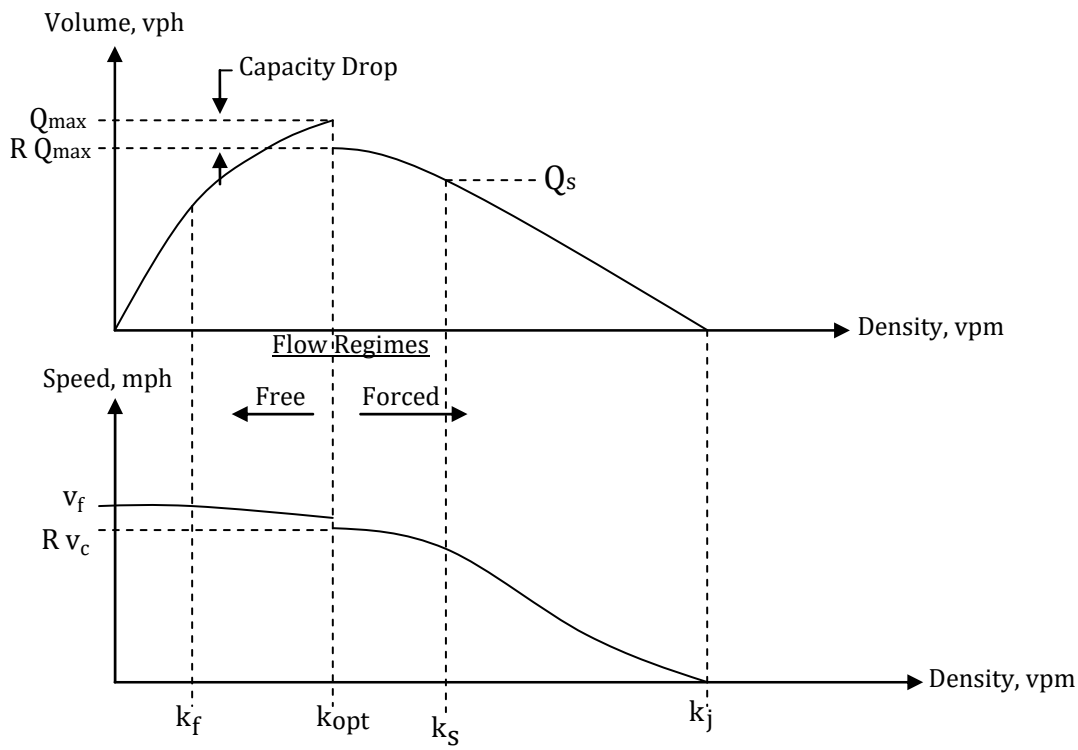


Figure 4-1. Fundamental Diagrams

5 ESTIMATION OF TRIP GENERATION TIME

Federal Government guidelines (see NUREG CR-7002 Rev. 1) 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 demographic survey. We define the sum of these distributions of elapsed times as the Trip Generation Time Distribution.

5.1 Background

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

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

At each level, the Federal guidelines specify a set of Actions to be undertaken by the Licensee, and by State and Local offsite authorities. As a Planning Basis, we will adopt a conservative posture, in accordance with Section 1.2 of NUREG/CR-7002 Rev. 1., that a rapidly escalating accident will be considered in calculating the Trip Generation Time. We will assume:

1. The Evacuation Order will be announced coincident with the emergency notification.
2. Mobilization of the general population will commence up to 15 minutes after the Evacuation Order alert notification.
3. ETE are measured relative to the Evacuation Order.

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 Evacuation Order. 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 Evacuation Order 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 Evacuation Order, 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, and loud speakers).
2. Receiving and correctly interpreting the information that is transmitted.

The population within the EPZ is dispersed over an area of approximately 275 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 4.3 of NUREG/CR-7002 Rev. 1, the information required to compute trip generation times is typically obtained surveys of EPZ residents. Such a survey was conducted in support of this ETE study. Appendix F presents the survey sampling plan, number of samples obtained, survey instrument, and survey results. The remaining discussion will focus on the application of the trip generation data obtained from the demographic survey to the development of the ETE documented in this report.

5.2 Fundamental Considerations

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

Activities are undertaken over a period of time. Activities may be in "series" (i.e. to undertake an activity implies the completion of all preceding events) or may be in parallel (two or more activities may take place over the same period of time). Activities conducted in series are

functionally dependent on the completion of prior activities; activities conducted in parallel are functionally independent of one another. The relevant events associated with the public's preparation for evacuation are:

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

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

These relationships are shown graphically in Figure 5-1.

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

As such, a completed Activity changes the 'state' of an individual (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) can result in rather *conservative* (that is, longer) estimates of mobilization times. It is reasonable to expect that at least some parts of these events will overlap for many households, but that assumption is not made in this study.

5.3 Estimated Time Distributions of Activities Preceding Event 5

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

Time Distribution No. 1, Notification Process: Activity 1 $\rightarrow$ 2

Federal regulations (10CFR50 Appendix E, Item IV.D.3) stipulate, "[t]he design objective of the prompt public alert and notification system shall be to have the capability to essentially complete the initial alerting and initiate notification of the public within the plume exposure pathway EPZ within about 15 minutes". Furthermore, 2019 Federal Emergency Management Agency (FEMA) Radiological Emergency Preparedness Program Manual Part V Section B.1 Bullet 3 states that "Notification methods will be established to ensure coverage within 45 minutes of essentially 100% of the population".

Given the federal regulations and guidance, and the presence of sirens within the EPZ, it is assumed that 100 percent of the population in the EPZ can be notified within 45 minutes. The assumed distribution for notifying the EPZ population is provided in Table 5-2.

Distribution No. 2, Prepare to Leave Work: Activity 2 $\rightarrow$ 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 $\rightarrow$ 3 shown in Table 5-3 reflects data obtained by the demographic survey. This distribution is plotted in Figure 5-2.

Distribution No. 3, Travel Home: Activity 3 $\rightarrow$ 4

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

Distribution No. 4, Prepare to Leave Home: Activity 2, 4 $\rightarrow$ 5

These data are provided directly by those households which responded to the demographic survey. This distribution is plotted in Figure 5-2 and listed in Table 5-5. It is assumed that this time includes the time to prepare pets for evacuation (see Figure F-15).

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 $\rightarrow$ 4) must precede Activity 4 $\rightarrow$ 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 5-6 presents the summing procedure to arrive at each designated distribution.

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

5.4.1 Statistical Outliers

As already mentioned, some portion of the survey respondents answer "Decline to State" 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 540 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 <u>overall</u> mobilization time/trip generation distributions, the following principles are used:

1) It is recognized that the overall trip generation distributions are <u>conservative</u> 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 are reviewed for outliers, and then the overall trip generation distributions are created (see Figure 5-1, Table 5-6, Table 5-7);

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 standard deviations are flagged for attention, taking special note of whether there are gaps (categories with zero entries) in the histogram display.

    In general, only flagged values more than 3.5 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.

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). 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, and D. 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. 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, and D properly displaced with respect to one another, are tabulated in Table 5-8 (Distribution B, Arrive Home, omitted for clarity).

The final two time periods (14 and 15) are 600 minutes long. These time periods are 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 these final time periods.

5.4.2 Staged Evacuation Trip Generation

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

1. PAZs comprising the 2 mile region are advised to evacuate immediately
2. PAZs 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 6-mile region will be treated as the 5 mile region described above due to the unique nature of the DCPP EPZ.
2. The EPZ population in PAZs beyond 6 miles will shelter-in-place (when staging 2 to 6 miles), with the exception of the 20% non-compliance.

3. The EPZ population in PAZs beyond 10 miles will shelter-in-place (when staging 6 to 10 miles), with the exception of the 20% non-compliance.
4. The population in the shadow region beyond the EPZ boundary, extending to approximately 20 miles radially from the plant (up to 28 miles in the southeast), 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.
5. 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 other venues. Also, notifying the transient population of a staged evacuation would prove difficult.
6. Employees will also be assumed to evacuate without first sheltering.
7. An additional staged evacuation was considered in which the 6-mile region evacuates, and PAZs comprising regions extending from 6 to 10 miles downwind are advised to shelter-in-place until the 90th percentile ETE for the 6-mile region (see Regions R21 through R25).

<u>Procedure</u>

1. Trip generation for population groups in the 2-mile region (and 6-mile region for second set of staged evacuation cases) will be as computed based upon the results of the demographic survey and analysis.
2. Trip generation for the population subject to staged evacuation will be formulated as follows:
    a. Identify the 90th percentile evacuation time for the PAZs comprising the 2-mile region (and 6-mile region for second set of staged evacuation cases). 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 Rev. 1 uses the statement "approximately 90th percentile" as the time to end staging and begin evacuating. The value of T_{Scen}^* is 1:00 for the 2-mile region and 1:30 for the 6-mile region.
3. Staged trip generation distributions are created for the following population groups:
    a. Residents with returning commuters
    b. Residents without returning commuters

Figure 5-5 presents the staged trip generation distributions for both residents with and without returning commuters; the 90th percentile two-mile and six-mile evacuation time are 60 minutes and 90 minutes, respectively, as discussed above. At the 90th percentile evacuation time, approximately 20% of the population (who have completed their mobilization activities) advised to shelter has nevertheless departed the area. These people do not comply with the shelter advisory. Also included on the plot are the trip generation distributions for these groups as applied to the regions advised to evacuate immediately.

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

Table 5-9 provides the trip generation for both 2-mile staged evacuation and 6-mile staged evacuation.

5.4.3 Trip Generation for Waterways and Recreational Areas

According to San Luis Obispo County/Cities Nuclear Power Plant Emergency Response Plan, those at sea on commercial or pleasure craft will be notified by marine radio broadcast from the U.S. Coast Guard and assistance can be provided by air resources as available. The State Department of Parks, County Sheriff's Department, Port San Luis Harbor District, County Fire and incorporated personal from city police, fire and other departments as necessary and, depending upon the jurisdiction, will carry out the appropriate notifications, as needed. Isolated rural population and transients may be notified by vehicles with mobile public address systems assisted by helicopter surveillance and warnings, as available.

As indicated in Table 5-2, this study assumes 100% notification in 45 minutes. Table 5-8 indicates that all transients will have mobilized within 90 minutes. It is assumed that this 90-minute timeframe is sufficient time for boaters, campers and other transients to return to their vehicles and begin their evacuation trip.

Table 5-1. Event Sequence for Evacuation Activities

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

Table 5-2. Time Distribution for Notifying the Public

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

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

Elapsed Time (Minutes)	Cumulative Percent Employees Leaving Work
0	0%
5	31%
10	56%
15	78%
20	84%
25	88%
30	96%
35	98%
40	98%
45	99%
50	100%

NOTE: The survey data was normalized to distribute the "Decline to state" 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 "Decline to state" responders, if the event takes place, would be the same as those responders who provided estimates.

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

Elapsed Time (Minutes)	Cumulative Percent Returning Home
0	0%
5	5%
10	16%
15	28%
20	40%
25	51%
30	66%
35	73%
40	84%
45	91%
50	97%
55	98%
60	100%

NOTE: The survey data was normalized to distribute the "Decline to state" response

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

Elapsed Time (Minutes)	Cumulative Percent Ready to Evacuate
0	0%
15	2%
30	18%
45	38%
60	58%
75	73%
90	78%
105	81%
120	86%
135	91%
150	92%
165	93%
180	95%
195	99%
210	100%

NOTE: The survey data was normalized to distribute the " Decline to state" response

Table 5-6. 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

Table 5-7. Description of the Distributions

Distribution	Description
A	Time distribution of commuters departing place of work (Event 3). Also applies to employees who work within the EPZ who live outside, and to Transients within the EPZ.
B	Time distribution of commuters arriving home (Event 4).
C	Time distribution of residents with commuters who return home, leaving home to begin the evacuation trip (Event 5).
D	Time distribution of residents without commuters returning home, leaving home to begin the evacuation trip (Event 5).

Table 5-8. 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)
1	15	6%	6%	0%	0%
2	15	33%	33%	0%	2%
3	30	57%	57%	2%	25%
4	30	4%	4%	16%	37%
5	15	0%	0%	15%	10%
6	15	0%	0%	17%	5%
7	30	0%	0%	23%	9%
8	30	0%	0%	11%	4%
9	30	0%	0%	7%	5%
10	15	0%	0%	2%	2%
11	15	0%	0%	2%	1%
12	15	0%	0%	2%	0%
13	30	0%	0%	3%	0%
14	600	0%	0%	0%	0%
15	600	0%	0%	0%	0%

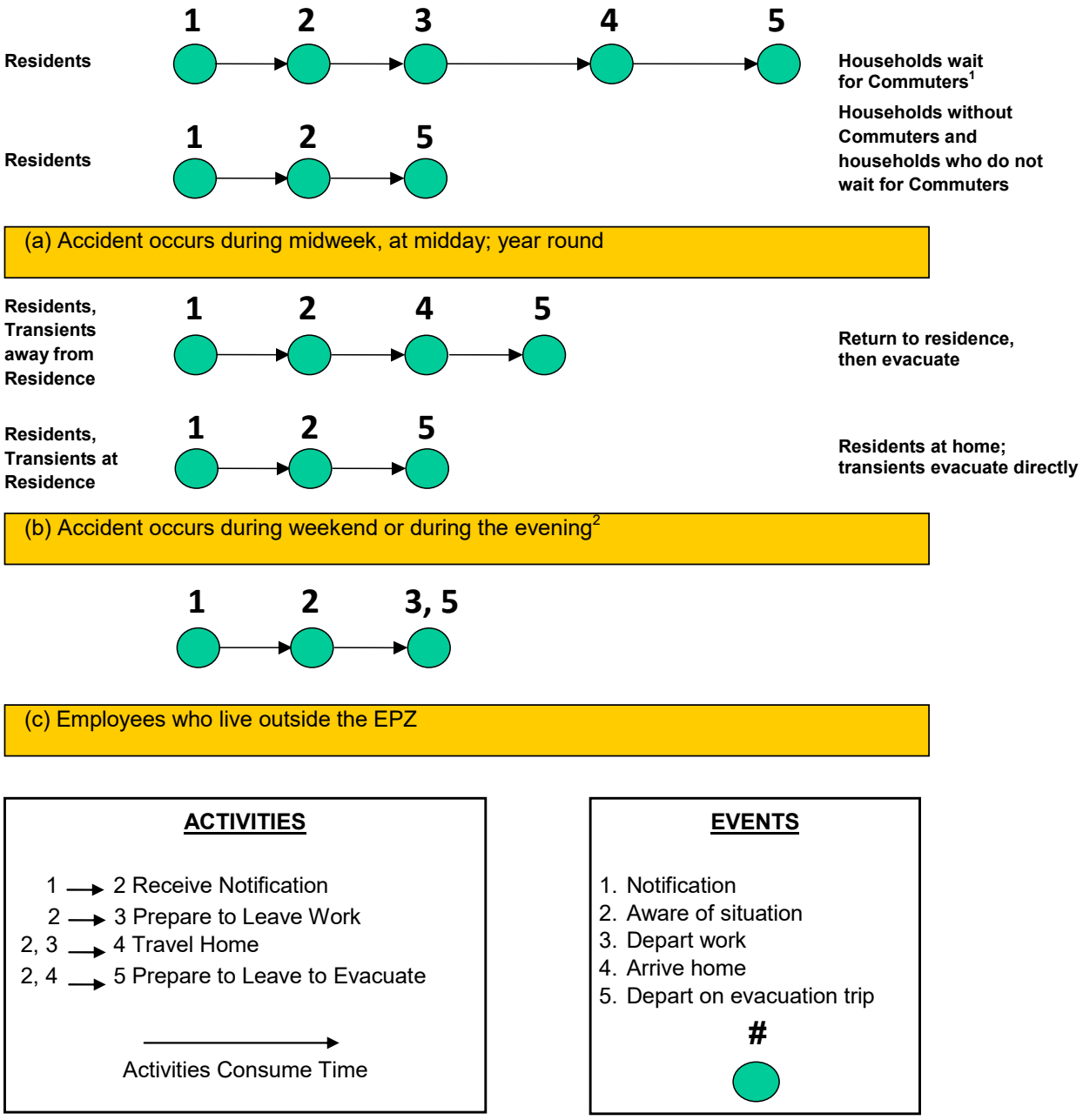
NOTE:

- Shadow vehicles are loaded onto the analysis network (Figure 1-2) using Distribution C.
- Special event vehicles are loaded using Distribution A.

Table 5-9. Trip Generation Histograms for the EPZ Population for Staged Evacuations

Time Period	Duration (Min)	Percent of Total Trips Generated Within Indicated Time Period* (2 to 6-Mile Region)		Percent of Total Trips Generated Within Indicated Time Period* (6 to 10-Mile Region)	
		Residents with Commuters (Distribution C)	Residents Without Commuters (Distribution D)	Residents with Commuters (Distribution C)	Residents Without Commuters (Distribution D)
1	15	0%	0%	0%	0%
2	15	0%	0%	0%	0%
3	30	0%	5%	0%	5%
4	30	18%	59%	4%	8%
5	15	15%	10%	29%	61%
6	15	17%	5%	17%	5%
7	30	23%	9%	23%	9%
8	30	11%	4%	11%	4%
9	30	7%	5%	7%	5%
10	15	2%	2%	2%	2%
11	15	2%	1%	2%	1%
12	15	2%	0%	2%	0%
13	30	3%	0%	3%	0%
14	600	0%	0%	0%	0%
15	600	0%	0%	0%	0%

- *Trip Generation for Employees and Transients (see Table 5-8) is the same for Unstaged and Staged Evacuation.



[1] Applies for evening and weekends also if commuters are at work.
[2] Applies throughout the year for transients.

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

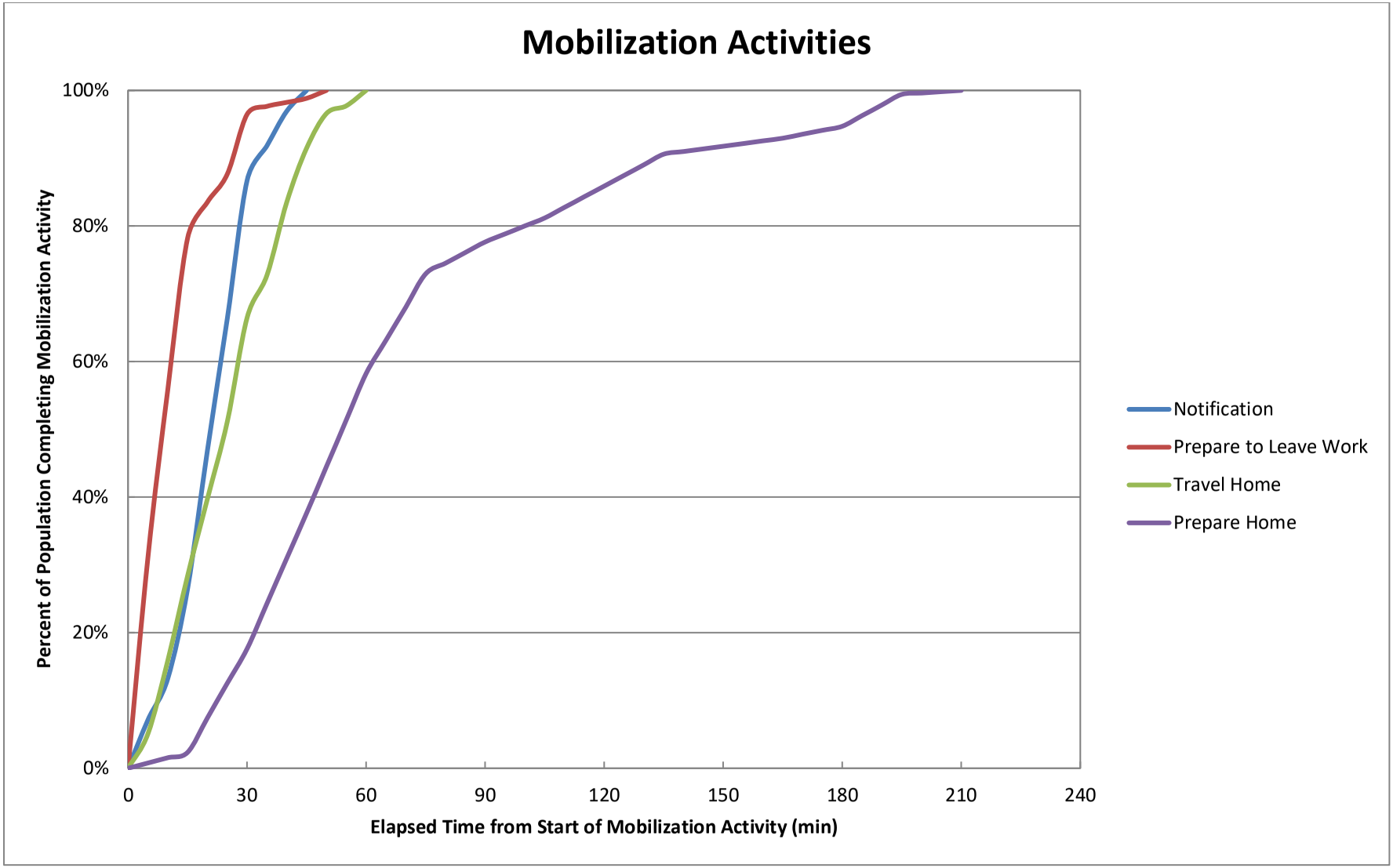


Figure 5-2. Evacuation Mobilization Activities

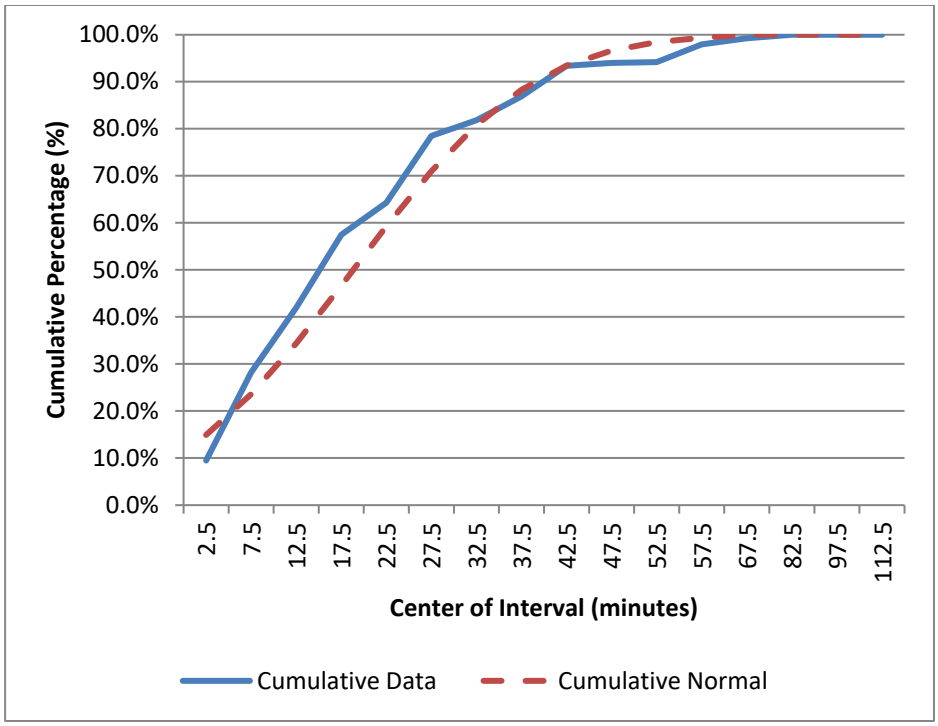


Figure 5-3. Comparison of Data Distribution and Normal Distribution

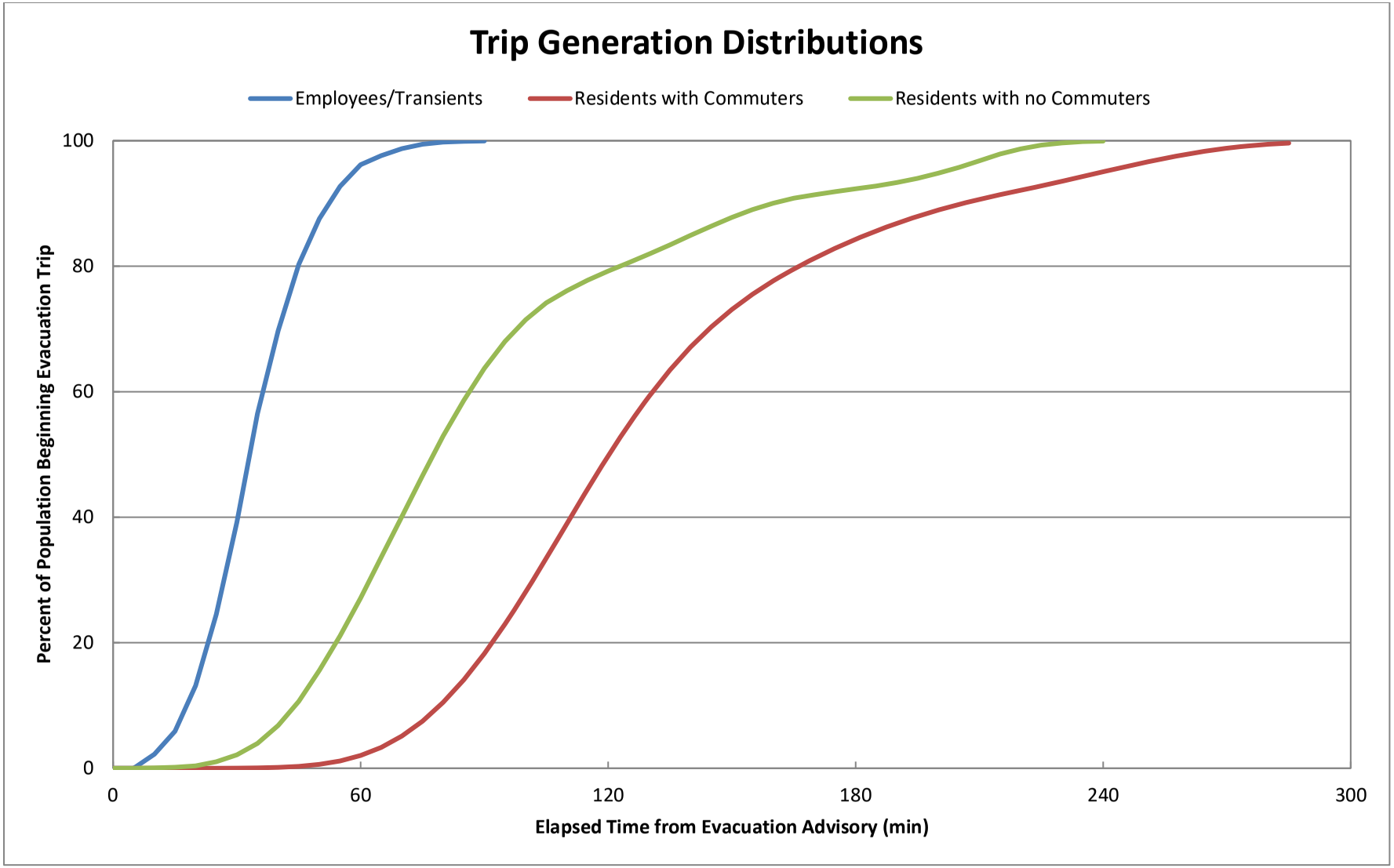


Figure 5-4. Comparison of Trip Generation Distributions

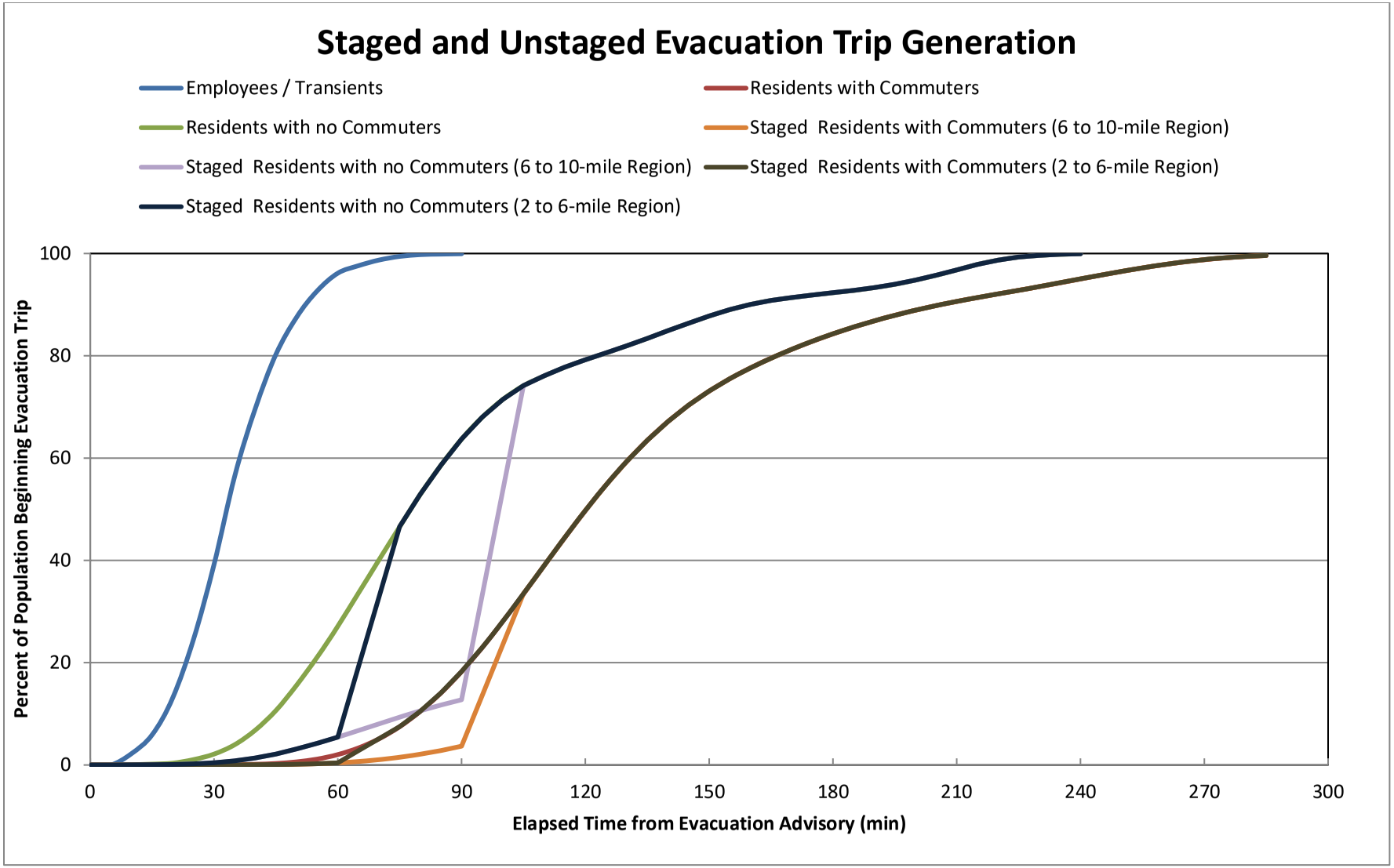


Figure 5-5. Comparison of Staged and Unstaged Trip Generation Distributions in the 2 to 6 Mile Region and the 6 to 10 Mile Region

6 EVACUATION CASES

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

Region A grouping of contiguous evacuating PAZs 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.

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

A description of each scenario is described below:

1. **Summer Midweek Midday (normal):** This scenario represents a typical normal weather daytime period when permanent residents are generally dispersed within the EPZ performing daily activities and major workplaces are at typical daytime levels. This scenario includes assumptions that permanent residents will evacuate from their place of residence; summer school is in session; hotel and motel facilities are occupied at average summer levels; and recreational facilities are at average summer daytime levels.
2. **Summer Midweek Midday (adverse):** This scenario represents an adverse weather daytime period when permanent residents are generally dispersed within the EPZ performing daily activities and major work places are at typical daytime levels. This scenario includes assumptions that permanent residents will evacuate from their place of residence; summer schools are in session; hotel and motel facilities are occupied at average summer levels; and recreational facilities are at average summer daytime levels.
3. **Summer Weekend Midday (normal):** This scenario represents a typical normal weather weekend period when permanent residents are both at home and dispersed within the EPZ performing typical summer weekend activities. This scenario includes assumptions that permanent residents will evacuate from their place of residence; schools are closed and students are at home or with their families; work places are staffed at typical weekend levels; hotel and motel facilities are occupied at average summer weekend levels; and recreational facilities are at average summer weekend levels.
4. **Summer Weekend Midday (adverse):** This scenario represents an adverse weather weekend period when permanent residents are both at home and dispersed within the EPZ performing typical summer weekend activities. This scenario includes assumptions that permanent residents will evacuate from their place of residence; schools are closed and students are at home or with their families; work places are staffed at typical weekend levels; hotel and motel facilities are occupied at average

summer weekend levels; and recreational facilities are at average summer weekend levels.

5. **Summer Midweek and Weekend Evening (normal):** This scenario represents a typical normal weather midweek and weekend evening period when permanent residents are generally at home with fewer dispersed within the EPZ performing evening activities. This scenario includes assumptions that permanent residents will evacuate from their place of residence; schools are closed and students are at home; work places are staffed at typical evening levels; hotel and motel facilities are occupied at average summer levels; and recreational facilities are at average summer evening levels. External traffic is reduced.
6. **Winter Midweek Midday (normal):** This scenario represents a typical normal weather weekday period during the winter when school is in session and the work force is at a full daytime level. This scenario includes assumptions that permanent residents will evacuate from their place of residence; students will evacuate directly from the schools; work places are fully staffed at typical daytime levels; hotel and motel facilities are occupied at average winter levels; and recreational facilities are at winter daytime levels.
7. **Winter Midweek Midday (adverse):** This scenario represents an adverse weather weekday period during the winter when school is in session and the work force is at a full daytime level. This scenario includes assumptions that permanent residents will evacuate from their place of residence; students will evacuate directly from the schools; work places are fully staffed at typical daytime levels; hotel and motel facilities are occupied at average winter levels; and recreational facilities are at winter daytime levels.
8. **Winter Weekend Midday (normal):** This scenario reflects a typical normal weather winter weekend period when permanent residents are both at home and dispersed within the EPZ, and the work force is at a weekend level. This scenario includes assumptions that permanent residents will evacuate from their place of residence; schools are closed and students are at home; work places are staffed at typical weekend levels; hotel and motel facilities are occupied at average winter weekend levels and recreational facilities are at winter weekend levels.
9. **Winter Weekend Midday (adverse):** This scenario reflects an adverse weather winter weekend period when permanent residents are both at home and dispersed within the EPZ, and the work force is at a weekend level. This scenario includes assumptions that permanent residents will evacuate from their place of residence; schools are closed and students are at home; work places are staffed at typical weekend levels; hotel and motel facilities are occupied at average winter weekend levels and recreational facilities are at winter weekend levels.
10. **Winter Midweek and Weekend Evening (normal):** This scenario reflects a typical normal midweek and weekend evening period when permanent residents are home and the work force is at a nighttime level. This scenario includes assumptions that permanent residents will evacuate from their place of residence; schools are closed

and students are at home; work places are staffed at typical nighttime levels; hotel and motel facilities are occupied at average winter levels; and recreational facilities are at winter evening levels.

11. **Special Events (normal):** This scenario reflects a special event activity where peak tourist populations are present within the EPZ. The population attending the event is developed considering both transients and permanent EPZ residents who may be in attendance to avoid double-counting residents. The remaining permanent resident percentage, those not attending the event, will be assumed to evacuate from their residence. Work places will be staffed at typical levels; hotel and motel facilities are occupied at peak special event levels; and recreational facilities are at appropriate levels based on the event and time of year.
12. **Roadway Impact Midweek Midday (normal):** The intent of this scenario is to represent a variety of conditions that may impact a roadway segment such as construction, flooding, vehicle accidents, etc. The roadway impact scenario assumes that during a summer midweek normal weather daytime scenario, one lane on US-101 is out of service and unavailable to evacuees.

A total of 25 Regions were defined which encompass all the groupings of PAZs considered. These Regions are defined in Table 6-1. The PAZ configurations are identified in Figure 6-1. Each keyhole sector-based area consists of a central circle centered at the power plant, and three adjoining sectors, each with a central angle of 22.5 degrees, as per NUREG/CR-7002 Rev. 1 guidance. The central sector coincides with the wind direction. These sectors extend to 10 miles from the plant (Regions R05 through R08) or to the EPZ boundary (Regions R09 through R15).

Regions R01, R02, and R03 represent evacuations of circular areas with radii of 2, 6, and approximately 10 miles, respectively. R03, which extends radially out to 10 miles, is also called the FEMA EPZ. Region R04 extends out to the EPZ boundary (Full EPZ). Region R20 is identical to Region R02 except that PAZ 2 is staged until 90% of the 2-mile region (R01) has evacuated. Regions R21 through R25 are identical to Regions R05, R06, R03, R07, and R08, respectively; however, those PAZs between 6 miles and 10 miles are staged until 90% of the 6-mile region (Region R02) has evacuated.

A total of 12 Scenarios were evaluated for all Regions. Thus, there are a total of 25x12=300 evacuation cases. Table 6-2 is a description of all Scenarios.

Each combination of region and scenario implies a specific population to be evacuated. Table 6-3 presents the percentage of each population group estimated to evacuate for each scenario. Table 6-4 presents the vehicle counts for each scenario for an evacuation of Region R04 – the Full EPZ.

The vehicle estimates presented in Section 3 are peak values. These peak values are adjusted depending on the scenario and region being considered to represent average numbers, using scenario and region specific percentages; the scenario percentages are presented in Table 6-3,

while the regional percentages are provided in Table H-1. The percentages presented in Table 6-3 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 69% (the number of households with at least one commuter) and 54% (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 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.

As shown in Appendix E, there is a significant amount of lodging and campgrounds offering overnight accommodations in the EPZ; thus, transient activity during evening hours is at its peak – 85% in the summer and 55% in the winter. Many of the recreational attractions (parks, beaches, golf courses, and marinas) have higher transient attendance during the summer. As such, transient activity on during midweek middays is estimated to be 50% and 25% during the summer and winter, respectively. Transient activity on weekend during the day is estimated to be 65% and 30% during the summer and winter, respectively.

As noted in the shadow footnote to Table 6-3, the shadow percentages are computed using a base of 20% (see assumption 7 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 6-4 for Scenario 1, the shadow percentage is computed as follows:

$$20\% \times \left(1 + \frac{8{,}542}{28{,}405 + 48{,}142}\right) = 22\%$$

One special event – July 4th Fireworks Show at Avila Beach (transients present at Avila Beach observing fireworks at Pismo Beach), Pismo Beach, and Morro Bay Harbor, and Cayucos – was considered as Scenario 11. Thus, the special event traffic is 100% evacuated for Scenario 11, and 0% for all other scenarios.

Schools are in session during the winter season, midweek, midday scenarios. As such, school buses and on and off campus students are all present during winter, midweek, midday scenarios. Since on campus students live in campus housing, it is assumed they are also present on weekends and evenings in the winter. It is estimated that summer school enrollment (including colleges) is approximately 10% of enrollment during the regular school year for

summer, midweek, midday scenarios. Similar to winter scenarios, on campus students are assumed to be present at the same rate (10%) during summer weekends and evenings. School and colleges are not in session during weekends and evenings, as such school buses and off campus students are assumed to be 0% for weekend and evening scenarios.

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

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	PAZ											
		1	2	3	4	5	6	7	8	9	10	11	12
R01	2-Mile Ring	X											
R02	6-Mile Ring (similar to the FEMA 5-mile ring)	X	X										
R03	FEMA EPZ	X	X	X	X	X							
R04	Full EPZ	X	X	X	X	X	X	X	X	X	X	X	X
Evacuate 2-Mile Radius and Downwind to 6 Miles													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
-	ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW	**Refer to Region R02**											
-	N, NNE, NE, ENE, E	**Refer to Region R01**											
Evacuate 6-Mile Radius and Downwind to 10 miles[1]													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R05	SE, SSE, S	X	X			X							
R06	SSW	X	X		X	X							
-	SW, WSW	**Refer to Region R03**											
R07	W, WNW	X	X	X	X								
R08	NW, NNW	X	X	X									
-	N, NNE, NE, ENE, E, ESE	**Refer to Region R02**											
Evacuate 6-Mile Radius and Downwind to EPZ Boundary													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R09	SE, SSE, S	X	X			X				X			
R10	SSW	X	X		X	X			X	X			
R11	SW	X	X	X	X	X			X	X			
R12	WSW	X	X	X	X	X		X	X	X		X	
R13	W, WNW	X	X	X	X		X	X	X		X	X	X
R14	NW	X	X	X			X	X			X	X	X
R15	NNW	X	X	X							X		X
-	N, NNE, NE, ENE, E, ESE	**Refer to Region R02**											

[1] The land-based portions of the DCPP EPZ are divided into 12 Protective Action Zones (PAZs) defined by local geographic boundaries. For the purposes of computing ETE's, PAZs 1-5 represent the FEMA 10-mile EPZ. The local geographic boundaries for PAZs 1-5 encompass the majority of land-based regions within approximately 10 miles of DCPP, excluding portions of PAZs 8 and 9 that are within 10 miles of DCPP. PAZs 6-12 cover the areas beyond 10 miles from DCPP. ETEs are computed for all regions within the EPZ boundary.

Site Specifc Regions													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R16	-	X	X		X								
R17	-	X	X	X			X						
R18	-	X	X	X	X								
R19	-	X	X		X	X							
Advanced Emergency Classification, 100% of the PAZ(s) already evacuated					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 6 Miles													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R20	ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW	X	X										
-	N, NNE, NE, ENE, E	**Refer to Region R01**											
Shelter-in-Place until 90% ETE for **R01**, then Evacuate					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

Staged Evacuation - 6-Mile Radius Evacuates, then Evacuate Downwind to 10 Miles													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R21	SE, SSE, S	X	X			X							
R22	SSW	X	X		X	X							
R23	SW, WSW (& FEMA EPZ)	X	X	X	X	X							
R24	W, WNW	X	X	X	X								
R25	NW, NNW	X	X	X									
-	N, NNE, NE, ENE, E, ESE	**Refer to Region R02**											
Shelter-in-Place until 90% ETE for **R02**, then Evacuate					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

Table 6-2. Evacuation Scenario Definitions

Scenarios	Season[2]	Day of Week	Time of Day	Weather	Special
1	Summer	Midweek	Midday	Good	None
2	Summer	Midweek	Midday	Rain	None
3	Summer	Weekend	Midday	Good	None
4	Summer	Weekend	Midday	Rain	None
5	Summer	Midweek, Weekend	Evening	Good	None
6	Winter	Midweek	Midday	Good	None
7	Winter	Midweek	Midday	Rain	None
8	Winter	Weekend	Midday	Good	None
9	Winter	Weekend	Midday	Rain	None
10	Winter	Midweek, Weekend	Evening	Good	None
11	Summer	Midweek	Evening	Good	Firework Shows at Avila Beach[3], Pismo Beach, and Morro Bay Harbor
12	Summer	Midweek	Midday	Good	Lane Closure southbound on US 101

[2] Winter assumes that school is in session (also applies to spring and autumn). Summer assumes that school is not in session.
[3] Transients present at Avila Beach to observe the fireworks at Pismo Beach

Table 6-3. Percent of Population Groups Evacuating for Various Scenarios

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Transients	Shadow	Special Event	Medical Facilities	On-Campus Students	School Buses/Off-Campus Students	Transit Buses	External Through Traffic
1	37%	63%	96%	50%	22%	0%	100%	10%	10%	100%	100%
2	37%	63%	96%	50%	22%	0%	100%	10%	10%	100%	100%
3	4%	96%	10%	65%	20%	0%	100%	10%	0%	100%	100%
4	4%	96%	10%	65%	20%	0%	100%	10%	0%	100%	100%
5	4%	96%	10%	85%	20%	0%	100%	10%	0%	100%	40%
6	37%	63%	100%	25%	22%	0%	100%	100%	100%	100%	100%
7	37%	63%	100%	25%	22%	0%	100%	100%	100%	100%	100%
8	4%	96%	10%	30%	20%	0%	100%	100%	0%	100%	100%
9	4%	96%	10%	30%	20%	0%	100%	100%	0%	100%	100%
10	4%	96%	10%	55%	20%	0%	100%	100%	0%	100%	40%
11	4%	96%	10%	85%	20%	100%	100%	10%	0%	100%	100%
12	37%	63%	96%	50%	22%	0%	100%	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 Event ..... **Additional vehicles in the EPZ due to the identified special event.**
School, Medical 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).**
On-Campus Students ..... **College students who live in college housing. Only college within the EPZ that provides campus housing is California Polytechnic State University. See Section 3.1.1.**
Off-Campus Students ..... **College students who go to college within the EPZ but live outside of the EPZ and commute using personal vehicles. See Section 3.1.1.**
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 60 minutes after the evacuation begins.**

Table 6-4. Vehicle Estimates by Scenario

Scenario	Households With Returning Commuters	Households Without Returning Commuters	Employees	Transients	Shadow	Special Event	Medical Vehicles	On-Campus Students	Off-Campus Students	School Buses	Transit Buses	External Through Traffic	Total Scenario Vehicles
1	28,405	48,142	8,542	8,895	3,310	-	142	154	967	82	156	5,318	104,113
2	28,405	48,142	8,542	8,895	3,310	-	142	154	967	82	156	5,318	104,113
3	2,841	73,707	890	11,563	3,012	-	142	154	-	-	156	5,318	97,783
4	2,841	73,707	890	11,563	3,012	-	142	154	-	-	156	5,318	97,783
5	2,841	73,707	890	15,121	3,012	-	142	154	-	-	156	2,127	98,150
6	28,405	48,142	8,898	4,447	3,323	-	142	1,541	9,668	820	156	5,318	110,860
7	28,405	48,142	8,898	4,447	3,323	-	142	1,541	9,668	820	156	5,318	110,860
8	2,841	73,707	890	5,337	3,012	-	142	1,541	-	-	156	5,318	92,944
9	2,841	73,707	890	5,337	3,012	-	142	1,541	-	-	156	5,318	92,944
10	2,841	73,707	890	9,784	3,012	-	142	1,541	-	-	156	2,127	94,200
11	2,841	73,707	890	15,121	3,012	52,122	142	154	-	-	156	5,318	153,463
12	28,405	48,142	8,542	8,895	3,310	-	142	154	967	82	156	5,318	104,113

Note: Vehicle estimates are for an evacuation of the Full EPZ (Region R04)

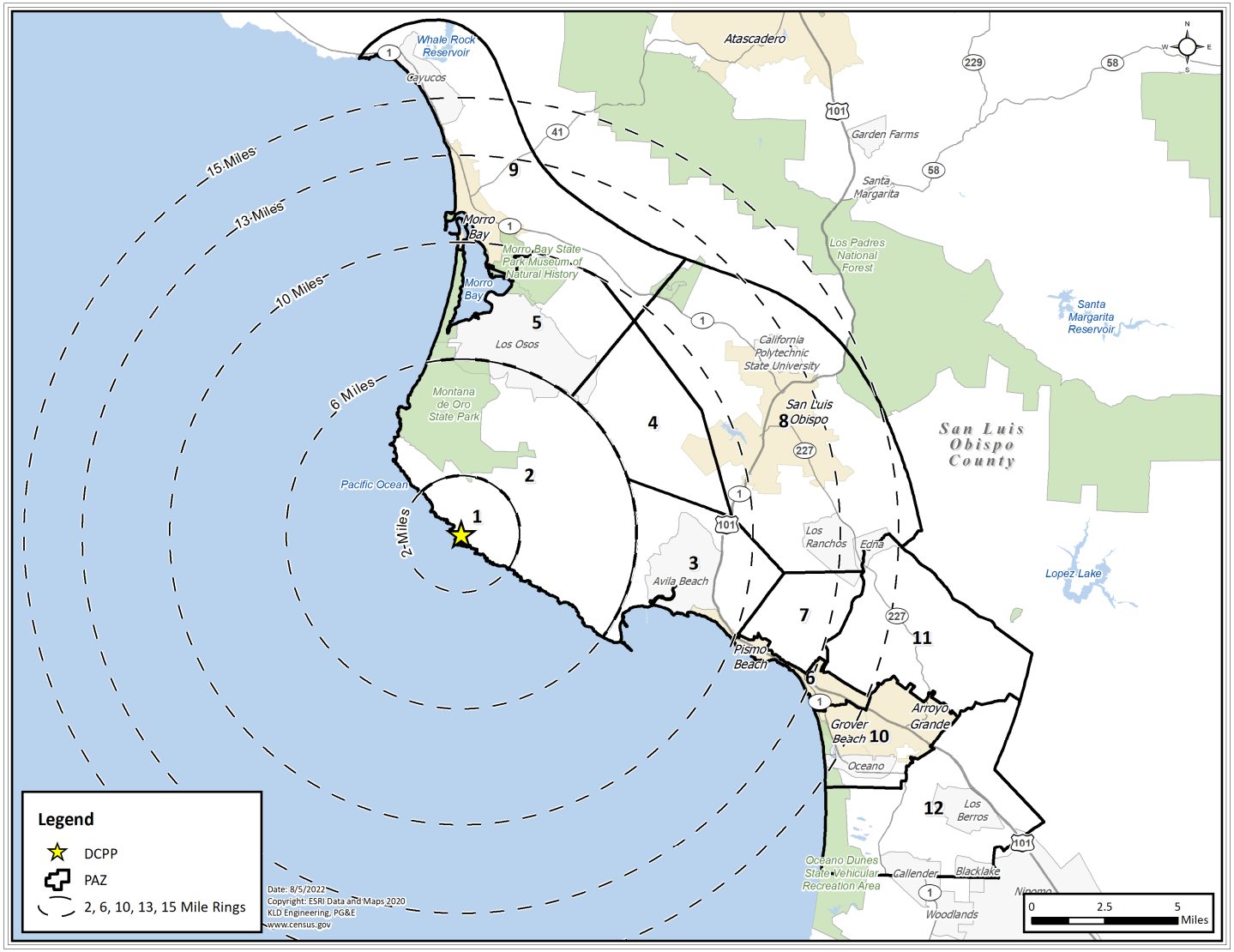


Figure 6-1. DCPP EPZ

7 GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE)

This section presents the ETE results of the computer analyses using the DYNEV II System described in Appendices B, C and D. These results cover 25 regions within the DCPP EPZ and the 12 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 and 6-mile region in both staged and un-staged regions are presented in Table 7-3 and Table 7-4. Table 7-5 define 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 PAZs for which an Evacuation Order has not been issued, yet who elect to evacuate. "Shadow evacuation" is the voluntary outward movement of some people from the Shadow Region (Public Education Zone) for whom no protective action decision 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 DCPP EPZ addresses the issue of voluntary evacuees in the manner shown in Figure 7-1 and Figure 7-2. Within the EPZ, 20 percent of people located in PAZs 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 7-3 presents the area identified as the Shadow Region. This region is called the Public Education Zone (PEZ). In this area, residents are provided with general information about Diablo Canyon but are not likely to be affected by an emergency at the power plant. 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 26,761 people reside in the Shadow Region; 20 percent of them would evacuate. See Table 6-4 for the number of evacuating vehicles from the Shadow Region.

Traffic generated within this Shadow Region, traveling away from the DCPP 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 Rev. 1, staged evacuation consists of the following:

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

2. PAZs comprising regions extending from 2 to 5 miles downwind (6 miles for DCPP) 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 (6) miles downwind continue preparation for evacuation while they shelter.
4. The population sheltering in the 2-to-5-mile (2-to-6-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%.

A second staged evacuation was considered for this study and consists of the following:

1. PAZs comprising the 6-mile region are advised to evacuate immediately.
2. PAZs comprising regions extending from 6 to 10 mile/FEMA EPZ downwind are advised to shelter-in-place while the 6-mile region is cleared.
3. As vehicles evacuate the 6-mile region, people from 6 to 10 mile/FEMA EPZ boundary downwind continue preparation for evacuation while they shelter.
4. The population sheltering in the 6 to 10 mile/FEMA EPZ boundary is advised to evacuate when approximately 90% of the 6-mile region evacuating traffic crosses the 6-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 7-4 through Figure 7-11 illustrate the patterns of traffic congestion that arise for the case when the Full EPZ (Region R04) 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 2016, page 5-5):

> The HCM uses LOS F to define operations that have either broken down (i.e., demand exceeds capacity) or have reached a point that most users would consider unsatisfactory, as described by a specified service measure value (or combination of service measure values). However, analysts may be interested in knowing just how bad the LOS F condition is, particularly for planning applications where different alternatives may be compared. Several measures are available for describing individually, or in combination, the severity of a LOS F condition:
>
> • *Demand-to-capacity ratios* describe the extent to which demand exceeds capacity during the analysis period (e.g., by 1%, 15%).

• *Duration of LOS F describes* how long the condition persists (e.g., 15 min, 1 h, 3 h).

• *Spatial extent measures* describe the areas affected by LOS F conditions. They include measures such as the back of queue and the identification of the specific intersection approaches or system elements experiencing LOS F conditions.

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

Figure 7-4 displays the developing congestion within the population centers of Morro Bay, San Luis Obispo, Avila Beach, Pismo Beach, Grover Beach and Arroyo Grande, just 30 minutes after the Evacuation Order. Note that State Highway 1 (SH-1)/US-101, which is servicing the external-external trips and the entering evacuating trips, is displaying heavy traffic demand between San Luis Obispo and Arroyo Grande. In addition, US-101 north of San Luis Obispo exhibits LOS F conditions near the lane drop (reduced capacity) and steep climb (reduced speeds) in Los Padres Nation Forest. At this time, approximately 10 percent of evacuees have mobilized, and approximately 3 percent of vehicles have evacuated the Full EPZ.

At one hour and 30 minutes after the Evacuation Order, Figure 7-5 displays fully developed congestion within these population centers, along SH-1 and US-101. The confluence of the congestion in the cities of Arroyo Grande and Grover Beach is impacting the rate of travel out of the southern portion of the EPZ. Many major evacuation routes leaving San Luis Obispo to the south (SR 227/Carpenter Canyon Rd, Corbett Canyon Rd, and Orcutt Rd) converge in Arroyo Grande and further converge with US-101 just south of the junction where these roads meet. The merge of these major routes creates a bottleneck that generates significant congestion. In addition, vehicles traveling northbound out of Los Osos and Morro Bay converge with SH-1 creating a bottleneck to the north of the EPZ as well. SH-1 drops to a single lane just north of the EPZ. This loss in capacity of nearly 50% creates a major bottleneck along SH-1 northbound. All north-south and east-west roadways in San Luis Obispo are exhibiting LOS F conditions due to the high evacuation demand in this area. Both PAZ 1 and PAZ 2 are now clear of congestion. As shown in Tables 3-1 and Table 3-5, there are not very many residents or transients in these two PAZs, and the only population group in PAZ 1 is the DCPP employees that have fully mobilized by this time. At this time, approximately 60 percent of evacuees have mobilized, and 16 percent of vehicles have evacuated the Full EPZ.

At 4 hours and 45 minutes after the Evacuation Order, the general population has fully mobilized, and all evacuees have begun their evacuation trip. As shown in Figure 7-6, the congestion in Avila Beach has cleared, but congestion in all other population centers remain. All evacuation routes out of San Luis Obispo remain congested. To the north of the EPZ, SH-1 is congested due to the lane drop just north of the EPZ. Beyond the study area, to the north, SH-46 is congested as evacuees divert to Paso Robles and are met with a limited capacity roundabout with Vineyard Dr just outside of Templeton. To the east, US-101 is severely congested due to the lane drop and steep incline leaving the EPZ in Los Padres National Forest, as well as due to the convergence with SH-41 and SH-46 in Atascadero and Templeton outside

of the study area. To the south many major evacuation routes converge in Grover Beach and Arroyo Grande and then few major evacuation routes proceed south out of these areas (US-101 and SH-1 being the primary two routes). As a result, these areas (and major evacuation routes) are severely congested. At this time, half of the evacuation demand has successfully cleared the Full EPZ.

At 6 hours and 45 minutes after the Evacuation Order, congestion has lessened in Morro Bay, Los Osos, San Luis Obispo, and Grover Beach. The last remnants of congestion within the 10 mile/FEMA EPZ are along SH-1 in PAZ 3 and S Bay Blvd in Los Osos, as shown in Figure 7-7. Arroyo Grande and the northern portion of San Luis Obispo still exhibit significant congestion. SH-1 northbound, US-101 northbound and SH-1/US-101 southbound are still exhibiting LOS F conditions throughout the Full EPZ. At this time, approximately 70 percent of vehicles have evacuated the Full EPZ.

At 7 hours and 30 minutes after the Evacuation Order, Los Osos is clear of congestion and San Luis Obispo is nearly clear of congestion, as shown in Figure 7-8. SH-1 northbound is still fully congested throughout PAZ 9 as evacuees continue to be processed through the limited capacity single lane section beyond the EPZ boundary. US-101 northbound is also severely congested north of San Luis Obispo. US-101 southbound continues to exhibit LOS F conditions in PAZ 3 and south. Congestion to the south (PAZs 6, 10, 11, and 12) is still very prevalent. At this time, approximately 77 percent of vehicles have evacuated the Full EPZ.

At 8 hours and 30 minutes after the Evacuation Order, congestion within the FEMA EPZ (PAZ 1 through PAZ 5) and San Luis Obispo are clear of congestion, as shown in Figure 7-9. Congestion with southern portion of the EPZ (PAZs 6, 10, 11, and 12) remains. SH-1 northbound is still congested but not as far into the EPZ. Congestion along US-101 northbound no longer penetrates the EPZ boundary. At this time, approximately 85 percent of vehicles have successfully evacuated the Full EPZ.

Figure 7-10 displays the patterns of congestion at 10 hours after the Evacuation Order. SH-1 northbound is nearly clear of congestion within the EPZ; this congestion clears 30 minutes later at 10 hours and 30 minutes after the Evacuation Order. Congestion to the south is now limited to PAZs 10, 11, and 12. The major routes in and leaving Arroyo Grande exhibit LOS F conditions, including SR227/Corbett Canyon Rd, Branch St, Fair Oaks Ave, SH-1, El Camino Real, and US-101. Heavy congestion in the southern portion of the Shadow Region on US-101, Thompson Ave, and Joshua St. At this time, approximately 95 percent of vehicles have evacuated the Full EPZ.

Finally, at 11 hours, 5 minutes, the EPZ is clear of congestion, as shown in Figure 7-11. The only congestion that remains is in the shadow region along SH-46 and Old Creek Rd to the north and US-101, Thompson Ave, and Joshua St to the south. All congestion within the Shadow Region clears approximately 50 minutes later at 11 hours and 55 minutes after the Evacuation Order.

7.4 Evacuation Rates

Evacuation is a continuous process, as implied by Figure 7-12 through Figure 7-23. These Figures indicate the rate at which traffic flows out of the indicated areas for the case of an evacuation of the 10-Mile region (Region R03) and Full EPZ (Region R04) under the indicated conditions. One figure is presented for each scenario considered.

As indicated in Figure 7-12, there is typically a long "tail" to these distributions. Vehicles begin to evacuate an area slowly at first, as people respond to the Evacuation Order 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 through Table 7-2 present the ETE values for all 25 Evacuation Regions and all 12 Evacuation Scenarios. Table 7-3 through Table 7-4 present the ETE values for the 6-Mile region for both staged and un-staged keyhole regions downwind to 10 miles. They 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 and 6-mile Regions, 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 and 6-mile Regions, 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 7-4 through Figure 7-11. Most of the congestion is located beyond the 6-mile area; this is reflected in the ETE statistics:

- The 90th percentile ETE for Regions R01 and R02 (2- and 6-mile areas) are comparable and generally range between 1:00 (hr:min) and 1:45.
- The 90th percentile ETE for Region R03 (FEMA EPZ) and R05 – R08 (which extend to approximately 10 miles) range between 1:45 (hr:min) and 3:25 for non-special scenarios. Regions that contain PAZ 5 (wind from the south and the 10-mile region/FEMA EPZ) take on average an hour and 15 minutes longer to clear than those regions that do not contain PAZ 5. Los Osos is the most congested area in the 10-mile region/FEMA EPZ.
- The 90th percentile ETE for Region R04 (Full EPZ) and R09 – R15 (which extend to the EPZ boundary) range between 3:50 (hr:min) and 10:05 for non-special scenarios. Regions that contain PAZs 8, 10, 11, and 12 (wind from the west and west-northwest and the Full EPZ) take on average 3 hours and 30 minutes longer to clear than those regions that do not contain PAZs 8, 10, 11, and 12. Arroyo Grande is the most congested area in the Full EPZ.

The 100th percentile ETE for Regions and Scenarios within 10-miles (FEMA EPZ), are the same values as, or close to, the time to mobilize[1]. This fact implies that the congestion within the 10-mile EPZ dissipates prior to the end of mobilization. However, for those evacuation regions that extend beyond 10 miles, the 100th percentile ETE is significantly longer than the time to mobilize, implying that traffic congestion does not clear prior to the completion of mobilization, as seen in Figure 7-6. The 100th percentile ETE for these regions (Regions R04 and R09 through R15) are dictated by the time for congestion to clear.

Comparison of Scenarios 5 and 11 in Table 7-1 indicates that the Special Event – firework show in Avila Beach, Pismo Beach, and Morro Bay Harbor – has a substantial impact on the ETE for the 90th percentile with increases in ETE of as much as 6 hours and 35 minutes.

Comparison of Scenarios 1 and 12 in Table 7-1 indicates that the roadway closure – one lane southbound on US-101 from the interchange with Los Osos Valley Rd to the interchange with State Highway 166 – has a material impact on 90th percentile ETE for keyhole regions with wind from the south-southwest to north-northwest (Regions R04, R06, R07, R08, and Regions R10 through R15) with increases of up to 3 hours and 35 minutes. When the wind blows in this direction, it results in an evacuation of all of the PAZs that utilize this stretch of roadway. The loss of a lane on US-101 cuts the capacity in half and forces evacuees to either use a single lane on US-101 or find alternative routes. As a result, congestion builds and ETE increases.

[1] Ninety minutes for Region R01, 290 minutes (mobilization time plus 5 minutes travel time to the boundary) for Region R02 and 295 minutes (mobilization time plus 10 minutes travel time to the boundary) for Region R03. The mobilization time is much quicker for Region R01 since this region only contains DCPP employees.

The results of the roadway impact scenario indicate that events such as adverse weather or traffic accidents which close a lane on US-101, could impact ETE. State and local police could consider traffic management tactics such as using the shoulder of the roadway as a travel lane or re-routing of traffic along other evacuation routes to avoid overwhelming US-101. All efforts should be made to remove any blockage on US-101.

7.6 Staged Evacuation Results

Table 7-3 and Table 7-4 present a comparison of the ETE compiled for the concurrent (un-staged) and staged evacuation studies. Note that Regions R21 through R25 are the same geographic areas as Regions R05, R06, R03, R07 and R08. Region R20 is the same geographic area as Region R02.

To determine whether the staged evacuation strategy is worthy of consideration, one must show that the ETE for the 2-mile region (or 6-mile region) can be reduced without significantly affecting the region between 2 miles and 6 miles (or between 6 miles and 10 miles). In all cases, as shown in these tables, the ETE for the 2-mile region and 6-mile region are unchanged when a staged evacuation is implemented. The reason for this is that the congestion within the 6-mile area does not extend upstream to the extent that it penetrates to within 2 miles of the plant, and the congestion within the 10-mile area does not extend upstream to the extent that it penetrates to within 6 miles of the plant. Therefore, staging the evacuation to sharply reduce congestion within the 6-mile or 10 mile area, provides no benefits to evacuees from within the 2-mile region or 6-mile region.

While failing to provide assistance to evacuees from within 2 and 6 miles of the plant, staging produces a negative impact on the ETE for those evacuating from within both the 6-mile and 10-mile area. A comparison of ETE between Regions, R20 and R02 reveals that staging increases the 90th percentile evacuation time for those in the 2 to 6-mile area (see Table 7-1) by up to 5 minutes. A comparison of ETE between Region R21 and R05; Region R22 and R06; Region R23 and R03; Region R24 and R07; and Region R25 and R08, reveals that staging retards the 90th percentile evacuation time for those in the 6 to 10-mile area by up to 50 minutes (see Table 7-1). 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 Evacuation Order, in creating congestion within the EPZ area beyond 6 miles.

In summary, the staged evacuation option provides no benefits to those within 2 and 6 miles of the plant and adversely impacts many evacuees located beyond 6 miles from the plant.

7.7 Guidance on Using ETE Tables

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

1. Identify the applicable **Evacuation Region**:

- Determine the projected azimuth direction of the plume (coincident with the wind direction). This direction is expressed in terms of compass orientation: from N, NNE, NE, …
- Determine the distance that the Evacuation Region will extend from the nuclear power plant. The applicable distances and their associated candidate Regions are given below:
  - 2 Miles (Region R01)
  - To 6 Miles (Region R02)
  - To 10 Miles (Region R03, R05 through R08)
  - To EPZ Boundary (Regions R04, R09 through R15)
  - Site Specific Regions (Regions R16 through R19)
- Enter Table 7-5 and identify the applicable group of candidate Regions based on the distance that the selected Region extends from the plant. Select the Evacuation Region identifier in that row, based on the azimuth direction of the plume, from the first column of the Table.

2. With the desired percentile ETE and Region identified, now 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
   - Special Event
     - July 4th Fireworks Show
     - Road Closure (A lane on US-101 SB is closed)
   - 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 (9) for rain 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.
3. Determine the **ETE Table based on the percentile selected.** Then, for the **Region** identified in Step 1 and the **Scenario** identified in Step 2, proceed as follows:
   - The columns of Table 7-1 are labeled with the Scenario numbers. Identify the row in this table that provides ETE values for the Region identified in Step 1.
   - Identify the proper column in the selected Table using the Scenario number defined 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.

<u>Example</u>

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 the southwest (SW).
- Wind speed is such that the distance to be evacuated is judged to be a 6-mile radius and downwind to EPZ boundary.
- 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 90th percentile ETE is desired. Proceed as follows:

1. Enter Table 7-5 and locate the Region described as "Evacuate 6-Mile Radius and Downwind to the EPZ Boundary" for wind direction from the SW and read "Region R11" in the PAZ column of that row.
2. 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.
3. Enter Table 7-1 to locate the data cell containing the value of the 90th percentile ETE for Region R11 and Scenario 4. This data cell is in the row for Region R11 and in column (4) contains the ETE value of 5:15 (hh:mm).

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

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

	Summer		Summer		Summer	Winter		Winter		Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek		Weekend		Midweek Weekend	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 6 Miles												
R20 (PAZ 1, 2)	1:15	1:15	1:30	1:30	1:30	1:15	1:15	1:45	1:45	1:30	1:30	1:15
Staged Evacuation - 6-Mile Radius Evacuates, then Evacuate Downwind to FEMA EPZ												
R21 (PAZ 1, 2, 5)	3:40	4:10	3:35	3:50	3:35	3:40	4:00	3:35	3:55	3:35	3:40	3:45
R22 (PAZ 1, 2, 4, 5)	3:45	4:00	3:40	3:55	3:40	3:45	4:05	3:40	4:05	3:40	3:40	3:45
R23 (PAZ 1, 2, 3, 4, 5)	3:25	3:40	3:25	3:35	3:30	3:30	3:40	3:25	3:40	3:30	3:30	4:00
R24 (PAZ 1, 2, 3, 4)	2:05	2:10	1:55	2:00	2:05	2:05	2:05	2:00	2:00	2:10	3:05	3:35
R25 (PAZ 1, 2, 3)	2:00	2:05	1:55	2:00	2:00	2:00	2:05	2:00	2:00	2:05	3:10	3:35

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	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
Entire 2-Mile Region, 6-Mile Region, FEMA EPZ and Full EPZ												
R01 (PAZ 1)	1:35	1:35	1:30	1:30	1:30	1:35	1:35	1:30	1:30	1:30	1:30	1:35
R02 (PAZ 1, 2)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R03 (PAZ 1, 2, 3, 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R04 (PAZ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12)	10:50	12:10	10:50	11:55	11:45	11:05	12:10	10:05	10:50	10:35	20:10	15:00
6-Mile Ring and Keyhole to FEMA EPZ												
R05 (PAZ 1, 2, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R06 (PAZ 1, 2, 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R07 (PAZ 1, 2, 3, 4)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R08 (PAZ 1, 2, 3)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
Evacuate 6-Mile Radius and Downwind to Full EPZ Boundary												
R09 (PAZ 1, 2, 5, 9)	5:10	5:35	5:15	5:40	5:10	5:10	5:45	5:00	5:10	5:10	7:00	5:15
R10 (PAZ 1, 2, 4, 5, 8, 9)	8:10	9:10	7:05	8:20	7:10	9:00	10:10	7:15	8:00	7:10	9:40	9:25
R11 (PAZ 1, 2, 3, 4, 5, 8, 9)	8:30	9:20	8:50	9:30	9:05	7:50	8:50	7:45	8:25	8:10	10:10	11:00
R12 (PAZ 1, 2, 3, 4, 5, 7, 8, 9, 11)	8:25	9:15	7:45	8:25	7:20	9:20	10:35	7:50	8:25	7:25	10:05	9:20
R13 (PAZ 1, 2, 3, 4, 6, 7, 8, 10, 11, 12)	10:50	11:45	10:35	11:50	11:20	10:20	11:30	9:20	10:05	9:50	18:55	15:15
R14 (PAZ 1, 2, 3, 6, 7, 10, 11, 12)	9:00	9:55	9:40	10:05	9:45	8:45	9:35	8:15	9:10	8:55	18:35	12:40
R15 (PAZ 1, 2, 3, 10, 12)	8:15	9:10	7:35	8:05	7:10	9:15	10:05	7:25	8:05	7:05	12:30	9:20
Site Specific Regions												
R16 (PAZ 1, 2, 4)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R17 (PAZ 1, 2, 3, 6)	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	5:00	13:40	6:15
R18 (PAZ 3, 4)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R19 (PAZ 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55

	Summer		Summer		Summer	Winter		Winter		Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek		Weekend		Midweek Weekend	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 6 Miles												
R20 (PAZ 1, 2)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
Staged Evacuation - 6-Mile Radius Evacuates, then Evacuate Downwind to FEMA EPZ												
R21 (PAZ 1, 2, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R22 (PAZ 1, 2, 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R23 (PAZ 1, 2, 3, 4, 5)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R24 (PAZ 1, 2, 3, 4)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55
R25 (PAZ 1, 2, 3)	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55	4:55

Table 7-3. Time to Clear *90* Percent of the 2-Mile and 6-Mile Areas within the Indicated Region

	Summer		Summer		Summer	Winter		Winter		Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek		Weekend		Midweek Weekend	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
2-Mile ETE												
Entire 2-Mile Region												
R01 (PAZ 1)	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00
Entire 6-Mile Region												
R02 (PAZ 1, 2)	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00
Staged Evacuation - Entire 6-Mile Region												
R20 (PAZ 1, 2)	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00	1:00
6-Mile ETE												
Entire 6-Mile Region												
R02 (PAZ 1, 2)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
Unstaged Evacuation - FEMA EPZ and Keyhole to 10 Miles												
R03 (PAZ 1, 2, 3, 4, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R05 (PAZ 1, 2, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R06 (PAZ 1, 2, 4, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R07 (PAZ 1, 2, 3, 4)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R08 (PAZ 1, 2, 3)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
Staged Evacuation -FEMA EPZ and Keyhole to 10 Miles												
R21 (PAZ 1, 2, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R22 (PAZ 1, 2, 4, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R23 (PAZ 1, 2, 3, 4, 5)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R24 (PAZ 1, 2, 3, 4)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15
R25 (PAZ 1, 2, 3)	1:15	1:15	1:30	1:30	1:25	1:15	1:15	1:45	1:45	1:30	1:25	1:15

Table 7-4. Time to Clear *100* Percent of the 2-Mile and 6-Mile Areas within the Indicated Region

	Summer		Summer		Summer	Winter		Winter		Winter	Summer	Summer
	Midweek		Weekend		Midweek Weekend	Midweek		Weekend		Midweek Weekend	Midweek Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Region	Midday		Midday		Evening	Midday		Midday		Evening	Evening	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Good Weather	Rain	Good Weather	Special Event	Roadway Impact
2-Mile ETE												
Entire 2-Mile Region												
R01 (PAZ 1)	1:35	1:35	1:30	1:30	1:30	1:35	1:35	1:30	1:30	1:30	1:30	1:35
Entire 6-Mile Region												
R02 (PAZ 1, 2)	1:35	1:35	1:30	1:30	1:30	1:35	1:35	1:30	1:30	1:30	1:30	1:35
Staged Evacuation - Entire 6-Mile Region												
R20 (PAZ 1, 2)	1:35	1:35	1:30	1:30	1:30	1:35	1:35	1:30	1:30	1:30	1:30	1:35
6-Mile ETE												
Entire 6-Mile Region												
R02 (PAZ 1, 2)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
Unstaged Evacuation - FEMA EPZ and Keyhole to 10 Miles												
R03 (PAZ 1, 2, 3, 4, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R05 (PAZ 1, 2, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R06 (PAZ 1, 2, 4, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R07 (PAZ 1, 2, 3, 4)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R08 (PAZ 1, 2, 3)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
Staged Evacuation -FEMA EPZ and Keyhole to 10 Miles												
R21 (PAZ 1, 2, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R22 (PAZ 1, 2, 4, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R23 (PAZ 1, 2, 3, 4, 5)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R24 (PAZ 1, 2, 3, 4)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50
R25 (PAZ 1, 2, 3)	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50	4:50

Table 7-5. Description of Evacuation Regions

Region	Description	PAZ											
		1	2	3	4	5	6	7	8	9	10	11	12
R01	2-Mile Ring	X											
R02	6-Mile Ring (similar to the FEMA 5-mile ring)	X	X										
R03	FEMA EPZ	X	X	X	X	X							
R04	Full EPZ	X	X	X	X	X	X	X	X	X	X	X	X
Evacuate 2-Mile Radius and Downwind to 6 Miles													
Region	**Wind Direction From:**	**PAZ**											
		1	2	3	4	5	6	7	8	9	10	11	12
-	ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW	**Refer to Region R02**											
-	N, NNE, NE, ENE, E	**Refer to Region R01**											
Evacuate 6-Mile Radius and Downwind to 10 Miles/FEMA EPZ[2]													
Region	**Wind Direction From:**	**PAZ**											
		1	2	3	4	5	6	7	8	9	10	11	12
R05	SE, SSE, S	X	X			X							
R06	SSW	X	X		X	X							
-	SW, WSW	**Refer to Region R03**											
R07	W, WNW	X	X	X	X								
R08	NW, NNW	X	X	X									
-	N, NNE, NE, ENE, E, ESE	**Refer to Region R02**											
Evacuate 6-Mile Radius and Downwind to EPZ Boundary													
Region	**Wind Direction From:**	**PAZ**											
		1	2	3	4	5	6	7	8	9	10	11	12
R09	SE, SSE, S	X	X			X				X			
R10	SSW	X	X		X	X			X	X			
R11	SW	X	X	X	X	X			X	X			
R12	WSW	X	X	X	X	X		X	X	X		X	
R13	W, WNW	X	X	X	X		X	X	X		X	X	X
R14	NW	X	X	X			X	X			X	X	X
R15	NNW	X	X	X							X		X
-	N, NNE, NE, ENE, E, ESE	**Refer to Region R02**											

[2] The land based portions of the DCPP EPZ are divided into 12 Protective Action Zones (PAZs) defined by local geographic boundaries. For the purposes of computing ETE's, PAZs 1-5 represent the FEMA 10-mile EPZ. The local geographic boundaries for PAZs 1-5 encompass the majority of land-based regions within approximately 10 miles of DCPP, excluding portions of PAZs 8 and 9 that are within 10 miles of DCPP. PAZs 6-12 cover the areas beyond 10 miles from DCPP. ETEs are computed for all regions within the EPZ boundary.

Site Specific Regions													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R16	-	X	X		X								
R17	-	X	X	X			X						
R18	-	X	X	X	X								
R19	-	X	X		X	X							
Advanced Emergency Classification, 100% of the PAZ(s) already evacuated					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 6 Miles													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R20	ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW	X	X										
-	N, NNE, NE, ENE, E	**Refer to Region R01**											
Shelter-in-Place until 90% ETE for **R01**, then Evacuate					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

Staged Evacuation - 6-Mile Radius Evacuates, then Evacuate Downwind to 10 Miles/FEMA EPZ													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R21	SE, SSE, S	X	X			X							
R22	SSW	X	X		X	X							
R23	SW, WSW (& FEMA EPZ)	X	X	X	X	X							
R24	W, WNW	X	X	X	X								
R25	NW, NNW	X	X	X									
-	N, NNE, NE, ENE, E, ESE	**Refer to Region R02**											
Shelter-in-Place until 90% ETE for **R02**, then Evacuate					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

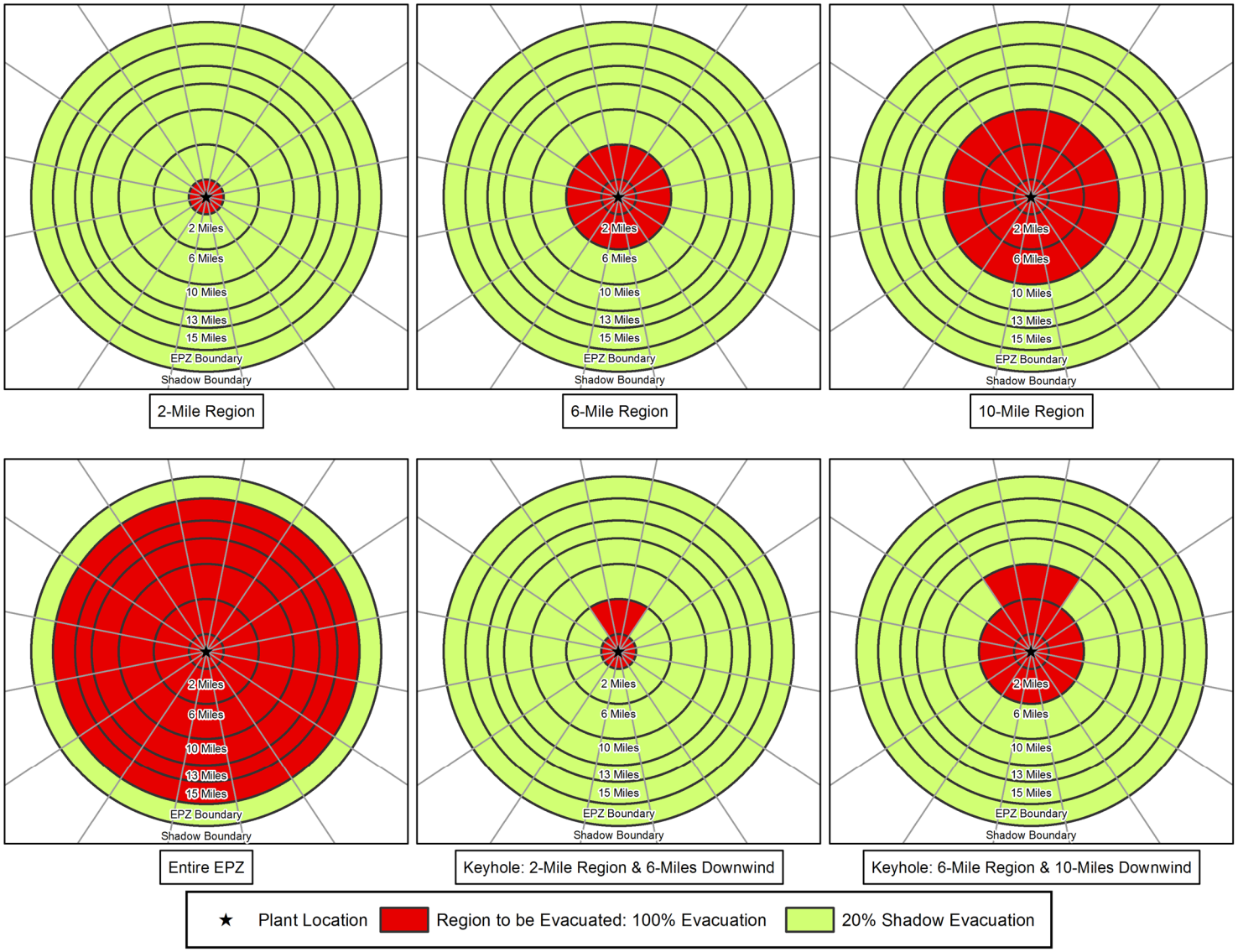


Figure 7-1. Voluntary Evacuation Methodology

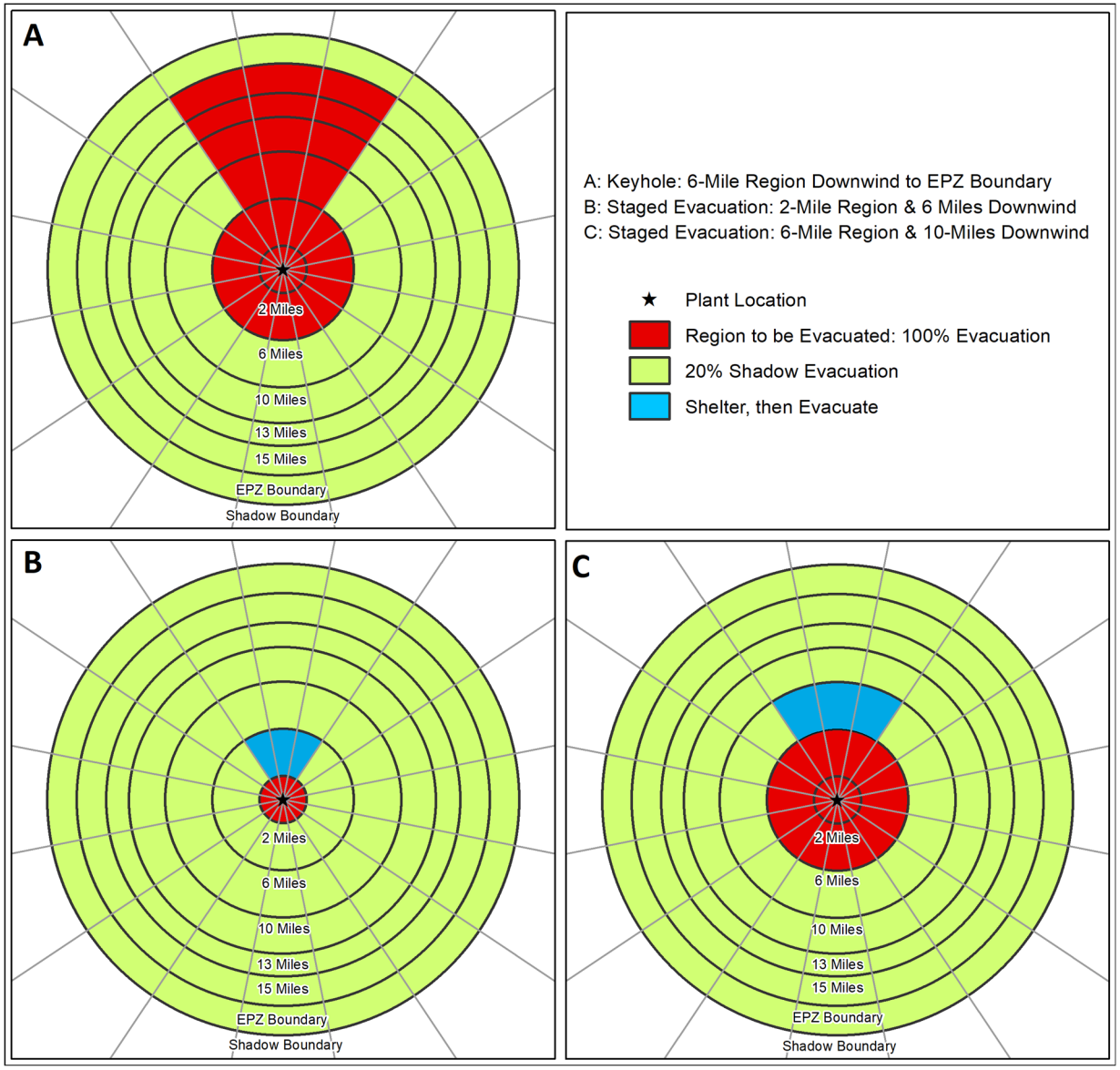


Figure 7-2. Voluntary Evacuation Methodology Including Staged Evacuation

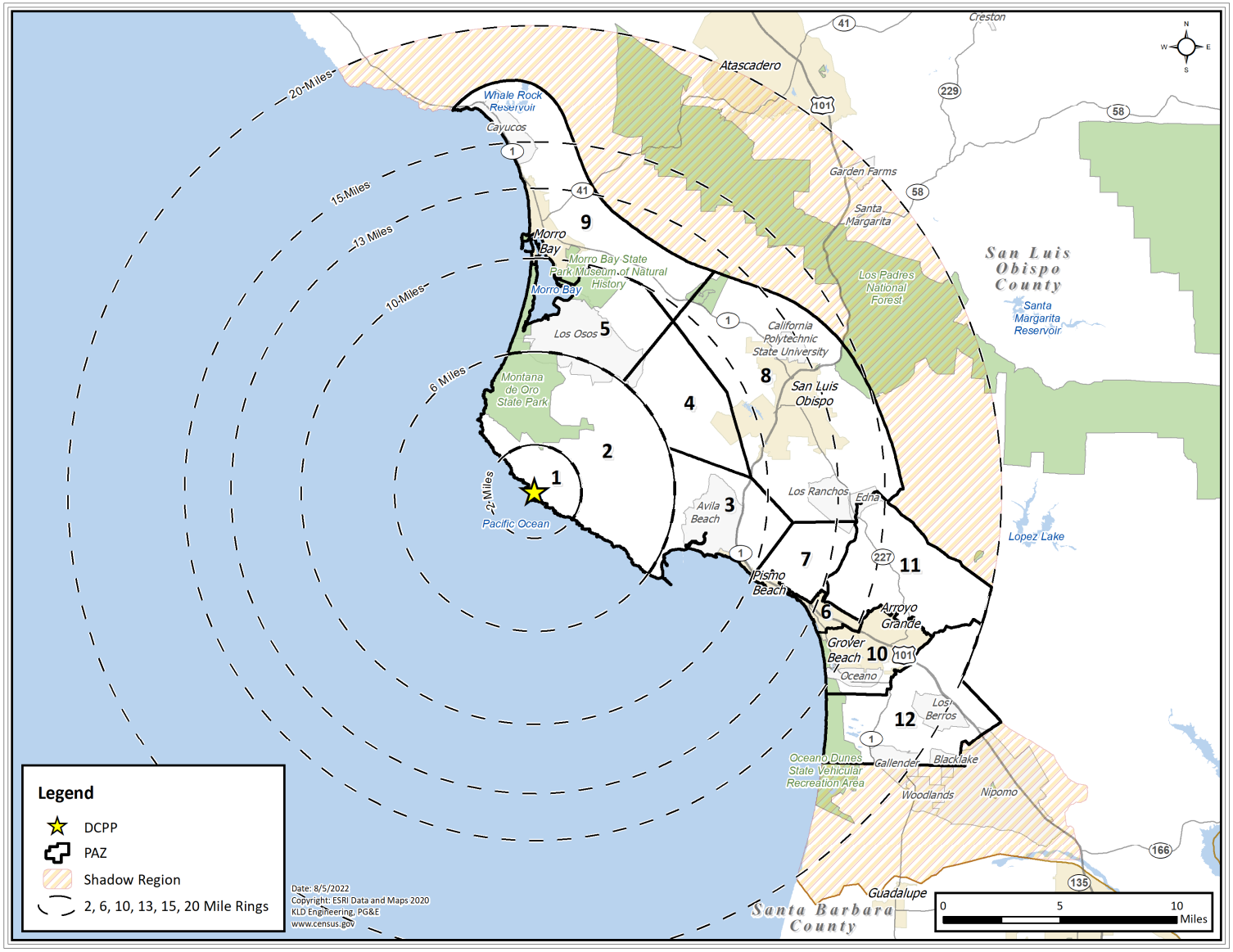


Figure 7-3. DCPP Shadow Region

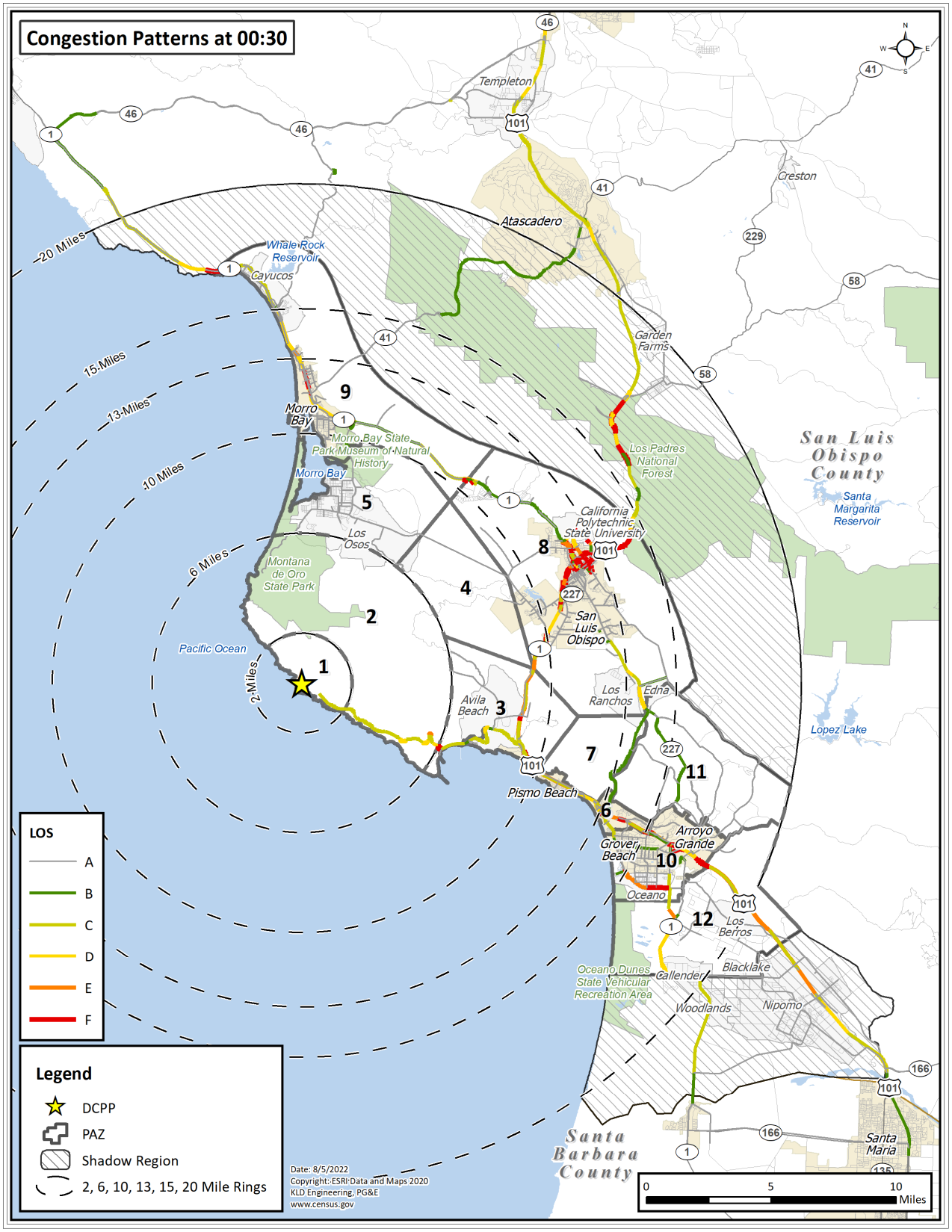


Figure 7-4. Congestion Patterns at 30 Minutes after the Evacuation Order

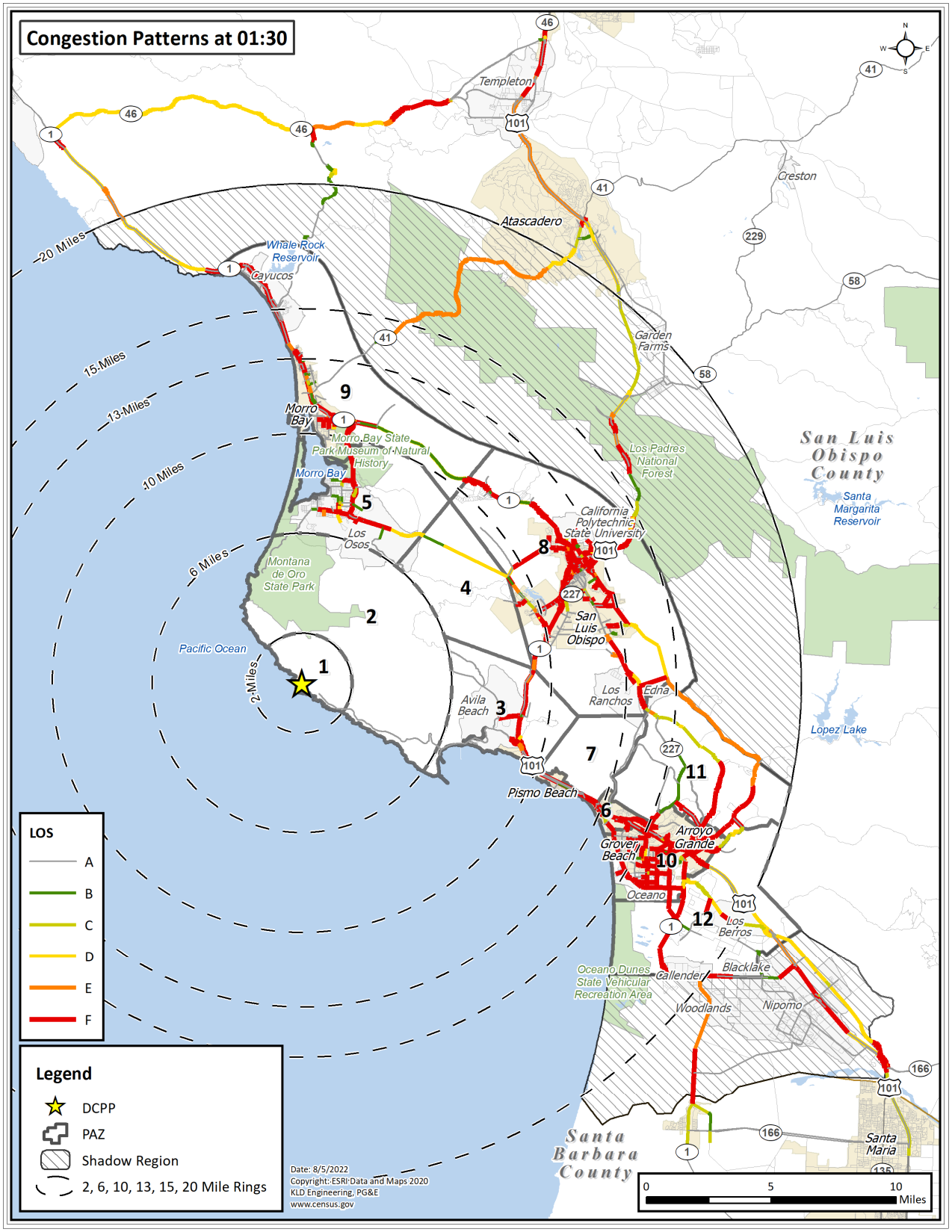


Figure 7-5. Congestion Patterns at 1 Hour, 30 Minutes after the Evacuation Order

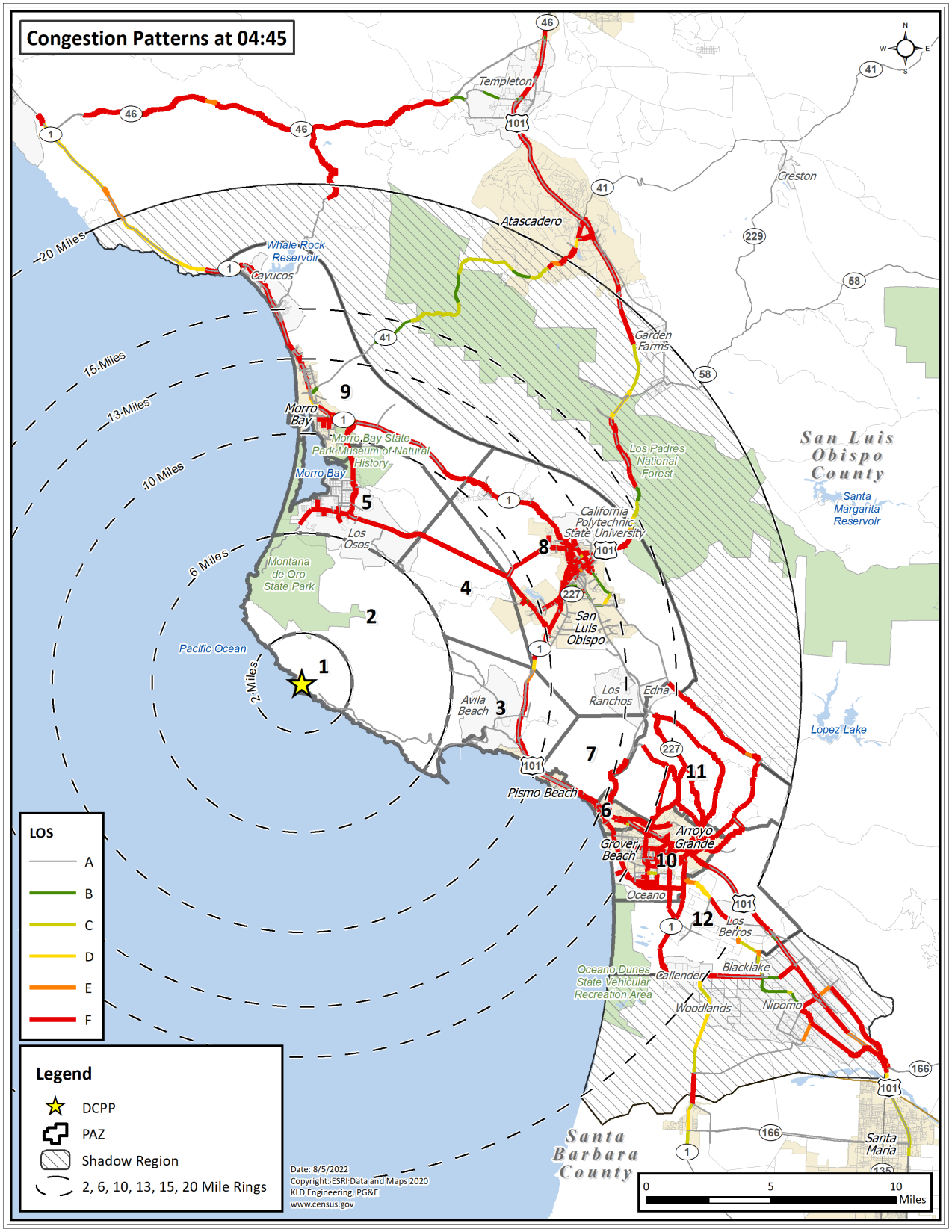


Figure 7-6. Congestion Patterns at 4 Hours, 45 Minutes after the Evacuation Order

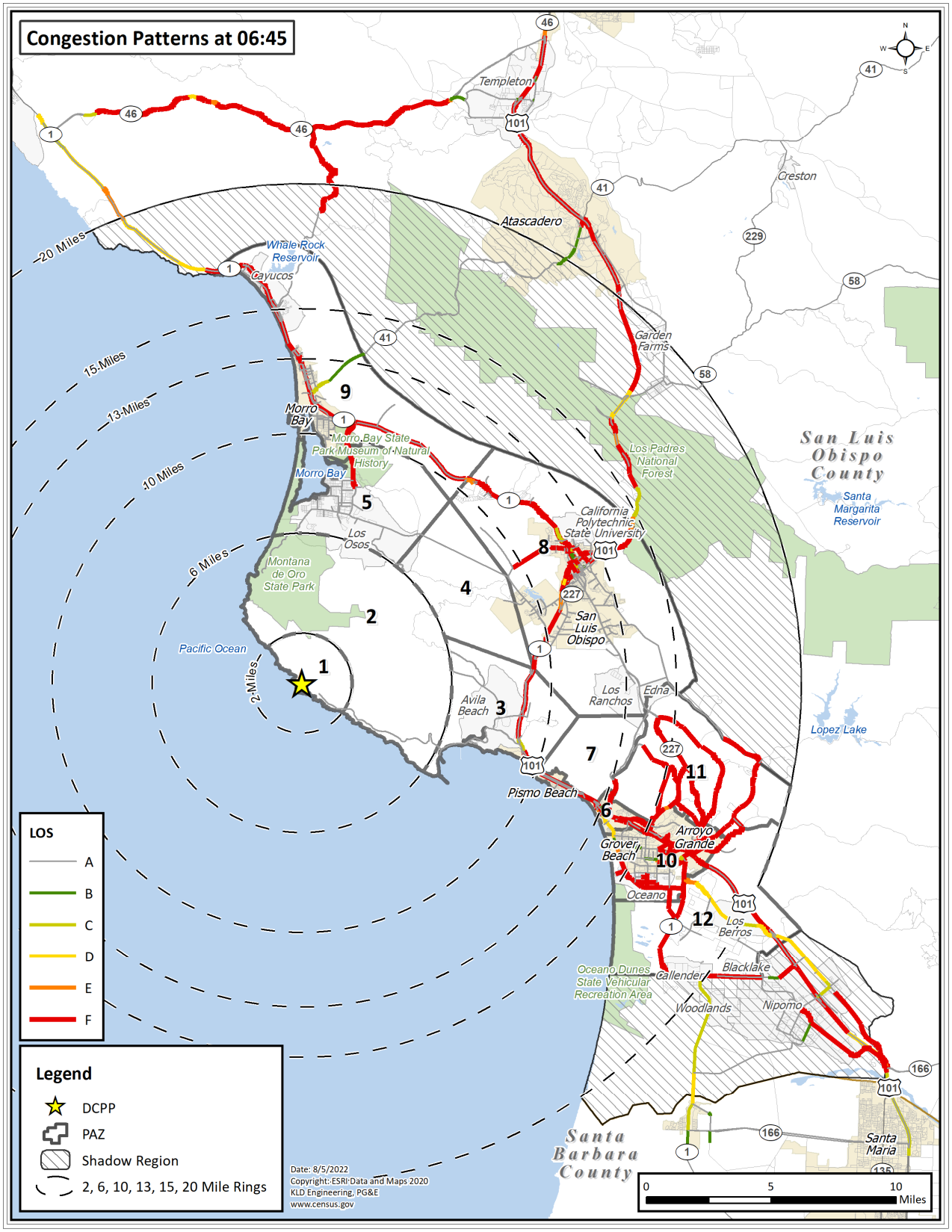


Figure 7-7. Congestion Patterns at 6 Hours, 45 Minutes after the Evacuation Order

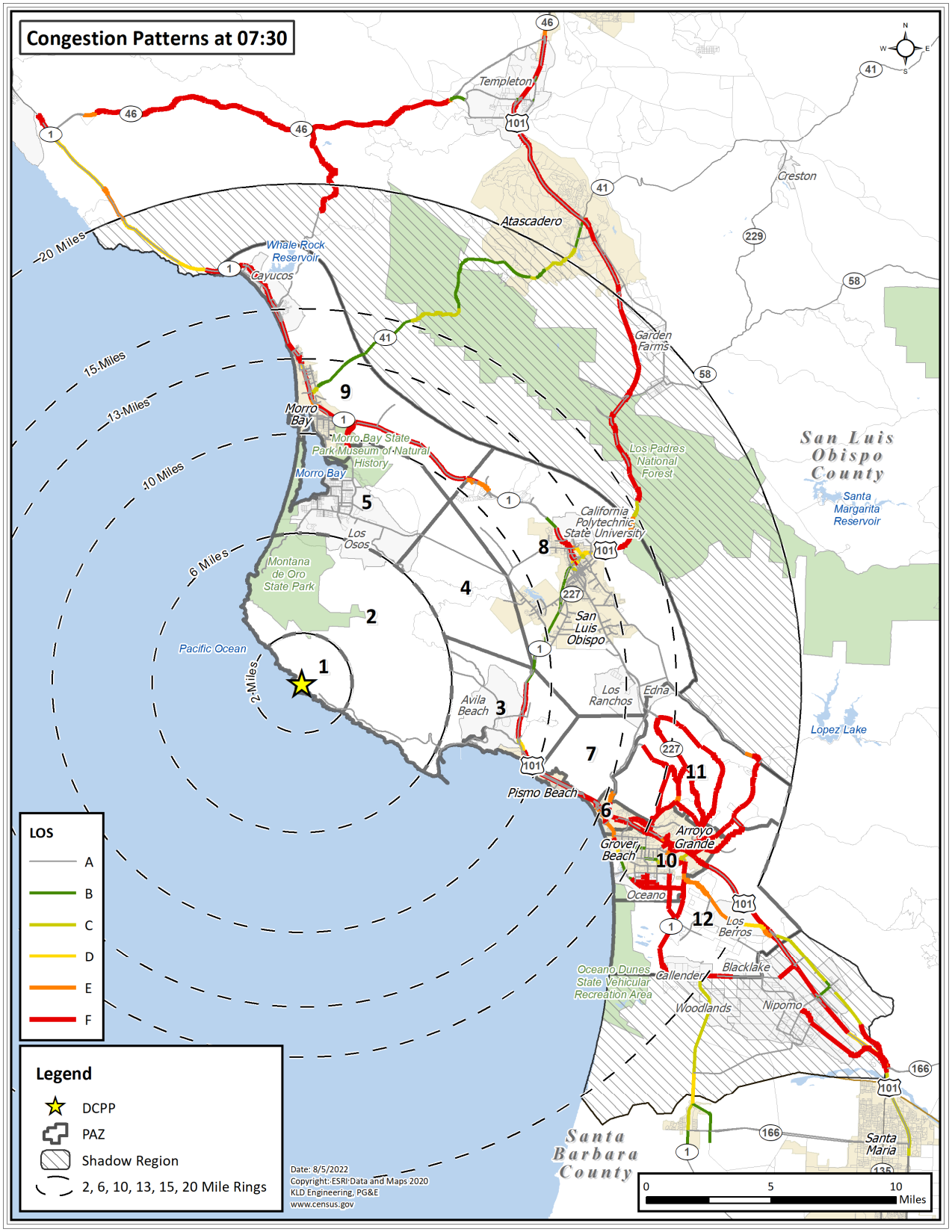


Figure 7-8. Congestion Patterns at 7 Hours, 30 Minutes after the Evacuation Order

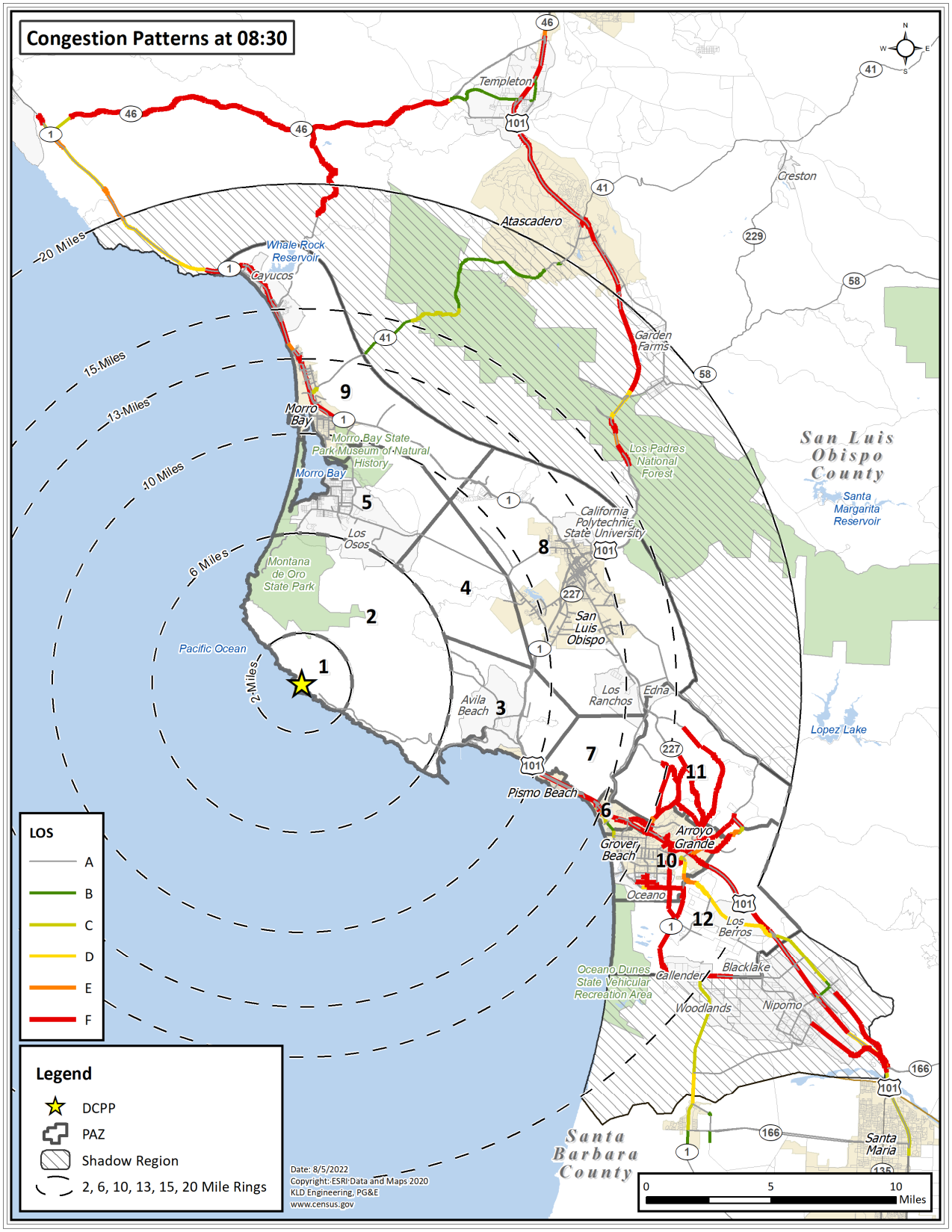


Figure 7-9. Congestion Patterns at 8 Hours, 30 Minutes after the Evacuation Order

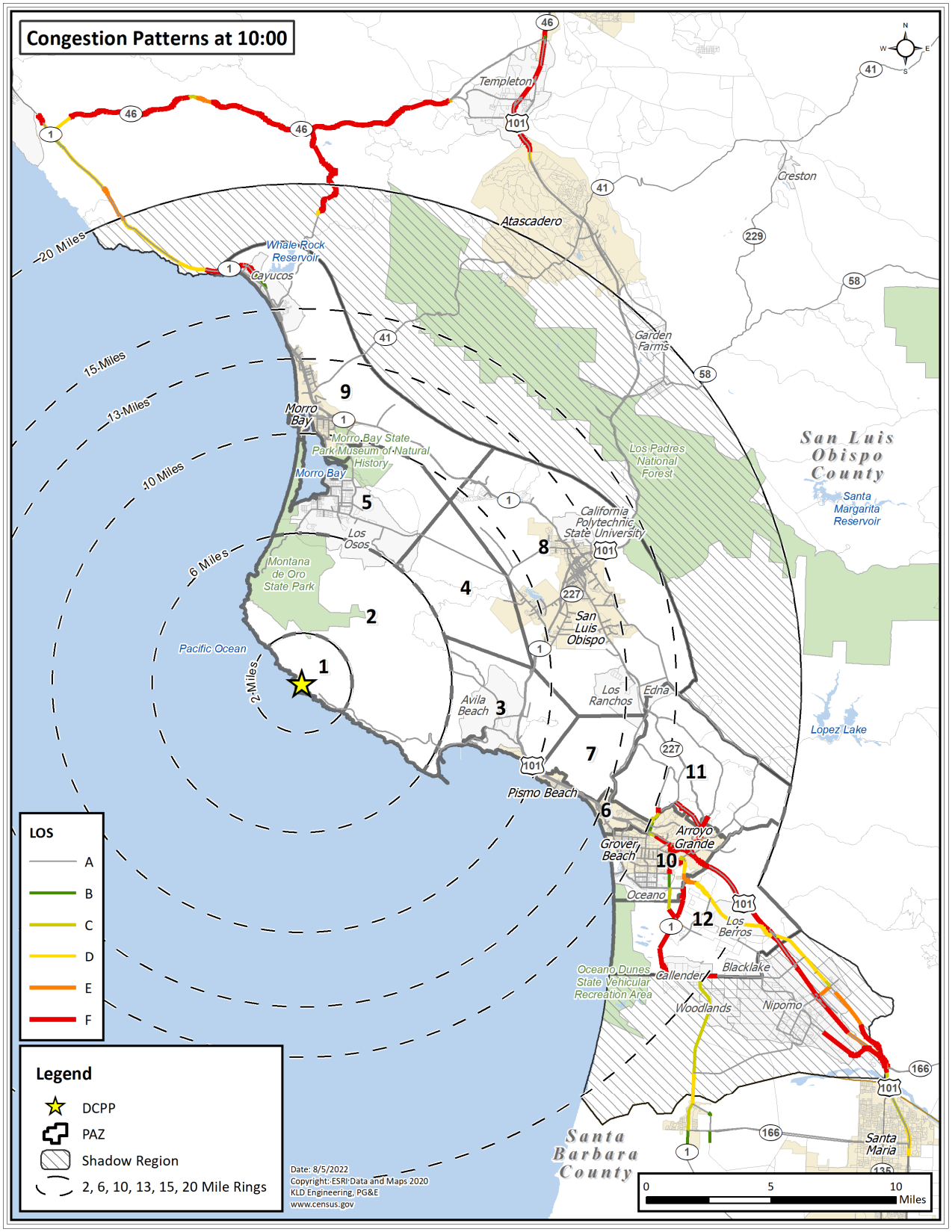


Figure 7-10. Congestion Patterns at 10 Hours after the Evacuation Order

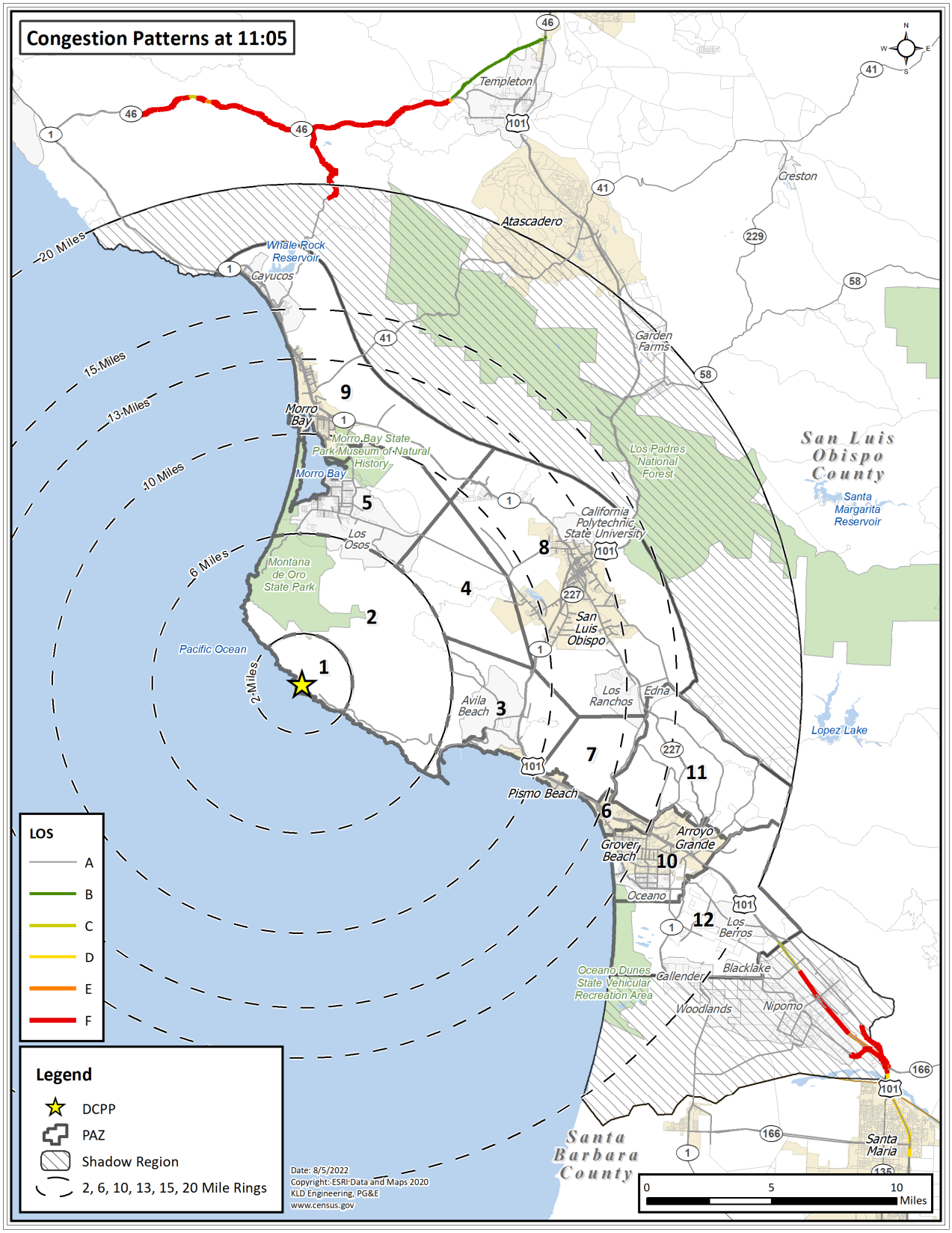


Figure 7-11. Congestion Patterns at 11 Hours, 5 Minutes after the Evacuation Order

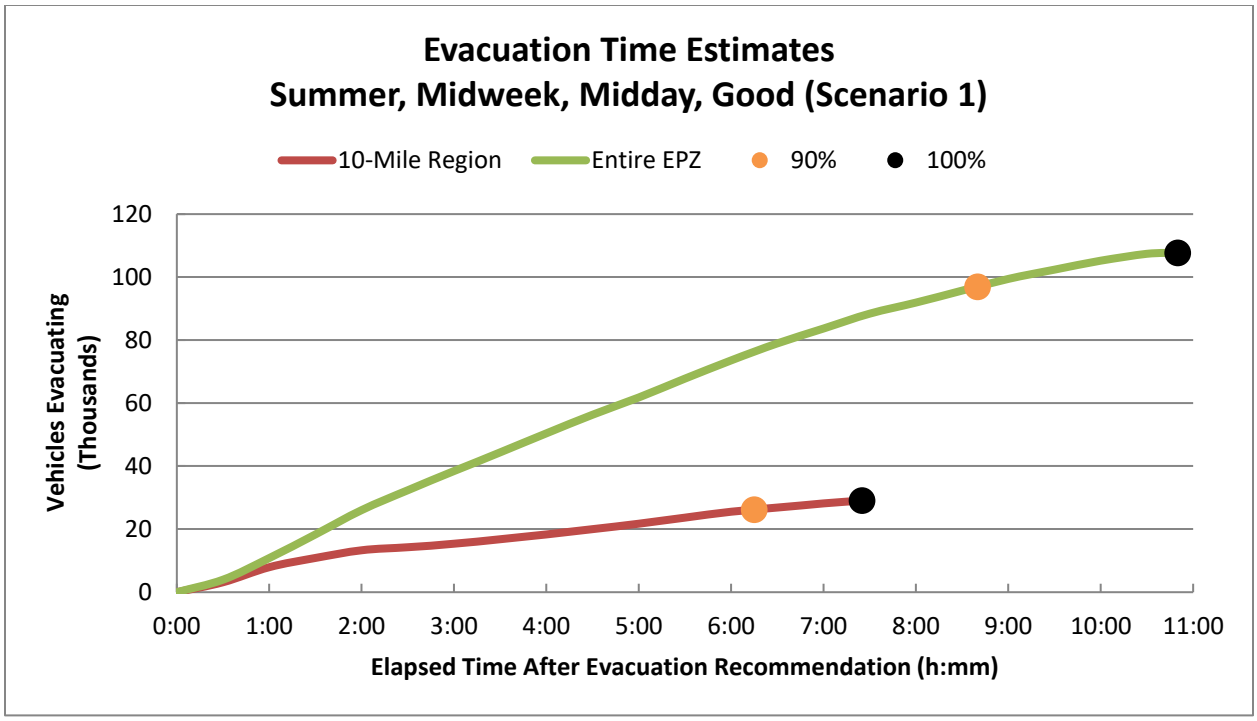


Figure 7-12. Evacuation Time Estimates - Scenario 1 for Region R04

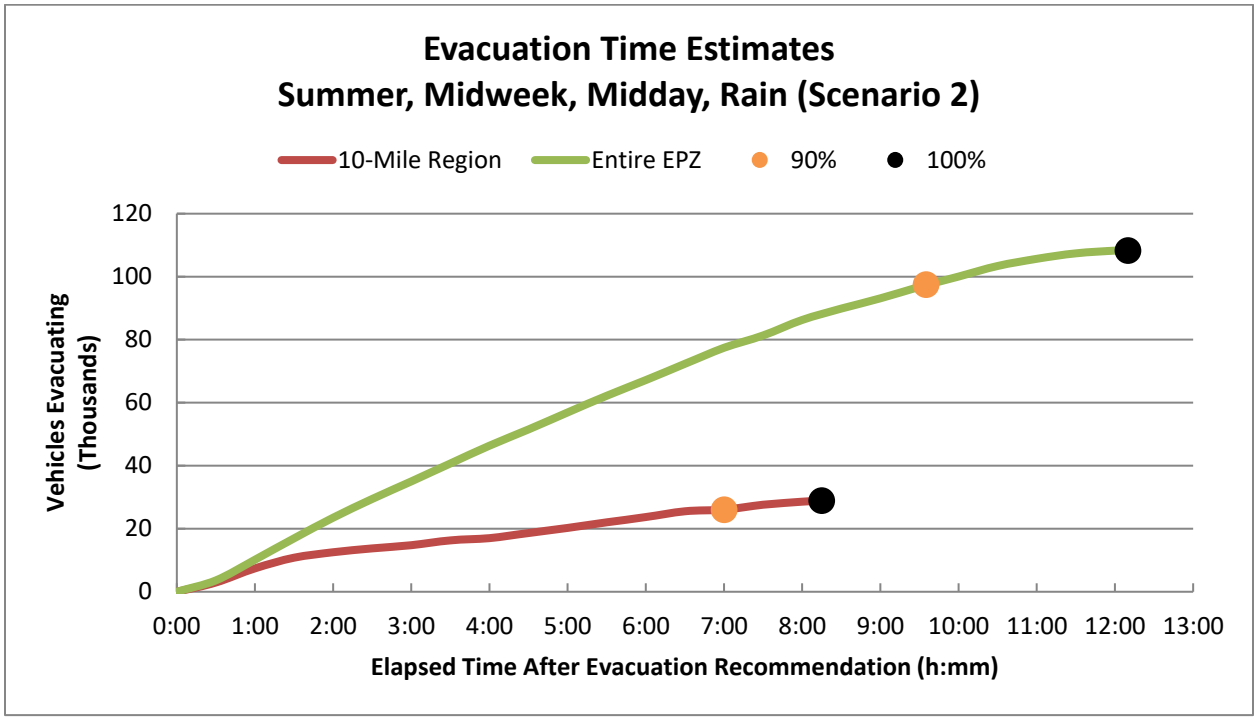


Figure 7-13. Evacuation Time Estimates - Scenario 2 for Region R04

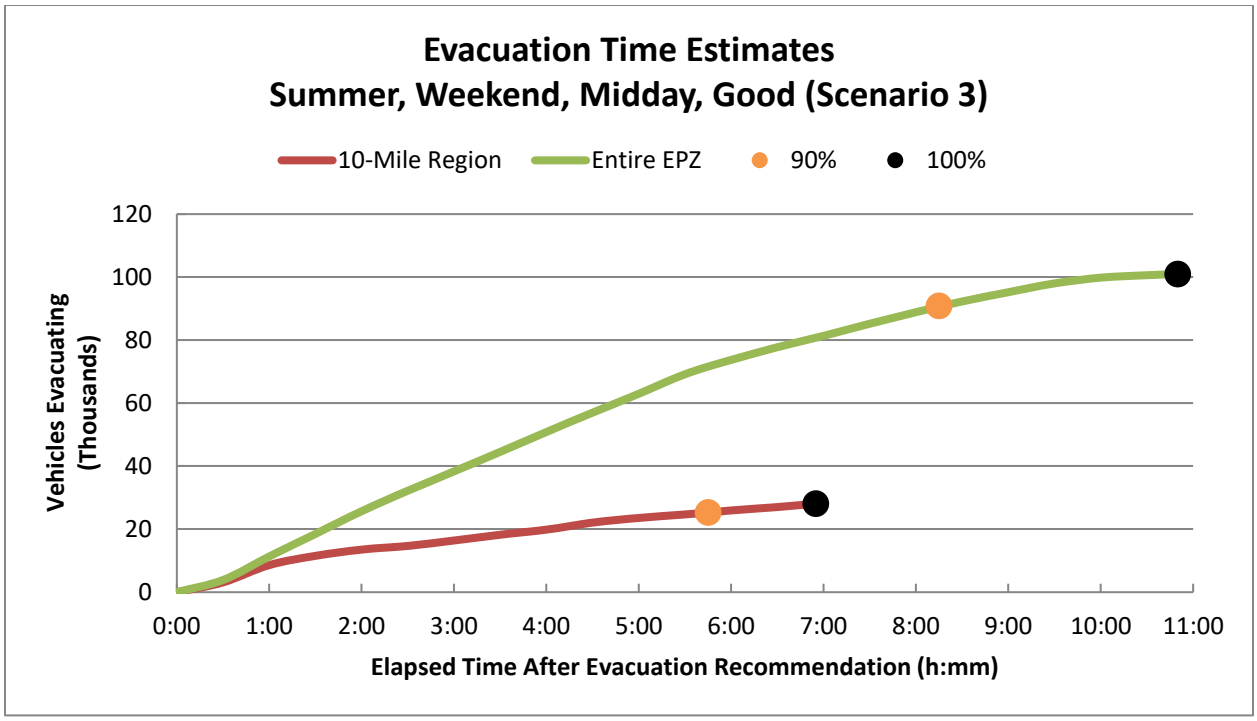


Figure 7-14. Evacuation Time Estimates - Scenario 3 for Region R04

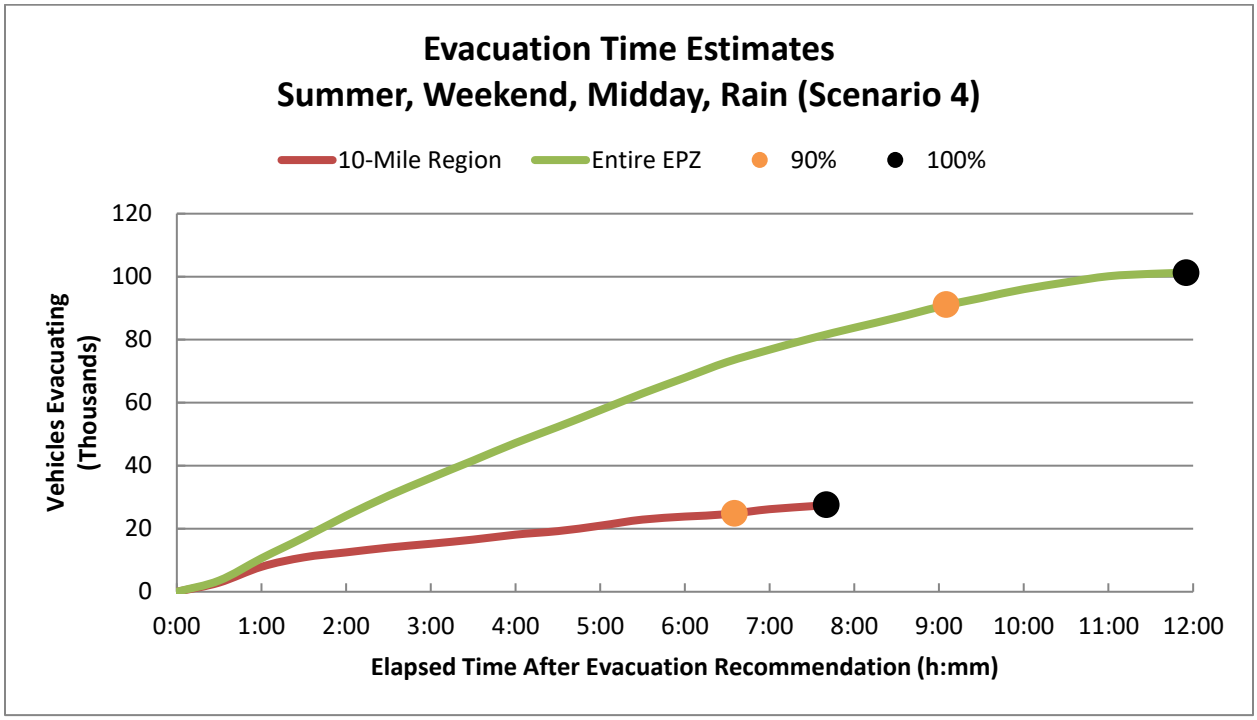


Figure 7-15. Evacuation Time Estimates - Scenario 4 for Region R04

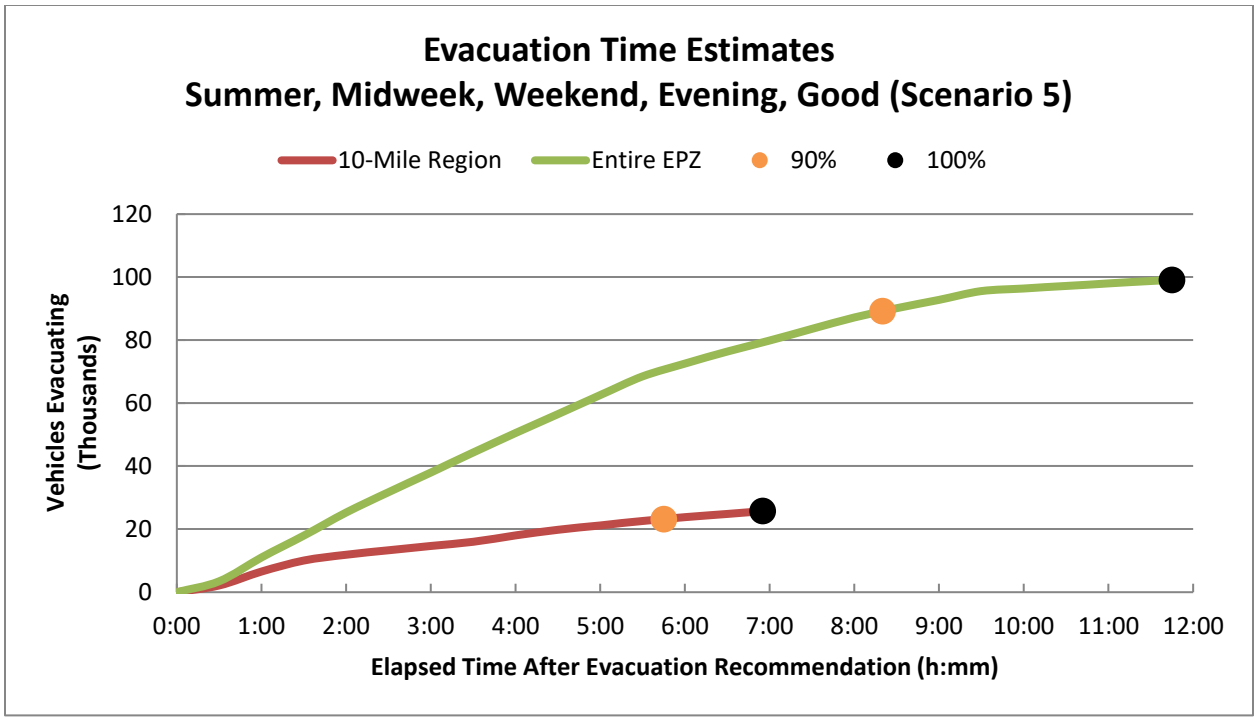


Figure 7-16. Evacuation Time Estimates - Scenario 5 for Region R04

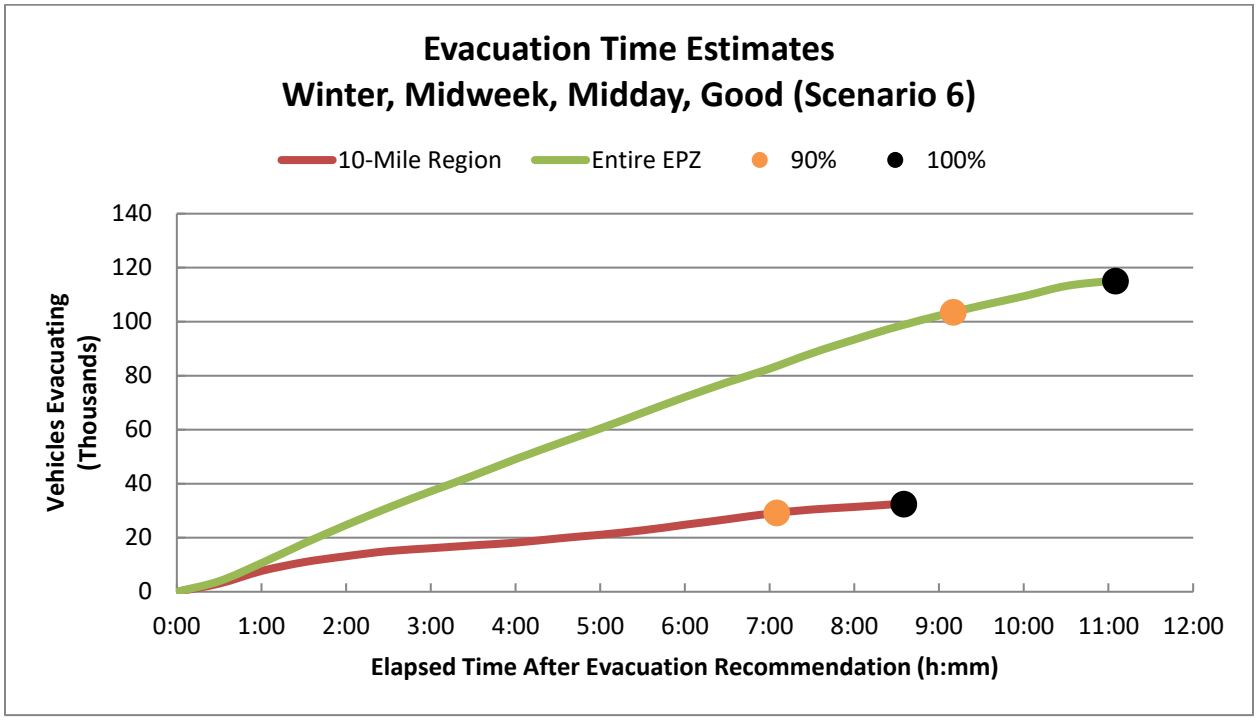


Figure 7-17. Evacuation Time Estimates - Scenario 6 for Region R04

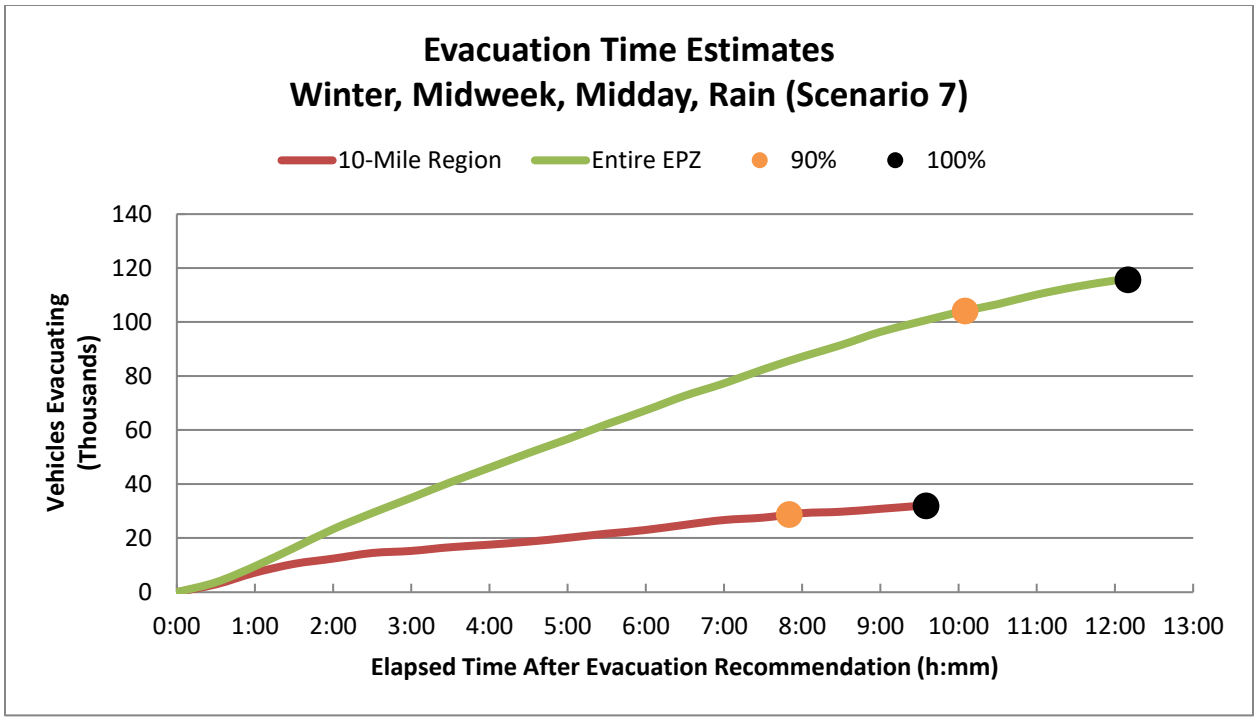


Figure 7-18. Evacuation Time Estimates - Scenario 7 for Region R04

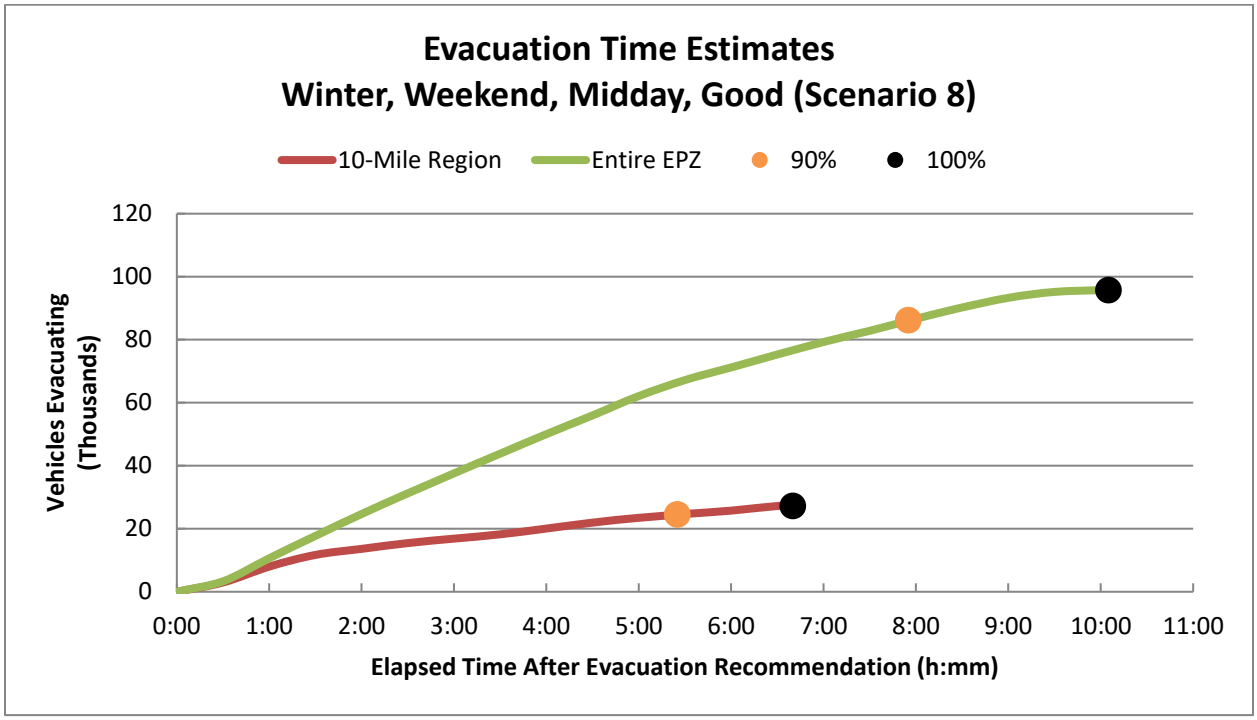


Figure 7-19. Evacuation Time Estimates - Scenario 8 for Region R04

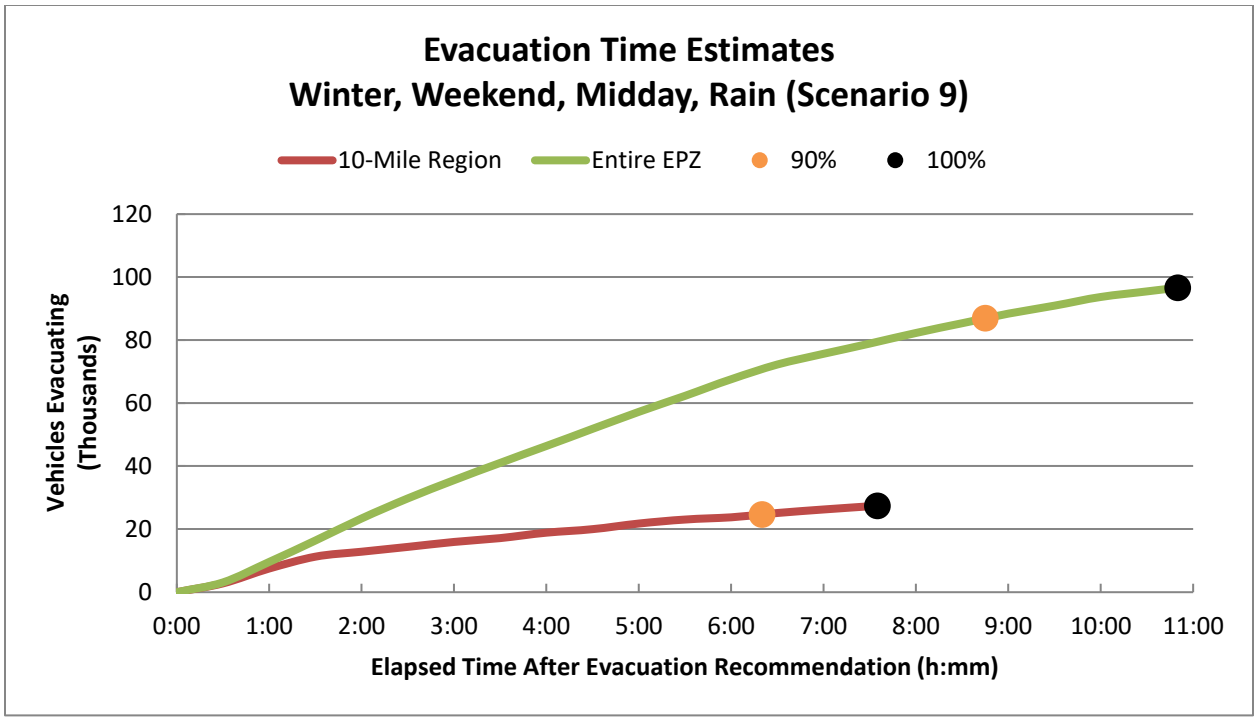


Figure 7-20. Evacuation Time Estimates - Scenario 9 for Region R04

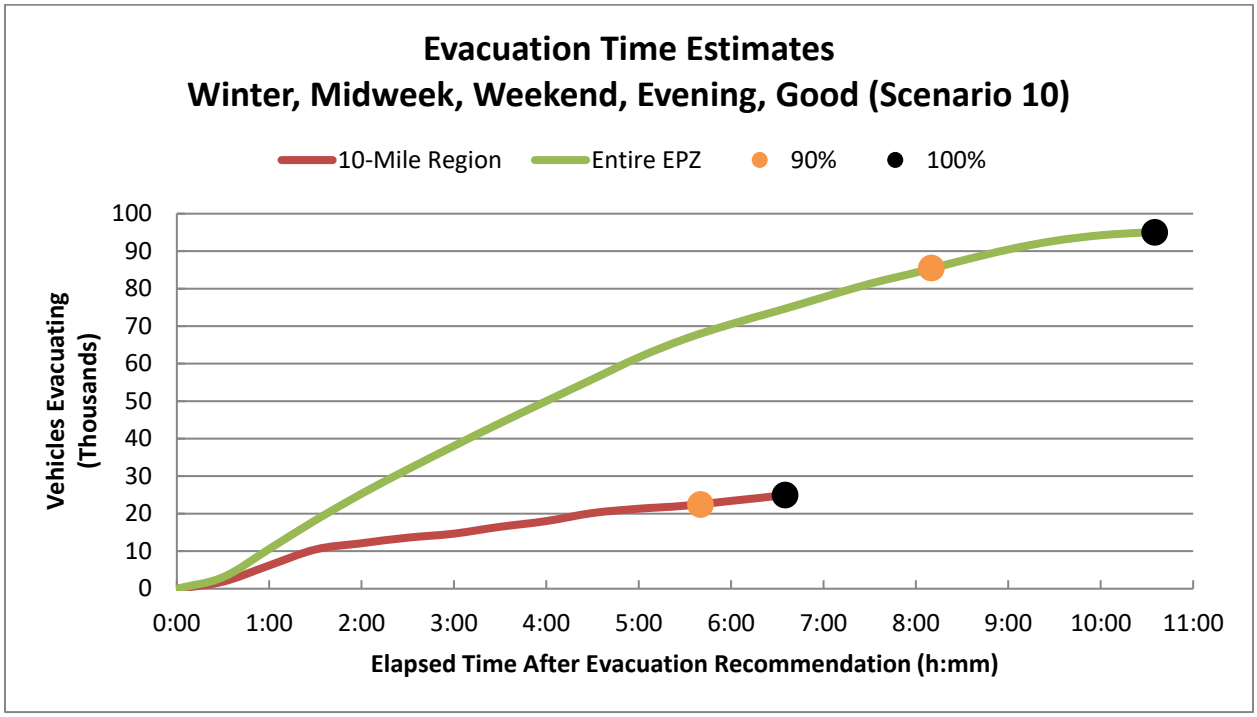


Figure 7-21. Evacuation Time Estimates - Scenario 10 for Region R04

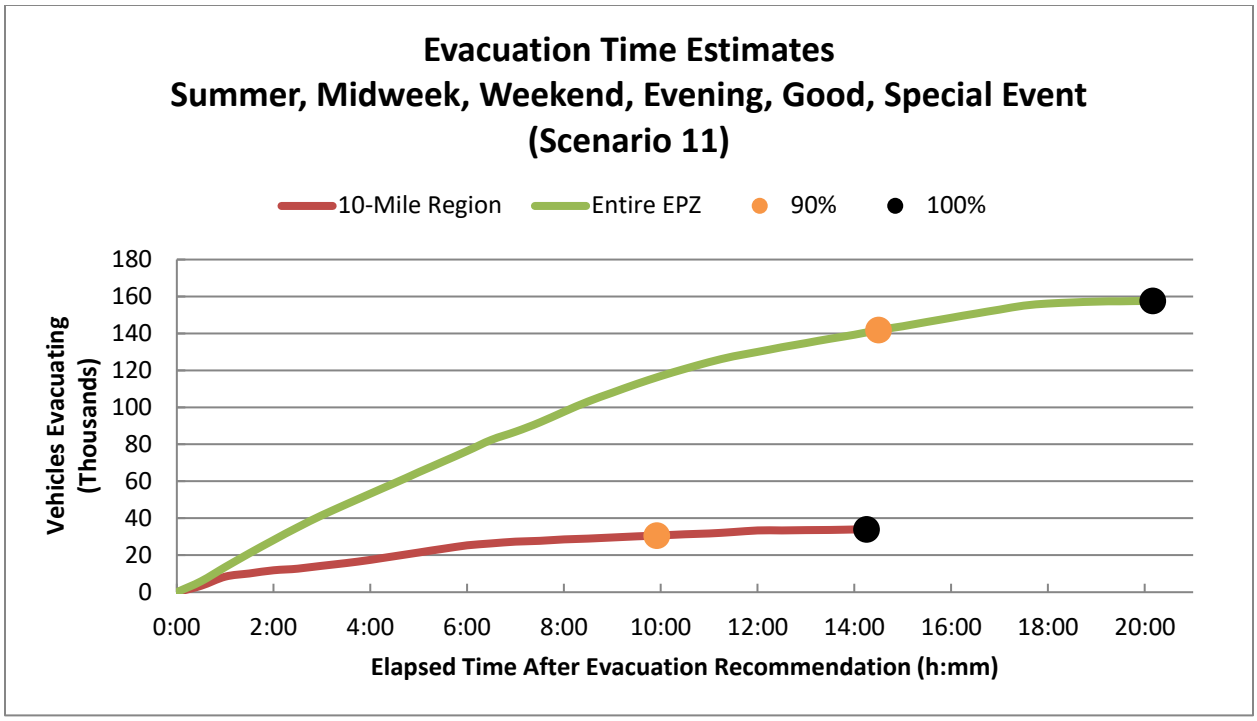


Figure 7-22. Evacuation Time Estimates - Scenario 11 for Region R04

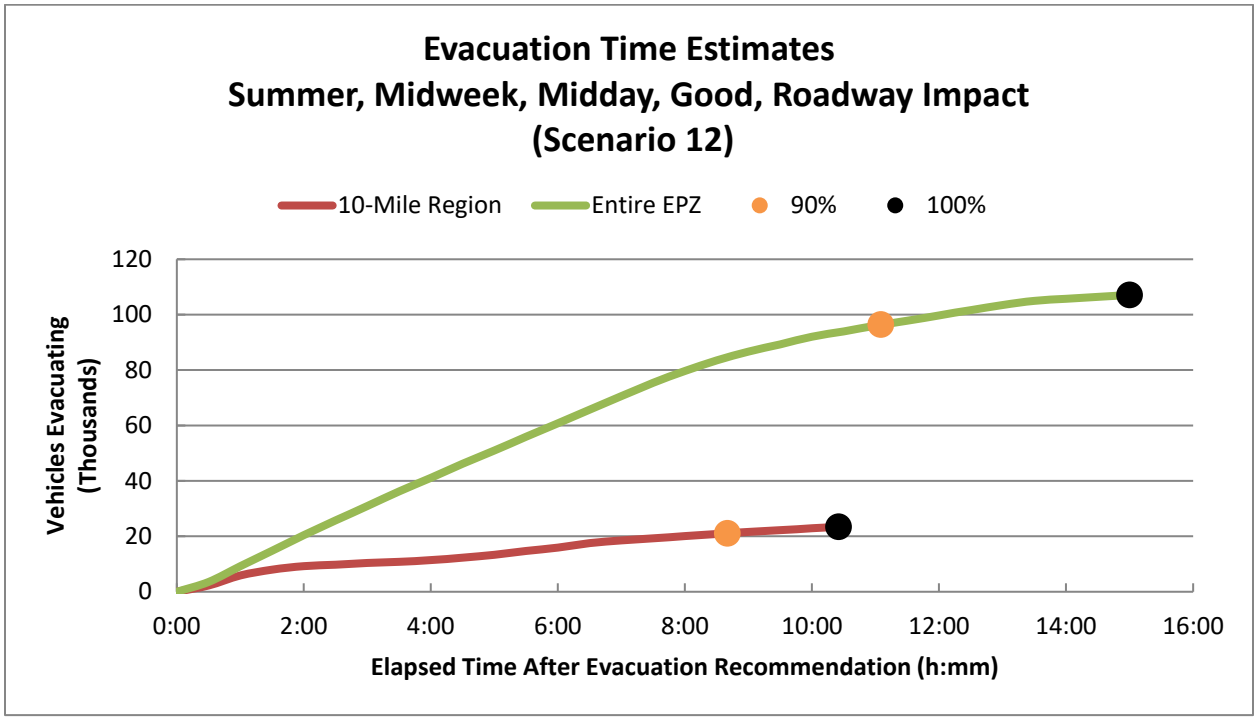


Figure 7-23. Evacuation Time Estimates - Scenario 12 for Region R04

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:

- residents with no vehicles available;
- residents of special facilities such as schools, medical facilities, and correctional facilities (shelter-in-place); and
- access and/or functional needs population.

These transit vehicles mix with the general evacuation traffic that is comprised mostly of "passenger cars" (pc's). The presence of each transit vehicle in the evacuating traffic stream is represented within the modeling paradigm described in Appendix D as equivalent to two pc's. This equivalence factor represents the 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. The location of bus depots impacts the time to travel from the bus depots to the facilities being evacuated. Locations of bus depots were not identified in this study. Rather, the offsite agencies were asked to factor the location of the depots and the distances to the EPZ into the estimate of mobilization time.

During this mobilization period, other mobilization activities are taking place. One of these is the action taken by parents, neighbors, relatives and friends to pick up children from school 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 DCPP EPZ indicates that schoolchildren will be evacuated to school relocation centers at emergency classification levels of Alert or higher, and that parents should pick schoolchildren up at school relocation centers. As discussed in Section 2, this study assumes a fast-breaking general emergency. Therefore, schools and special facilities receive initial notification at the same time as the rest of the EPZ and children are evacuated to school relocation centers. 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, Rev. 1), to present an upper bound estimate of buses required. It is assumed that children at day-care centers that do not

have a means for transportation 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 school relocation centers

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.

8.1 ETEs for Schools, Transit Dependent People, and Special Facilities

Table 8-1 lists the transportation resources and transportation needs to evacuate the transit dependent and special facility population in the EPZ. As shown in the table, there are insufficient bus resources to evacuate the entire transit dependent population in the EPZ at once. EPZ bus resources are assigned to evacuating schoolchildren (if school is in session at the time of the Evacuation Order) 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 or school relocation 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 R04 (the Full 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.

School Evacuation

Activity: Mobilize Drivers (A→B→C)

Mobilization is the elapsed time from the Evacuation Order until the time the buses arrive at the facilities to be evacuated. Based on discussions with San Luis Obispo County Office of Emergency Services (SLOCOES), it is estimated that for a rapidly escalating radiological emergency with no observable indication before the fact, school bus drivers would likely require 120 minutes to be contacted, to travel to the depot, be briefed, and to travel to the transit-dependent facilities. Mobilization time is 10 minutes slower in rain to account for slower travel speeds and reduced roadway capacity.

Activity: Board Passengers (C→D)

Based on discussions with SLOCOES, a loading time of 15 minutes (20 minutes for rain) for school buses is used.

Activity: Travel to EPZ Boundary (D→E)

The buses servicing the schools are ready to begin their evacuation trips at 135 minutes after the Evacuation Order – 120 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 relocation 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 10-2 (refer to the maps of the link-node analysis network in Appendix K for node locations). Data provided by DYNEV during the appropriate timeframe depending on the mobilization and loading times (i.e., 135 minutes after the Evacuation Order for good weather) were used to compute the average speed for each route, as follows:

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

The average speed computed (using this methodology) for the buses servicing each of the schools in the EPZ is shown in Table 8-2 and Table 8-3 for school evacuation. The travel time to the EPZ boundary was computed for each bus using the computed average speed and the distance to the EPZ boundary along the most likely route out of the EPZ. The travel time from the EPZ boundary to the school relocation center was computed assuming an average speed of 55 mph and 50 mph for good weather and rain, respectively.

Table 8-2 (good weather) and Table 8-3 (rain) present the following evacuation time estimates (rounded up to the nearest 5 minutes) for schools in the EPZ:

1. The elapsed time from the Evacuation Order until the bus exits the EPZ; and
2. The elapsed time until the bus reaches the school relocation 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: 120 min. + 15 + 231 = 6:10 for Bellevue-Santa Fe Charter School, with good weather, rounded up to the nearest 5 minutes). The average

single-wave ETE, for schools, is 4 hours and 55 minutes (9:10 - 4:15 = 4:55) less than the 90th percentile ETE for evacuation of the general population in the Full EPZ (Region R04) under winter, midweek, midday, good weather (Scenario 6) conditions.

The evacuation time to the school relocation center is determined by adding the time associated with Activity E→F (discussed below), to this EPZ evacuation time.

Activity: Travel to School Relocation Centers (E→F)

The distances from the EPZ boundary to the school relocation centers are measured using GIS software along the most likely route from the EPZ exit point to the school relocation center. The school relocation centers are mapped in Figure 10-3. For a one-wave evacuation, this travel time outside the EPZ does not contribute to the ETE. Assumed bus speeds of 55 mph and 50 mph for good weather and rain, respectively, will be applied for this activity for buses servicing the school 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 →D→E)

As shown in Table 8-1, there is a shortfall of buses for evacuation of children in a single wave, if the Full EPZ is evacuated at once (a highly unlikely event). As such, a two-wave evacuation may be needed for some schools. Due to the large number of schools in the EPZ, second wave ETE were not computed for each school. Rather, the following representative ETE is provided to estimate the additional time needed for a second wave evacuation of schools. The travel time from school relocation center back to the EPZ boundary and then back to the school was computed assuming an average speed of 55 mph (good weather) and 50 mph (rain) as buses will be traveling counter to the evacuation traffic. Time and distance are based on averages for all schools in the EPZ for good weather:

- School buses arrive at the school relocation centers at 4:35.
- Bus discharges passengers (5 minutes) and driver takes a 10-minute rest: 15 minutes.
- Bus returns to EPZ and completes second route: 18 minutes (equal to average travel time to school relocation center for good weather) + 8 minutes (7.3 miles, average distance to EPZ boundary from Table 8-2 @ 55 mph) + 60 minutes (7.3 miles, average distance to EPZ boundary from Table 8-2 @ 7.37 mph, average network speed at this time) = 86 minutes.
- Loading Time: 15 minutes.
- Bus exits EPZ at time 4:35 + 0:15 + 1:26 + 0:15 = 6:35 after the Evacuation Order.

Given the average single wave ETE for schools is 4:15, a second wave evacuation would require an additional 2 hours and 20 minutes, on average for good weather.

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

A detailed computation of transit dependent population was done and is discussed in Section 3.6. The total number of transit dependent people per PAZ was determined using a weighted distribution based on population. See Table 3-10 for the distribution used. As discussed in Section 3.6, the number of buses required to evacuate this population and pets was determined by the capacity of 20 people per bus. KLD designed 5 bus routes to service the major evacuation routes and carless collection points (as discussed in Section 10). The routes are shown graphically in Figure 10-2 and described in Table 10-1. Those buses servicing the transit-dependent evacuees will first travel along these routes, gather people at the carless collection points, then proceed out of the EPZ.

Activity: Mobilize Drivers (A→B→C)

Mobilization time is the elapsed time from the Evacuation Order until the time the buses arrive at their designated route. The buses dispatched from the depots to service the transit-dependent evacuees will be scheduled so that they arrive at their respective routes after majority of their passengers have completed their mobilization. As shown in Figure 5-4 (Residents with no Commuters), approximately 80% of the evacuees will have completed their mobilization when the buses will begin their routes, approximately 120 minutes after the Evacuation Order for good weather. Those routes with multiple buses have been designed such that buses are dispatched using 20-minute headways. The use of bus headways ensures that those people who take longer to mobilize will be picked up.

Activity: Board Passengers (C→D)

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

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

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

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

Assigning reasonable estimates:

- B = 80 seconds: a generous value for a single passenger, carrying personal items and pets, to board per stop
- v = 25 mph = 37 ft/sec
- a = 4 ft/sec/sec, a moderate average rate

Then, P ≈ 1.5 minutes per stop. Allowing 30 minutes pick-up time per bus run implies 20 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.

Activity: Travel to EPZ Boundary (D→E)

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

Table 8-4 and Table 8-5 present the transit-dependent population evacuation time estimates for each bus route calculated using the above procedures for good weather and rain, respectively.

For example, the ETE for the first group of buses on the bus route servicing PAZs 5 and 9 (route number 48) is computed as 120 + 364 + 30 = 8:35 for good weather (rounded up to nearest 5 minutes). Here, 364 minutes is the time to travel 16 miles at the average speed output by the model for this route starting at 120 minutes (2.64 mph).

The average single wave ETE for the transit dependent population does not exceed the 90th percentile ETE for the general population for a winter, midweek, midday, good weather scenario.

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 10-3. For a one-wave evacuation, this travel time outside the EPZ does not contribute to the ETE. Assumed bus speeds of 55 mph and 50 mph for good weather and rain, 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→D→E)

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 the start of 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 the first group of buses on the bus route servicing PAZs 5 and 9 (route number 48) is computed as follows for good weather:

- Bus arrives at reception center at 9:14 in good weather (8:35 to exit EPZ + 39-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: 39 minutes (equal to travel time to reception center) + 17.5 minutes (16 miles @ 55 mph – assumed speed to start of route) + 17.5 minutes (16 miles @ 55 mph – network wide speed at time bus starts route for the second time) = 74 minutes.
- Bus completes pick-ups along route: 30 minutes.
- Bus exits EPZ at time 9:14 + 0:15 + 1:14 + 0:30 = 11:15 (rounded up to nearest 5 minutes) after the Evacuation Order.

The ETE for the completion of the second wave for all transit-dependent bus routes are provided in Table 8-4 and Table 8-5.

The average ETE (9 hours and 10 minutes) for a two-wave evacuation of the transit-dependent population is equal to the ETE for the general population at the 90th percentile for an evacuation of the Full EPZ (Region R04) under winter, midweek, midday, good weather conditions (Scenario 6).

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

Activity: Mobilize Drivers (A→B→C)

As discussed in Section 2.4, it is assumed that the mobilization time for medical facilities average 90 minutes in good weather and 100 minutes in rain. Specially trained medical support staff (working their regular shift) will be on site to assist in the evacuation of patients. Additional staff (if needed) could be mobilized over this same 90-minute timeframe.

Activity: Board Passengers (C→D)

Item 5 of assumption 2.4 discusses transit vehicle loading times for medical facilities. Loading times are assumed to be 1 minute per ambulatory passenger, 5 minutes per wheelchair bound passenger, and 15 minutes per bedridden passenger for buses, wheelchair buses, and ambulances, respectively. Item 3 of Section 2.4 discusses transit vehicle capacities to cap loading times per vehicle type.

Activity: Travel to EPZ Boundary (D→E)

The travel distance along the respective pick-up routes within the EPZ is estimated using the UNITES software. 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 8-6 and Table 8-7 summarize the ETE for medical facilities for good weather, and rain. As discussed in Item 2 of Section 2.4, small medical facilities are not included in these ETE

calculations since it is assumed patients at small medical facilities are evacuated in staff personal vehicles. Average speeds output by the model, capped at 55 mph (50 mph for rain), are used to compute travel time to the EPZ boundary. 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, such that the maximum loading times for buses, wheelchair buses ambulance are 30, 75 and 30 minutes. All ETE are rounded up to the nearest 5 minutes.

For example, the calculation of ETE for the ambulatory residents at Avila Senior Living SLO during good weather is:

ETE: 90 + 6 x 1 + 63 = 159 min. or 2:40 rounded up to the nearest 5 minutes.

It is assumed that special 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.

The average single wave ETE for medical facilities in the EPZ does not exceed the 90th percentile ETE for the general population for a winter, midweek, midday, good weather scenario.

<u>Activity: Vehicles Travel to Host Facilities (E→F), Passengers Leave (F→G), Vehicle Returns to Route for Second Wave Evacuation (G→C→D→E)</u>

As shown in Table 8-1, there are insufficient buses and ambulances to evacuate the ambulatory and bedridden patients at the medical facilities in the EPZ. Due to the large number of medical facilities in the EPZ, second wave ETE for these vehicle types were not computed for each medical facility. Rather, the following representative ETE is provided to estimate the additional time needed for a second wave evacuation using school buses after the schools have been evacuated and ambulances after the first wave has completed their trip. Times and distances are based on facility-wide averages:

- Ambulatory patients (buses):
  - Buses arrive at School Relocation Centers at 4:35 (average travel time to School Relocation Centers Table 8-2).
  - Bus discharges passengers (23 minutes – average loading time from Table 8-6) and driver takes a 10-minute rest: 33 minutes.
  - Bus returns to facility: 18 minutes to travel back to the EPZ boundary (equal to the average travel time to reception center for good weather from Table 8-2) + 7 minutes to travel back to the facility (average distance to EPZ = 6 miles from Table 8-6 @ 55 mph) = 25 minutes.
  - Remaining ambulatory patients loaded on bus (maximum): 23 minutes (average from Table 8-6 capped at 30 passengers per bus).
  - Bus travels to EPZ boundary: 62 minutes (average distance from hospitals to EPZ boundary (6 miles) at 5.85 mph (network wide average speed at 6:00).
  - Bus exits EPZ at time 4:35 + 0:33 + 0:25 + 0:23 + 1:02 = 7:00 (rounded up to nearest 5 minutes) after the Evacuation Order.
- Bedridden patients (ambulances) assuming host facilities are equidistant to the EPZ

as School Relocation Centers:

- Ambulances arrive at host facilities at 4:35 (average travel time to School Relocation Centers Table 8-2[1]).
- Bus discharges passengers (24 minutes – average ambulance loading time from Table 8-6) and driver takes a 10-minute rest: 34 minutes.
- Bus returns to medical facility: 18 minutes to travel back to the EPZ boundary (equal to the average travel time to reception center for good weather from Table 8-2) + 7 minutes to travel back to the facility (average distance to EPZ 6 miles from Table 8-6 @ 55 mph) = 25 minutes.
- Remaining bedridden patients loaded on bus (maximum): 24 minutes (average from Table 8-6 capped at 2 passengers per bus).
- Bus travels to EPZ boundary: 62 minutes (average distance from hospitals to EPZ boundary (6 miles) at 5.85 mph (network wide average speed at 6:00).
- Bus exits EPZ at time 4:35 + 0:34 + 0:25 + 0:24 + 1:02 = 7:00 (rounded up to nearest 5 minutes) after the Evacuation Order.

Thus, the second wave evacuation requires an additional 2 hours and 20 minutes (7 hours – 3 hours 40 minutes) than the first wave ETE. The average ETE for a two-wave evacuation of medical facilities also does not exceed the ETE for the general population at the 90th percentile for a winter, midweek, midday, good weather scenario.

Evacuation of Correctional Facilities

As detailed in Table E-8, there are three correctional facilities in the EPZ – San Luis Obispo County Jail, San Luis Obispo County Juvenile Hall and California Men's Colony. The total inmate population at these facilities is 7,135 people. According to San Luis Obispo County emergency management personnel, the inmates would shelter in place if an evacuation were ordered. Thus, ETE are not computed for these facilities.

8.2 ETE for Access and/or Functional Needs Population

The access and/or functional needs population registered within the EPZ was provided by SLO County. Table 8-8 summarizes the ETE for access and/or functional needs population who would need transportation assistance in the event of an emergency. 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. Due to the limitations on driving for access and/or functional needs persons, it assumed they will be picked up from their homes. Furthermore, it is conservatively assumed that ambulatory and wheelchair bound access and/or functional needs households are spaced 3 miles apart and bedridden households are spaced 5 miles apart. Due to the pronounced traffic congestion in the EPZ, van and bus speeds approximate 20 mph between households and ambulance speeds approximate 30 mph in good weather (10% slower in rain). Mobilization times of 120 minutes

[1] In the absence of data on the location and capacity of host medical facilities, the average travel time to school relocation centers was utilized as an estimate of the time required to travel from the host medical facility back to the medical facility for a second wave evacuation for ambulances.

were used (130 minutes for rain). 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), 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. Loading times of 5 minutes, 5 minutes, and 15 minutes are assumed for ambulatory patients, wheelchair bound patients, and bedridden patients, respectively.

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.

For example, assuming no more than one access and/or functional needs person per HH implies that 444 ambulatory households need to be serviced. While only 23 buses are needed from a capacity perspective, if 25 buses are deployed to service the access and/or functional needs ambulatory HH, then each would require about 18 stops. The following outlines the ETE calculations:

1. Assume 25 buses are deployed, each with about 18 stops, to service a total of 444 HH.
2. The ETE for good weather is calculated as follows:
    a. Buses arrive at the first pickup location: 120 minutes
    b. Load HH members at first pickup: 1 minute
    c. Travel to subsequent pickup locations: 17 @ 9 minutes = 153 minutes
    d. Load HH members at subsequent pickup locations: 17 @ 1 minute = 17 minutes
    e. Travel to EPZ boundary: 58 minutes (5 miles at 5.1 mph).

    ETE: 120 + 1 + 153 + 17 + 58 = 5:50 rounded to the nearest 5 minutes.

The average ETE of a first-wave evacuation of the ambulatory access and/or functional needs population within the EPZ is less than the 90th percentile ETE for evacuation of the general population in the Full EPZ (Region R04) under winter, midweek, midday, good weather (Scenario 6) conditions.

The following outlines the ETE calculations of a second wave needed using school buses after the schools have been evacuated (see Table 8-2):

a. School buses arrive at reception center: 4:35 on average
b. Unload patients at pick-up point: 5 minutes.
c. Driver takes 10-minute rest: 10 minutes.
d. Travel time back to EPZ: 18 minutes (average time of "Travel Time from EPZ Bdry to S.R.C. from Table 8-2).
e. Travel to first household: 9 minutes (3 miles x 20 mph).
f. Loading time at first household: 1 minute.
g. Travel to subsequent pickup locations: 17 @ 9 minutes = 153 minutes
h. Loading time at subsequent households: 17 stops @ 1 minutes = 17 minutes
i. Travel time to EPZ boundary at 5 miles @ 7.55 mph (at 8:10) = 40 minutes

Bus exits EPZ at time: 4:35 + 5 + 10 + 18 + 9 + 1 + 153 + 17 + 40 = 8:50 after the Evacuation Order.

The average ETE of a second-wave evacuation of the ambulatory access and/or functional needs population within the EPZ is 20 minutes shorter than the 90th percentile ETE for evacuation of the general population in the Full EPZ (Region R04) under winter, midweek, midday, good weather (Scenario 6) conditions.

The following outlines the ETE calculations of a second wave needed using ambulances after the medical facilities have been evacuated (see Table 8-2 and Table 8-6) assuming host medical facilities are equidistant to the EPZ as School Relocation Centers:

a. School buses arrive at reception center: 4:35 on average
b. Unload patients at pick-up point: 15 minutes.
c. Driver takes 10-minute rest: 10 minutes.
d. Travel time back to EPZ: 18 minutes (average time of "Travel Time from EPZ Bdry to S.R.C. From Table 8-2).
e. Travel to first household: 10 minutes (5 miles x 30 mph).
f. Loading time at first household: 15 minutes.
g. Travel to subsequent pickup locations: 1 @ 10 minutes = 10 minutes
h. Loading time at subsequent households: 1 stop @ 15 minutes = 15 minutes
i. Travel time to EPZ boundary at 5 miles @ 6.01 mph (at 6:10) = 50 minutes

Bus exits EPZ at time: 4:35 + 15 + 10 + 18 + 10 + 15 + 10 + 15 + 50 = 7:00 after the Evacuation Order.

The average ETE of a second-wave evacuation of the bedridden access and/or functional needs population within the EPZ is 2 hours and 10 minutes shorter than the 90th percentile ETE for evacuation of the general population in the Full EPZ (Region R04) under winter, midweek, midday, good weather (Scenario 6) conditions.

Table 8-1. Summary of Transportation Resources

Transportation Resource	Drivers	Cars & Vans	Buses[2]	Wheelchair Transport Vehicles	Ambulances
School Resources Available					
San Luis Coastal Unified School District (SLCUSD)	28	0	39	12	0
Lucia Mar Unified (LMUSD)	37	12	33	13	0
Cayucos School District	1	0	1	0	0
Atascadero Unified	15	0	26	6	0
Coast Unified	8	0	11	7	0
Paso Robles Joint Unified	33	0	36	13	0
San Miguel Joint Unified	7	0	6	3	0
Shandon Joint Unified	5	0	6	2	0
Templeton Unified	5	0	4	4	0
SLO County Office of Education	6	0	4	0	0
Community Action Partnership	10	0	10	0	0
Total School Resources:	**155**	**12**	**176**	**60**	**0**
Public Transit Resources Available					
ATASCADERO TRANSIT (no weekend service)	10	0	6	6	0
Morro Bay Transit (No weekend service)	4	0	5	5	0
Paso Robles Transit (No Sunday service)	10	0	6	6	0
Ride On	50	42	9	26	0
San Luis Obispo Regional Transit Authority (SLORTA) (Fixed Route)	52	0	27	27	0
San Luis Obispo Regional Transit Authority (SLORTA) (Door-to-Door)	14	12	0	12	0
South County Area Transit (SCAT)	18	0	6	6	0
Total Public Transit Resources:	**158**	**54**	**59**	**88**	**0**
Private Contractor Resources Available					
FUNRIDE (cars & vans)	0	13	0	0	0
Silverado Stages (chartered buses) limited availability	24	0	14	2	0

[2]Buses have varying capacities.

Transportation Resource	Drivers	Cars & Vans	Buses[2]	Wheelchair Transport Vehicles	Ambulances
Silver Bay Tours (chartered buses) limited availability	4	1	0	0	0
AmericanStar Trailways	24	0	19	2	0
Total Private Contractor Resources:	**52**	**14**	**33**	**4**	**0**
Long-Term Eldercare Resources Available					
Bella Vista Trans (SNF)	1	1	0	1	0
Garden Creek (RCFE)	1	2	1	1	0
Bayside Care Center (SNF)	1	1	0	1	0
Casa De Flores (RFCE)	1	1	0	1	0
Wyndham (RCFE)	1	1	0	1	0
Country Care (SNF)	1	1	0	1	0
Atascadero Christian (RCFE)	1	1	0	1	0
Ingleside (RCFE)	1	1	0	1	0
Total Long-Term Eldercare Resources:	**8**	**9**	**1**	**8**	**0**
Resources Needed					
Schools (See Table 3-8):		0	410	0	0
Medical Facilities (See Table 3-6):		0	36	25	20
Transit-Dependent Population (See Section 3.6):		0	78	0	0
Access and/or functional Needs (See Table 8-8):		0	25	10	5
Correctional Facilities:		Shelter-In-Place			
TOTAL TRANSPORTATION NEEDS:		**0**	**549**	**35**	**25**

.

Table 8-2. School Evacuation Time Estimates - Good Weather

School	Driver Mobilization Time	Loading Time (min)	Dist. To EPZ Bdry (mi.)	Average Speed (mph)	Travel Time to EPZ Bdry (min.)	ETE (hr:min)	Dist. EPZ bdry to S.R.C. (mi.)	Travel Time from EPZ Bdry to S.R.C. (min)	ETA to S.R.C. (hr:min)
SAN LUIS OBISPO SCHOOLS									
Bellevue-Santa Fe Charter School	120	15	8.0	2.08	231	**6:10**	26.0	28	**6:40**
Heartland Christian Academy	120	15	10.9	2.39	274	**6:50**	25.4	28	**7:20**
Monarch Grove Elementary School	120	15	11.1	2.44	273	**6:50**	25.4	28	**7:20**
Manzanita School	120	15	8.9	2.87	187	**5:25**	25.4	28	**5:55**
Baywood Elementary School	120	15	8.9	2.87	185	**5:20**	25.4	28	**5:50**
Los Osos Middle School	120	15	8.4	2.55	198	**5:35**	25.4	28	**6:05**
Shell Beach Elementary School	120	15	13.1	3.46	228	**6:05**	1.9	2	**6:10**
Judkins Middle School	120	15	9.6	4.36	133	**4:30**	1.9	2	**4:35**
Discovery House Montessori	120	15	6.4	2.79	139	**4:35**	26.0	28	**5:05**
Laguna Middle School	120	15	6.6	2.72	145	**4:40**	26.0	28	**5:10**
Christ Classical School	120	15	19.2	3.33	345	**8:00**	25.4	28	**8:30**
Pacific Beach High School	120	15	6.3	2.83	135	**4:30**	26.0	28	**5:00**
San Luis Community School	120	15	6.2	2.80	132	**4:30**	26.0	28	**5:00**
C. L. Smith Elementary School	120	15	6.9	2.81	147	**4:45**	26.0	28	**5:15**
Montessori Children's School	120	15	6.9	3.22	128	**4:25**	26.0	28	**4:55**
Grizzly Challenge Charter School	120	15	12.8	3.44	223	**6:00**	25.4	28	**6:30**
Bishop's Peak Elementary School	120	15	16.3	3.15	310	**7:25**	25.4	28	**7:55**
Old Mission School	120	15	3.8	6.67	34	**2:50**	26.0	28	**3:20**
Pacheco Elementary School	120	15	16.0	3.14	305	**7:20**	25.4	28	**7:50**
Mission College Preparatory Catholic High School	120	15	3.8	6.67	34	**2:50**	26.0	28	**3:20**
Hawthorne Elementary School	120	15	4.7	4.41	64	**3:20**	26.0	28	**3:50**

School	Driver Mobilization Time	Loading Time (min)	Dist. To EPZ Bdry (mi.)	Average Speed (mph)	Travel Time to EPZ Bdry (min.)	ETE (hr:min)	Dist. EPZ bdry to S.R.C. (mi.)	Travel Time from EPZ Bdry to S.R.C. (min)	ETA to S.R.C. (hr:min)
Christian Day School	120	15	5.2	4.49	69	**3:25**	26.0	28	**3:55**
San Luis Obispo Christian School	120	15	3.7	3.67	60	**3:15**	26.0	28	**3:45**
Sinsheimer Elementary School	120	15	4.4	3.44	76	**3:35**	26.0	28	**4:05**
California Polytechnic State University	120	15	3.9	4.11	57	**3:15**	26.0	28	**3:45**
San Luis Obispo High School	120	15	3.2	4.26	45	**3:00**	26.0	28	**3:30**
Charles E. Teach Elementary School	120	15	3.1	4.14	44	**3:00**	26.0	28	**3:30**
Chris Jespersen	120	15	3.1	4.14	44	**3:00**	26.0	28	**3:30**
Olive Grove Charter School	120	15	3.1	4.14	44	**3:00**	26.0	28	**3:30**
San Luis Obispo Classical Academy	120	15	3.1	4.14	44	**3:00**	26.0	28	**3:30**
Los Ranchos Elementary School	120	15	8.8	4.48	118	**4:15**	26.0	28	**4:45**
Rancho El Chorro Outdoor School	120	15	11.5	3.76	183	**5:20**	25.4	28	**5:50**
Loma Vista Community School	120	15	11.5	3.76	183	**5:20**	25.4	28	**5:50**
Morro Bay High School	120	15	3.6	17.70	12	**2:30**	25.4	28	**3:00**
Del Mar Elementary School	120	15	4.5	45.30	6	**2:25**	25.4	28	**2:55**
Cayucos Elementary School	120	15	1.5	14.55	6	**2:25**	11.9	13	**2:40**
Grover Heights Elementary School	120	15	8.1	5.62	86	**3:45**	1.9	2	**3:50**
Grover Beach Elementary School	120	15	7.9	3.54	133	**4:30**	1.9	2	**4:35**
Dandy Lion Montessori School	120	15	8.3	4.66	108	**4:05**	3.0	3	**4:10**
Highland Preparatory School	120	15	6.9	3.67	114	**4:10**	1.9	2	**4:15**
Oceano Elementary School	120	15	9.2	4.88	114	**4:10**	1.9	2	**4:15**
Ocean View Elementary School	120	15	6.8	6.45	63	**3:20**	1.9	2	**3:25**
Lopez Continuation High School	120	15	7.4	4.95	90	**3:45**	3.0	3	**3:50**
Coastal Christian High School	120	15	6.5	4.02	97	**3:55**	3.0	3	**4:00**

School	Driver Mobilization Time	Loading Time (min)	Dist. To EPZ Bdry (mi.)	Average Speed (mph)	Travel Time to EPZ Bdry (min.)	ETE (hr:min)	Dist. EPZ bdry to S.R.C. (mi.)	Travel Time from EPZ Bdry to S.R.C. (min)	ETA to S.R.C. (hr:min)
Fairgrove Elementary School	120	15	7.9	3.91	121	**4:20**	1.9	2	**4:25**
Saint Patrick's School	120	15	6.6	6.12	65	**3:20**	3.0	3	**3:25**
Arroyo Grande Montessori	120	15	6.0	6.99	52	**3:10**	3.0	3	**3:15**
Harloe Elementary School	120	15	6.7	4.92	81	**3:40**	1.9	2	**3:45**
Valley View Adventist Academy	120	15	6.2	5.98	62	**3:20**	3.0	3	**3:25**
Lighthouse Christian School	120	15	6.6	3.67	108	**4:05**	3.0	3	**4:10**
Arroyo Grande High School	120	15	6.6	3.67	108	**4:05**	1.9	2	**4:10**
Paulding Middle School	120	15	6.6	5.10	78	**3:35**	1.9	2	**3:40**
Coastal Christian School	120	15	7.5	3.29	137	**4:35**	1.9	2	**4:40**
Branch Elementary School	120	15	8.8	3.44	154	**4:50**	1.9	2	**4:55**
Lopez High School	120	15	5.3	15.16	21	**2:40**	4.6	5	**2:45**
Pacific View Academy	120	15	5.3	15.16	21	**2:40**	4.6	5	**2:45**
Mesa Middle School	120	15	6.9	11.03	37	**2:55**	4.6	5	**3:00**
					Maximum for EPZ:	**8:00**		**Maximum:**	**8:30**
					Average for EPZ:	**4:15**		**Average:**	**4:35**

Table 8-3. School Evacuation Time Estimates – Rain

School	Driver Mobilization Time	Loading Time (min)	Dist. To EPZ Bdry (mi.)	Average Speed (mph)	Travel Time to EPZ Bdry (min.)	ETE (hr:min)	Dist. EPZ bdry to S.R.C. (mi.)	Travel Time from EPZ Bdry to S.R.C. (min)	ETA to S.R.C. (hr:min)
SAN LUIS OBISPO SCHOOLS									
Bellevue-Santa Fe Charter School	130	20	8.0	2.12	227	**6:20**	26.0	31	**6:55**
Heartland Christian Academy	130	20	10.9	2.43	270	**7:00**	25.4	30	**7:30**
Monarch Grove Elementary School	130	20	11.1	2.39	278	**7:10**	25.4	30	**7:40**
Manzanita School	130	20	8.9	3.14	171	**5:25**	25.4	30	**5:55**
Baywood Elementary School	130	20	8.9	3.13	170	**5:20**	25.4	30	**5:50**
Los Osos Middle School	130	20	8.4	2.80	180	**5:30**	25.4	30	**6:00**
Shell Beach Elementary School	130	20	13.1	3.41	231	**6:25**	1.9	2	**6:30**
Judkins Middle School	130	20	9.6	4.68	124	**4:35**	1.9	2	**4:40**
Discovery House Montessori	130	20	6.4	2.87	135	**4:45**	26.0	31	**5:20**
Laguna Middle School	130	20	6.6	2.79	142	**4:55**	26.0	31	**5:30**
Christ Classical School	130	20	19.2	3.30	348	**8:20**	25.4	30	**8:50**
Pacific Beach High School	130	20	6.3	2.99	127	**4:40**	26.0	31	**5:15**
San Luis Community School	130	20	6.2	2.96	125	**4:35**	26.0	31	**5:10**
C. L. Smith Elementary School	130	20	6.9	2.89	143	**4:55**	26.0	31	**5:30**
Montessori Children's School	130	20	6.9	3.20	129	**4:40**	26.0	31	**5:15**
Grizzly Challenge Charter School	130	20	12.8	4.34	177	**5:30**	25.4	30	**6:00**
Bishop's Peak Elementary School	130	20	16.3	3.63	269	**7:00**	25.4	30	**7:30**
Old Mission School	130	20	3.8	6.10	37	**3:10**	26.0	31	**3:45**
Pacheco Elementary School	130	20	16.0	3.61	265	**6:55**	25.4	30	**7:25**
Mission College Preparatory Catholic High School	130	20	3.8	6.10	37	**3:10**	26.0	31	**3:45**
Hawthorne Elementary School	130	20	4.7	4.14	69	**3:40**	26.0	31	**4:15**

School	Driver Mobilization Time	Loading Time (min)	Dist. To EPZ Bdry (mi.)	Average Speed (mph)	Travel Time to EPZ Bdry (min.)	ETE (hr:min)	Dist. EPZ bdry to S.R.C. (mi.)	Travel Time from EPZ Bdry to S.R.C. (min)	ETA to S.R.C. (hr:min)
Christian Day School	130	20	5.2	4.14	75	**3:45**	26.0	31	**4:20**
San Luis Obispo Christian School	130	20	3.7	3.43	64	**3:35**	26.0	31	**4:10**
Sinsheimer Elementary School	130	20	4.4	3.32	79	**3:50**	26.0	31	**4:25**
California Polytechnic State University	130	20	3.9	3.61	64	**3:35**	26.0	31	**4:10**
San Luis Obispo High School	130	20	3.2	4.08	47	**3:20**	26.0	31	**3:55**
Charles E. Teach Elementary School	130	20	3.1	3.97	46	**3:20**	26.0	31	**3:55**
Chris Jespersen	130	20	3.1	3.97	46	**3:20**	26.0	31	**3:55**
Olive Grove Charter School	130	20	3.1	3.97	46	**3:20**	26.0	31	**3:55**
San Luis Obispo Classical Academy	130	20	3.1	3.97	46	**3:20**	26.0	31	**3:55**
Los Ranchos Elementary School	130	20	8.8	4.25	124	**4:35**	26.0	31	**5:10**
Rancho El Chorro Outdoor School	130	20	11.5	4.58	151	**5:05**	25.4	30	**5:35**
Loma Vista Community School	130	20	11.5	4.58	151	**5:05**	25.4	30	**5:35**
Morro Bay High School	130	20	3.6	28.13	8	**2:40**	25.4	30	**3:10**
Del Mar Elementary School	130	20	4.5	38.35	7	**2:40**	25.4	30	**3:10**
Cayucos Elementary School	130	20	1.5	12.95	7	**2:40**	11.9	14	**2:55**
Grover Heights Elementary School	130	20	8.1	5.80	84	**3:55**	1.9	2	**4:00**
Grover Beach Elementary School	130	20	7.9	3.29	143	**4:55**	1.9	2	**5:00**
Dandy Lion Montessori School	130	20	8.3	4.30	117	**4:30**	3.0	4	**4:35**
Highland Preparatory School	130	20	6.9	3.30	126	**4:40**	1.9	2	**4:45**
Oceano Elementary School	130	20	9.2	4.47	124	**4:35**	1.9	2	**4:40**
Ocean View Elementary School	130	20	6.8	6.08	67	**3:40**	1.9	2	**3:45**
Lopez Continuation High School	130	20	7.4	4.74	94	**4:05**	3.0	4	**4:10**
Coastal Christian High School	130	20	6.5	3.81	103	**4:15**	3.0	4	**4:20**

School	Driver Mobilization Time	Loading Time (min)	Dist. To EPZ Bdry (mi.)	Average Speed (mph)	Travel Time to EPZ Bdry (min.)	ETE (hr:min)	Dist. EPZ bdry to S.R.C. (mi.)	Travel Time from EPZ Bdry to S.R.C. (min)	ETA to S.R.C. (hr:min)
Fairgrove Elementary School	130	20	7.9	3.71	128	**4:40**	1.9	2	**4:45**
Saint Patrick's School	130	20	6.6	5.80	68	**3:40**	3.0	4	**3:45**
Arroyo Grande Montessori	130	20	6.0	6.72	54	**3:25**	3.0	4	**3:30**
Harloe Elementary School	130	20	6.7	4.68	85	**3:55**	1.9	2	**4:00**
Valley View Adventist Academy	130	20	6.2	5.74	65	**3:35**	3.0	4	**3:40**
Lighthouse Christian School	130	20	6.6	3.35	119	**4:30**	3.0	4	**4:35**
Arroyo Grande High School	130	20	6.6	3.35	119	**4:30**	1.9	2	**4:35**
Paulding Middle School	130	20	6.6	4.72	84	**3:55**	1.9	2	**4:00**
Coastal Christian School	130	20	7.5	3.14	144	**4:55**	1.9	2	**5:00**
Branch Elementary School	130	20	8.8	3.10	171	**5:25**	1.9	2	**5:30**
Lopez High School	130	20	5.3	11.98	26	**3:00**	4.6	6	**3:10**
Pacific View Academy	130	20	5.3	11.98	26	**3:00**	4.6	6	**3:10**
Mesa Middle School	130	20	6.9	9.53	43	**3:15**	4.6	6	**3:25**
					Maximum for EPZ:	**8:20**		**Maximum:**	**8:50**
					Average for EPZ:	**4:30**		**Average:**	**4:50**

Table 8-4. Transit-Dependent Evacuation Time Estimates - Good Weather

Route Number	Number of Buses	Number of Stops	One-Wave						Two-Wave						
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to Rec. Ctr (miles)	Travel Time to Rec. Ctr (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
48	8	20	120	16	2.64	364	30	**8:35**	36	39	5	10	74	30	**11:15**
	7	20	140	16	2.71	355	30	**8:45**	36	39	5	10	74	30	**11:25**
49	8	20	120	18	3.55	304	30	**7:35**	12	13	5	10	52	30	**9:30**
50	11	20	120	13	5.59	140	30	**4:50**	26	28	5	10	57	30	**7:05**
	11	20	140	13	5.62	139	30	**5:10**	26	28	5	10	57	30	**7:25**
51	10	20	120	9	1.97	274	30	**7:05**	26	28	5	10	48	30	**9:10**
52	12	20	120	22	5.83	226	30	**6:20**	15	16	5	10	64	30	**8:30**
	11	20	140	22	6.15	215	30	**6:25**	15	16	5	10	64	30	**8:35**
							Maximum ETE:	**8:45**						**Maximum ETE:**	**11:25**
							Average ETE:	**6:50**						**Average ETE:**	**9:10**

Table 8-5. Transit-Dependent Evacuation Time Estimates – Rain

Route Number	Number of Buses	Number of Stops	One-Wave						Two-Wave						
			Mobilization (min)	Route Length (miles)	Speed (mph)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)	Distance to Rec. Ctr (miles)	Travel Time to Rec. Ctr (min)	Unload (min)	Driver Rest (min)	Route Travel Time (min)	Pickup Time (min)	ETE (hr:min)
48	8	20	130	16	2.54	379	40	**9:10**	36	43	5	10	82	40	**12:15**
	7	20	150	16	2.60	370	40	**9:20**	36	43	5	10	82	40	**12:25**
49	8	20	130	18	3.44	314	40	**8:05**	12	14	5	10	58	40	**10:15**
50	11	20	130	13	4.94	158	40	**5:30**	26	31	5	10	62	40	**8:00**
	11	20	150	13	5.21	150	40	**5:40**	26	31	5	10	62	40	**8:10**
51	10	20	130	9	2.00	270	40	**7:25**	26	31	5	10	53	40	**9:45**
52	12	20	130	22	5.32	248	40	**7:00**	15	18	5	10	71	40	**9:25**
	11	20	150	22	5.44	243	40	**7:15**	15	18	5	10	71	40	**9:40**
							Maximum ETE:	**9:20**						**Maximum ETE:**	**12:25**
							Average ETE:	**7:25**						**Average ETE:**	**10:00**

Table 8-6. Medical Facilities 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)	Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
SAN LUIS OBISPO, CA									
Avila Senior Living SLO	Ambulatory	90	1	6	6	4.1	3.9	63	**2:40**
	Wheelchair bound	90	5	2	10	4.1	3.9	63	**2:45**
Vista Rosa	Ambulatory	90	1	14	14	4.6	3.7	75	**3:00**
	Wheelchair bound	90	5	4	20	4.6	3.6	77	**3:10**
	Bedridden	90	15	1	15	4.6	3.7	75	**3:00**
Garden Creek Assisted Living	Ambulatory	90	1	41	30	4.6	3.6	77	**3:20**
	Wheelchair bound	90	5	11	55	4.6	3.6	77	**3:45**
	Bedridden	90	15	2	30	4.6	3.6	77	**3:20**
Casa de Vida	Ambulatory	90	1	28	28	3.7	3.6	62	**3:00**
	Wheelchair bound	90	5	7	35	3.7	3.6	62	**3:10**
	Bedridden	90	15	1	15	3.7	3.8	58	**2:45**
Sierra Vista Regional Medical Center	Ambulatory	90	1	77	30	3.7	3.6	62	**3:05**
	Wheelchair bound	90	5	21	75	3.7	3.6	62	**3:50**
	Bedridden	90	15	2	30	3.7	3.6	62	**3:05**
French Hospital Medical Center	Ambulatory	90	1	27	27	4.1	3.6	68	**3:05**
	Wheelchair bound	90	5	7	35	4.1	3.5	70	**3:15**
	Bedridden	90	15	1	15	4.1	3.7	66	**2:55**
San Luis Obispo Mental Health	Ambulatory	90	1	8	8	4.1	3.9	63	**2:45**
	Wheelchair bound	90	5	2	10	4.1	3.9	63	**2:45**
The Village at Sydney Creek	Ambulatory	90	1	48	30	5.0	3.3	91	**3:35**
	Wheelchair bound	90	5	13	65	5.0	3.4	88	**4:05**
	Bedridden	90	15	2	30	5.0	3.3	91	**3:35**
Bella Vista Transitional Care	Ambulatory	90	1	94	30	5.0	3.3	91	**3:35**
	Wheelchair bound	90	5	24	75	5.0	3.4	88	**4:15**
	Bedridden	90	15	4	30	5.0	3.3	91	**3:35**

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Mission View Health Center	Ambulatory	90	1	93	30	5.0	3.3	91	**3:35**
	Wheelchair bound	90	5	24	75	5.0	3.4	88	**4:15**
	Bedridden	90	15	4	30	5.0	3.3	91	**3:35**
Garden House	Ambulatory	90	1	9	9	8.4	5.2	97	**3:20**
	Wheelchair bound	90	5	2	10	8.4	5.2	97	**3:20**
Casa De Flores	Ambulatory	90	1	69	30	9.3	5.5	101	**3:45**
	Wheelchair bound	90	5	18	75	9.3	5.4	103	**4:30**
	Bedridden	90	15	3	30	9.3	5.5	101	**3:45**
Bayside Care Center	Ambulatory	90	1	84	30	7.4	3.6	123	**4:05**
	Wheelchair bound	90	5	22	75	7.4	3.4	131	**5:00**
	Bedridden	90	15	3	30	7.4	3.6	123	**4:05**
Wyndham Residence	Ambulatory	90	1	41	30	7.4	3.6	123	**4:05**
	Wheelchair bound	90	5	11	55	7.4	3.4	131	**4:40**
	Bedridden	90	15	2	30	7.4	3.6	123	**4:05**
Arroyo Grande Care Center	Ambulatory	90	1	57	30	7.4	3.6	123	**4:05**
	Wheelchair bound	90	5	15	75	7.4	3.4	131	**5:00**
	Bedridden	90	15	2	30	7.4	3.6	123	**4:05**
Alder House	Ambulatory	90	1	18	18	7.4	3.6	123	**3:55**
	Wheelchair bound	90	5	5	25	7.4	3.6	123	**4:00**
	Bedridden	90	15	1	15	7.4	3.7	120	**3:45**
Arroyo Grande Community Hospital	Ambulatory	90	1	58	30	7.4	3.6	123	**4:05**
	Wheelchair bound	90	5	16	75	7.4	3.4	131	**5:00**
	Bedridden	90	15	2	30	7.4	3.6	123	**4:05**
Oak Park Manor Assisted Living	Ambulatory	90	1	18	18	8.3	3.6	138	**4:10**
	Wheelchair bound	90	5	5	25	8.3	3.6	138	**4:15**
	Bedridden	90	15	1	15	8.3	3.7	135	**4:00**

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Casa Rosa Elder Care	Ambulatory	90	1	13	13	6.7	11.0	37	**2:20**
	Wheelchair bound	90	5	3	15	6.7	11.0	37	**2:25**
	Bedridden	90	15	1	15	6.7	11.0	37	**2:25**
								Maximum ETE:	**5:00**
								Average ETE:	**3:40**

Table 8-7. Medical Facilities Evacuation Time Estimates – Rain

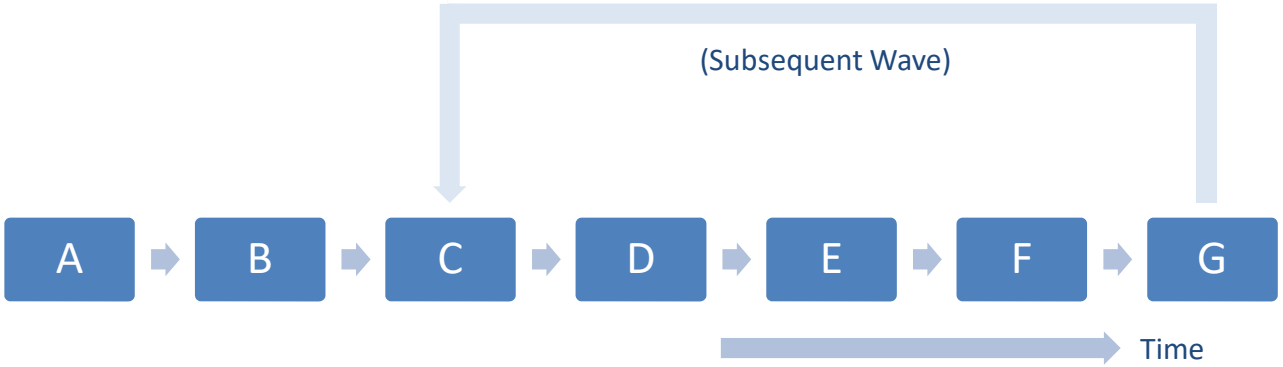
Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
SAN LUIS OBISPO, CA									
Avila Senior Living SLO	Ambulatory	100	1	6	6	4.1	3.6	68	**2:55**
	Wheelchair bound	100	5	2	10	4.1	3.6	68	**3:00**
Vista Rosa	Ambulatory	100	1	14	14	4.6	3.6	77	**3:15**
	Wheelchair bound	100	5	4	20	4.6	3.6	77	**3:20**
	Bedridden	100	15	1	15	4.6	3.6	77	**3:15**
Garden Creek Assisted Living	Ambulatory	100	1	41	30	4.6	3.6	77	**3:30**
	Wheelchair bound	100	5	11	55	4.6	3.6	77	**3:55**
	Bedridden	100	15	2	30	4.6	3.6	77	**3:30**
Casa de Vida	Ambulatory	100	1	28	28	3.7	3.6	62	**3:10**
	Wheelchair bound	100	5	7	35	3.7	3.6	62	**3:20**
	Bedridden	100	15	1	15	3.7	3.6	62	**3:00**
Sierra Vista Regional Medical Center	Ambulatory	100	1	77	30	3.7	3.6	62	**3:15**
	Wheelchair bound	100	5	21	75	3.7	3.6	62	**4:00**
	Bedridden	100	15	2	30	3.7	3.6	62	**3:15**
French Hospital Medical Center	Ambulatory	100	1	27	27	4.1	3.6	68	**3:15**
	Wheelchair bound	100	5	7	35	4.1	3.6	68	**3:25**
	Bedridden	100	15	1	15	4.1	3.6	68	**3:05**
San Luis Obispo Mental Health	Ambulatory	100	1	8	8	4.1	3.6	68	**3:00**
	Wheelchair bound	100	5	2	10	4.1	3.6	68	**3:00**
The Village at Sydney Creek	Ambulatory	100	1	48	30	5.0	3.5	86	**3:40**
	Wheelchair bound	100	5	13	65	5.0	3.4	88	**4:15**
	Bedridden	100	15	2	30	5.0	3.5	86	**3:40**
Bella Vista Transitional Care	Ambulatory	100	1	94	30	5.0	3.5	86	**3:40**
	Wheelchair bound	100	5	24	75	5.0	3.4	88	**4:25**
	Bedridden	100	15	4	30	5.0	3.5	86	**3:40**

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Mission View Health Center	Ambulatory	100	1	93	30	5.0	3.5	86	**3:40**
	Wheelchair bound	100	5	24	75	5.0	3.4	88	**4:25**
	Bedridden	100	15	4	30	5.0	3.5	86	**3:40**
Garden House	Ambulatory	100	1	9	9	8.4	5.2	97	**3:30**
	Wheelchair bound	100	5	2	10	8.4	5.2	97	**3:30**
Casa De Flores	Ambulatory	100	1	69	30	9.3	4.5	124	**4:15**
	Wheelchair bound	100	5	18	75	9.3	5.0	112	**4:50**
	Bedridden	100	15	3	30	9.3	4.5	124	**4:15**
Bayside Care Center	Ambulatory	100	1	84	30	7.4	3.4	131	**4:25**
	Wheelchair bound	100	5	22	75	7.4	3.2	139	**5:15**
	Bedridden	100	15	3	30	7.4	3.4	131	**4:25**
Wyndham Residence	Ambulatory	100	1	41	30	7.4	3.4	131	**4:25**
	Wheelchair bound	100	5	11	55	7.4	3.3	135	**4:50**
	Bedridden	100	15	2	30	7.4	3.4	131	**4:25**
Arroyo Grande Care Center	Ambulatory	100	1	57	30	7.4	3.4	131	**4:25**
	Wheelchair bound	100	5	15	75	7.4	3.2	139	**5:15**
	Bedridden	100	15	2	30	7.4	3.4	131	**4:25**
Alder House	Ambulatory	100	1	18	18	7.4	3.5	127	**4:05**
	Wheelchair bound	100	5	5	25	7.4	3.5	127	**4:15**
	Bedridden	100	15	1	15	7.4	3.6	123	**4:00**
Arroyo Grande Community Hospital	Ambulatory	100	1	58	30	7.4	3.4	131	**4:25**
	Wheelchair bound	100	5	16	75	7.4	3.2	139	**5:15**
	Bedridden	100	15	2	30	7.4	3.4	131	**4:25**
Oak Park Manor Assisted Living	Ambulatory	100	1	18	18	8.3	3.6	138	**4:20**
	Wheelchair bound	100	5	5	25	8.3	3.5	142	**4:30**
	Bedridden	100	15	1	15	8.3	3.7	135	**4:10**

Medical Facility	Patient	Mobilization (min)	Loading Rate (min per person)	People	Total Loading Time (min)	Dist. To EPZ Bdry (mi)	Speed (mph)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Casa Rosa Elder Care	Ambulatory	100	1	13	13	6.7	10.2	39	**2:35**
	Wheelchair bound	100	5	3	15	6.7	10.2	39	**2:35**
	Bedridden	100	15	1	15	6.7	10.2	39	**2:35**
								Maximum ETE:	**5:15**
								Average ETE:	**3:50**

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

Vehicle Type	Households Requiring Vehicle	Vehicles deployed	Stops per Vehicle	Weather Conditions	Mobiliza -tion Time (min)	Loading Time at 1st Stop (min)	Travel to Subsequent Stops (min)	Total Loading Time at Subsequent Stops (min)	Travel Time to EPZ Boundary (min)	ETE (hr:min)
Buses	444	25	18	Normal	120	1	153	17	58	**5:50**
				Rain	130		170		64	**6:25**
Wheelchair Buses	100	10	10	Normal	120	5	81	45	65	**5:20**
				Rain	130		90		70	**5:40**
Ambulances	10	5	2	Normal	120	15	10	15	63	**3:45**
				Rain	130		11		69	**4:00**
									Maximum ETE:	**6:25**
									Average ETE:	**5:10**



Event	
A	Evacuation Order
B	Bus Dispatched from Depot
C	Bus Arrives at Facility/Carless Collection Point
D	Bus Departs for Reception Center/School Relocation Center
E	Bus Exits Region
F	Bus Arrives at Reception Center/School Relocation Center
G	Bus Available for "Second Wave" Evacuation Service
Activity	
A→B	Driver Mobilization
B→C	Travel to Facility or to Carless Collection Point
C→D	Passengers Board the Bus
D→E	Bus Travels Towards Region Boundary
E→F	Bus Travels Towards Reception Center/School Relocation Center Outside the EPZ
F→G	Passengers Leave Bus; Driver Takes a Break

Figure 8-1. Chronology of Transit Evacuation Operations

9 TRAFFIC MANAGEMENT STRATEGY

This section discusses the suggested traffic 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 on 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 identified by the county emergency plans serve as the basis of the traffic management plan, as per NUREG/CR-7002, Rev. 1. The ETE analysis treated all controlled intersections that are existing TCP locations in the county plans as being controlled by actuated signals. Appendix K identifies the number of intersections that were modeled as TCPs.
2. Evacuation simulations were run using DYNEV II to predict traffic congestion during evacuation (see Section 7.3 and Figure 7-4 through Figure 7-11). These simulations help to identify the best routing and critical intersections that experience pronounced congestion during evacuation. Any critical intersections that would benefit from traffic

control which are not already identified in the existing offsite plans are examined. No additional TCPs were identified as part of this study.

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

Appendix G documents the existing TMP and list of priority TCPs using the process enumerated above.

9.1 Assumptions

- The ETE calculations documented in Section 7 and 8 assume that the traffic management plan is implemented during evacuation.
- The ETE calculations reflect the assumptions that all "external-external" trips are interdicted and diverted after 2 hours have elapsed from the Evacuation Order by access control points (ACPs) along the major highways traversing the EPZ.
- All transit vehicles and other responders entering the EPZ to support the evacuation are assumed to be unhindered by personal manning TCPs and ACPs.
- Study assumptions 1 and 2 in Section 2.5 discuss TCP and ACP operations.

9.2 Additional Considerations

The use of Intelligent Transportation Systems (ITS) technologies can reduce the 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/care center information. DMS placed outside of the EPZ will warn motorists to avoid using routes that may conflict with the flow of evacuees away from the power plant. Highway Advisory Radio (HAR) can be used to broadcast information to evacuees during egress through their vehicles stereo systems. Automated Travel Information Systems (ATIS) can also be used to provide evacuees with information. Internet websites can provide traffic and evacuation route information before the evacuee begins their trip, while the on-board navigation systems (GPS units) and smartphones can be used to provide information during evacuation trip.

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

10 EVACUATION ROUTES AND RECEPTION CENTERS

10.1 Evacuation Routes

Evacuation routes are comprised of two distinct components:

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

Evacuees will select routes within the EPZ in such a way as to minimize their exposure to risk. This expectation is met by the DYNEV II model routing traffic away from the location of the plant, 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 major evacuation routes for the EPZ are presented in Figure 10-1. These routes will be used by the general population evacuating in private vehicles, and by the transit-dependent population evacuating in buses. Transit-dependent evacuees will be routed to reception centers. Schools will be evacuated to school relocation centers. General population may evacuate to either a reception center or some alternate destination (e.g., lodging facility, relative's home, campground) outside the EPZ.

The routing of transit-dependent evacuees from the EPZ boundary to reception centers is designed to minimize the amount of travel outside the EPZ, from the points where these routes cross the EPZ boundary. The 5 bus routes shown graphically in Figure 10-2 and described in Table 10-1 were designed as part of this study to service the major routes through each PAZ and to service the pre-defined carless collection points. It is assumed that residents and the homeless population will walk to and congregate at these pre-designated collection points.

Special facilities (schools and medical facilities) were routed along the most likely path from the facility being evacuated to the EPZ boundary, traveling toward the appropriate reception center or school relocation center.

The specified bus routes are documented in Table 10-2 (refer to the maps of the link-node analysis network in Appendix K for node locations). This study does not consider the transport of evacuees from reception centers to congregate care centers, if the parishes do make the decision to relocate evacuees.

10.2 Reception Centers

Figure 10-3 present maps showing the general population reception centers and school relocation centers for evacuees. Table 10-3 presents a list of the school relocation centers for each school in the EPZ. It is assumed that all school evacuees will be taken to the appropriate school relocation center and subsequently picked up by parents or guardians. Transit-dependent evacuees are transported to the nearest reception center for each PAZ. 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.

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

Route	No. of Buses	Carless Pickup Areas	Serving PAZ	Length (mi.)
48	15	Baywood, Los Osos, Morro Bay & Cayucos	5 & 9	16
49	8	Avila Beach, Pismo Beach, San Luis Bay & Shell Beach	3 & 6	18
50	22	San Luis Obispo & Cal Poly	8	13
51	10	Cuesta	8	9
52	23	City of Arroyo Grande, Five Cities, Grover Beach, Nipomo, Oceano, & Pismo Beach	6, 10 & 12	22
Total:	**78**			

Table 10-2. Bus Route Descriptions

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
1	Los Osos Middle School	507, 162, 163, 164, 165, 504, 166, 167, 168, 505, 506, 169, 61, 177, 62, 76, 830, 78, 829, 79, 80, 81, 82
2	Manzanita School	378, 1126, 956, 162, 163, 164, 165, 504, 166, 167, 168, 505, 506, 169, 61, 177, 62, 76, 830, 78, 829, 79, 80, 81, 82
	Baywood Elementary School	
3	Monarch Grove Elementary School	154, 155, 1000, 156, 157, 158, 891, 159, 160, 161, 507, 162, 163, 164, 165, 504, 166, 167, 168, 505, 506, 169, 61, 177, 62, 76, 830, 78, 829, 79, 80, 81, 82
4	Heartland Christian Academy	156, 157, 158, 891, 159, 160, 161, 507, 162, 163, 164, 165, 504, 166, 167, 168, 505, 506, 169, 61, 177, 62, 76, 830, 78, 829, 79, 80, 81, 82
5	Grizzly Challenge Charter School	55, 1067, 56, 57, 58, 59, 60, 170, 169, 61, 177, 62, 76, 830, 78, 829, 79, 80, 81, 82
	San Luis Obispo County Jail	
6	Pacheco Elementary School	386, 385, 51, 52, 516, 53, 54, 513, 55, 1067, 56, 57, 58, 59, 60, 170, 169, 61, 177, 62, 76, 830, 78, 829, 79, 80, 81, 82
	Bishop's Peak Elementary School	
7	Charles E. Teach Elementary School	774, 1132, 398, 395, 821, 394, 396, 22, 557, 21, 20, 19, 18
	Chris Jespersen	
	Olive Grove Charter School	
	San Luis Obispo Classical Academy	
8	Laguna Middle School	581, 579, 186, 1155, 1156, 897, 900, 901, 310, 311, 786, 314, 554, 555, 24, 545, 525, 47, 48, 524, 803, 23, 527, 389, 22, 557, 21, 20, 19, 18
9	Discovery House Montessori	579, 186, 897, 900, 901, 310, 311, 786, 314, 554, 555, 24, 545, 525, 47, 48, 524, 803, 23, 527, 389, 22, 557, 21, 20, 19, 18
	C. L. Smith Elementary School	
10	Pacific Beach High School	186, 1155, 1156, 897, 900, 901, 310, 311, 786, 314, 554, 555, 24, 545, 525, 47, 48, 524, 803, 23, 527, 389, 22, 557, 21, 20, 19, 18
	San Luis Community School	
11	San Luis Obispo High School	526, 393, 552, 392, 394, 396, 22, 557, 21, 20, 19, 18

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
12	Old Mission School	565, 539, 545, 525, 47, 48, 524, 803, 23, 527, 389, 22, 557, 21, 20, 19, 18
	Mission College Preparatory Catholic High School	
13	San Luis Obispo Christian School	331, 332, 333, 526, 393, 552, 392, 394, 396, 22, 557, 21, 20, 19, 18
14	Montessori Children's School	400, 785, 401, 573, 571, 25, 315, 314, 554, 555, 24, 545, 525, 47, 48, 524, 803, 23, 527, 389, 22, 557, 21, 20, 19, 18
15	Hawthorne Elementary School	193, 536, 537, 538, 565, 539, 545, 525, 47, 48, 524, 803, 23, 527, 389, 22, 557, 21, 20, 19, 18
	Christian Day School	
	Los Ranchos Elementary School	
16	Bellevue-Santa Fe Charter School	908, 994, 595, 31, 32, 603, 33, 612, 34, 611, 615, 1100, 407, 35, 495, 439, 440, 631, 36, 37, 38
17	Shell Beach Elementary School	608, 609, 611, 615, 1100, 407, 35, 495, 439, 440, 631, 36, 37, 38, 39, 664, 425, 424, 422, 40, 41, 709, 42, 716, 1120
18	Judkins Middle School	623, 1097, 440, 631, 36, 37, 38, 39, 664, 425, 424, 422, 40, 41, 709, 42, 716, 1120
19	Grover Heights Elementary School	942, 37, 38, 39, 664, 425, 424, 422, 40, 41, 709, 42, 716, 1120
20	SinSheimer Elementary School	330, 331, 332, 333, 526, 393, 552, 392, 394, 396, 22, 557, 21, 20, 19, 18
21	Cayucos Elementary School	359, 1124, 360, 361, 358, 69, 496, 70, 71, 72, 73
22	Lighthouse Christian School	227, 1115, 421, 222, 671, 423, 226, 424, 422, 40, 41, 709, 42
	Arroyo Grande High School	
23	Arroyo Grande Montessori	226, 424, 422, 40, 41, 709, 42, 716, 1120
24	Branch Elementary School	1010, 1009, 1008, 1007, 1006, 422, 40, 41, 709, 42
25	California Polytechnic State University	773, 925, 774, 1132, 398, 395, 821, 394, 396, 22, 557, 21, 20, 19, 18
26	Dandy Lion Montessori School	472, 665, 666, 227, 1115, 421, 1006, 422, 40, 41, 709, 42
27	Del Mar Elementary School	832, 1298, 833, 829, 79, 80, 81, 82, 83, 84, 85, 501, 86
28	Grover Beach Elementary School	426, 470, 224, 932, 663, 225, 226, 424, 422, 40, 41, 709, 42
	Highland Preparatory School	
29	Harloe Elementary School	228, 227, 1115, 421, 1006, 422, 40, 41, 709, 42, 716, 1120
30	Lopez Continuation High School	472, 665, 666, 227, 1115, 421, 1006, 422, 40, 41, 709, 42, 716, 1120

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
31	Rancho El Chorro Outdoor School	57, 58, 59, 60, 170, 169, 61, 177, 62, 76, 830, 78, 829, 79, 80, 81, 82
	Loma Vista Community School	
32	Lopez High School	236, 237, 238, 717, 239
	Pacific View Academy	
33	Mesa Middle School & Casa Rosa Elder Care	234, 235, 236, 237, 238, 717, 239
34	Morro Bay High School	1027, 77, 78, 829, 79, 80, 81, 82
35	Coastal Christian High School	472, 225, 226, 424, 422, 40, 41, 709, 42
	Fairgrove Elementary School	
36	Ocean View Elementary School	931, 471, 664, 425, 424, 422, 40, 41, 709, 42, 716, 1120
37	Oceano Elementary School	246, 429, 1034, 493, 702, 701, 234, 235, 236, 237, 238, 717, 239
	Lucia Mar Adult School	
38	Paulding Middle School	221, 222, 671, 423, 226, 424, 422, 40, 41, 709, 42, 716, 1120
39	Coastal Christian School	433, 639, 432, 934, 933, 931, 471, 664, 425, 424, 422, 40, 41, 709, 42
40	Saint Patrick's School	668, 667, 931, 471, 664, 425, 424, 422, 40, 41, 709, 42, 716, 1120
41	The University of San Luis Obispo School of Law	193, 536, 537, 538, 565, 539, 545, 525, 47, 48, 524, 803, 23, 527, 389, 22, 557, 21, 20, 19, 18
42	Valley View Adventist Academy	671, 423, 226, 424, 422, 40, 41, 709, 42, 716, 1120
43	SLO Medical Routes	315, 314, 554, 555, 24, 545, 525, 47, 48, 524, 803, 23, 527, 389, 22, 557, 21, 20, 19, 18
44	The Village at Sydney Cree, Bella Vista Transitional Care & Mission View Health Center	328, 329, 330, 331, 332, 333, 526, 393, 552, 392, 769, 390, 527, 389, 22, 557, 21, 20, 19, 18
45	PAZ 9 Medical Routes	62, 76, 63, 75, 362, 1288, 64, 364, 65, 839, 66, 67, 497, 68, 357, 358, 69, 496, 70, 71, 72, 73
46	PAZ 10 Medical Routes	465, 466, 467, 468, 469, 426, 470, 224, 932, 1112, 931, 471, 664, 425, 424, 422, 40, 41, 709, 42, 716, 1120
47	PAZ 11 Medical Routes	434, 433, 639, 432, 934, 933, 931, 471, 664, 425, 424, 422, 40, 41, 709, 42, 716, 1120

Bus Route Number	Description	Nodes Traversed from Route Start to EPZ Boundary
48	Baywood, Los Osos, Morro Bay & Cayucos Transit-Dependent Route	159, 160, 161, 507, 162, 163, 164, 165, 504, 166, 167, 168, 505, 506, 169, 61, 177, 62, 76, 63, 75, 362, 1288, 64, 364, 65, 839, 66, 67, 497, 68, 357, 358, 69, 496
49	Avila Beach, Pismo Beach & Shell Beach Transit-Dependent Route	905, 299, 300, 301, 302, 303, 904, 592, 593, 594, 908, 994, 595, 31, 32, 603, 33, 612, 34, 611, 615, 1100, 407, 35, 495, 439, 440, 631, 36, 37, 38, 39, 664, 425, 424, 422, 40, 41, 709, 42, 716, 1120
50	San Luis Obispo & Cal Poly Transit-Dependent Route	388, 770, 391, 771, 390, 527, 389, 22, 557, 21, 20, 19, 18
51	Cuesta Transit-Dependent Route	513, 54, 53, 516, 52, 51, 385, 50, 517, 802, 49, 191, 523, 524, 803, 23, 527, 389, 22, 557, 21, 20, 19, 18
52	City of Pismo Beach, Grover Beach, Arroyo Grande, Five Cities Southern Potion, Oceano & Nipomo (North of Willow Road) Transit-Dependent Route	472, 1084, 922, 493, 702, 701, 234, 235, 236, 237, 238, 717, 239

Table 10-3. School Relocation Centers

School	School Relocation Center
Dandy Lion Montessori School	Nipomo Elementary School
Lopez Continuation High School	
Coastal Christian High School	
Saint Patrick's School	
Arroyo Grande Montessori	
Valley View Adventist Academy	
Lighthouse Christian School	
Shell Beach Elementary School	Nipomo High School
Judkins Middle School	
Grover Heights Elementary School	
Grover Beach Elementary School	
Highland Preparatory School	
Oceano Elementary School	
Ocean View Elementary School	
Fairgrove Elementary School	
Harloe Elementary School	
Arroyo Grande High School	
Paulding Middle School	
Coastal Christian School	
Branch Elementary School	
Lopez High School	
Pacific View Academy	
Mesa Middle School	

School	School Relocation Center
Christ Classical School	Paso Robles Event Center (Mid State Fairgrounds)
Bellevue-Santa Fe Charter School	
Heartland Christian Academy	
Monarch Grove Elementary School	
Manzanita School	
Baywood Elementary School	
Los Osos Middle School	
Discovery House Montessori	
Laguna Middle School	
Pacific Beach High School	
San Luis Community School	
C. L. Smith Elementary School	
Montessori Children's School	
Grizzly Challenge Charter School	
Bishop's Peak Elementary School	
Old Mission School	
Pacheco Elementary School	
Mission College Preparatory Catholic High School	
Hawthorne Elementary School	
Christian Day School	
San Luis Obispo Christian School	
Sinsheimer Elementary School	
California Polytechnic State University	
San Luis Obispo High School	
Charles E. Teach Elementary School	
Chris Jespersen	
Olive Grove Charter School	
San Luis Obispo Classical Academy	
Los Ranchos Elementary School	
Rancho El Chorro Outdoor School	
Loma Vista Community School	
Morro Bay High School	
Del Mar Elementary School	
Cayucos Elementary School	Santa Lucia School in Cambria

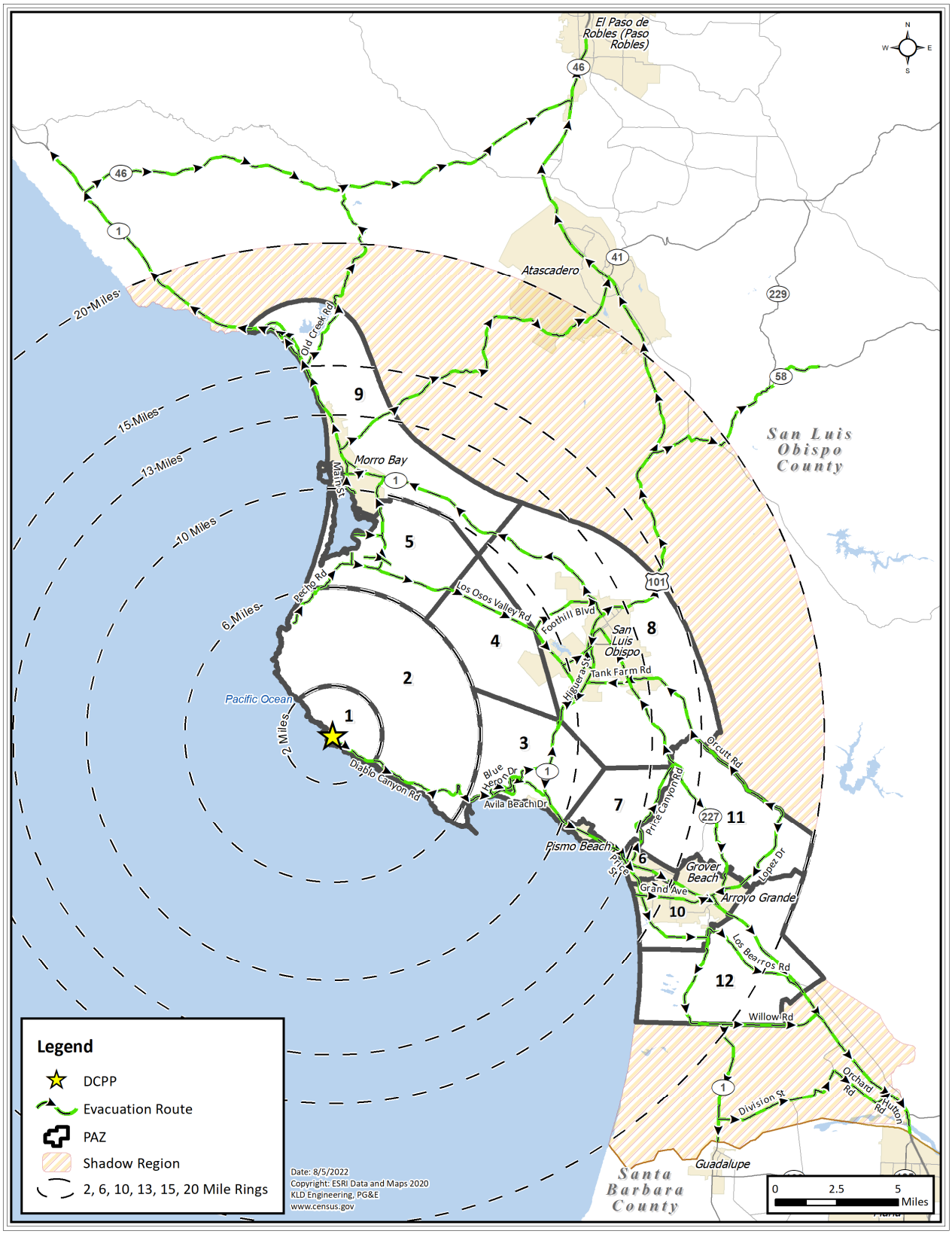


Figure 10-1. Evacuation Route Map

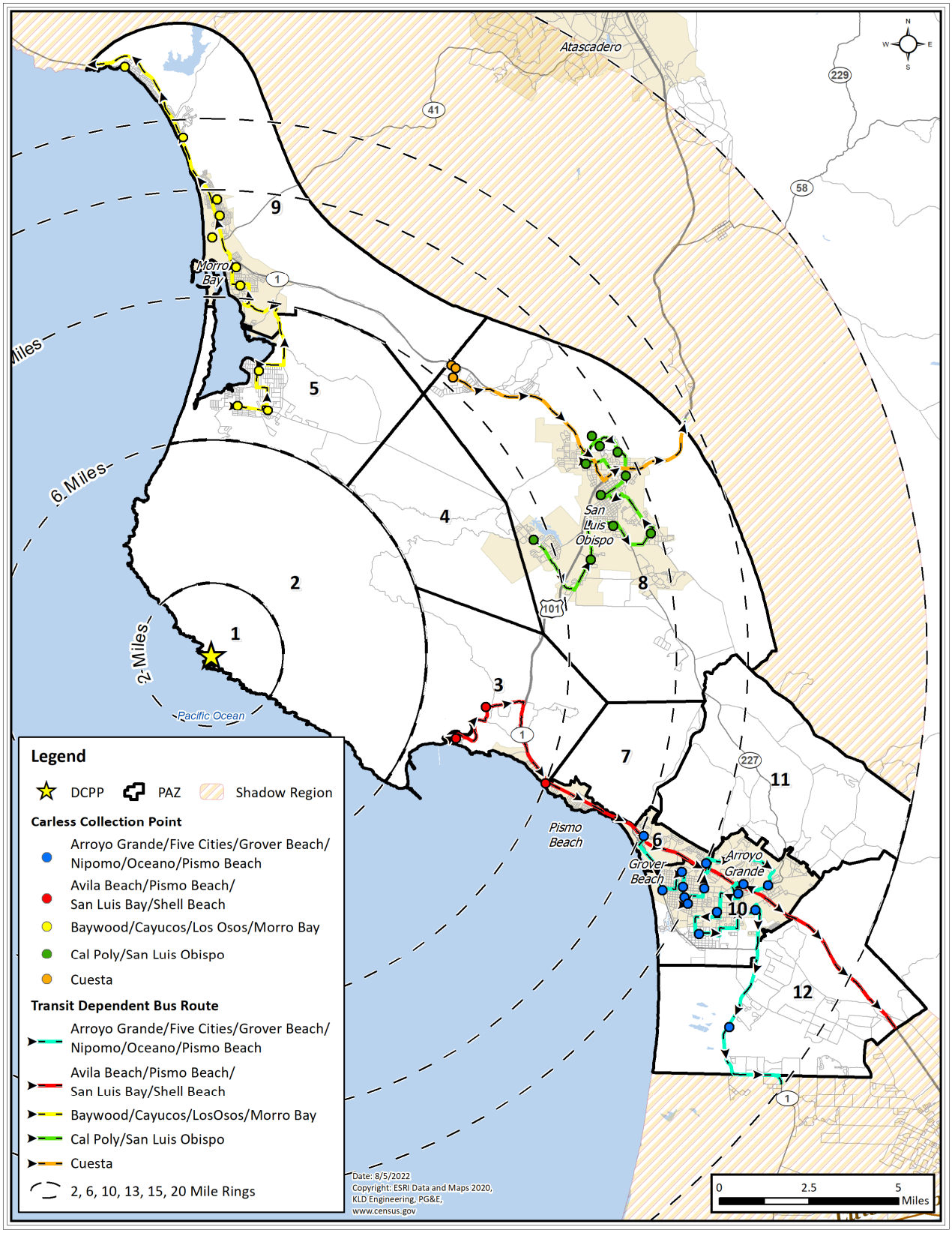


Figure 10-2. Transit-Dependent Bus Routes and Careless Collection Points

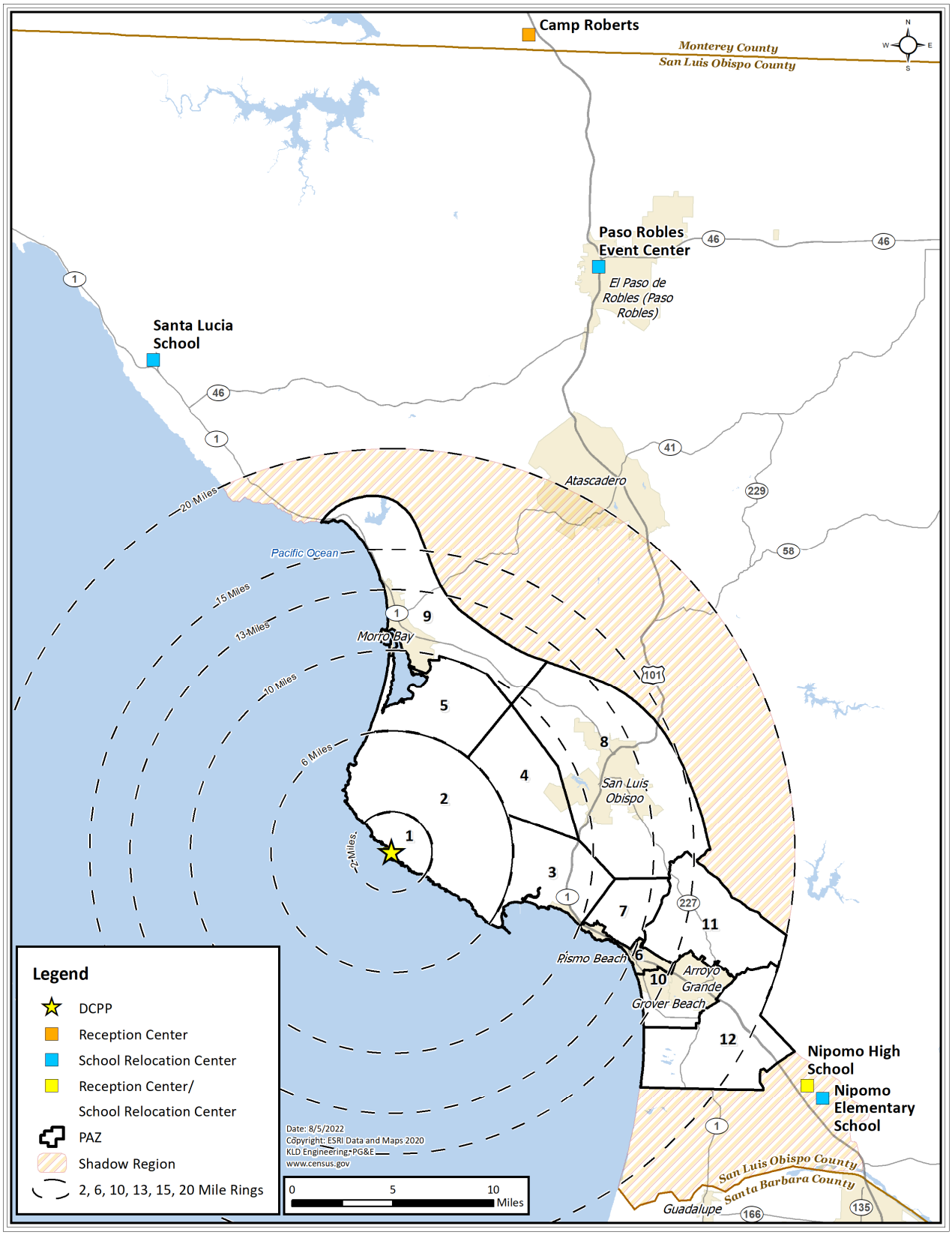


Figure 10-3. General Population Reception Centers and Public School Relocation Centers

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 DYNEVII 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 the power plant and to access major highways. The specific destination nodes within this set that are selected by travelers and the selection of the connecting paths of travel, are both determined by DTRAD. This determination is made by a logit-based path choice model in DTRAD, so as to minimize the trip "cost", as discussed later.

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

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

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

  where c_a is the generalized cost for link a, and α, β, and γ are cost coefficients for link travel time, distance, and supplemental cost, respectively. Distance and supplemental costs are defined as invariant properties of the network model, while travel time is a dynamic property dictated by prevailing traffic conditions. The DYNEV simulation model

computes travel times on all edges in the network and DTRAD uses that information to constantly update the costs of paths. The route choice decision model in the next simulation iteration uses these updated values to adjust the route choice behavior. This way, traffic demands are dynamically re-assigned based on time dependent conditions. The interaction between the DTRAD 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 the plant:

  $s_a = -\beta \ln(p),\ 0 \le p \le l\ ;\ \beta > 0$

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

  d_n = Distance of node, n, from the plant
  d_0 =Distance from the plant where there is zero risk
  β = Scaling factor

The value of d_o = 20 miles, the outer distance of the EPZ. Note that the supplemental cost, s_a, of link, a, is (high, low), if its downstream node, n, is (near, far from) the power plant.

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.

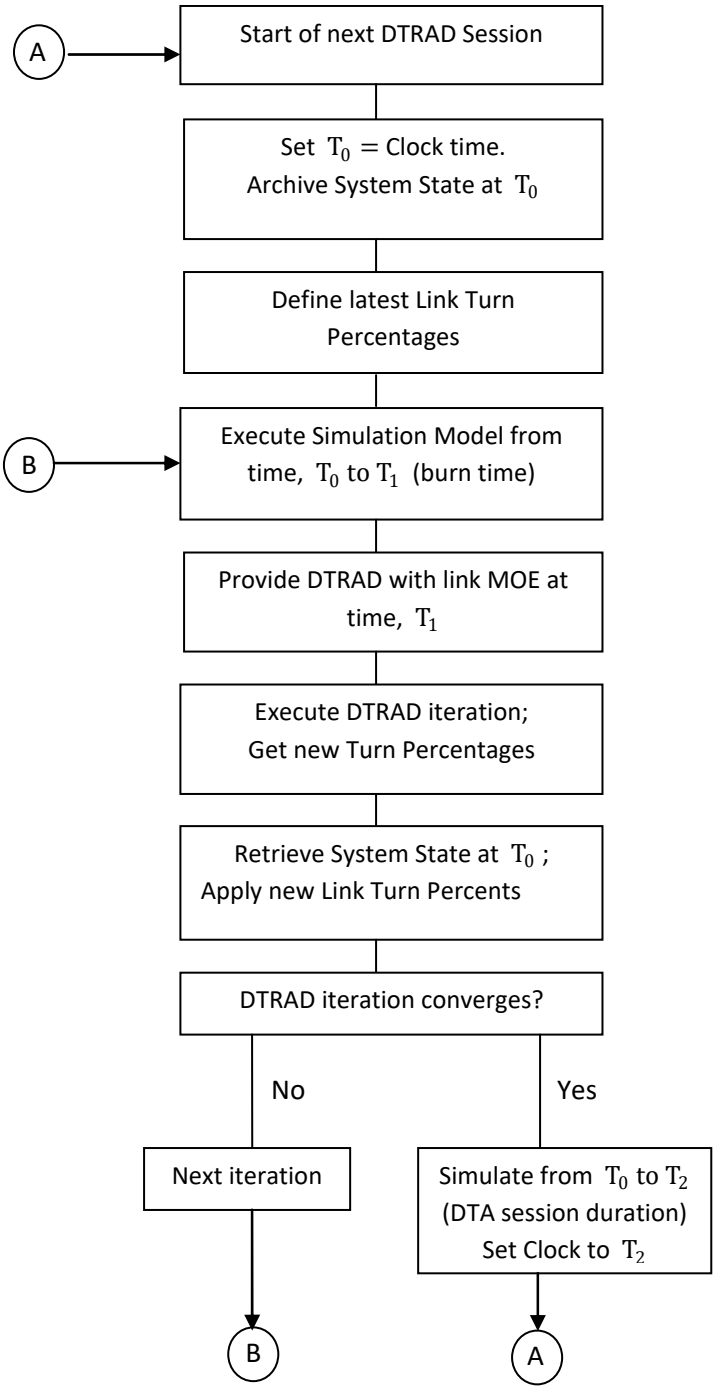


Figure B-1. Flow Diagram of Simulation-DTRAD Interface

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.

C.1 Methodology

C.1.1 The Fundamental Diagram

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

The fundamental diagram is applied to <u>moving</u> 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 $Q = \left(0.98 - 0.0056\,\bar{k}\right) RQ_{max}$ for $\bar{k}_s \leq \bar{k} \leq \bar{k}_j$, where $\bar{k}_s = 50$ and $\bar{k}_j = 175$.

C.1.2 The Simulation Model

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

The formulation and the associated logic presented below are designed to solve the unit problem for each sweep over the network (discussed below), for each turn movement serviced

on each link that comprises the evacuation network, and for each TI over the duration of the evacuation.

Given = Q_b , M_b , L , TI , E_0 , LN , G/C , h , L_v , R_0 , L_c , E , M
Compute = O , Q_e , M_e
Define $O = O_Q + O_M + O_E$; $E = E_1 + E_2$

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

2. Calculate $v(k)$ such that $k \leq 130$ using the analytical representations of the fundamental diagram.
   Calculate $Cap = \frac{Q_{max}(TI)}{3600} \left(G/C\right) LN$, in vehicles, this value may be reduced due to metering
   Set $R = 1.0$ if $G/C < 1$ or if $k \leq k_c$; Set $R = 0.9$ only if $G/C = 1$ and $k > k_c$
   Calculate queue length, $L_b = Q_b \frac{L_v}{LN}$

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

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

5. If $Q_b \geq Cap$, then
   $O_Q = Cap$, $O_M = O_E = 0$
   If $t_1 > 0$, then
   $Q'_e = Q_b + M_b + E_1 - Cap$
   Else
   $Q'_e = Q_b - Cap$
   End if
   Calculate Q_e and M_e using Algorithm A (below)

6. Else $(Q_b < Cap)$
   $O_Q = Q_b$, $RCap = Cap - O_Q$

7. If $M_b \leq RCap$, then

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

$Q'_e = E_1 - O_E$

If $Q'_e > 0$, then

Calculate Q_e, M_e with Algorithm A

Else

$Q_e = 0$, $M_e = E_2$

End if

Else $(t_1 = 0)$

$O_M = \left(\frac{v(TI) - L_b}{L - L_b}\right) M_b$ and $O_E = 0$

$M_e = M_b - O_M + E$; $Q_e = 0$

End if

9. Else $(M_b > RCap)$

$O_E = 0$

If $t_1 > 0$, then

$O_M = RCap$, $Q'_e = M_b - O_M + E_1$

Calculate Q_e and M_e using Algorithm A

10. Else $(t_1 = 0)$

$M_d = \left[\left(\frac{v(TI) - L_b}{L - L_b}\right) M_b\right]$

If $M_d > RCap$, *then*

$O_M = RCap$

$Q'_e = M_d - O_M$

Apply Algorithm A to calculate Q_e and M_e

Else

$O_M = M_d$

$M_e = M_b - O_M + E$ and $Q_e = 0$

End if

End if

End if

End if

11. Calculate a new estimate of average density, $\bar{k}_n = \frac{1}{4}[k_b + 2\,k_m + k_e]$,

where k_b = density at the beginning of the TI

k_e = density at the end of the TI

k_m = density at the mid-point of the TI

All values of density apply only to the <u>moving</u> vehicles.

If $|\bar{k}_n - \bar{k}_{n-1}| > \epsilon$ and $n < N$

where $N = \max$ number of iterations, and ϵ is a convergence criterion, then

12. set $n = n + 1$, and return to step 2 to perform iteration, n, using $k = \bar{k}_n$.
End if

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

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

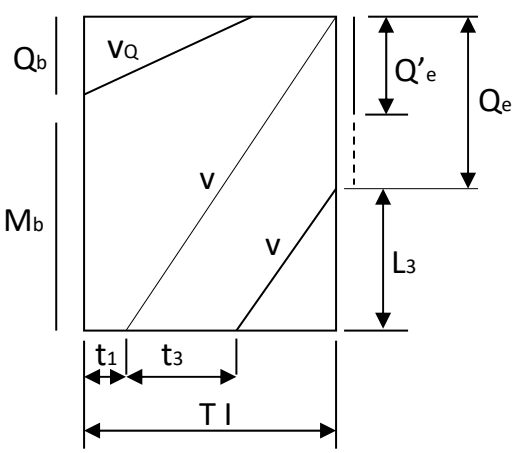
The number of excess vehicles that cause spillback is: $SB = Q_e + M_e - \frac{(L-W)\cdot LN}{L_v}$, where W is the width of the upstream intersection. To prevent spillback, meter the outflow from the feeder approaches and from the source flow, S, during this TI by the amount, SB. That is, set

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

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:

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

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

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

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 <u>after</u> 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.

C.2.2 Interfacing with Dynamic Traffic Assignment (DTRAD)

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

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

As indicated in Figure B-1, the simulation model supports the DTRAD session by providing it with operational link MOE that are needed by the path choice model and included in the DTRAD cost function. These MOE represent the operational state of the network at a time, $T_1 \leq T_2$, which lies within the session duration, $[T_0, T_2]$. This "burn time", $T_1 - T_0$, is selected by the analyst. For each DTRAD iteration, the simulation model computes the change in network operations over this burn time using the latest set of link turn percentages computed by the DTRAD model. Upon convergence of the DTRAD iterative procedure, the

simulation model accepts the latest turn percentages provided by the Dynamic Traffic Assignment (DTA) model, returns to the origin time, T_0 , and executes until it arrives at the end of the DTRAD session duration at time, T_2 . At this time the next DTA session is launched and the whole process repeats until the end of the **DYNEV II** run.

Additional details are presented in Appendix B.

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

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

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

HIGHWAY NETWORK

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

GENERATED TRAFFIC VOLUMES

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

TRAFFIC CONTROL SPECIFICATIONS

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

DRIVER'S AND OPERATIONAL CHARACTERISTICS

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

DYNAMIC TRAFFIC ASSIGNMENT

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

INCIDENTS

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

Table C-3. Glossary

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

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

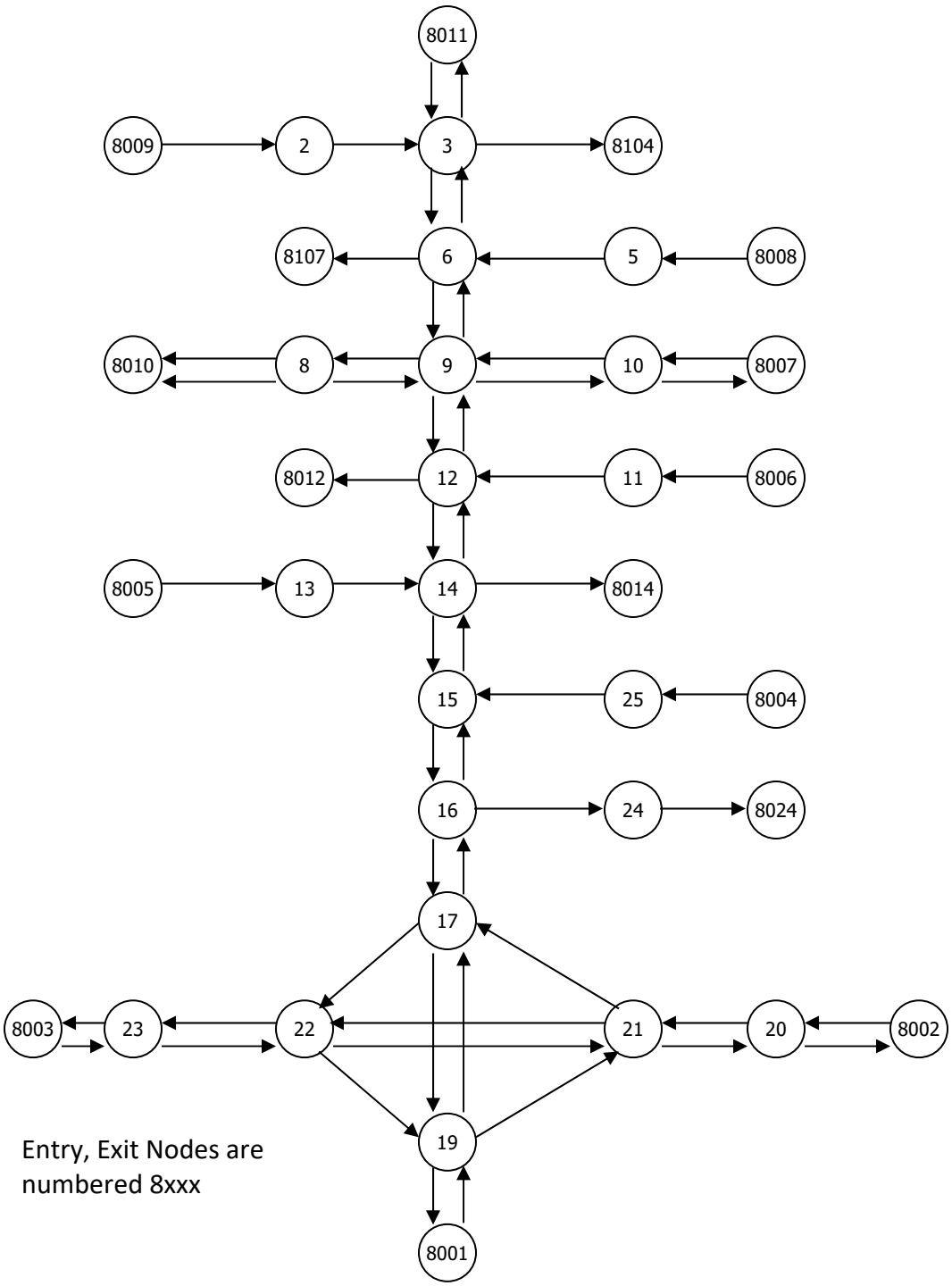


Figure C-1. Representative Analysis Network

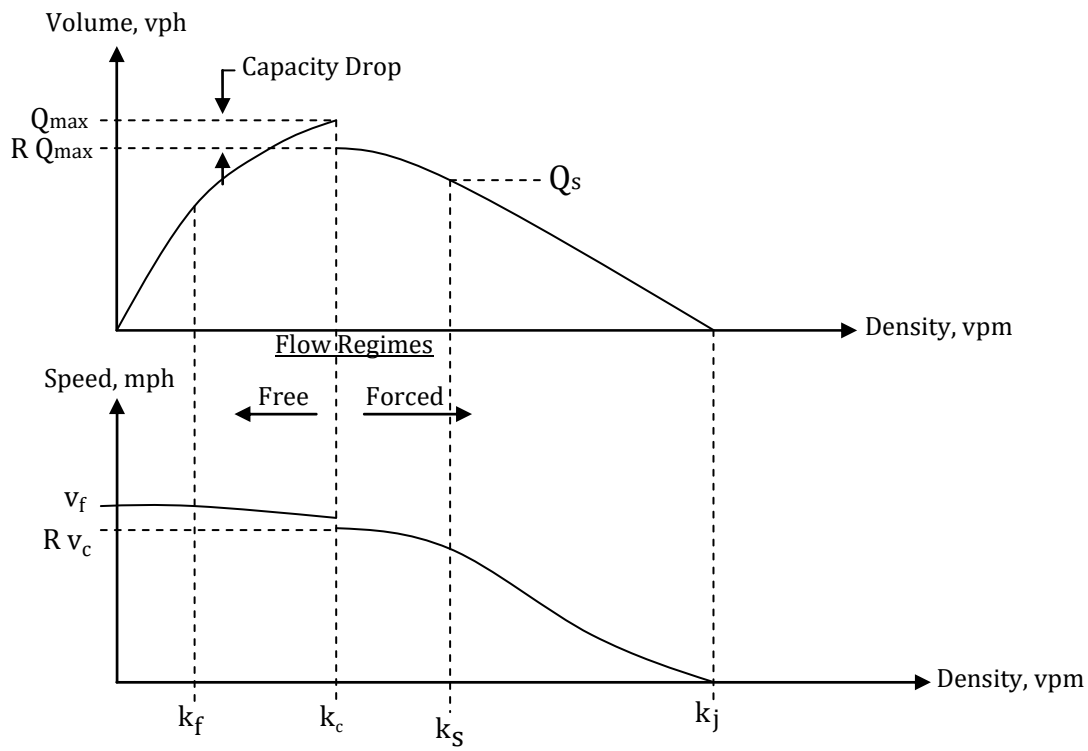


Figure C-2. Fundamental Diagrams

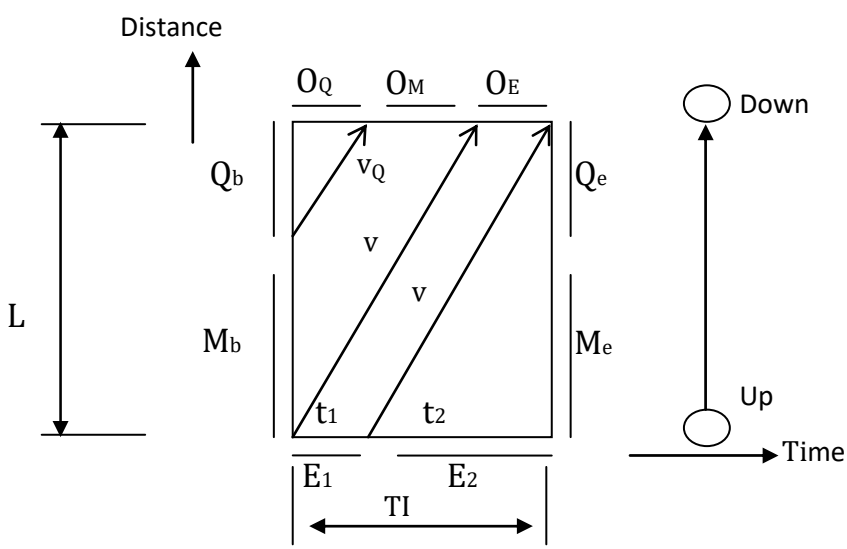


Figure C-3. A UNIT Problem Configuration with $t_1 > 0$

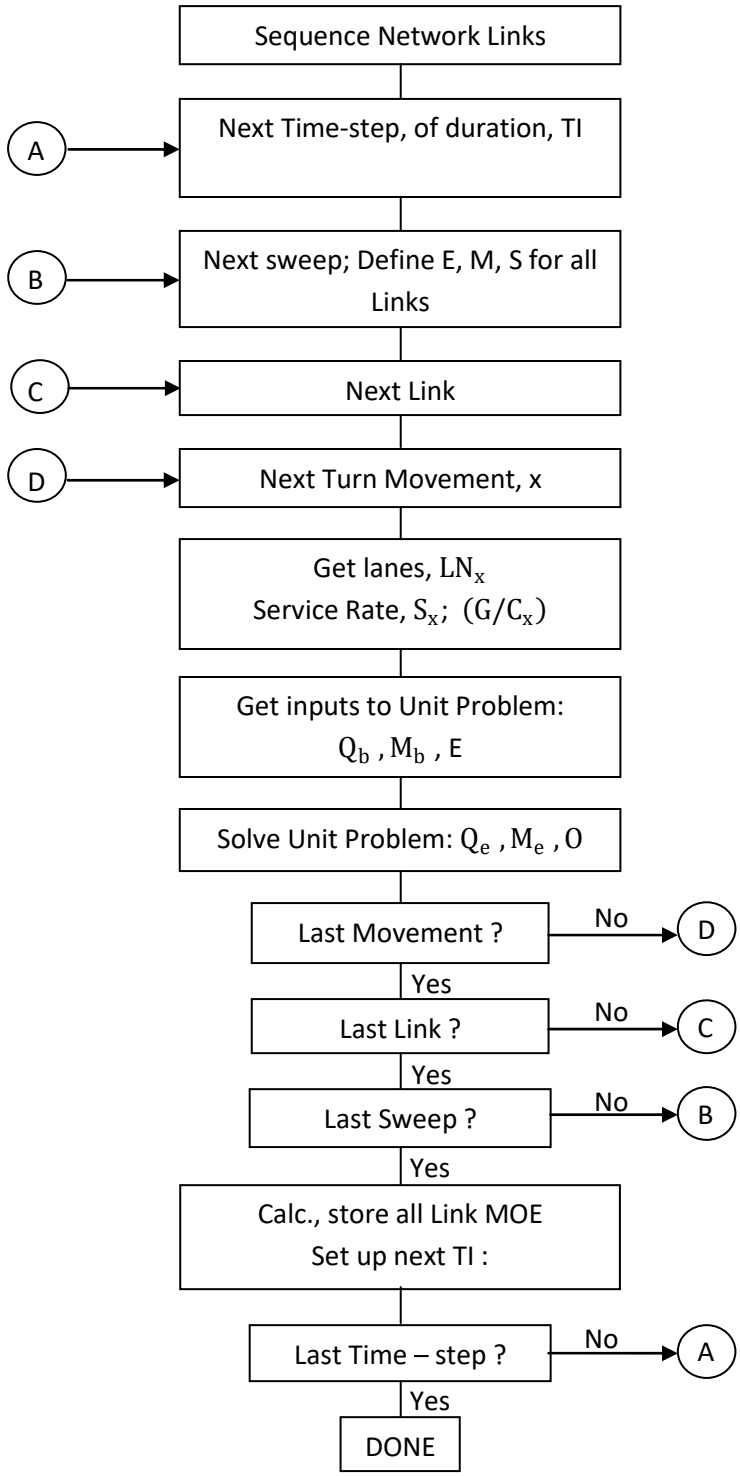


Figure C-4. Flow of Simulation Processing (See Glossary: Table C-3)

APPENDIX D

Detailed Description of Study Procedure

D. DETAILED DESCRIPTION OF STUDY PROCEDURE

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

Step 1

The first activity was to obtain Emergency Planning Zone (EPZ) boundary information and create a Geographic Information System (GIS) base map. The base map extends beyond the Shadow Region (Public Education Zone (PEZ)) which extends approximately 5 miles (radially) beyond the EPZ boundary. The base map incorporates the local roadway topology, a suitable topographic background and the EPZ and Protective Action Zone (PAZ) boundaries.

Step 2

2020 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 data were provided by the San Luis Obispo County Office of Emergency Services (SLOCOES) and PG&E. The percent of non-EPZ employees was estimated using the U.S. Census Bureau's Longitudinal Employer-Household Dynamics interactive website[1]. Transient, school, and other special facility data were provided by the SLOCOES.

Step 3

A kickoff meeting was conducted with major stakeholders (county emergency managers and on-site and off-site utility emergency managers). The purpose of the kickoff meeting was to present an overview of the work effort, identify key agency personnel, and indicate the data requirements for the study. Specific requests for information were presented to the county. 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.

[1] https://onthemap.ces.census.gov/

Step 5

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

Step 7

The EPZ is subdivided into 12 PAZs. Based on wind direction and speed, Regions (groupings of PAZ) 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 Full 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 EVAN software see Section 1.3) 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. Traffic management plans are analyzed, and traffic control points are prioritized, if applicable. Additional analysis is conducted to identify the sensitivity of the ETE to change in some base evacuation conditions and model assumptions.

Step 16

Once vehicular evacuation results are accepted, average travel speeds for transit and special facility routes 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 Rev. 1.

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.

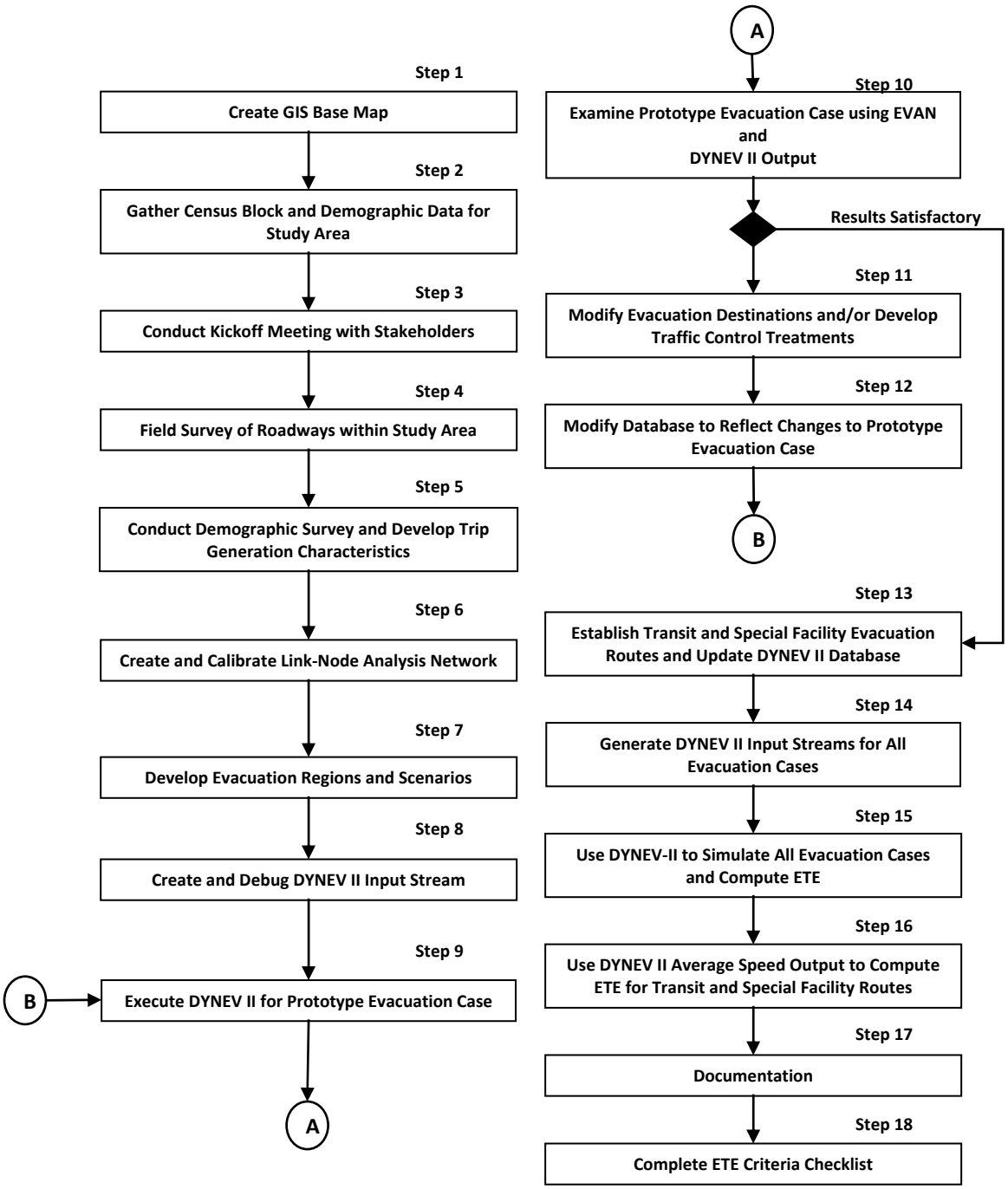


Figure D-1. Flow Diagram of Activities

APPENDIX E

Special Facility Data

E. SPECIAL FACILITY DATA

The following tables list population information, as of February 2022, for special facilities that are located within the DCPP EPZ. Special facilities are defined as schools, medical facilities, and correctional facilities. Transient population data is included in the tables for recreational areas (beaches, campgrounds, golf courses, marinas, parks, other recreational facilities) and lodging facilities. Employment data is included in the table for major employers. Each table is grouped by county. The location of the facility is defined by its straight-line distance (miles) and direction (magnetic bearing) from the center point of the plant. Maps of each school, medical facility, major employer, recreational area (beach, campground, golf course, marina, park, other recreational facility), lodging facility, and correctional facility are also provided.

Table E-1. Schools within the Full EPZ

PAZ	Distance (miles)	Dire-ction	School Name	Street Address	Municipality	Enroll-ment
3	8.0	E	Bellevue-Santa Fe Charter School	1401 San Luis Bay Dr	San Luis Obispo	156
5	6.7	N	Heartland Christian Academy	1480 Santa Ysabel Ave	Los Osos	20
5	7.0	N	Monarch Grove Elementary School	348 Los Osos Valley Rd	Baywood	278
5	7.9	N	Manzanita School	1443 9th St	Los Osos	24
5	8.0	N	Baywood Elementary School	1330 9th St	Baywood	358
5	8.1	NNE	Los Osos Middle School	1555 El Moro St	Los Osos	536
6	10.6	ESE	Shell Beach Elementary School	2100 Shell Beach Rd	Pismo Beach	309
6	13.1	ESE	Judkins Middle School	680 Wadsworth St	Pismo Beach	460
8	9.6	ENE	Discovery House Montessori	11245 Los Osos Valley Rd	San Luis Obispo	16
8	9.6	ENE	Laguna Middle School	11050 Los Osos Valley Rd	San Luis Obispo	678
8	9.8	ENE	Christ Classical School	880 Laureate Ln	San Luis Obispo	120
8	9.9	ENE	Pacific Beach High School	11950 Los Osos Valley Rd	San Luis Obispo	71
8	10.0	ENE	San Luis Community School	1981 Vicente Dr	San Luis Obispo	50
8	10.0	ENE	C. L. Smith Elementary School	1375 Balboa St	San Luis Obispo	410
8	10.3	E	Montessori Children's School	4200 S Higuera St	San Luis Obispo	57
8	10.4	NE	Cuesta College	N Hwy 1	San Luis Obispo	13,000
8	10.4	NE	Grizzly Challenge Charter School	Hwy 1	San Luis Obispo	225
8	11.1	ENE	Laurus College	81 Higuera St	San Luis Obispo	88
8	11.3	ENE	Bishop's Peak Elementary School	451 Jaycee Dr	San Luis Obispo	380
8	11.7	ENE	Old Mission School	761 Broad St	San Luis Obispo	263
8	11.7	ENE	Pacheco Elementary School	261 Cuesta Dr	San Luis Obispo	505
8	11.7	ENE	Mission College Preparatory Catholic High School	682 Palm St	San Luis Obispo	350
8	11.8	ENE	Hawthorne Elementary School	2125 Story St	San Luis Obispo	347
8	12.0	ENE	Christian Day School	2750 Broad St	San Luis Obispo	45
8	12.2	E	The University of San Luis Obispo School of Law	4119 Broad St # 200	San Luis Obispo	235
8	12.5	ENE	San Luis Obispo Christian School	2075 Johnson Ave	San Luis Obispo	43
8	12.5	ENE	Sinsheimer Elementary School	2755 Augusta St	San Luis Obispo	380
8	12.6	ENE	California Polytechnic State University	1 Grand Ave	San Luis Obispo	20,944
8	12.7	ENE	San Luis Obispo High School	1499 San Luis Dr	San Luis Obispo	1,447
8	12.7	ENE	Charles E. Teach Elementary School	451 Jaycee Dr	San Luis Obispo	176
8	12.7	ENE	Chris Jespersen	251 Grand Ave	San Luis Obispo	15
8	12.8	ENE	Olive Grove Charter School	165 Grand Ave	San Luis Obispo	75

PAZ	Distance (miles)	Dire-ction	School Name	Street Address	Municipality	Enroll-ment
8	12.8	ENE	San Luis Obispo Classical Academy	165 Grand Ave	San Luis Obispo	260
8	13.2	E	Los Ranchos Elementary School	5785 Los Ranchos Rd	San Luis Obispo	452
9	11.0	NE	Rancho El Chorro Outdoor School	2450 Pennington Creek Rd	San Luis Obispo	160
9	11.1	NE	Loma Vista Community School	2494 Pennington Creek Rd	San Luis Obispo	90
9	11.8	N	Morro Bay High School	235 Atascadero Rd	Morro Bay	848
9	12.7	N	Del Mar Elementary School	501 Sequoia St	Morro Bay	315
9	16.8	N	Cayucos Elementary School	301 Cayucos Dr	Cayucos	220
10	14.5	ESE	Grover Heights Elementary School	770 N 8th St	Grover Beach	439
10	14.8	ESE	Grover Beach Elementary School	365 S 10th St	Grover Beach	506
10	15.0	ESE	Dandy Lion Montessori School	1089 Baden Ave	Grover Beach	15
10	15.6	ESE	Highland Preparatory School	1285 Poplar St	Arroyo Grande	10
10	15.7	ESE	Oceano Elementary School	1551 17th St	Oceano	465
10	15.7	ESE	Ocean View Elementary School	1208 Linda Dr	Arroyo Grande	558
10	15.7	ESE	Lucia Mar Adult School[1]	1425 19th St	Oceano	-
10	15.9	ESE	Lopez Continuation High School	1055 Mesa View Dr	Arroyo Grande	105
10	15.9	ESE	Coastal Christian High School	1220 Farroll Ave	Arroyo Grande	274
10	15.9	ESE	Fairgrove Elementary School	2101 The Pike	Grover Beach	462
10	16.0	ESE	Saint Patrick's School	900 W Branch St	Arroyo Grande	275
10	16.3	ESE	Arroyo Grande Montessori	216 Oak St	Arroyo Grande	23
10	16.4	ESE	Harloe Elementary School	901 Fair Oaks Ave	Arroyo Grande	632
10	16.5	ESE	Valley View Adventist Academy	230 Vernon St	Arroyo Grande	66
10	16.8	ESE	Lighthouse Christian School	497 Fair Oaks Ave	Arroyo Grande	38
10	16.9	ESE	Arroyo Grande High School	495 Valley Rd	Arroyo Grande	2,174
10	17.1	ESE	Paulding Middle School	600 Crown Hill	Arroyo Grande	656
11	15.0	ESE	Coastal Christian School	1005 N Oak Park Blvd	Pismo Beach	196
11	19.2	ESE	Branch Elementary School	970 School Rd	Arroyo Grande	330
12	17.9	SE	Lopez High School	1055 Mesa View Dr	Arroyo Grande	137
12	17.9	SE	Pacific View Academy	1065 Mesa View Dr	Arroyo Grande	517
12	18.2	ESE	Mesa Middle School	2555 Halcyon Rd	Arroyo Grande	520
					EPZ TOTAL:	**52,804**

[1] As per SLO County Office of Emergency Services (OES), all the students in Lucie Mar Adult School are adults who are responsible for their own transportation. In the event of an emergency, they will evacuate along with the permanent residents.

Table E-2. Medical Facilities within the Full EPZ

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Capa-city	Current Census	Ambul-atory Patients	Wheel-chair Patients	Bed-ridden Patients
5	6.8	NNE	Sea Gardens	923 Highland Dr	Baywood-Los Osos	6	6	5	1	0
5	6.8	N	Rose Garden II	709 Mar Vista Dr	Los Osos	5	5	4	1	0
5	6.8	N	Pacific Heights Residential	781 Lilac Dr	Los Osos	5	4	3	1	0
5	6.9	N	Sunrise Terrace RCFE VI	725 Manzanita Dr	Los Osos	6	4	3	1	0
5	6.9	N	Bay Osos RCFE III	2393 Clelland Ave	Los Osos	6	6	5	1	0
5	6.9	N	Los Osos Residential Care II	2280 Inyo St	Los Osos	6	4	3	1	0
5	7.0	N	Jaj Residential Care	517 Los Osos Valley Rd	Los Osos	6	4	3	1	0
5	7.1	N	Sunrise Terrace RCFE V	2117 Del Norte St	Los Osos	6	4	3	1	0
5	7.5	N	Sachele Senior Guest Home III LLC	1758 7th St	Los Osos	6	4	3	1	0
5	7.5	NNE	M&L South Bay MaxiCare	1820 Mountain View Dr	Los Osos	6	4	3	1	0
5	7.7	NNE	Bay Osos RCFE II	1675 13th St	Los Osos	6	4	3	1	0
5	7.7	NNE	Bay Osos RCFE I	1663 13th St	Baywood-Los Osos	6	4	3	1	0
5	7.7	NNE	Los Osos Residential Care I	1667 18th St	Los Osos	6	4	3	1	0
5	7.8	NNE	Jaj Residential Care II	1631 17th St	Los Osos	6	6	5	1	0
5	7.9	NNE	Sunrise Terrace RCFE VII	1557 16th St	Los Osos	6	4	3	1	0
5	7.9	NNE	Welcome Home II	1555 16th St	Baywood-Los Osos	6	4	3	1	0
5	7.9	NNE	Baywood Manor RCFE II	1090 Paso Robles Ave	Los Osos	6	4	3	1	0
5	7.9	NNE	Baywood Manor RCFE	1489 11th St	Los Osos	6	4	3	1	0
5	8.0	NNE	Orchid Garden Residential Care	1457 18th St	Los Osos	4	3	2	1	0
5	8.0	NNE	Southbay Maxi Care	1410 13th St	Los Osos	6	4	3	1	0
5	8.0	NNE	Caluya's Residential Care	1415 16th St	Los Osos	4	4	3	1	0
5	8.4	NNE	Caluya's Residential Care II	1160 15th St	Los Osos	4	3	2	1	0
8	9.3	ENE	Sunrise Terrace RCFE IV	920 Del Rio Ave	San Luis Obispo	6	4	3	1	0
8	9.4	ENE	Greenbrook Elderly Care	1062 Del Rio Ave	San Luis Obispo	5	5	4	1	0
8	9.4	ENE	Valley Vista Residential Care	1095 San Adriano St	San Luis Obispo	6	4	3	1	0
8	9.4	ENE	Sunrise Terrace RCFE III	1015 San Adriano St	San Luis Obispo	6	4	3	1	0

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Capa-city	Current Census	Ambul-atory Patients	Wheel-chair Patients	Bed-ridden Patients
8	9.4	ENE	Miriam's Place	1728 Royal Ct	San Luis Obispo	6	4	3	1	0
8	9.7	ENE	Singletree Caring Hands	1789 Singletree Ct	San Luis Obispo	6	4	3	1	0
8	9.7	ENE	Sunrise Terrace RCFE I	1135 Oceanaire Dr	San Luis Obispo	6	4	3	1	0
8	9.8	ENE	Sunrise Terrace RCFE II	1338 Royal Way	San Luis Obispo	6	4	3	1	0
8	9.9	ENE	Valley Vista Residential Care III	1557 Galleon Way	San Luis Obispo	6	4	3	1	0
8	9.9	ENE	Valley Vista Residential Care II	1712 Vicente Dr	San Luis Obispo	6	4	3	1	0
8	10.1	ENE	Madonna Cottage	1168 Madonna Rd	San Luis Obispo	6	6	5	1	0
8	11.2	ENE	The Residence	3220 Calle Malva	San Luis Obispo	6	4	3	1	0
8	11.2	ENE	The Park Grove	338 Margarita Ave	San Luis Obispo	6	4	3	1	0
8	11.3	ENE	The Residence IV	347 Calle Lupita	San Luis Obispo	6	4	3	1	0
8	11.5	ENE	Avila Senior Living SLO	475 Marsh St	San Luis Obispo	11	8	6	2	0
8	11.5	ENE	Welcome Home Residential	402 Woodbridge St	San Luis Obispo	6	4	3	1	0
8	11.6	ENE	Vista Rosita Elder Care	461 Hill St	San Luis Obispo	6	4	3	1	0
8	11.6	ENE	San Luis Residential Care	260 Westmont Ave	San Luis Obispo	6	6	5	1	0
8	11.6	ENE	Vista Rosa	467 Hill St	San Luis Obispo	25	19	14	4	1
8	11.7	ENE	Foothills Residential Care	696 Foothill Blvd	San Luis Obispo	6	4	3	1	0
8	11.7	ENE	Garden Creek Assisted Living	73 Broad St	San Luis Obispo	72	54	41	11	2
8	11.9	ENE	Casa de Vida	879 Meinecke Ave	San Luis Obispo	59	36	28	7	1
8	12.0	ENE	Sierra Vista Regional Medical Center	1010 Murray Ave	San Luis Obispo	162	100	77	21	2
8	12.3	ENE	Bob and Corky's Care Home III	2456 Santa Clara St	San Luis Obispo	6	4	3	1	0
8	12.4	ENE	French Hospital Medical Center	1911 Johnson Ave	San Luis Obispo	98	35	27	7	1
8	12.5	ENE	Bob and Corky's Care Home IV	2525 Augusta St	San Luis Obispo	6	4	3	1	0
8	12.6	ENE	Bob and Corky's Care Home	2425 Gerda St	San Luis Obispo	6	4	3	1	0
8	12.6	ENE	San Luis Obispo Mental Health	2178 Johnson Ave	San Luis Obispo	16	10	8	2	0
8	12.7	ENE	The Village at Sydney Creek	1234 Laurel Ln	San Luis Obispo	84	63	48	13	2
8	12.7	ENE	Bella Vista Transitional Care	3033 Augusta St	San Luis Obispo	162	122	94	24	4
8	12.8	ENE	Mission View Health Center	1425 Woodside Dr	San Luis Obispo	161	121	93	24	4
8	12.8	ENE	Anna's Gardens	2719 El Cerrito St	San Luis Obispo	8	6	5	1	0
8	12.9	ENE	Chateau Rose	1555 Laurel Ln	San Luis Obispo	6	4	3	1	0
8	13.0	ENE	Bob and Corky's Care Home V	3210 Flora St	San Luis Obispo	6	4	3	1	0
9	10.3	N	Garden House	480 Main St	Morro Bay	15	11	9	2	0

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Capa-city	Current Census	Ambul-atory Patients	Wheel-chair Patients	Bed-ridden Patients
9	10.7	N	Casa De Flores	1405 Teresa Dr	Morro Bay	120	90	69	18	3
9	10.7	N	Bayside Care Center	1405 Teresa Dr	Morro Bay	145	109	84	22	3
10	13.9	ESE	Anna's Gardens	100 Carmelde Ln	Grover Beach	6	6	5	1	0
10	14.5	ESE	Get Total TLC	797 Saratoga Ave	Grover Beach	6	6	5	1	0
10	15.2	ESE	Family Care Home	1095 Bodega Ct	Grover Beach	6	6	5	1	0
10	15.2	ESE	Full Circle Residence I	1445 Huntington Ave	Grover Beach	4	4	3	1	0
10	15.3	ESE	Golden Sunrise	917 Savannah Dr	Grover Beach	5	5	4	1	0
10	15.3	ESE	Family Home Care II	989 Savannah Dr	Grover Beach	6	6	5	1	0
10	15.3	ESE	Parkview Village II	1577 Baden Ave	Grover Beach	6	6	5	1	0
10	15.4	ESE	La Serena Residence	1589 La Selva Ave	Grover Beach	4	4	3	1	0
10	15.5	ESE	Heritage Residence	1724 Baden Ave	Grover Beach	4	4	3	1	0
10	15.6	ESE	Full Circle Residence II	483 Noel St	Arroyo Grande	6	4	3	1	0
10	15.7	ESE	Five Cities Residence	472 Dixson St	Arroyo Grande	6	4	3	1	0
10	15.7	ESE	Parkview Village	431 Dixson St	Arroyo Grande	5	4	3	1	0
10	15.7	ESE	Bella Vita Senior Living	145 Andre Dr	Arroyo Grande	6	4	3	1	0
10	15.8	ESE	Wyndham Residence	222 S Elm St	Arroyo Grande	72	54	41	11	2
10	15.9	ESE	Arroyo Grande Care Center	1212 Farroll Ave	Arroyo Grande	99	74	57	15	2
10	15.9	ESE	Sacred Heart Residential Care Facility	785 Via Bandolero	Arroyo Grande	6	6	5	1	0
10	16.3	ESE	Alder House	295 Alder St	Arroyo Grande	32	24	18	5	1
10	16.4	ESE	Graceful Living 2	389 Spanish Moss Ln	Arroyo Grande	6	4	3	1	0
10	16.4	ESE	Arroyo Grande Community Hospital	345 S Halcyon Rd	Arroyo Grande	84	76	58	16	2
10	16.4	ESE	Graceful Living	381 Spanish Moss Ln	Arroyo Grande	6	4	3	1	0
10	16.9	ESE	Hillside Villa Retirement Home	547 May St	Arroyo Grande	6	4	3	1	0
10	17.0	ESE	Hillside Villa Retirement Home II	533 Le Point St	Arroyo Grande	6	4	3	1	0
11	14.0	E	Edna Rose Residence	6430 Mira Cielo	San Luis Obispo	6	6	5	1	0
11	15.1	ESE	Oak Park Manor Assisted Living	1073 Oak Park Rd	Arroyo Grande	32	24	18	5	1
12	18.5	ESE	Cypress Ridge Home Care	2312 Sanderling Ct	Arroyo Grande	6	4	3	1	0
12	18.6	SE	Cypress Garden Home Care	824 Jacana Ct	Arroyo Grande	6	4	3	1	0
12	18.9	ESE	Casa Rosa Elder Care	2172 S Halcyon Rd	Arroyo Grande	22	17	13	3	1
					EPZ TOTAL:	**1,858**	**1,342**	**1,031**	**279**	**32**

Table E-3. Major Employers within the Full EPZ

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Employees (Max Shift)	% Employees Commuting into the EPZ	Employees Commuting into the EPZ	Employee Vehicles Commuting into the EPZ
1	-	-	Diablo Canyon Power Plant	PO Box 56	Avila Beach	850	67.6%	575	542
3, 9 10	-	-	State Parks[2]	Various locations throughout the EPZ		-			
6, 10, 11, 12	-	-	Lucia Mar Unified School District[3]	Various locations throughout the EPZ		-			
8	10.4	ENE	U.S. Postal Service	1655 Dalidio Dr	San Luis Obispo	285	51.0%	145	137
8	10.6	NE	Cuesta College	Highway 1	San Luis Obispo	400	80.0%	320	302
8	10.7	E	Sports Warehouse	181 Suburban Rd	San Luis Obispo	400	56.0%	224	211
8	10.7	ENE	San Luis Obispo Tribune	3825 S Higuera St	San Luis Obispo	200	51.0%	102	96
8	10.9	ENE	Madonna Inn Resort	100 Madonna Rd	San Luis Obispo	125	50.0%	63	59
8	11.1	ENE	California DOT	50 Higuera St	San Luis Obispo	400	51.0%	204	192
8	11.9	ENE	City of San Luis Obispo	990 Palm St	San Luis Obispo	200	50.0%	100	94
8	11.9	ENE	Heritage Oaks Bank	1144 Morro St	San Luis Obispo	210	51.0%	107	101
8	12.0	NE	CA Mens Colony	Highway 1	San Luis Obispo	900	60.0%	540	509
8	12.0	ENE	Sierra Vista RMC Hospital	1010 Murray Ave	San Luis Obispo	783	51.0%	399	376
8	12.0	ENE	County of San Luis Obispo	1055 Monterey St	San Luis Obispo	3,000	74.0%	2,220	2,094
8	12.1	ENE	Trust Rcm	3000 Broad St, #209A	San Luis Obispo	117	60.0%	70	66
8	12.1	ENE	Martin Resorts	1201 Palm St	San Luis Obispo	250	51.0%	128	121
8	12.2	E	Mindbody	4051 Broad St, Ste 220	San Luis Obispo	482	87.0%	419	395
8	12.4	ENE	French Hospital	1911 Johnson Ave	San Luis Obispo	650	51.0%	332	313
8	12.4	E	SLO Regional Airport	975 Airport Dr, Ste 1	San Luis Obispo	736	51.0%	375	354
8	12.6	ENE	San Luis Coastal USD	1500 Lizzie St	San Luis Obispo	760	51.0%	388	366
8	12.6	ENE	Community Action Partnership of SLO	1030 Southwood Dr	San Luis Obispo	94	50.0%	47	44
8	12.7	ENE	Cal Poly	1 Grand Ave	San Luis Obispo	3,500	51.0%	1,785	1,684
8	12.7	ENE	Mission View Health Center	1425 Woodside Dr	San Luis Obispo	250	51.0%	128	121
9	10.7	N	Compass Health - MB	1405 Teresa Rd	Morro Bay	1,200	51.0%	612	577

[2] There are three state parks in the Full EPZ. According to SLO County OES, the maximum total number of staff per shift is 300; however, the number of staff at each state park is less than 200. Therefore, the state parks are not considered as the major employers for this study.
[3] There are 20 schools within Lucia Mar Unified School District. According to SLO County OES, the maximum total number of employees per shift is 1,000; however, the number of employees at each school is less than 200. Therefore, schools in this school district are not considered as the major employers for this study.

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Employees (Max Shift)	% Employees Commuting into the EPZ	Employees Commuting into the EPZ	Employee Vehicles Commuting into the EPZ
10	16.2	ESE	Arroyo Grande Hospital	345 S Halcyon Rd	Arroyo Grande	300	51.0%	153	144
					EPZ TOTAL:	**16,092**	**-**	**9,436**	**8,898**

Table E-4. Beaches, Golf Courses and Marinas within the Full EPZ

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Facility Type	Transients	Vehicles
3	7.1	ESE	Avila Beach	Front St	Avila Beach	Beach	1,500	389
3	7.2	ESE	Avila Beach Golf Resort	6464 Ana Bay Dr	Avila Beach	Golf Course	150	75
3	8.3	ESE	Cave Landing/Pirates Cove	Cave Landing Rd	Avila Beach	Beach	240	120
5	7.2	N	Sea Pines Golf Course	1930 Solano St	Los Osos	Golf Course	180	75
8	9.5	ENE	Laguna Lake Municipal Golf Course	11175 Los Osos Valley Rd	San Luis Obispo	Golf Course	64	23
8	10.9	NE	Dairy Creek Golf Course	2990 Dairy Creek Rd	San Luis Obispo	Golf Course	250	200
8	12.9	E	San Luis Obispo Golf and Country Club	255 Country Club Dr	San Luis Obispo	Golf Course	76	33
9	9.3	N	Morro Bay State Park Marina[4]	State Park Rd	Morro Bay	Marina	0	0
9	10.0	N	Bay Front Marina	201 Main St	Morro Bay	Marina	38	14
9	10.0	N	Morro Bay Golf Course	201 State Park Rd	Morro Bay	Golf Course	200	120
9	10.4	N	Morro Bay Yacht Club	541 Embarcadero	Morro Bay	Marina	30	11
9	10.5	N	Morro Bay Marina	699 Embarcadero #11	Morro Bay	Marina	27	10
9	12.4	N	Morro Strand State Beach	Azure St	Morro Bay	Beach	648	162
9	16.5	N	Cayucos State Beach	Ocean Front Ave	Cayucos	Beach	500	75
10	13.9	ESE	Pismo State Beach Golf Course	25 W Grand Ave	Grover Beach	Golf Course	122	61
12	18.9	SE	Cypress Ridge Golf Course	780 Cypress Ridge Pkwy	Arroyo Grande	Golf Course	297	110
12	20.9	SE	Blacklake Golf Course	1490 Golf Course Ln	Nipomo	Golf Course	167	73
						EPZ TOTAL:	**4,489**	**1,551**

[4] Morro Bay State Park includes the day use park, marina, golf course, and campground. The transients and transient vehicles at this facility are included in Table E-6.

Table E-5. Campgrounds within the Full EPZ

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Facility Type	Transients	Vehicles
2	3.4	N	Montana De Oro Campground	-	Los Osos	Campground	532	136
2	4.6	NNW	Islay Creek Campground	3550 Pecho Valley Rd	Los Osos	Campground	135	100
3	6.1	ESE	Avila Beach Campground	Diablo Canyon Rd	Avila Beach	Campground	405	300
3	6.2	ESE	Port San Luis RV Campground	3950 Avila Beach Dr	Avila Beach	Campground	105	72
3	8.8	ESE	Avila Beach KOA	7075 Ontario Rd	San Luis Obispo	Campground	300	140
6	13.4	ESE	Pismo Coast Village RV Resort	165 S Dolliver St	Pismo Beach	Campground	745	648
6	13.6	ESE	Pismo State Beach, North Beach Campground	399 S Dolliver St	Pismo Beach	Campground	816	204
9	9.4	N	Morro Bay State Park Campground[4]	Main St	Morro Bay	Campground	0	0
9	10.4	N	Blue Heron Terrace MHP[5]	475 S Bay Blvd	Morro Bay	Campground	Local residents only	
9	10.6	NNE	Bay Pines Travel Trailer Park[5]	1501 Quintana Rd	Morro Bay	Campground	Local residents only	
9	10.6	NNE	Bay Pines Mobile Home Park[5]	505 Jelecote Dr	Morro Bay	Campground	Local residents only	
9	11.6	N	Morro Strand RV Park	221 Atascadero Rd	Morro Bay	Campground	162	140
9	13.0	N	Morro Strand Campground	Oceanside Dr	Morro Bay	Campground	219	162
10	14.0	ESE	Le Sage Riviera RV Park	319 N Hwy	Grover Beach	Campground	112	98
10	14.8	ESE	Oceano Dunes State Vehicular Recreation Area	100 Pier Ave	Oceano	Campground	7,000	3,500
10	14.8	ESE	Pismo State Beach, Oceano Campground	555 Pier Ave	Oceano	Campground	676	180
10	14.9	ESE	Coastal Dunes RV Park & Campground	1001 Pacific Blvd	Oceano	Campground	500	225
10	14.9	ESE	Oceano Memorial Campground	494 Air Park Dr	Oceano	Campground	332	144
10	15.8	ESE	Pacific Dunes Ranch RV Resort	1205 Silver Spur Pl	Oceano	Campground	581	430
						EPZ TOTAL:	**12,620**	**6,479**

[5] The 2020 census data indicates residents at Blue Heron Terrace MHP, Bay Pines Travel Trailer Park and Bay Pines Mobile Home Park are permanent residents that have been included in Section 3.1.

Table E-6. Parks and Other Recreational Areas within the Full EPZ

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Facility Type	Transients	Vehicles
2	4.6	NNW	Montana De Oro State Park	Pecho Valley Rd	Los Osos	Park	203	88
3	6.2	ESE	Port San Luis Harbor	3975 Avila Beach Dr	San Luis Obispo	Other, Not Listed	1,000	350
3	7.1	ESE	Avila Beach Park	50 San Juan St	Avila Beach	Park	75	30
5	6.9	NNE	Los Osos Oaks State Reserve	1801 Los Osos Valley Rd	Los Osos	Park	50	15
5	7.0	N	Los Osos Community Park	2180 Palisades Ave	Los Osos	Park	180	90
6	13.0	ESE	Pismo Beach State Park	Pomeroy Ave	Pismo Beach	Park	302	112
8	10.1	E	Bob Jones Trail	4400 Octagon Way	San Luis Obispo	Park	300	50
8	10.8	NE	El Chorro Regional Park & Campground	Highway One at Dairy Creek Rd	San Luis Obispo	Park	400	250
8	11.5	ENE	Bishop Peak Trail and Nature Area	Highland Dr, Patricia Dr	San Luis Obispo	Other, Not Listed	75	15
8	13.2	ENE	Cuesta Park	2400 Loomis St	San Luis Obispo	Park	120	60
9	9.4	N	Morro Bay State Park	20 State Park Rd	Morro Bay	Park	1,120	280
9	10.1	N	Tidelands Park/Boat Launch	301-351 Embarcadero	Morro Bay	Park	70	70
9	12.9	N	Del Mar Park	Ironwood Ave	Morro Bay	Park	117	51
9	16.3	N	Paul Andrew Community Park	3rd St	Cayucos	Park	70	35
9	16.8	N	Hardie Park	Ash Ave at B St	Cayucos	Park	80	40
						EPZ TOTAL:	**4,162**	**1,536**

Table E-7. Lodging Facilities within the Full EPZ

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Transients	Vehicles
3	6.8	ESE	San Luis Bay Inn - Diamond Resorts	3254 Avila Beach Dr	Avila Beach	500	167
3	7.1	ESE	Avila Lighthouse Suites	550 Front St	Avila Beach	216	54
3	7.2	ESE	Avila La Fonda Hotel	101 San Miguel St	Avila Beach	120	60
3	7.3	ESE	Best Western Somerset Inn	103 Jefferson Dr	San Luis Obispo	198	73
3	7.3	ESE	Inn at Avila Beach	256 Front St	Avila Beach	80	26
3	7.7	ESE	Avila Village Inn	6655 Bay Laurel Pl	Avila Beach	60	30
3	8.3	ESE	Sycamore Mineral Springs Resort	1215 Avila Beach Dr	San Luis Obispo	245	150
3	8.9	ESE	Avila Hot Springs	250 Avila Beach Dr	San Luis Obispo	84	31
3	9.8	ESE	The Cliffs Resort	2757 Shell Beach Rd	Pismo Beach	400	207
3	9.9	ESE	Dolphin Bay Resort and Spa	2727 Shell Beach Rd	Pismo Beach	240	200
3	10.0	ESE	Spyglass Inn	2705 Spyglass Dr	Pismo Beach	246	50
5	7.2	N	Sea Pines Golf Resort	1945 Solano St	Los Osos	160	80
5	7.5	N	Pelican Cove Vacation Rental	1681 Broderson Ave	Los Osos	3	1
5	8.0	N	Baywood Inn B&B	1370 2nd St	Baywood Park	50	16
5	8.0	N	Back Bay Inn	1391 2nd St	Los Osos	65	28
6	10.9	ESE	The Palomar Inn	1601 Shell Beach Rd	Shell Beach	36	14
6	11.1	ESE	Ocean View Motel	1001 Shell Beach Rd	Pismo Beach	31	14
6	11.2	ESE	Shell Beach Inn	653 Shell Beach Rd	Pismo Beach	25	12
6	11.7	ESE	Inn at the Cove	2555 Price St	Pismo Beach	150	50
6	12.1	ESE	Shore Cliff Hotel	2651 Price St	Pismo Beach	290	100
6	12.3	ESE	Pismo Lighthouse Suites	2411 Price St	Pismo Beach	350	120
6	12.4	ESE	Cottage Inn by the Sea	2351 Price St	Pismo Beach	225	75
6	12.4	ESE	SeaCrest Ocean Front Hotel	2241 Price St	Pismo Beach	450	200
6	12.5	ESE	The Tides Oceanview Inn & Cottages	2121 Price St	Pismo Beach	70	54
6	12.6	ESE	Kon Tiki Inn	1621 Price St	Pismo Beach	215	86
6	12.9	ESE	Edgewater Inn & Suites	280 Wadsworth Ave	Pismo Beach	396	100
6	12.9	ESE	Sea Gypsy Motel	1020 Cypress St	Pismo Beach	342	70
6	13.0	ESE	Dolphin Cove Motel	170 Main St	Pismo Beach	60	20
6	13.0	ESE	Beach House Inn & Suites	198 Main St	Pismo Beach	46	18
6	13.0	ESE	Valentina Suites	371 Pismo Ave	Pismo Beach	60	30
6	13.0	ESE	Motel 6 Pismo Beach - Pacific Ocean	250 Main St	Pismo Beach	87	29
6	13.0	ESE	Beach Bum Holiday Rentals	354 Main St, Ste A	Pismo Beach	400	100

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Transients	Vehicles
6	13.0	ESE	Pismo Beach Hotel	230 Pomeroy Ave	Pismo Beach	56	28
6	13.1	ESE	Inn at The Pier	601 Cypress St	Pismo Beach	281	104
6	13.1	ESE	Vespera ON OCEAN, Autograph Collection	147 Stimson Ave	Pismo Beach	335	124
6	13.1	ESE	BeachComber Inn	541 Cypress St	Pismo Beach	16	8
6	13.1	ESE	Sandcastle Hotel on the Beach	100 Stimson Ave	Pismo Beach	300	75
6	13.2	ESE	SeaVenture Beach Hotel	100 Oean View Ave	Pismo Beach	140	60
6	13.2	ESE	Beachwalker Inn & Suites	490 Dolliver St	Pismo Beach	58	22
6	13.2	ESE	Sea Garden Motel	340 Stimson Ave	Pismo Beach	42	21
6	13.2	ESE	Cypress by the Sea Too	269 Cypress St	Pismo Beach	8	3
6	13.3	ESE	Ocean Palms Motel Pismo Beach	390 Ocean View Ave	Pismo Beach	88	23
6	13.3	ESE	Blue Seal Inn	230 Dolliver St	Pismo Beach	75	25
6	13.7	ESE	Quality Inn Pismo Beach	230 5 Cities Dr	Pismo Beach	300	100
6	14.2	ESE	Hilton Garden Inn San Luis Obispo/Pismo Beach	601 James Way	Pismo Beach	360	240
6	14.2	ESE	Motel 6 Pismo Beach	860 4th St	Pismo Beach	411	140
6	14.3	ESE	Oxford Suites Pismo Beach	651 5 Cities Dr	Pismo Beach	363	122
8	9.3	ENE	Laguna Lake Mobile Estates	1801 Prefumo Canyon Rd	San Luis Obispo	1,056	528
8	9.9	E	Motel 6 San Luis Obispo South	1625 Calle Joaquin	San Luis Obispo	234	135
8	9.9	ENE	Courtyard Marriott San Luis Obispo Hotel	1605 Calle Joaquin	San Luis Obispo	278	139
8	9.9	E	Rose Garden Inn	1585 Calle Joaquin	San Luis Obispo	130	65
8	10.0	ENE	Hampton Inn	1530 Calle Joaquin	San Luis Obispo	220	92
8	10.1	ENE	Motel 6 San Luis Obispo North	1433 Calle Joaquin	San Luis Obispo	172	88
8	10.6	ENE	Best Western Royal Oak Hotel	214 Madonna Rd	San Luis Obispo	297	100
8	10.7	ENE	Vagabond Inn San Luis Obispo	210 Madonna Rd	San Luis Obispo	120	63
8	10.7	ENE	Embassy Suites San Luis Obispo	333 Madonna Rd	San Luis Obispo	390	195
8	10.9	ENE	The Madonna Inn	100 Madonna Rd	San Luis Obispo	220	110
8	11.4	ENE	Avenue Inn	345 Marsh St	San Luis Obispo	102	34
8	11.7	ENE	SLO Brew Lofts	738 Higuera St	San Luis Obispo	22	10
8	11.8	ENE	Hotel Cerro	1125 Garden St	San Luis Obispo	195	65
8	11.8	ENE	Garden Street Inn	1212 Garden St	San Luis Obispo	26	13
8	11.8	ENE	Homestead Motel	920 Olive St	San Luis Obispo	36	36
8	11.9	ENE	Downtown SLO Inn	950 Olive St	San Luis Obispo	64	32
8	11.9	ENE	The Economy Motel	652 Morro St	San Luis Obispo	48	10
8	11.9	ENE	Hotel San Luis Obispo	877 Palm St	San Luis Obispo	196	100

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Transients	Vehicles
8	11.9	ENE	Heritage Inn B&B	978 Olive St	San Luis Obispo	14	10
8	11.9	ENE	Olive Tree Inn San Luis Obispo	1000 Olive St	San Luis Obispo	122	60
8	11.9	ENE	Budget Inn	1001 Olive St	San Luis Obispo	54	27
8	11.9	ENE	Granada Hotel	1126 Morro St	San Luis Obispo	42	10
8	12.0	ENE	San Luis Inn & Suites	404 Santa Rosa St	San Luis Obispo	70	33
8	12.1	ENE	Hostel Obispo	1617 Santa Rosa St	San Luis Obispo	14	4
8	12.4	ENE	Petit Soleil	1473 Monterey St	San Luis Obispo	32	16
8	12.4	ENE	The Butler Hotel	1511 Monterey St	San Luis Obispo	12	5
8	12.5	ENE	Los Padres Motel	1575 Monterey St	San Luis Obispo	32	7
8	12.5	ENE	Lamplighter Inn & Suites	1604 Monterey St	San Luis Obispo	180	40
8	12.5	ENE	Quality Suites Downtown San Luis Obispo	1631 Monterey St	San Luis Obispo	276	139
8	12.6	ENE	Sunbeam Motel (Bishop Inn)	1656 Monterey St	San Luis Obispo	30	15
8	12.6	ENE	Villa Motel	1670 Monterey St	San Luis Obispo	28	15
8	12.7	ENE	The Kinney San Luis Obispo, Tapestry Collection by Hilton	1800 Monterey St	San Luis Obispo	200	100
8	12.7	ENE	University Inn at SLO	1825 Monterey St	San Luis Obispo	80	36
8	12.7	ENE	La Quinta Inn & Suites	1845 Monterey St	San Luis Obispo	300	140
8	12.7	ENE	Sands Suites & Motel	1930 Monterey St	San Luis Obispo	140	48
8	12.7	ENE	San Luis Creek Lodge	1941 Monterey St	San Luis Obispo	50	20
8	12.7	ENE	Inn at San Luis Obispo	1895 Monterey St	San Luis Obispo	120	50
8	12.8	ENE	Mission Inn SLO	1951 Monterey St	San Luis Obispo	96	35
8	12.8	ENE	Judson Terrace Lodge	3042 Augusta St	San Luis Obispo	65	28
8	12.8	ENE	Hotel Buena Vista	2050 Garfield St	San Luis Obispo	150	50
8	12.8	ENE	Peach Tree Inn	2001 Monterey St	San Luis Obispo	76	46
8	12.8	ENE	Apple Farm	2015 Monterey St	San Luis Obispo	208	104
8	12.8	ENE	La Cuesta Inn	2074 Monterey St	San Luis Obispo	144	65
8	13.7	E	Old Edna Vacation Farmhouse and Cottage Rentals	1653 Old Price Canyon Rd	San Luis Obispo	4	2
8	13.7	E	Old Edna Vacation Farmhouse and Cottage Rentals - vrbo	1655 Maxwellton St	San Luis Obispo	8	8
9	9.7	N	Inn at Morro Bay	60 State Park Rd	Morro Bay	240	100
9	10.4	N	Embarcadero Inn	456 Embarcadero	Morro Bay	112	70
9	10.4	N	Morro Bay Sandpiper Inn	540 Main St	Morro Bay	44	22
9	10.4	N	Gray's Inn and Gallery	561 Embarcadero	Morro Bay	6	3
9	10.5	N	Harbor Front Suites	593 Embarcadero	Morro Bay	12	4
9	10.5	N	Comfort Inn Downtown (Twin Dolphin Inn)	590 Morro Ave	Morro Bay	102	34

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Transients	Vehicles
9	10.5	N	Marina Street Inn	305 Marina St	Morro Bay	8	4
9	10.5	N	Sundown Inn	640 Main St	Morro Bay	29	15
9	10.5	N	Best Western Plus San Marcos Inn	250 Pacific St	Morro Bay	41	15
9	10.5	N	Morro Crest Inn	670 Main St	Morro Bay	36	19
9	10.6	N	Fireside Inn Motel	730 Morro Ave	Morro Bay	36	22
9	10.6	N	The Landing at Morro Bay	780 Market Ave	Morro Bay	92	28
9	10.6	N	Ascot Suites	260 Morro Bay Blvd	Morro Bay	128	32
9	10.6	N	Sea Air Inn	845 Morro Ave	Morro Bay	54	25
9	10.7	N	Blue Sail Inn	851 Market Ave	Morro Bay	152	48
9	10.7	N	Pacific Shores Inn	890 Morro Ave	Morro Bay	44	22
9	10.7	N	Pleasant Inn	235 Harbor St	Morro Bay	22	10
9	10.7	N	Bay View Inn	225 Harbor St	Morro Bay	44	25
9	10.7	N	Anderson Inn	897 Embarcadero	Morro Bay	16	8
9	10.7	N	La Serena Inn	990 Morro Ave	Morro Bay	80	34
9	10.8	N	Morro Bluff Inn	213 Dunes St	Morro Bay	8	3
9	10.8	N	Harbor House Inn	1095 Main St	Morro Bay	132	51
9	10.8	N	Seaside Inn Morro Bay	220 Beach St	Morro Bay	89	33
9	10.8	N	Rockview Inn and Suites	1080 Market Ave	Morro Bay	60	35
9	10.8	N	Beach Bungalow Inn & Suites	1050 Morro Ave	Morro Bay	43	16
9	10.8	N	Coastal Breeze Inn Morro Bay CA	1098 Main St	Morro Bay	50	25
9	10.8	N	Best Western Tradewinds	225 Beach St	Morro Bay	72	24
9	10.8	N	Front Street Inn and Spa	1140 Front St	Morro Bay	8	4
9	10.9	N	Morro Bay Beach Inn	1100 Main St	Morro Bay	48	16
9	10.9	N	Bayfront Inn	1150 Embarcadero	Morro Bay	32	16
9	10.9	N	A Garden Cottage	1145 Morro Ave	Morro Bay	5	2
9	10.9	N	Salty Sister Boutique Hotel	1170 Front St	Morro Bay	18	7
9	10.9	N	Masterpiece Hotel	1206 Main St	Morro Bay	60	22
9	11.6	N	Morro Shores Inn & Suites	290 Atascadero Rd	Morro Bay	90	30
9	11.6	N	Motel 6 Morro Bay	298 Atascadero Rd	Morro Bay	240	80
9	12.1	N	Twins Bay Inn	2460 Main St	Morro Bay	57	25
9	12.2	N	Holland Inn and Suites	2630 Main St	Morro Bay	48	26
9	12.5	N	Pacific Cottage Motel	2830 Alder Ave	Morro Bay	28	14
9	16.3	N	Beachwalker Inn & Suites Cayucos	501 S Ocean Ave	Cayucos	72	20

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Transients	Vehicles
9	16.3	N	Dolphin Inn	399 S Ocean Ave	Cayucos	40	20
9	16.3	N	Cayucos Beach Inn	333 S Ocean Ave	Cayucos	144	42
9	16.4	N	Cayucos Sunset Inn	95 S Ocean Ave	Cayucos	19	8
9	16.4	N	Cypress Tree Motel	125 S Ocean Ave	Cayucos	27	11
9	16.4	N	Cayucos Sunset Inn Bed and Breakfast	95 S Ocean Ave	Cayucos	20	15
9	16.4	N	Sea Gull Motel	51 S Ocean Ave	Cayucos	4	2
9	16.4	N	Cayucos Motel	20 S Ocean Ave	Cayucos	19	8
9	16.4	N	Seaside Motel	42 S Ocean Ave	Cayucos	26	12
9	16.5	N	Cayucos-Motel	20 S Ocean Ave	Cayucos	20	10
9	16.5	N	The Shoreline Inn	1 N Ocean Ave	Cayucos	90	30
9	16.5	N	Cayucos Pier View Suites	12 N Ocean Ave	Cayucos	24	20
9	16.6	N	On The Beach Bed & Breakfast	181 N Ocean Ave	Cayucos	30	10
9	16.7	N	Cass House	222 N Ocean Ave	Cayucos	10	10
9	16.7	N	Beachside Rentals	151 Cayucos Dr	Cayucos	300	98
10	14.4	ESE	Seaview Inn	150 N 5th St	Grover Beach	69	23
10	14.8	ESE	Pacific Plaza Resort	444 Pier Ave	Oceano	195	65
10	14.9	ESE	Grover Beach Motel	123 N St	Grover Beach	2	2
10	15.0	ESE	Oceano Inn	1252 Pacific Blvd	Oceano	54	21
10	15.1	ESE	Holiday Inn Express Grover Beach-Pismo Beach Area	775 N Oak Park Blvd	Grover Beach	80	60
10	15.1	ESE	Best Western Casa Grande Inn	850 Oak Park Rd	Arroyo Grande	350	200
10	15.4	ESE	Premier Inns Pismo Beach	555 Camino Mercado	Arroyo Grande	200	100
10	15.4	ESE	Hampton Inn & Suites Arroyo Grande/Pismo Beach Area	1400 W Branch St	Arroyo Grande	309	100
10	16.3	ESE	Aloha Inn	611 El Camino Real	Arroyo Grande	126	41
10	16.3	ESE	Beachway Inn Motel	617 E Grand Ave	Arroyo Grande	40	20
10	16.4	ESE	Abella Garden Inn Bed & Breakfast	210 Oak St	Arroyo Grande	15	6
10	16.5	ESE	Grieb Farmhouse Inn	851 Todd Ln	Arroyo Grande	4	2
10	16.8	ESE	House of Another Tyme Bed & Breakfast	227 Le Point St	Arroyo Grande	6	3
11	15.3	ESE	Vista Seas	875 Noyes Rd	Arroyo Grande	6	3
11	15.6	ESE	Olive Tree Cottages--Libretto Cottage / Olive Tree Cabin	715 Dixie Ln	San Luis Obispo	4	2
11	16.6	E	Casita Las Brisas - Airbnb	1678 La Finca Ct	Arroyo Grande	8	2
					EPZ TOTAL:	**19,785**	**8,223**

Table E-8. Correctional Facilities within the Full EPZ

PAZ	Distance (miles)	Dire-ction	Facility Name	Street Address	Municipality	Current Census
8	10.4	NE	San Luis Obispo County Jail	1585 Kansas Ave	San Luis Obispo	600
8	10.5	NE	San Luis Obispo County Juvenile Hall	1065 Kansas Ave	San Luis Obispo	50
8	11.9	NE	California Men's Colony	Highway 1	San Luis Obispo	6,485
					EPZ TOTAL:	**7,135**

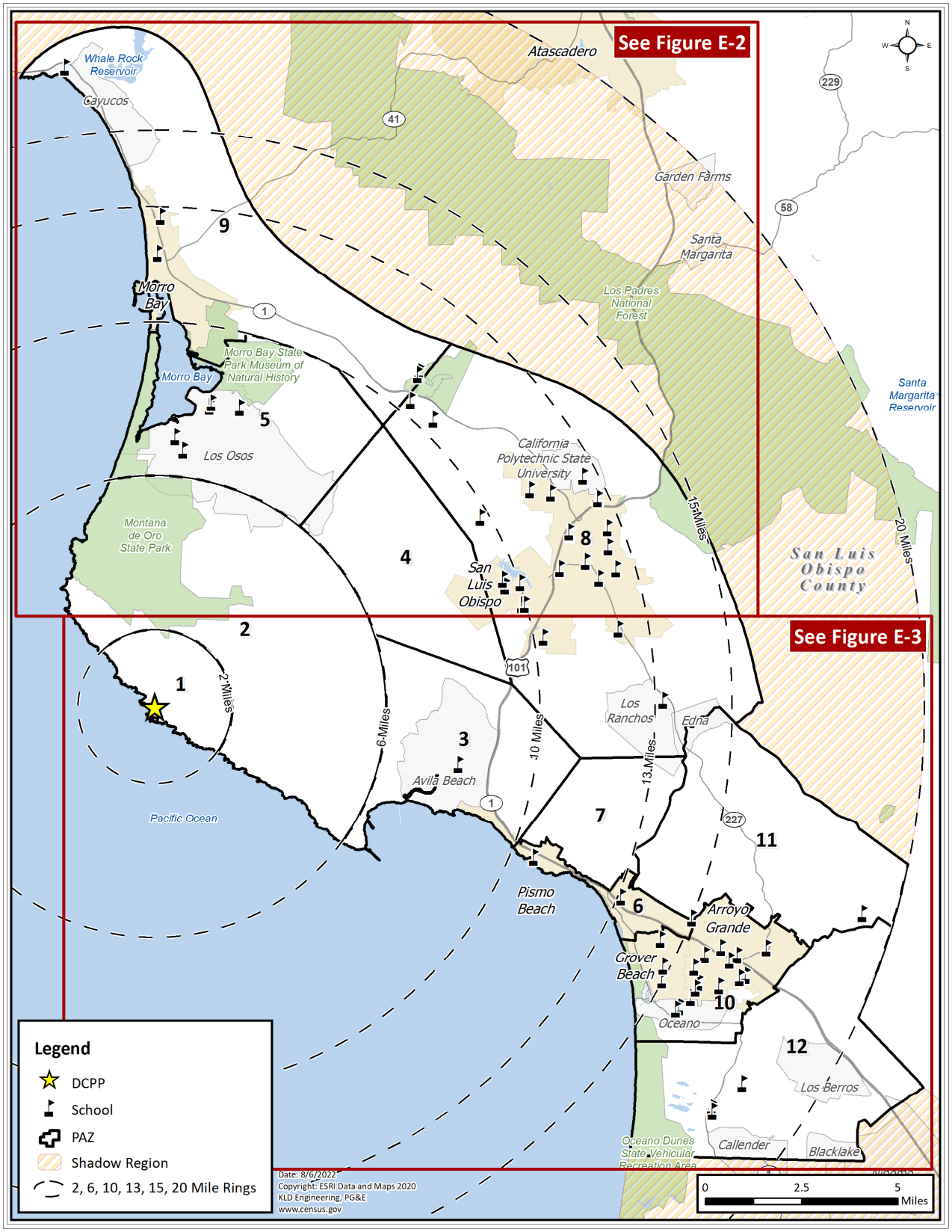
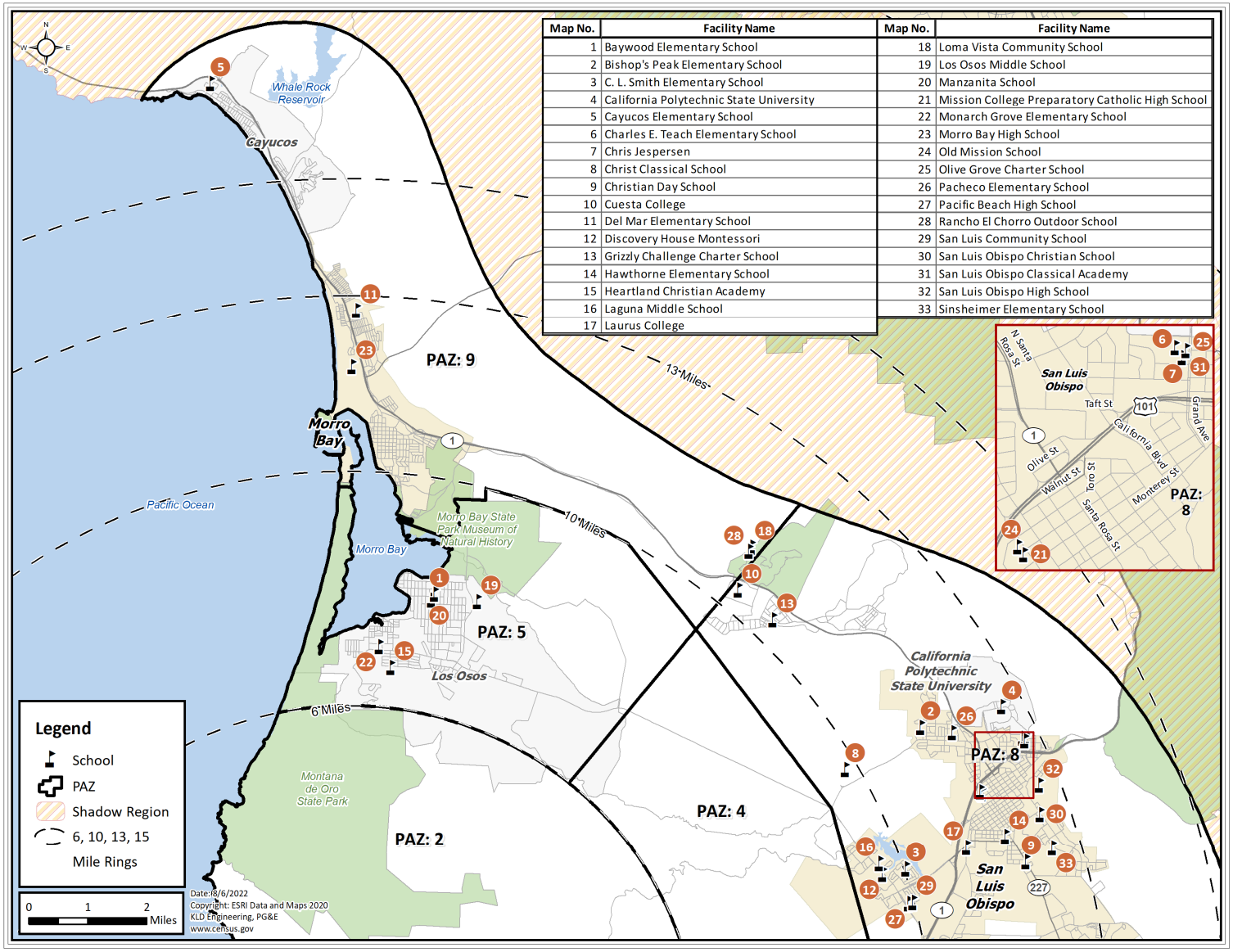
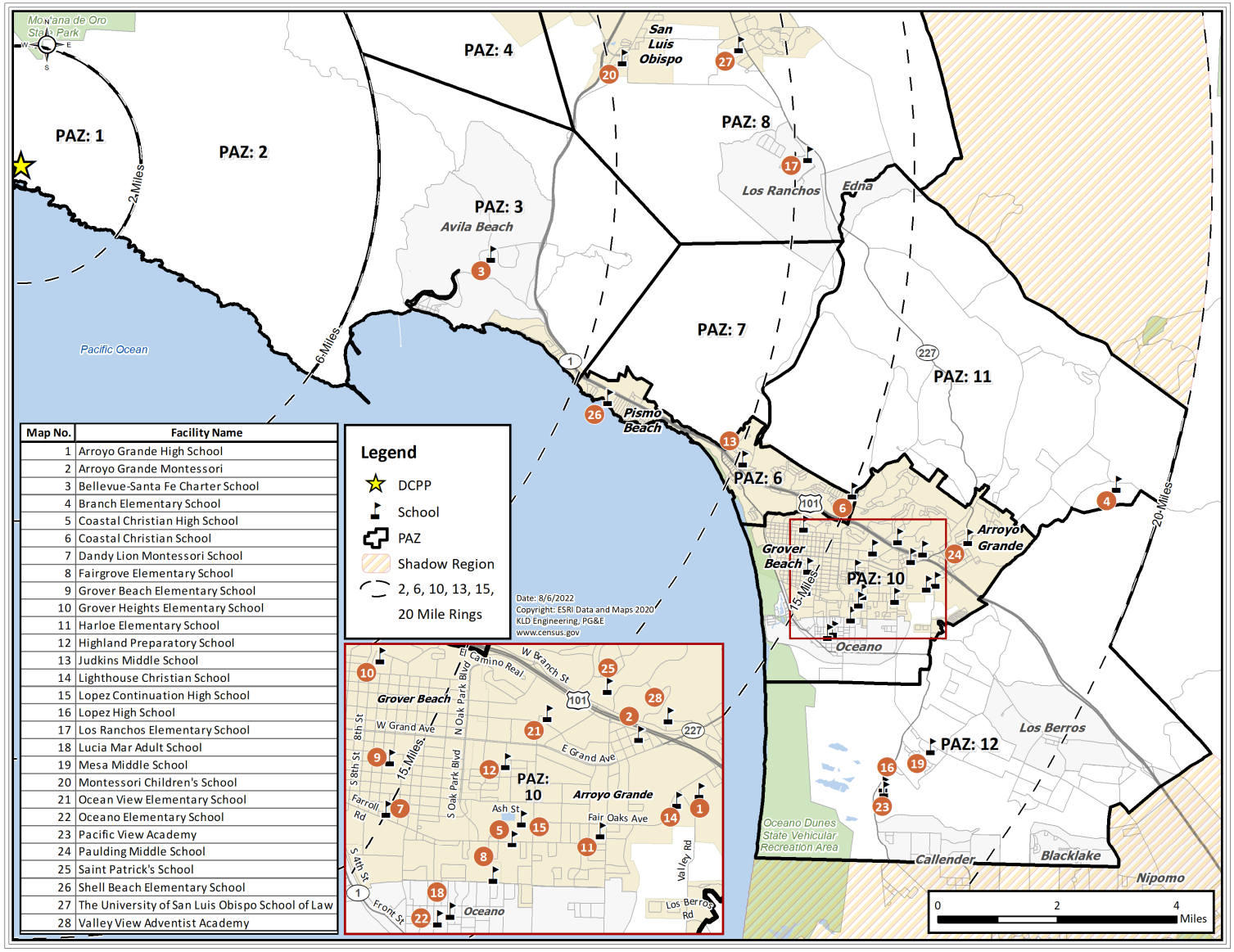


Figure E-1. Overview of Schools within the DCPP Full EPZ



Map No.	Facility Name	Map No.	Facility Name
1	Baywood Elementary School	18	Loma Vista Community School
2	Bishop's Peak Elementary School	19	Los Osos Middle School
3	C. L. Smith Elementary School	20	Manzanita School
4	California Polytechnic State University	21	Mission College Preparatory Catholic High School
5	Cayucos Elementary School	22	Monarch Grove Elementary School
6	Charles E. Teach Elementary School	23	Morro Bay High School
7	Chris Jespersen	24	Old Mission School
8	Christ Classical School	25	Olive Grove Charter School
9	Christian Day School	26	Pacheco Elementary School
10	Cuesta College	27	Pacific Beach High School
11	Del Mar Elementary School	28	Rancho El Chorro Outdoor School
12	Discovery House Montessori	29	San Luis Community School
13	Grizzly Challenge Charter School	30	San Luis Obispo Christian School
14	Hawthorne Elementary School	31	San Luis Obispo Classical Academy
15	Heartland Christian Academy	32	San Luis Obispo High School
16	Laguna Middle School	33	Sinsheimer Elementary School
17	Laurus College		

Figure E-2. Schools within the North of the DCPP Full EPZ



Map No.	Facility Name
1	Arroyo Grande High School
2	Arroyo Grande Montessori
3	Bellevue-Santa Fe Charter School
4	Branch Elementary School
5	Coastal Christian High School
6	Coastal Christian School
7	Dandy Lion Montessori School
8	Fairgrove Elementary School
9	Grover Beach Elementary School
10	Grover Heights Elementary School
11	Harloe Elementary School
12	Highland Preparatory School
13	Judkins Middle School
14	Lighthouse Christian School
15	Lopez Continuation High School
16	Lopez High School
17	Los Ranchos Elementary School
18	Lucia Mar Adult School
19	Mesa Middle School
20	Montessori Children's School
21	Ocean View Elementary School
22	Oceano Elementary School
23	Pacific View Academy
24	Paulding Middle School
25	Saint Patrick's School
26	Shell Beach Elementary School
27	The University of San Luis Obispo School of Law
28	Valley View Adventist Academy

Figure E-3. Schools within the South of the DCPP Full EPZ

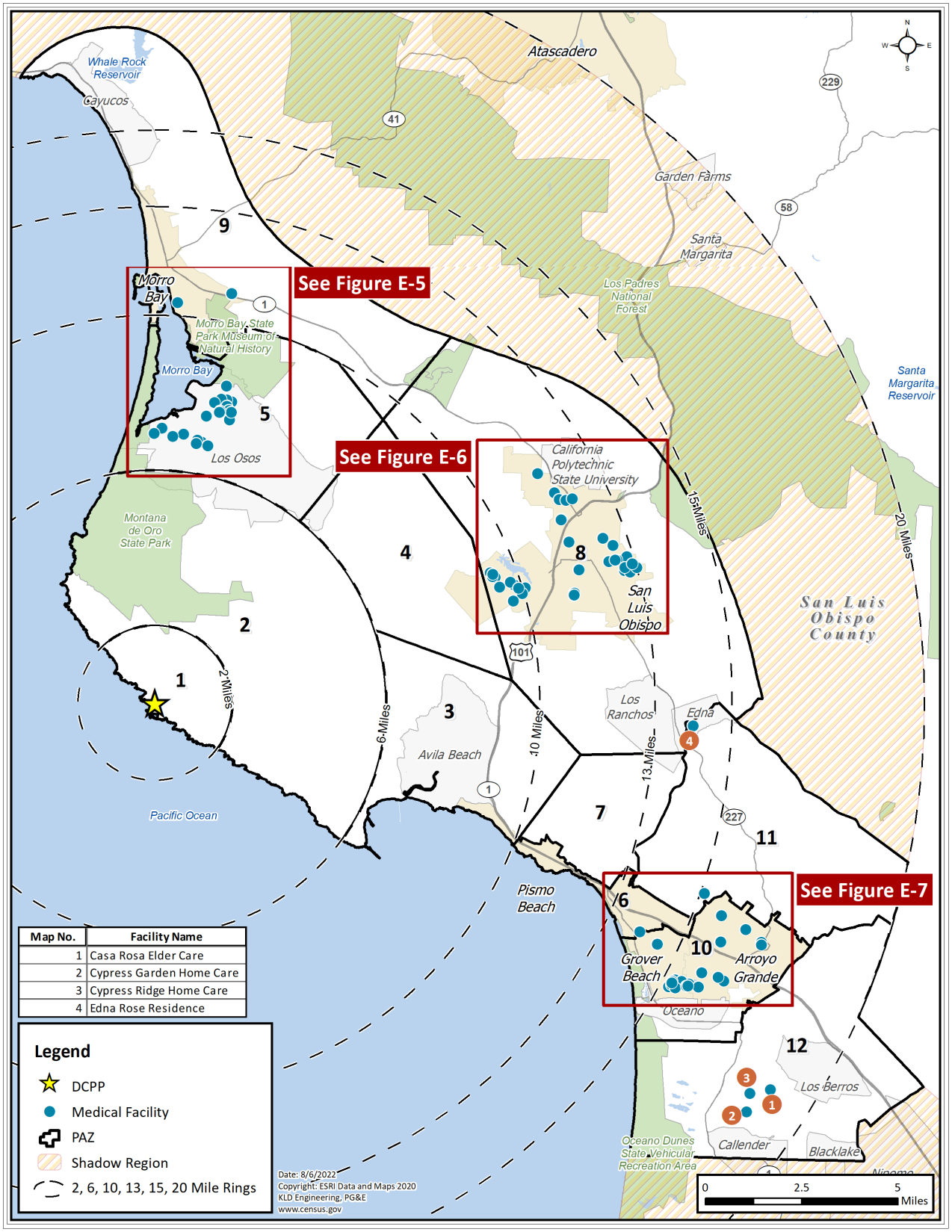


Figure E-4. Overview of Medical Facilities within the DCPP Full EPZ

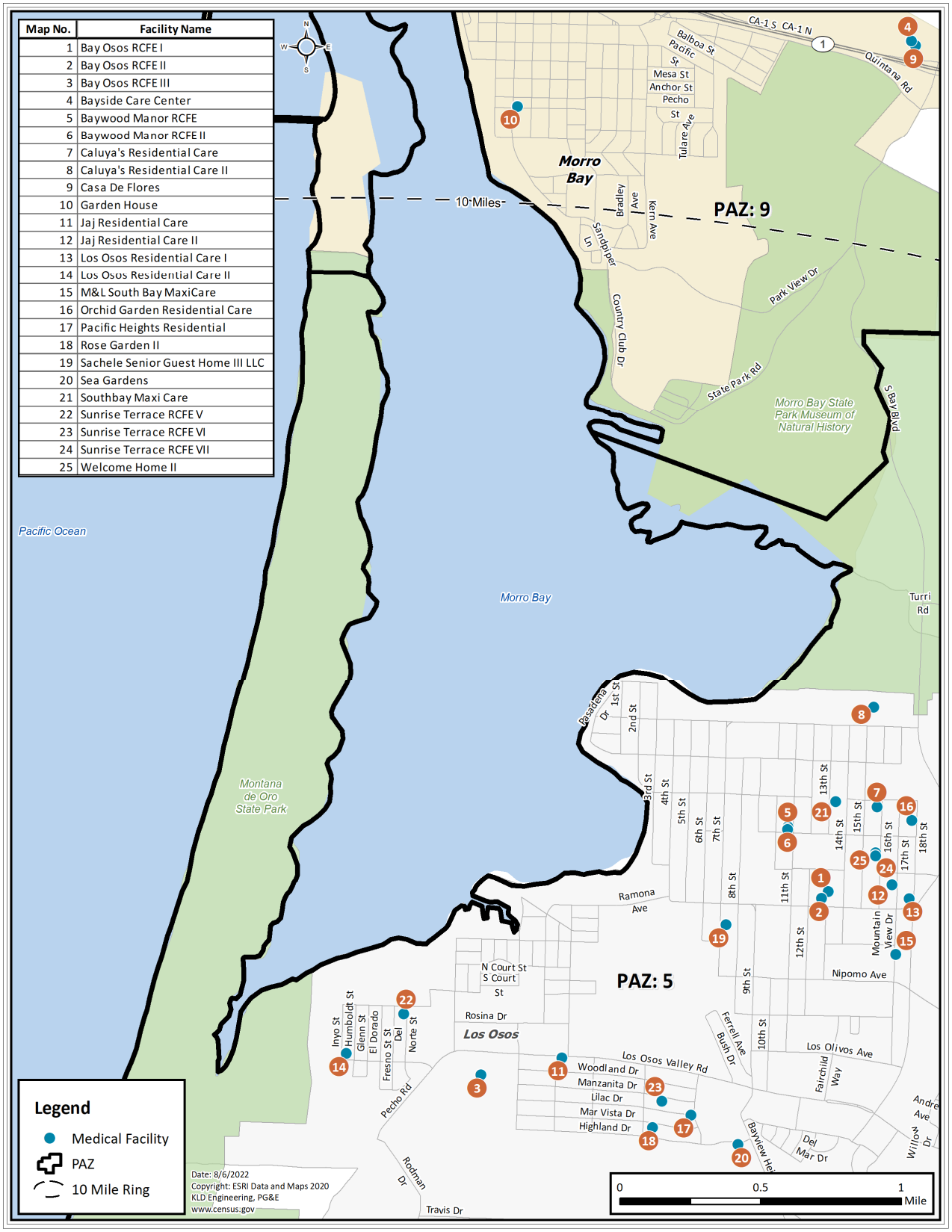
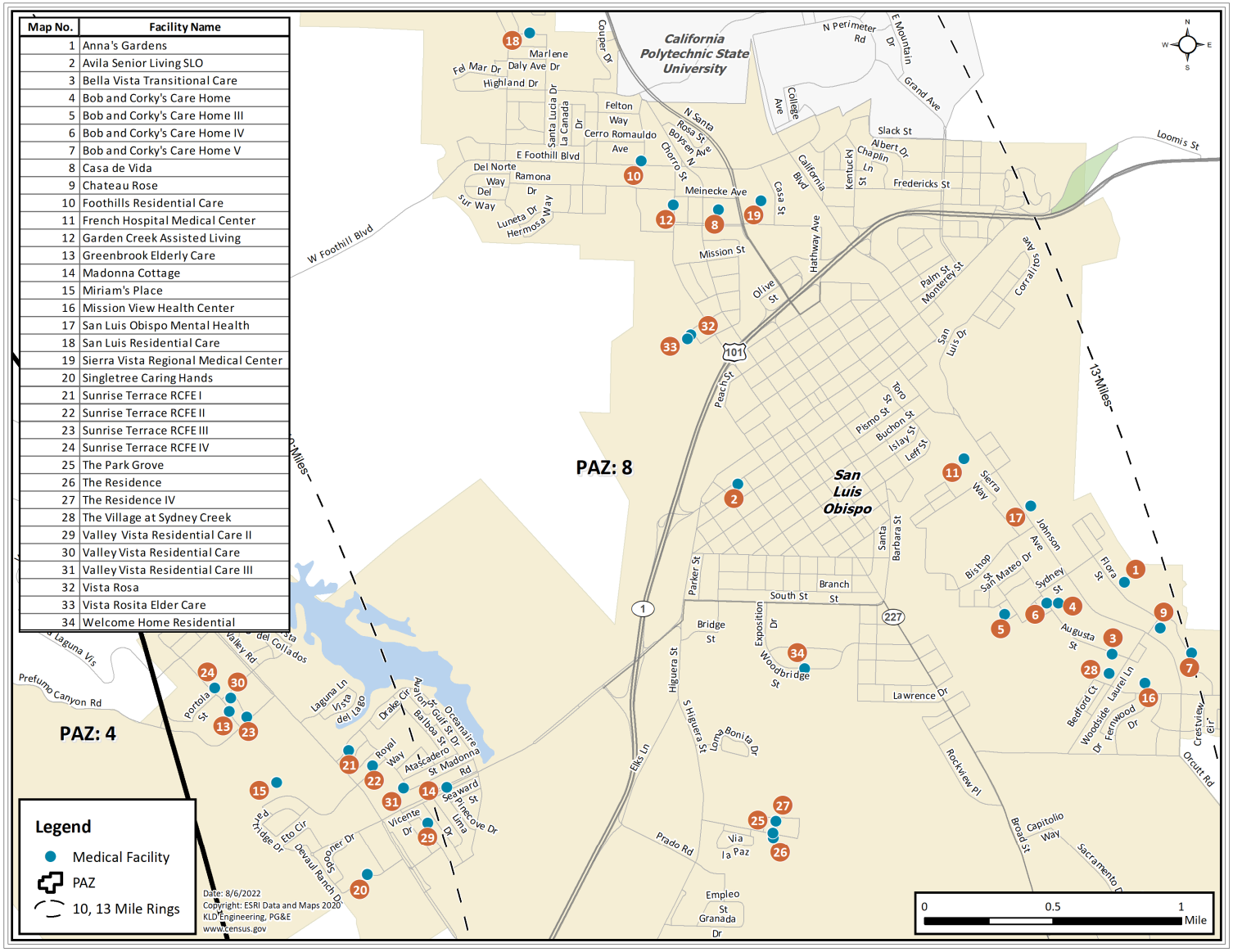
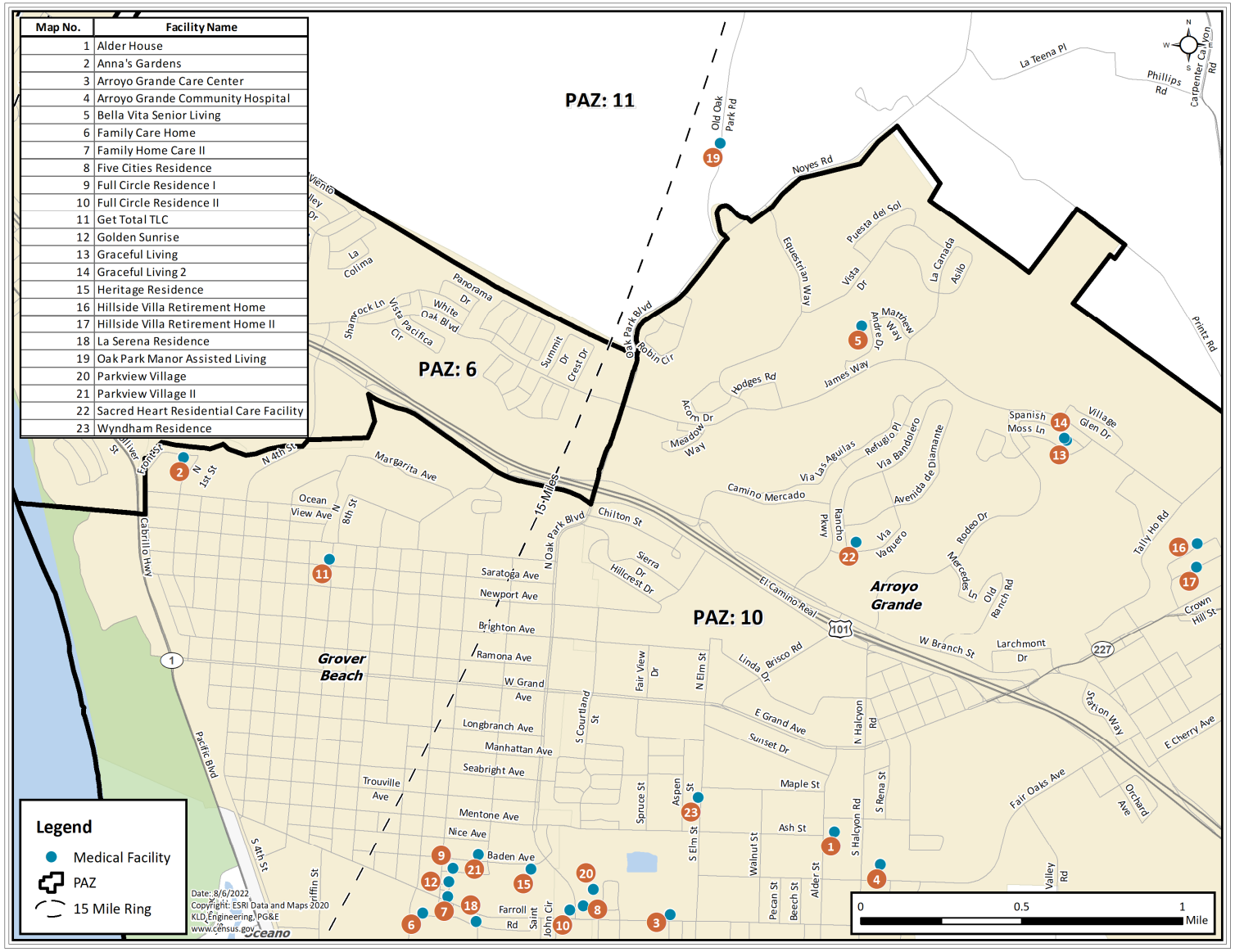


Figure E-5. Medical Facilities within the DCPP Full EPZ – PAZs 5 and 9



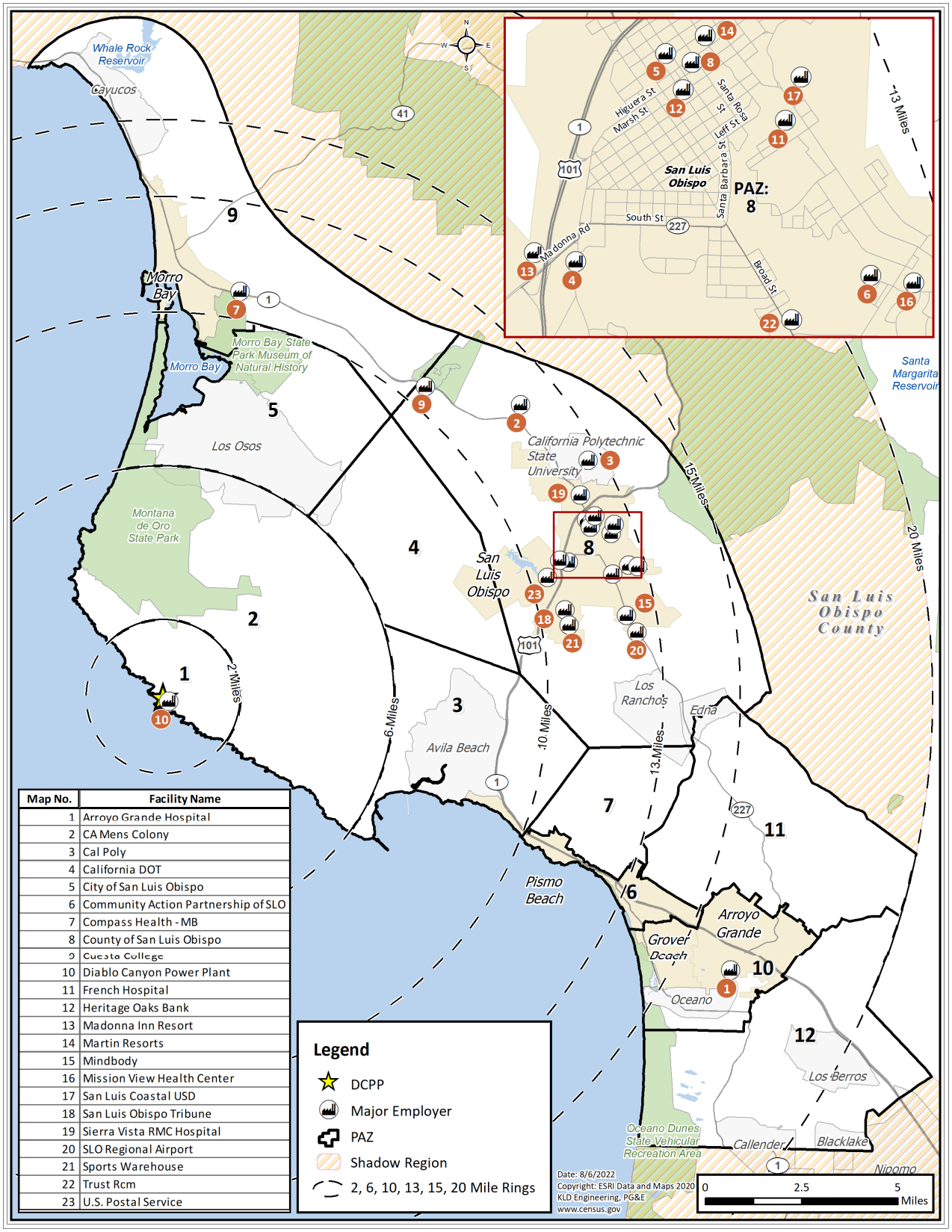
Map No.	Facility Name
1	Anna's Gardens
2	Avila Senior Living SLO
3	Bella Vista Transitional Care
4	Bob and Corky's Care Home
5	Bob and Corky's Care Home III
6	Bob and Corky's Care Home IV
7	Bob and Corky's Care Home V
8	Casa de Vida
9	Chateau Rose
10	Foothills Residential Care
11	French Hospital Medical Center
12	Garden Creek Assisted Living
13	Greenbrook Elderly Care
14	Madonna Cottage
15	Miriam's Place
16	Mission View Health Center
17	San Luis Obispo Mental Health
18	San Luis Residential Care
19	Sierra Vista Regional Medical Center
20	Singletree Caring Hands
21	Sunrise Terrace RCFE I
22	Sunrise Terrace RCFE II
23	Sunrise Terrace RCFE III
24	Sunrise Terrace RCFE IV
25	The Park Grove
26	The Residence
27	The Residence IV
28	The Village at Sydney Creek
29	Valley Vista Residential Care II
30	Valley Vista Residential Care
31	Valley Vista Residential Care III
32	Vista Rosa
33	Vista Rosita Elder Care
34	Welcome Home Residential

Figure E-6. Medical Facilities within the DCPP Full EPZ – PAZ 8



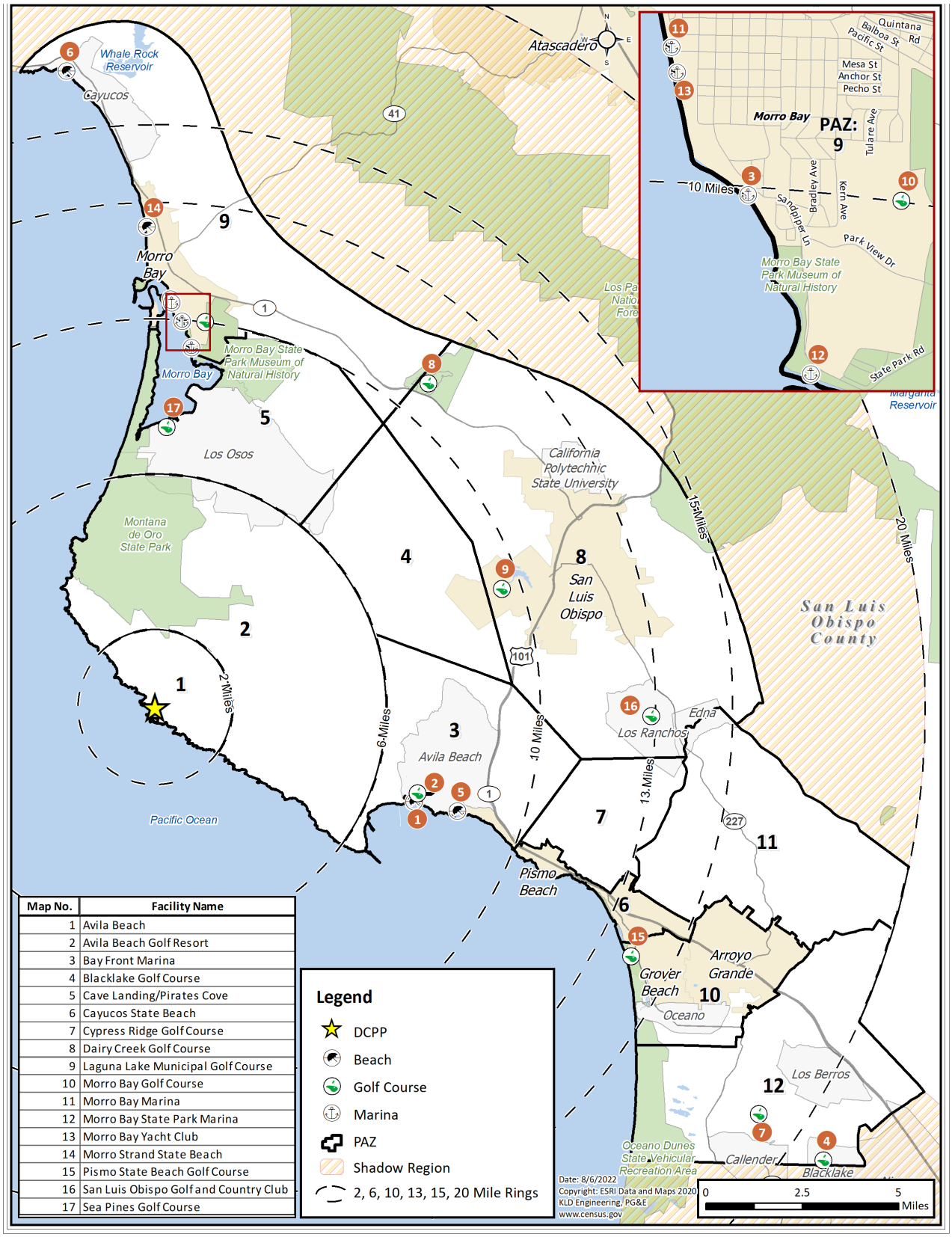
Map No.	Facility Name
1	Alder House
2	Anna's Gardens
3	Arroyo Grande Care Center
4	Arroyo Grande Community Hospital
5	Bella Vita Senior Living
6	Family Care Home
7	Family Home Care II
8	Five Cities Residence
9	Full Circle Residence I
10	Full Circle Residence II
11	Get Total TLC
12	Golden Sunrise
13	Graceful Living
14	Graceful Living 2
15	Heritage Residence
16	Hillside Villa Retirement Home
17	Hillside Villa Retirement Home II
18	La Serena Residence
19	Oak Park Manor Assisted Living
20	Parkview Village
21	Parkview Village II
22	Sacred Heart Residential Care Facility
23	Wyndham Residence

Figure E-7. Medical Facilities within the DCPP Full EPZ – PAZs 10 and 11



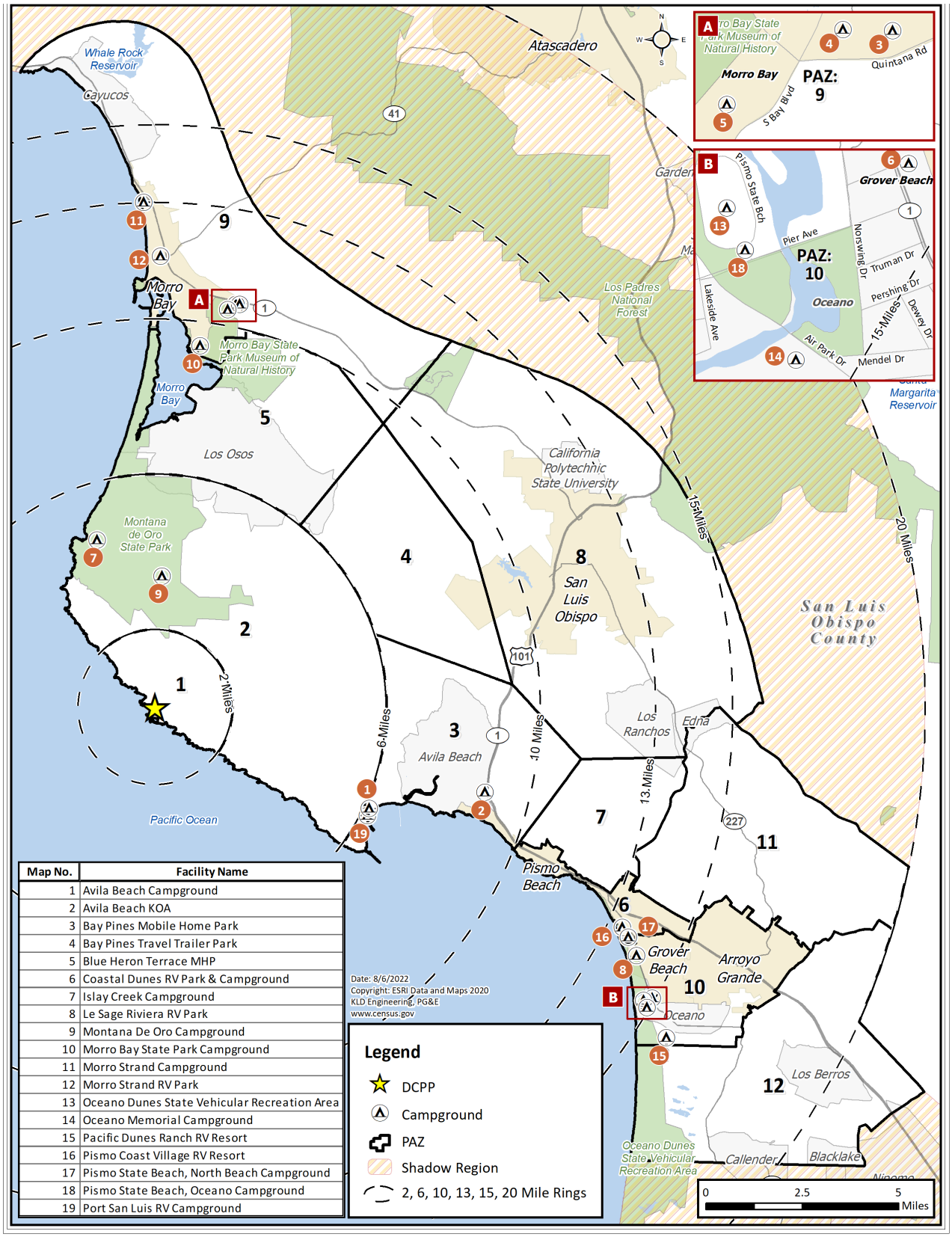
Map No.	Facility Name
1	Arroyo Grande Hospital
2	CA Mens Colony
3	Cal Poly
4	California DOT
5	City of San Luis Obispo
6	Community Action Partnership of SLO
7	Compass Health - MB
8	County of San Luis Obispo
9	Cuesta College
10	Diablo Canyon Power Plant
11	French Hospital
12	Heritage Oaks Bank
13	Madonna Inn Resort
14	Martin Resorts
15	Mindbody
16	Mission View Health Center
17	San Luis Coastal USD
18	San Luis Obispo Tribune
19	Sierra Vista RMC Hospital
20	SLO Regional Airport
21	Sports Warehouse
22	Trust Rcm
23	U.S. Postal Service

Figure E-8. Major Employers within the Full EPZ



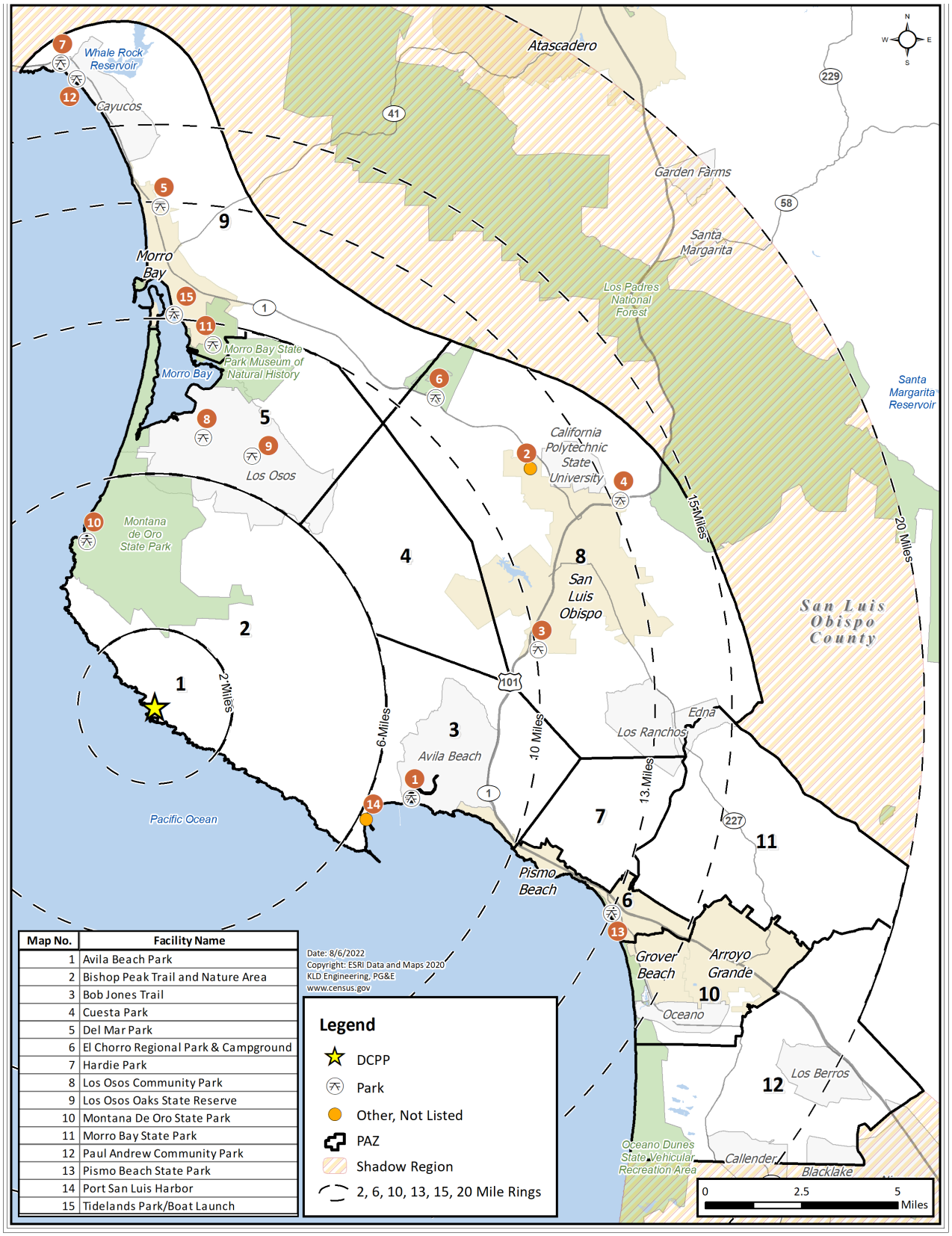
Map No.	Facility Name
1	Avila Beach
2	Avila Beach Golf Resort
3	Bay Front Marina
4	Blacklake Golf Course
5	Cave Landing/Pirates Cove
6	Cayucos State Beach
7	Cypress Ridge Golf Course
8	Dairy Creek Golf Course
9	Laguna Lake Municipal Golf Course
10	Morro Bay Golf Course
11	Morro Bay Marina
12	Morro Bay State Park Marina
13	Morro Bay Yacht Club
14	Morro Strand State Beach
15	Pismo State Beach Golf Course
16	San Luis Obispo Golf and Country Club
17	Sea Pines Golf Course

Figure E-9. Beaches, Golf Courses and Marinas within the Full EPZ



Map No.	Facility Name
1	Avila Beach Campground
2	Avila Beach KOA
3	Bay Pines Mobile Home Park
4	Bay Pines Travel Trailer Park
5	Blue Heron Terrace MHP
6	Coastal Dunes RV Park & Campground
7	Islay Creek Campground
8	Le Sage Riviera RV Park
9	Montana De Oro Campground
10	Morro Bay State Park Campground
11	Morro Strand Campground
12	Morro Strand RV Park
13	Oceano Dunes State Vehicular Recreation Area
14	Oceano Memorial Campground
15	Pacific Dunes Ranch RV Resort
16	Pismo Coast Village RV Resort
17	Pismo State Beach, North Beach Campground
18	Pismo State Beach, Oceano Campground
19	Port San Luis RV Campground

Figure E-10. Campgrounds within the DCPP Full EPZ



Map No.	Facility Name
1	Avila Beach Park
2	Bishop Peak Trail and Nature Area
3	Bob Jones Trail
4	Cuesta Park
5	Del Mar Park
6	El Chorro Regional Park & Campground
7	Hardie Park
8	Los Osos Community Park
9	Los Osos Oaks State Reserve
10	Montana De Oro State Park
11	Morro Bay State Park
12	Paul Andrew Community Park
13	Pismo Beach State Park
14	Port San Luis Harbor
15	Tidelands Park/Boat Launch

Figure E-11. Parks and Other Recreational Areas within the DCPP Full EPZ

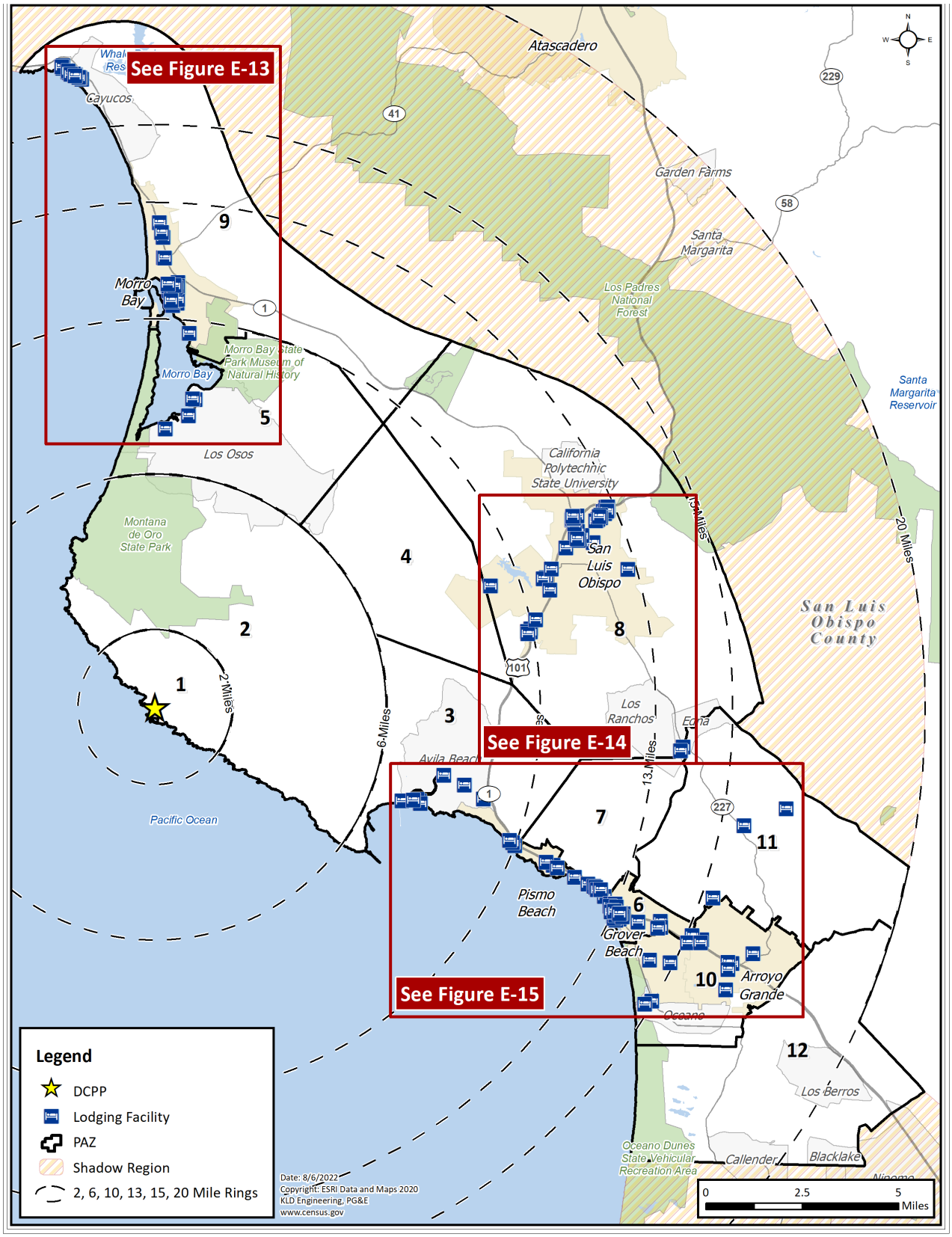
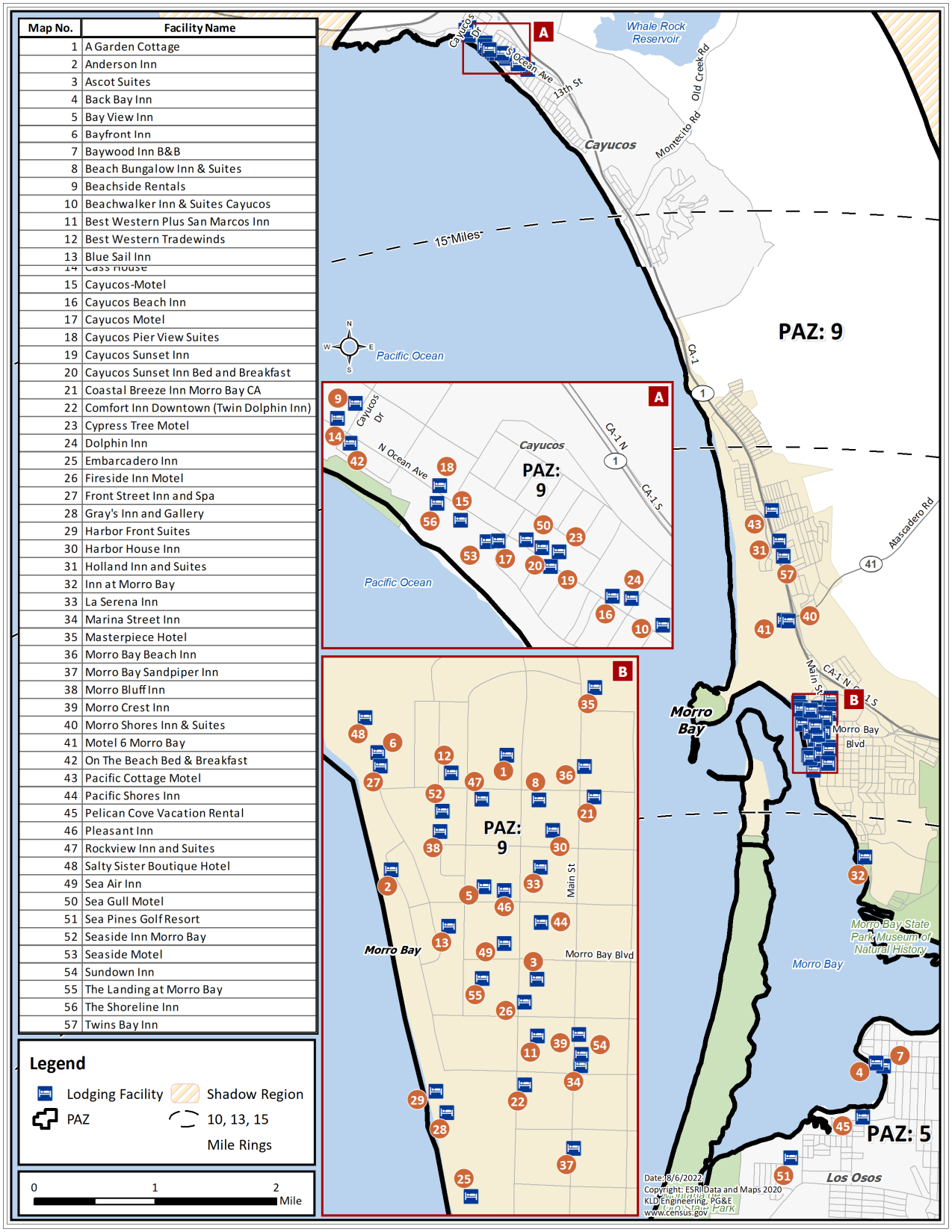


Figure E-12. Overview of Lodging Facilities within the DCPP Full EPZ



Map No.	Facility Name
1	A Garden Cottage
2	Anderson Inn
3	Ascot Suites
4	Back Bay Inn
5	Bay View Inn
6	Bayfront Inn
7	Baywood Inn B&B
8	Beach Bungalow Inn & Suites
9	Beachside Rentals
10	Beachwalker Inn & Suites Cayucos
11	Best Western Plus San Marcos Inn
12	Best Western Tradewinds
13	Blue Sail Inn
14	Cass House
15	Cayucos-Motel
16	Cayucos Beach Inn
17	Cayucos Motel
18	Cayucos Pier View Suites
19	Cayucos Sunset Inn
20	Cayucos Sunset Inn Bed and Breakfast
21	Coastal Breeze Inn Morro Bay CA
22	Comfort Inn Downtown (Twin Dolphin Inn)
23	Cypress Tree Motel
24	Dolphin Inn
25	Embarcadero Inn
26	Fireside Inn Motel
27	Front Street Inn and Spa
28	Gray's Inn and Gallery
29	Harbor Front Suites
30	Harbor House Inn
31	Holland Inn and Suites
32	Inn at Morro Bay
33	La Serena Inn
34	Marina Street Inn
35	Masterpiece Hotel
36	Morro Bay Beach Inn
37	Morro Bay Sandpiper Inn
38	Morro Bluff Inn
39	Morro Crest Inn
40	Morro Shores Inn & Suites
41	Motel 6 Morro Bay
42	On The Beach Bed & Breakfast
43	Pacific Cottage Motel
44	Pacific Shores Inn
45	Pelican Cove Vacation Rental
46	Pleasant Inn
47	Rockview Inn and Suites
48	Salty Sister Boutique Hotel
49	Sea Air Inn
50	Sea Gull Motel
51	Sea Pines Golf Resort
52	Seaside Inn Morro Bay
53	Seaside Motel
54	Sundown Inn
55	The Landing at Morro Bay
56	The Shoreline Inn
57	Twins Bay Inn

Figure E-13. Lodging Facilities within the DCPP Full EPZ – PAZs 5 and 9

Map No.	Facility Name
1	Apple Farm
2	Avenue Inn
3	Best Western Royal Oak Hotel
4	Budget Inn
5	Courtyard Marriott San Luis Obispo Hotel
6	Downtown SLO Inn
7	Embassy Suites San Luis Obispo
8	Garden Street Inn
9	Granada Hotel
10	Hampton Inn
11	Heritage Inn B&B
12	Homestead Motel
13	Hostel Obispo
14	Hotel Buena Vista
15	Hotel Cerro
16	Hotel San Luis Obispo
17	Inn at San Luis Obispo
18	Judson Terrace Lodge
19	La Cuesta Inn
20	La Quinta Inn & Suites
21	Laguna Lake Mobile Estates
22	Lamplighter Inn & Suites
23	Los Padres Motel
24	Mission Inn SLO
25	Motel 6 San Luis Obispo North
26	Motel 6 San Luis Obispo South
27	Old Edna Vacation Farmhouse and Cottage Rentals
28	Old Edna Vacation Farmhouse and Cottage Rentals - vrbo
29	Olive Tree Inn San Luis Obispo
30	Peach Tree Inn
31	Petit Soleil
32	Quality Suites Downtown San Luis Obispo
33	Rose Garden Inn
34	San Luis Creek Lodge
35	San Luis Inn & Suites
36	Sands Suites & Motel
37	SLO Brew Lofts
38	Sunbeam Motel (Bishop Inn)
39	The Butler Hotel
40	The Economy Motel
41	The Kinney San Luis Obispo, Tapestry Collection by Hilton
42	The Madonna Inn
43	University Inn at SLO
44	Vagabond Inn San Luis Obispo
45	Villa Motel

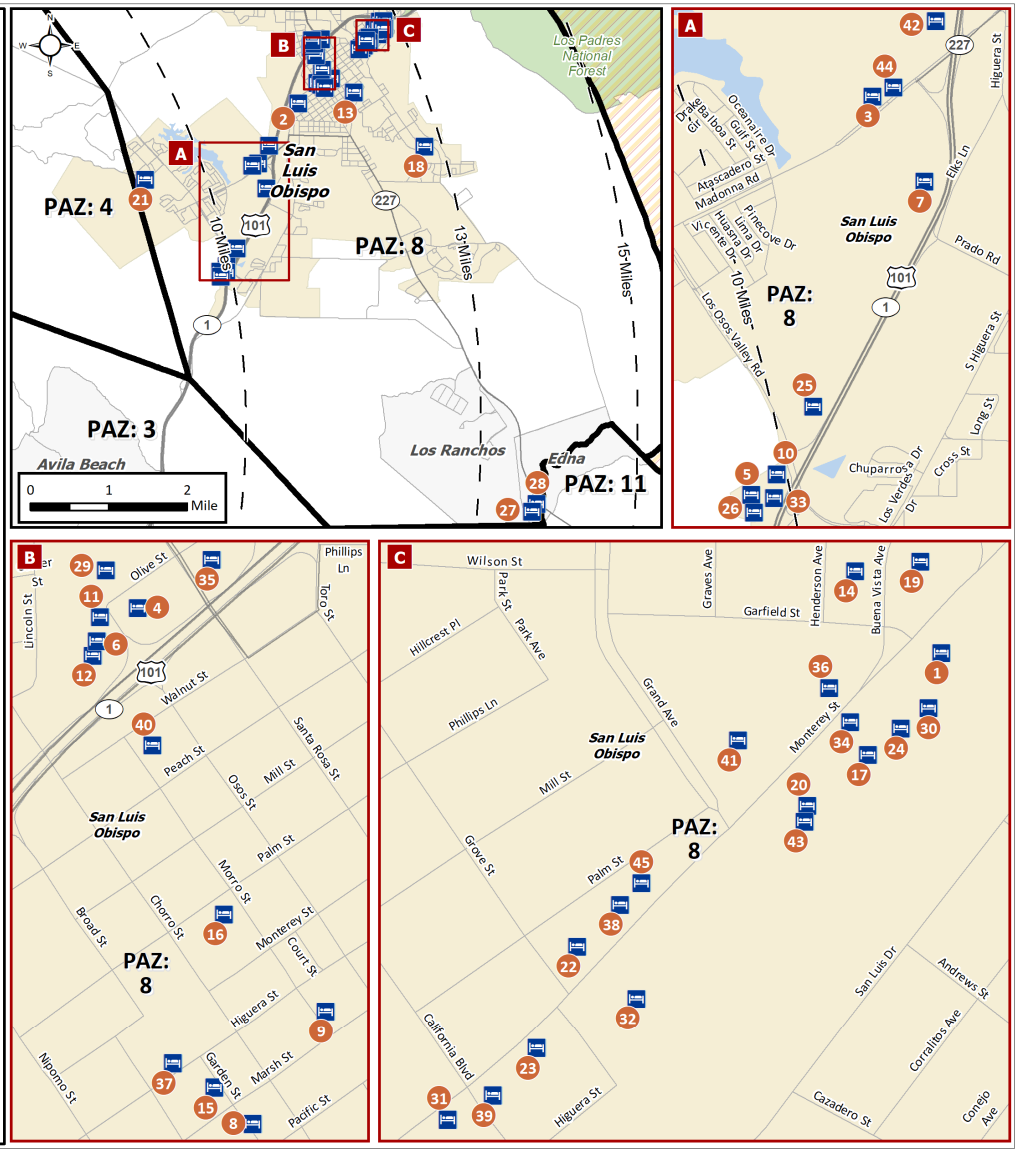
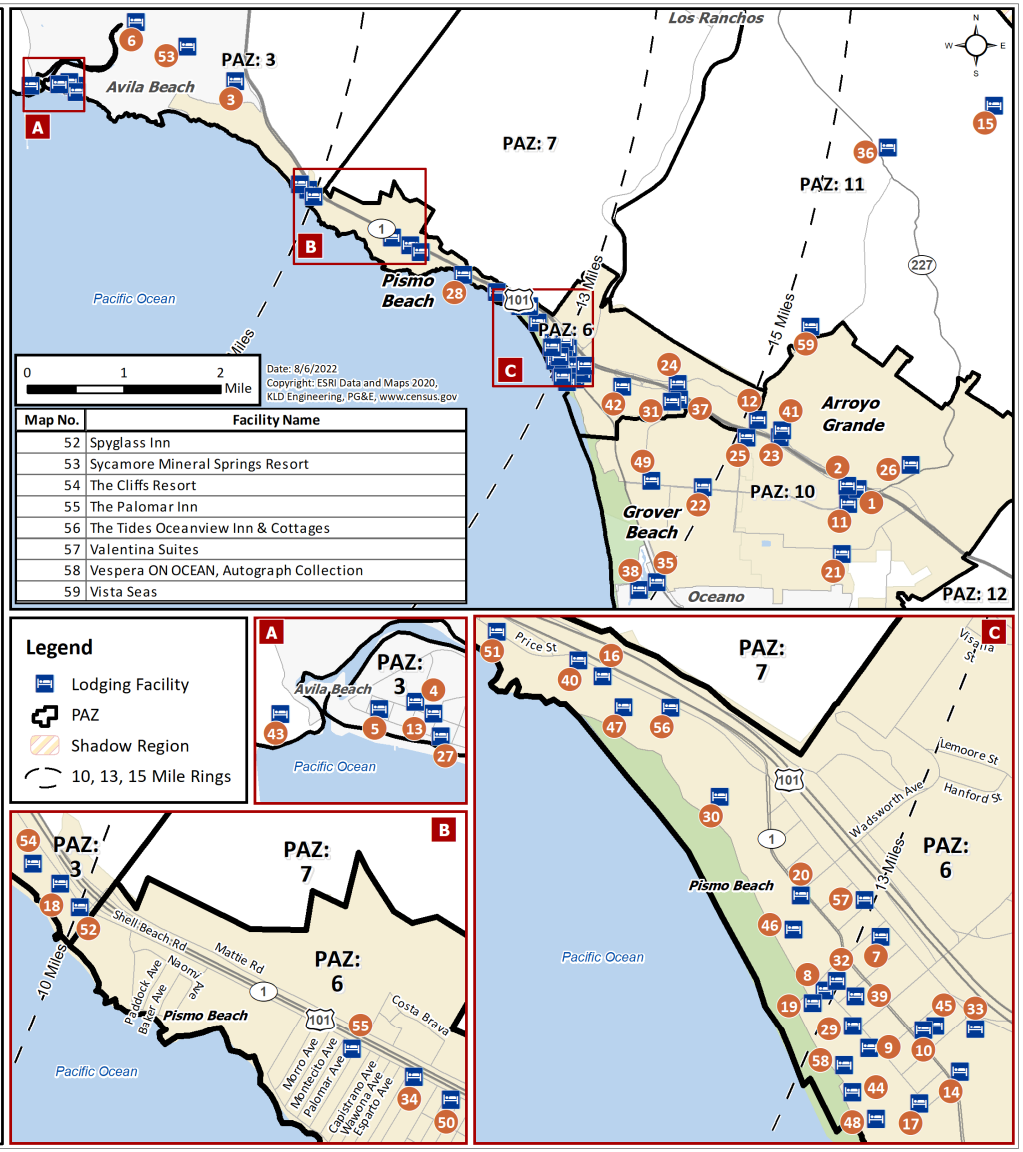


Figure E-14. Lodging Facilities within the DCPP Full EPZ – PAZ 8

Map No.	Facility Name
1	Abella Garden Inn Bed & Breakfast
2	Aloha Inn
3	Avila Hot Springs
4	Avila La Fonda Hotel
5	Avila Lighthouse Suites
6	Avila Village Inn
7	Beach Bum Holiday Rentals
8	Beach House Inn & Suites
9	BeachComber Inn
10	Beachwalker Inn & Suites
11	Beachway Inn Motel
12	Best Western Casa Grande Inn
13	Best Western Somerset Inn
14	Blue Seal Inn
15	Casita Las Brisas - Airbnb
16	Cottage Inn by the Sea
17	Cypress by the Sea Too
18	Dolphin Bay Resort and Spa
19	Dolphin Cove Motel
20	Edgewater Inn & Suites
21	Grieb Farmhouse Inn
22	Grover Beach Motel
23	Hampton Inn & Suites Arroyo Grande/Pismo Beach Area
24	Hilton Garden Inn San Luis Obispo/Pismo Beach
25	Holiday Inn Express Grover Beach-Pismo Beach Area
26	House of Another Tyme Bed & Breakfast
27	Inn at Avila Beach
28	Inn at the Cove
29	Inn at The Pier
30	Kon Tiki Inn
31	Motel 6 Pismo Beach
32	Motel 6 Pismo Beach - Pacific Ocean
33	Ocean Palms Motel Pismo Beach
34	Ocean View Motel
35	Oceano Inn
36	Olive Tree Cottages--Libretto Cottage / Olive Tree Cabin
37	Oxford Suites Pismo Beach
38	Pacific Plaza Resort
39	Pismo Beach Hotel
40	Pismo Lighthouse Suites
41	Premier Inns Pismo Beach
42	Quality Inn Pismo Beach
43	San Luis Bay Inn - Diamond Resorts
44	Sandcastle Hotel on the Beach
45	Sea Garden Motel
46	Sea Gypsy Motel
47	SeaCrest Ocean Front Hotel
48	SeaVenture Beach Hotel
49	Seaview Inn
50	Shell Beach Inn
51	Shore Cliff Hotel



Map No.	Facility Name
52	Spyglass Inn
53	Sycamore Mineral Springs Resort
54	The Cliffs Resort
55	The Palomar Inn
56	The Tides Oceanview Inn & Cottages
57	Valentina Suites
58	Vespera ON OCEAN, Autograph Collection
59	Vista Seas

Figure E-15. Lodging Facilities within the DCPP Full EPZ – PAZs 3, 6, 10 and 11

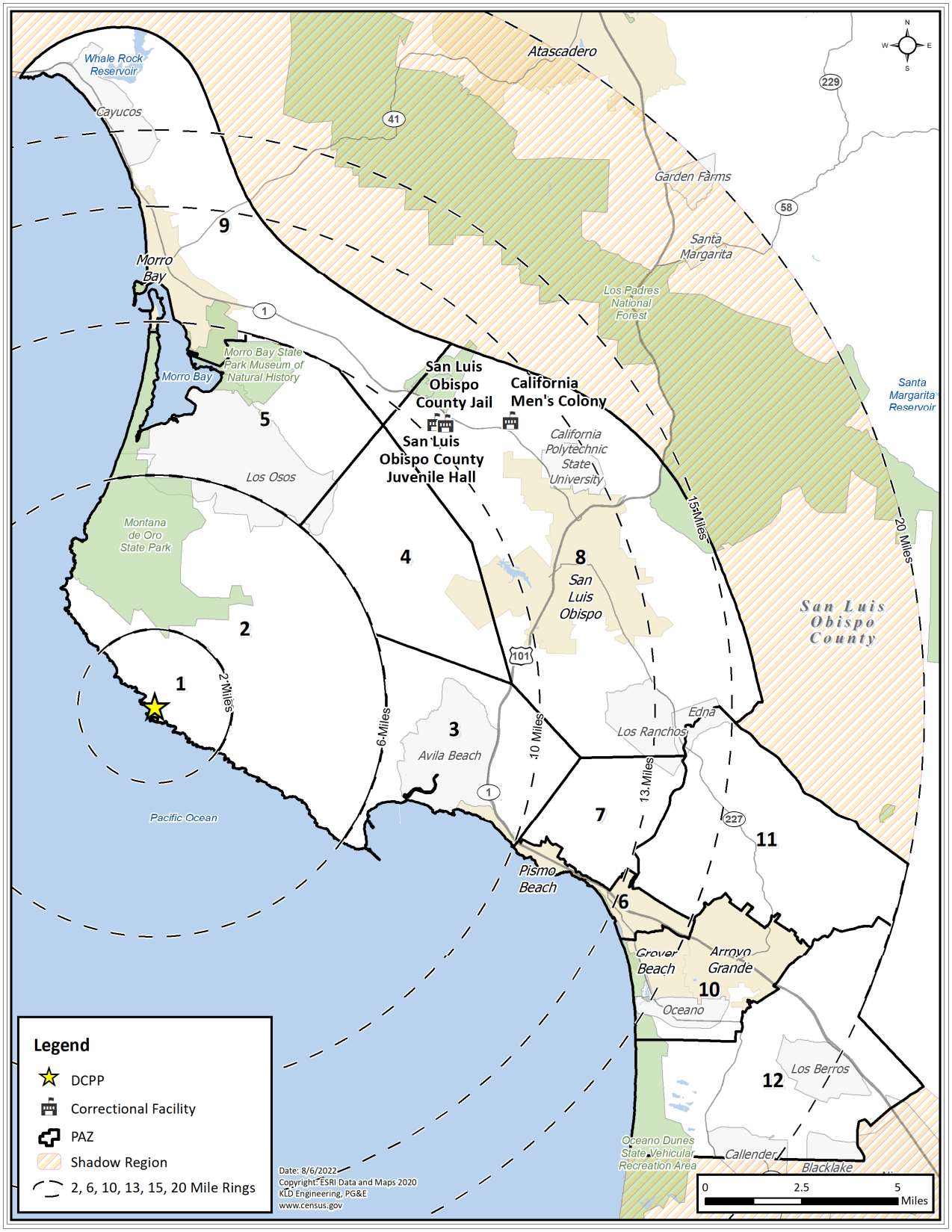


Figure E-16. Correctional Facilities within the DCPP Full EPZ

APPENDIX F

Demographic Survey

F. DEMOGRAPHIC SURVEY

F.1 Introduction

The development of ETE for the EPZ of the Diablo Canyon Power Plant (DCPP) requires the identification of travel patterns, car ownership and household size of the population within the study area. 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 study area and consequently may not accurately represent the anticipated behavioral characteristics of the evacuating populace.

These concerns are addressed by conducting a demographic survey of a representative sample of the study area 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. Since the demographic survey discussed herein was performed in 2020 and the 2020 Census data had not been released, 2010 Census data was used to develop the sampling plan.

A sample size of approximately 475 **completed** survey forms would yield results with a sampling error of ±4.5% at the 95% confidence level. The survey sample must be drawn from the study area population. Consequently, a list of zip codes in the EPZ and Shadow Region 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 study area 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 2010 average household size value contained in Table F-1 was a sampling plan estimate and was not used in the ETE study.

A total of 177 completed samples were obtained corresponding to a sampling error of ±7.36% at the 95% confidence level based on the 2020 Census data. Table F-1 also shows the number of samples obtained within each zip code. Despite the number of samples obtained falling short of the survey goal, the distribution of survey samples adhered to the plan with the majority of the responses obtained from zip codes 93401, 93402, 93405, 93420, and 93422.

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 "decline to state" entry for a response. It is accepted practice in conducting surveys of this type to accept the answers of a respondent who offers a decline to state response for a few questions or who refuses to answer a few questions. To address the issue of occasional decline to state 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 decline to state responses are ignored and the distributions are based upon the positive data that is acquired.

F.3.1 Household Demographic Results

Gender

Of the survey respondents, 51 percent are male, and 49 percent indicated that they are female. Thus, the results of this survey show no gender bias. These percentages are in good agreement with the 2020 Census data for San Luis Obispo County, CA (50.6% male and 49.4% female) and, therefore, indicate the reliability of the survey.

Household Size

Figure F-1 presents the distribution of household size within the study area. The average household surveyed contains 2.70 people, which was the number used for the analysis in the report. The estimated household size (2.62 persons) (Table F-1) was drawn from raw 2020 Census data and is 2.96% less than the average obtained from the survey. As noted in Section F.2, the survey sampling error is ±7.36%. The agreement (within error bounds) between the average household size obtained from the survey and from the Census is another indication of the reliability of the survey. The average household size obtained from the survey (2.70 people) is used in this study.

Automobile Ownership

The average number of automobiles available per household in the study area is 2.4. It should be noted that all households have access to at least one vehicle. The distribution of automobile ownership is presented in Figure F-2. Figure F-3 present the automobile availability by household size. As expected, 90 percent of all households of 2 or more people have access to at least two vehicles.

Ridesharing

The overwhelming proportion of the households (76.5%) surveyed responded that they would share a ride with a neighbor, relative, or friend if a car was not available to them when asked to evacuate. Figure F-4 presents this response.

Commuters

Figure F-5 presents the distribution of the number of commuters in each household. Commuters are defined as household members who travel to work or college on a daily basis. The data shows an average of 1.02 commuters in each household in the study area. In total, 69% of households have at least one commuter.

Commuter Travel Modes

Figure F-6 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 1.06 employees per vehicle, assuming 2 people per vehicle – on average – for carpools.

Impact of COVID-19 on Commuters

Figure F-7 presents the distribution of the number of commuters in each household that were temporarily impacted by the COVID-19 pandemic. About 66% of households indicated someone in their household had a work and/or school commute that was temporarily impacted by the COVID-19 pandemic.

Functional or Transportation Needs

Figure F-8 presents the distribution of the number of individuals with functional or transportation need. The data shows that less than 4% of households have functional or transportation needs. Of those with functional or transportation needs, 17% require a medical bus/van, 17% require a wheelchair accessible van, 8% require an ambulance and 58% require a child car seat.

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-9. On average, evacuating households would use 1.51 vehicles.

"Would your family await the return of other family members prior to evacuating the area?" Of the survey participants who responded, 54 percent said they would await the return of other family members before evacuating and 46 percent indicated that they would not await the return of other family members.

"Do you have any service animals?" And "do you have sufficient room in your vehicle to evacuate with your service animal?" Based on the responses to the survey, four percent of

households own a service animal. Of the households with service animals, 85 percent of them indicated that they have sufficient room in their vehicles to evacuate with them.

"Outside of a service animal, do you have any other pet(s) and/or animal(s)? If so, what would you do with your pet(s) and/or animal(s) if you were directed to evacuate?" Based on the responses to the survey, 36 percent of households do not own a pet or animal. Of the households with pets, 14 percent of them indicated that they would take their pets to a shelter and 82 percent would take them somewhere else. Approximately four percent of households would leave pets or animals at home, as shown in Figure F-10. Of the households that would evacuate with their pet(s) and/or animal(s), 95 percent indicated that they have sufficient room in their vehicle to evacuate with their pets or animals, two percent would use a trailer, one percent would need assistance, and two percent do not have sufficient room in their vehicles.

"What type of pet(s) and/or animal(s) do you have?" Based on responses from the survey, 89 percent of households have a household pet (dog, cat, bird, reptile, fish, rabbit, ferret, guinea pig or hamster) and about 10% of households have farm animals (horse, chicken, goat, pig or sheep). Approximately one percent of households own other small pets or animals.

"Emergency officials direct you to stay off the roads and stay tuned for more information because you are not in the area of risk. Would you?" This question is designed to elicit information regarding compliance with instructions to stay off the roads (monitor and prepare). The results indicate that 92 percent of households who are advised to stay off the roads would do so; the remaining 8 percent would choose to evacuate the area. Note the baseline ETE study assumes 20 percent of households will not comply with the monitor and prepare advisory, as per Section 2.5.2 of NUREG/CR-7002 Rev 1. A sensitivity study was conducted to estimate the impact of shadow evacuation non-compliance of monitor and prepare advisory on ETE – see Appendix M.

"Emergency officials direct you to stay off the roads and stay tuned to allow other areas to evacuate. Would you?" This question is designed to elicit information specifically related to the possibility of a staged evacuation. That is, asking a population to stay off the roads and stay tuned to allow other areas to evacuate and then to evacuate after a specified period of time. Results indicate that 87 percent of households would follow instructions and delay the start of evacuation until so advised, while the balance of 13 percent would choose to begin evacuating immediately.

"Emergency officials advise you to evacuate due to an emergency. Where would you evacuate to?" This question is designed to elicit information regarding the destination of evacuees in case of an evacuation. Approximately 48 percent of households indicated that they would evacuate to a friend or relatives' home, two percent to a reception center, 20 percent to a hotel, motel or campground, five percent to a second or seasonal home, one percent of households would not evacuate, and the remaining 24 percent answered other/don't know to this question. See Figure F-11.

F.3.3 Time Distribution Results

The survey asked several questions about the amount of time it takes to perform certain pre-evacuation activities. These activities involve actions taken by residents during the course of their day-to-day lives. Thus, the answers fall within the realm of the responder's experience.

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

As discussed in Section F.3.1 and shown in Figure F-7, the COVID-19 pandemic had an impact on the majority of commuters in the study area. To minimize uncertainty in the trip generation time, data from the 2012 demographic survey was compared to the trip generate distributions involving commuters (time to prepare to leave work/college and time to travel home from work/college). For this reason, both the results of this survey, and the results of the 2012 survey for these questions are discussed herein.

"How long does it take the commuter to complete preparation for leaving work?" Figure F-12 presents the cumulative distribution; in the 2021 data, the activity is completed by about 50 minutes. Eighty-four percent can leave within 20 minutes. In 2012, the activity is completed by 60 minutes and 82% leave within 20 minutes. As shown in Figure F-12, the two graphs follow the same trend. For this reason, it is assumed the patterns for preparing to leave work/college have not significantly changed due to the COVID-19 pandemic, and therefore, the 2021 data is utilized in this study.

"How long would it take the commuter to travel home?" Figure F-13 presents the work to home travel time for the study area from the 2012 and 2021 survey results. Approximately 84 percent of commuters can arrive home within 40 minutes of leaving work; all within 60 minutes according to the 2021 survey results. Approximately 94 percent of commuters can arrive home within 30 minutes of leaving work; all within 60 minutes according to the 2012 survey results.

As shown in Figure F-13, although the two graphs have the same endpoints, the new commuter travel patterns show a shift to the right indicating longer times to travel home from work. The results of this question were presented to PG&E emergency planning personnel who live within the EPZ. It was indicated congestion along Highway 227 and Highway 101 have worsened since 2012 and commuting times have increased overall. As a result, the 2021 results for this mobilization activity are utilized in this study as they represent more recent travel patterns.

"How long would it take the family to pack clothing, secure the house, and load the car?" Figure F-14 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-14 has a long "tail." Approximately 85 percent of households can be ready to leave home within two hours; the remaining households require up to an additional one hour and 30 minutes.

"How long would it take to pack up your pets?" Figure F-15 presents the cumulative distribution; in all cases, the activity is completed by about 55 minutes. About 88 percent can prepare pets within 25 minutes. Due to the short duration of this activity and long duration of the time needed to prepare the home for evacuation (Figure F-14), it is assumed the time to prepare pets is also included in the responses given to the previous question.

Table F-1. DCPP Demographic Survey Sampling Plan

Zip Code	POP2010	HH 2010	POP2020	HH 2020	Desired Sample	Sample Obtained
93401	27,995	13,358	29,884	13,278	70	37
93402	14,318	6,505	14,500	6,040	34	18
93405	25,496	9,345	35,528	8,557	49	14
93420	28,413	12,440	30,266	11,975	65	26
93424	1,261	919	1,223	663	5	7
93430	2,972	2,526	2,853	1,384	13	3
93433	13,159	5,746	12,643	5,168	30	12
93442	10,649	6,595	11,382	5,275	35	5
93444	19,241	7,180	22,462	8,052	37	7
93445	7,173	2,976	7,130	2,593	16	3
93449	7,656	5,572	8,098	4,067	29	5
93422	30,354	12,735	32,878	12,872	67	28
93453	2,899	1,355	3,017	1,213	7	1
93465	9,153	3,530	10,023	3,643	18	11
Totals	**200,739**	**90,782**	**221,887**	**84,780**	**475**	**177**
Average 2010 HH Size:		**2.21**	**Average 2020 HH Size:**		**2.62**	

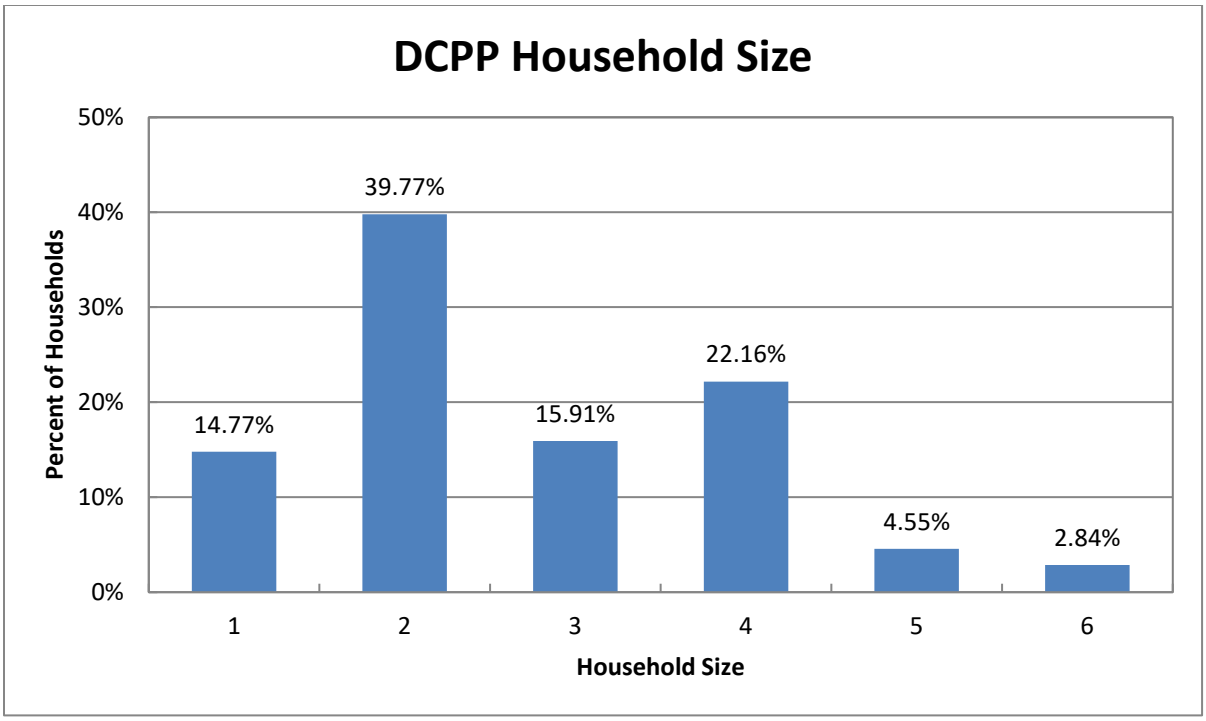


Figure F-1. Household Size in the Study Area

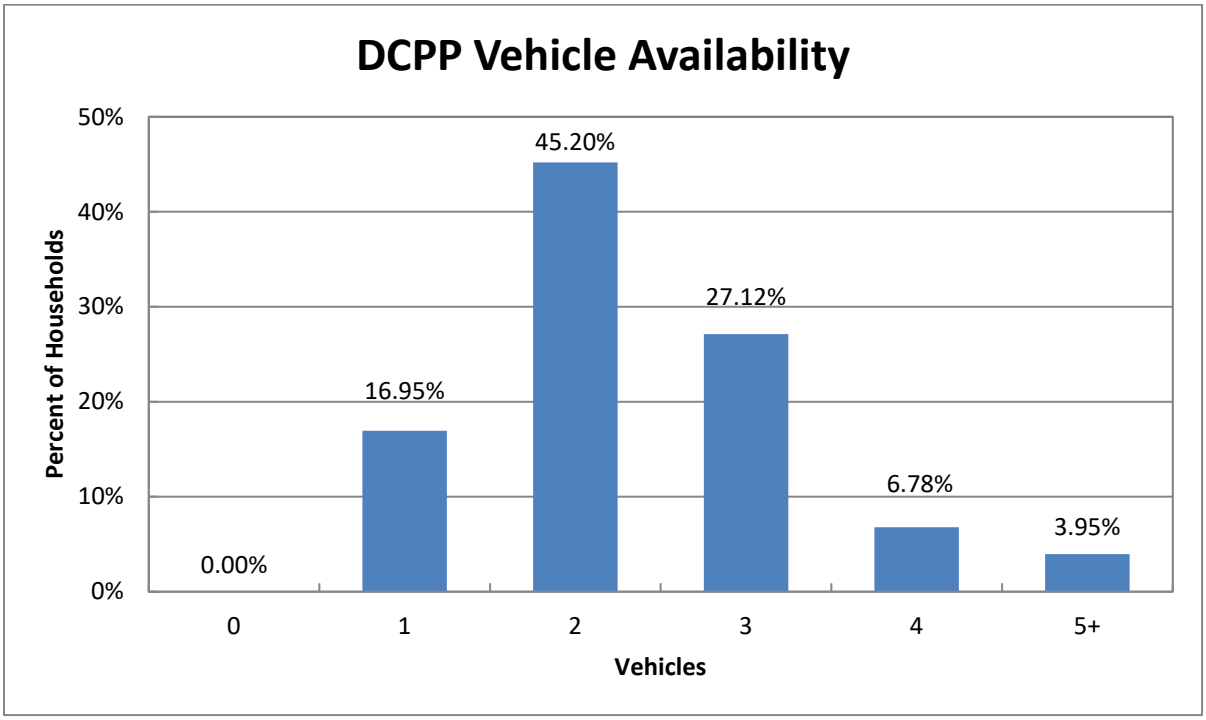


Figure F-2. Household Vehicle Availability

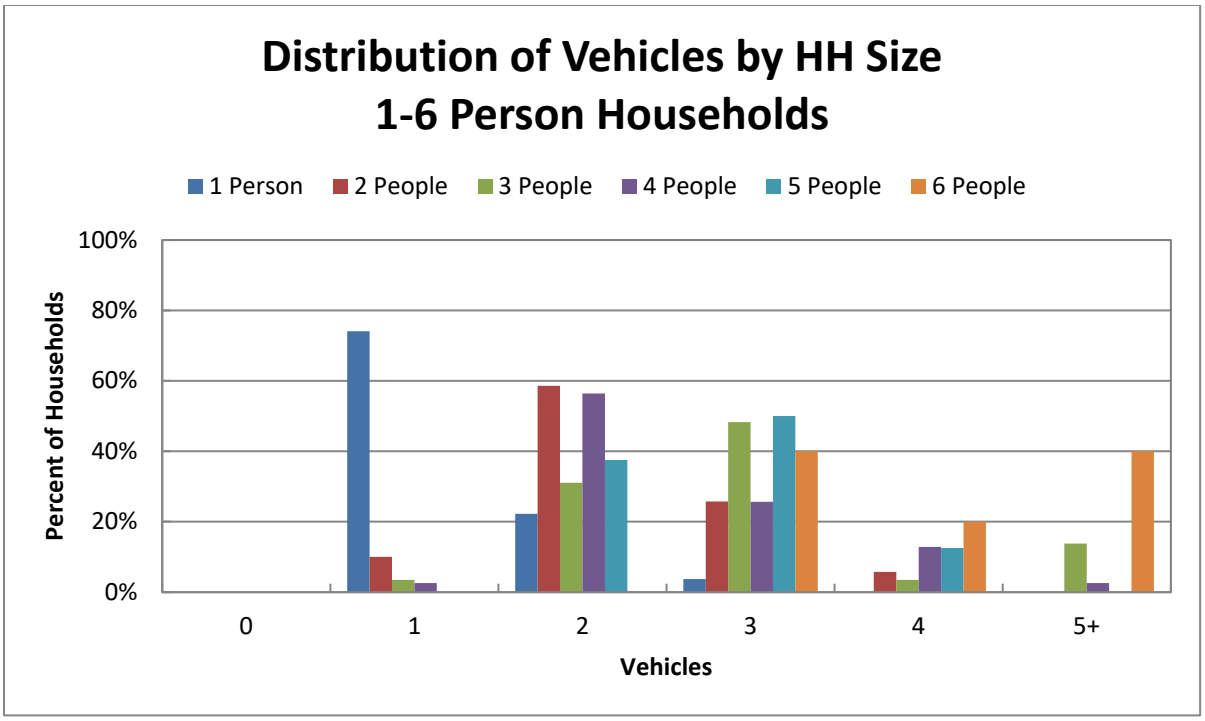


Figure F-3. Vehicle Availability - 1 to 6 Person Households

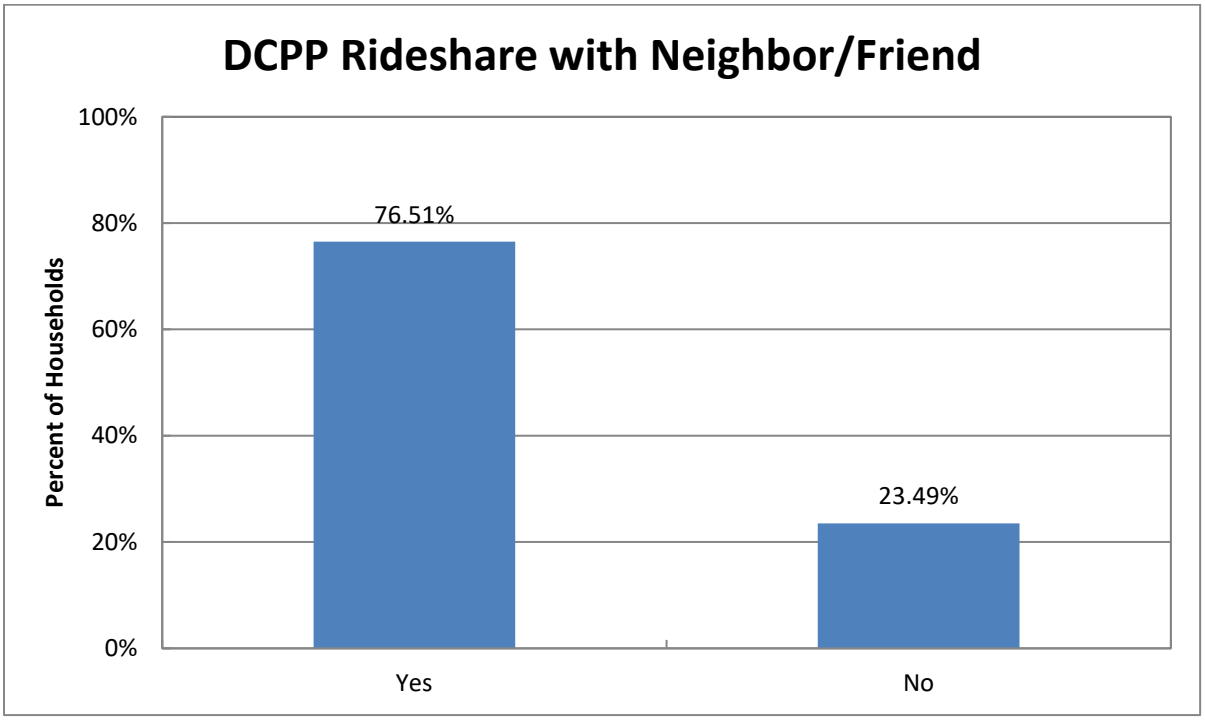


Figure F-4. Household Ridesharing Preference

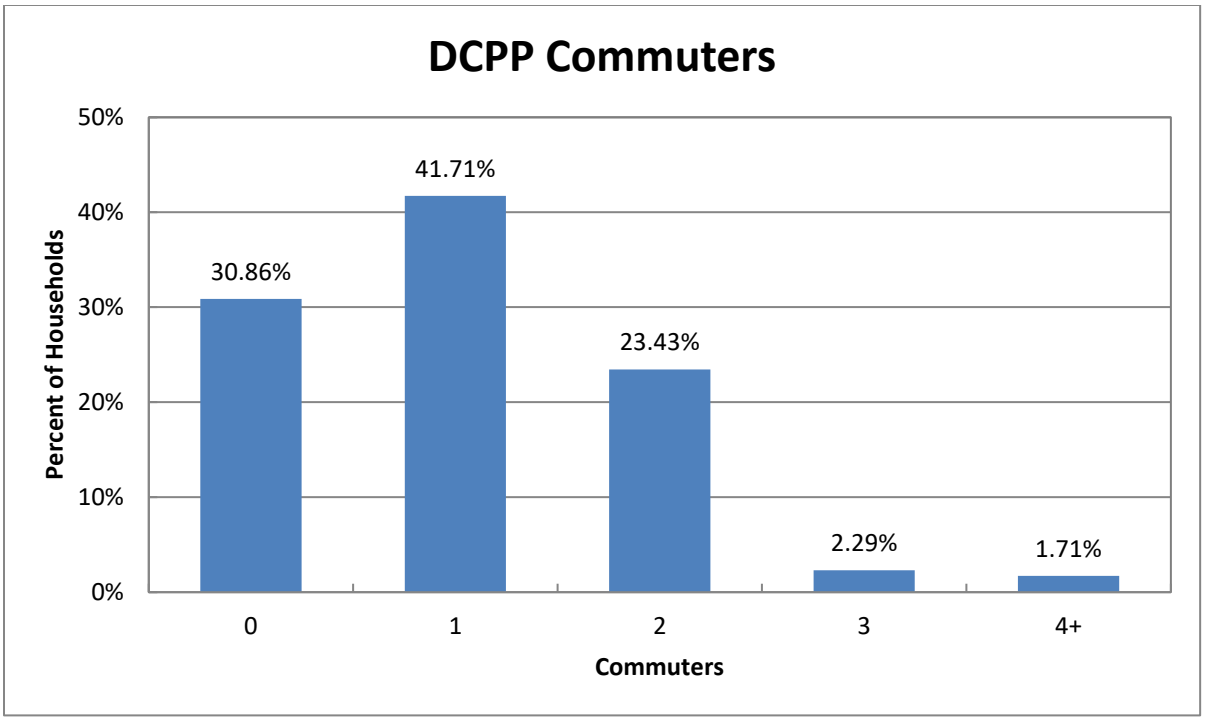


Figure F-5. Commuters in Households in the Study Area

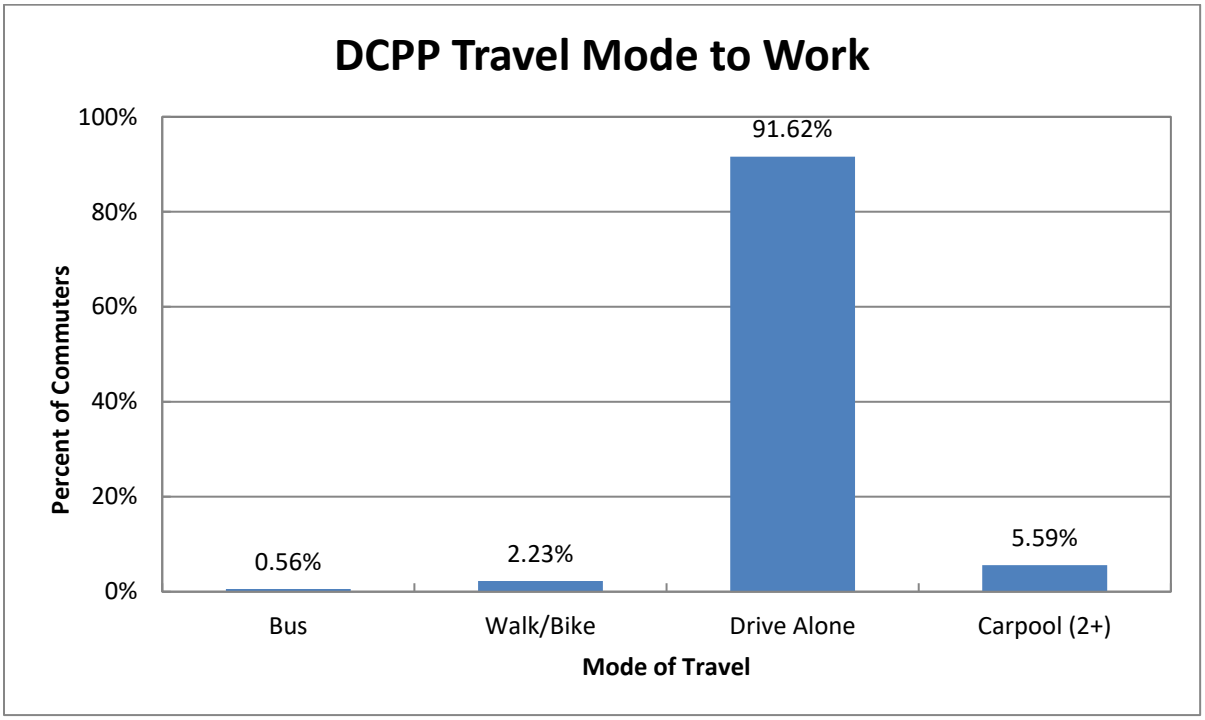


Figure F-6. Modes of Travel in the Study Area

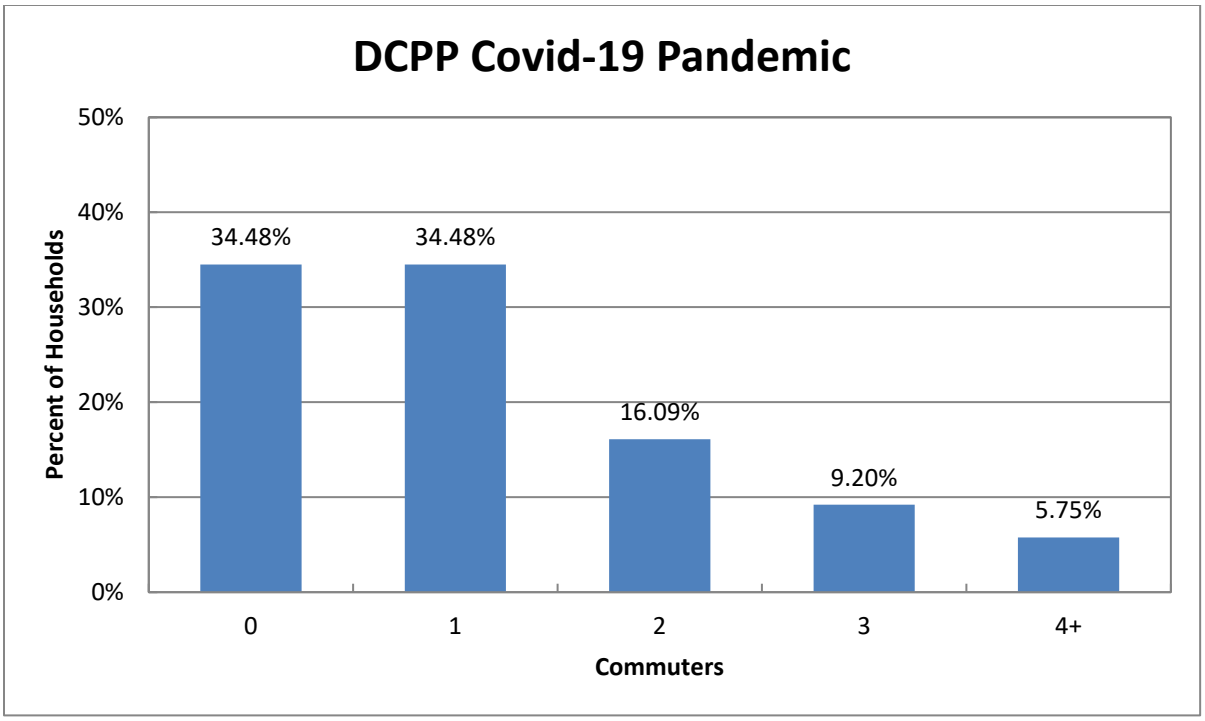


Figure F-7. Impact to Commuters due to the COVID-19 Pandemic

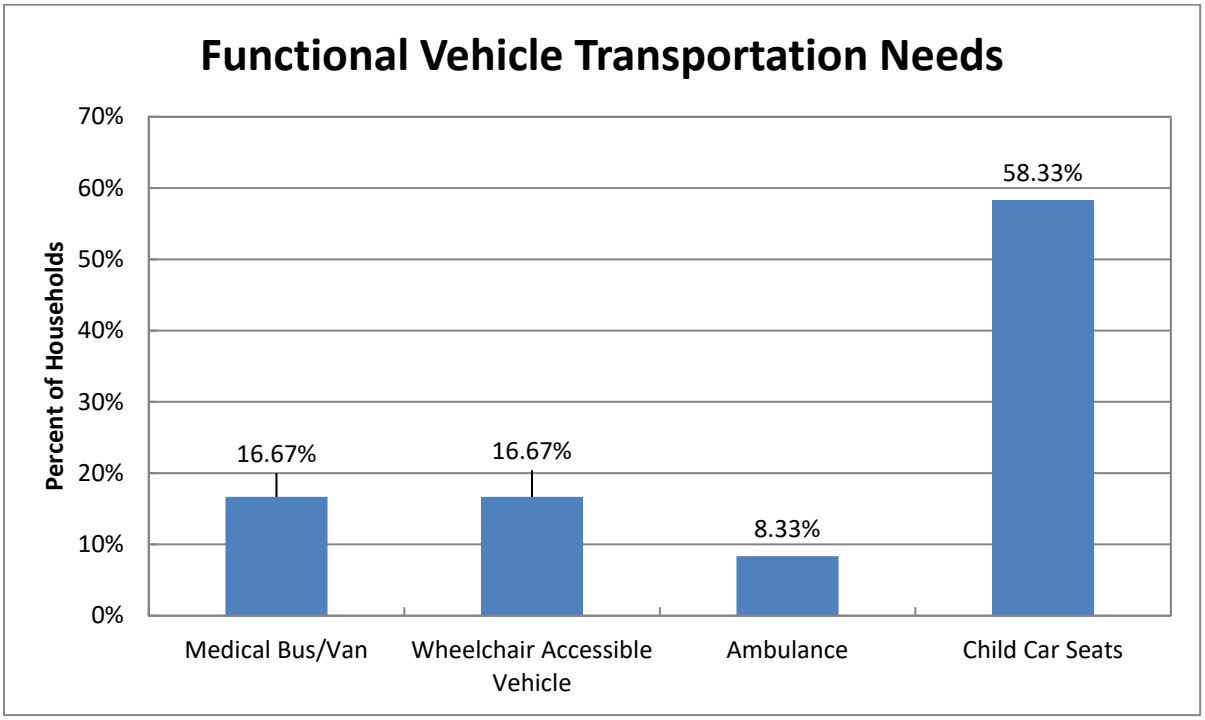


Figure F-8. Households with Functional or Transpiration Needs

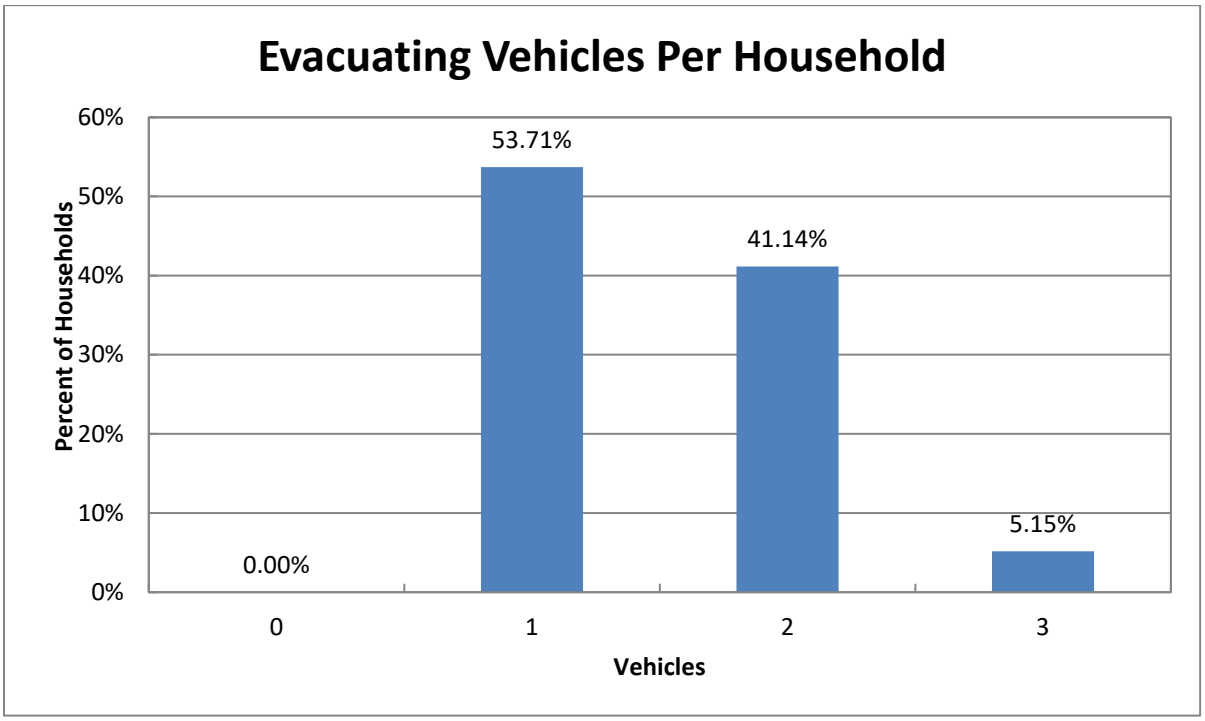


Figure F-9. Number of Vehicles Used for Evacuation

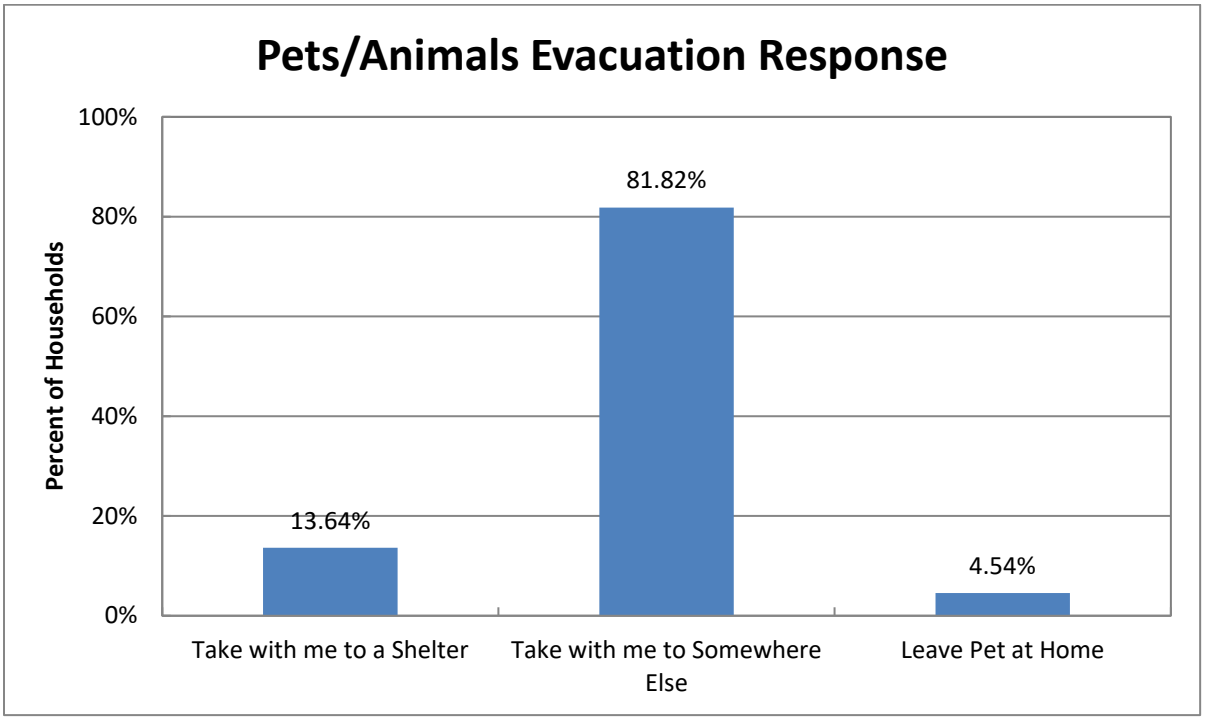


Figure F-10. Households Evacuating with Pets/Animals to Shelters

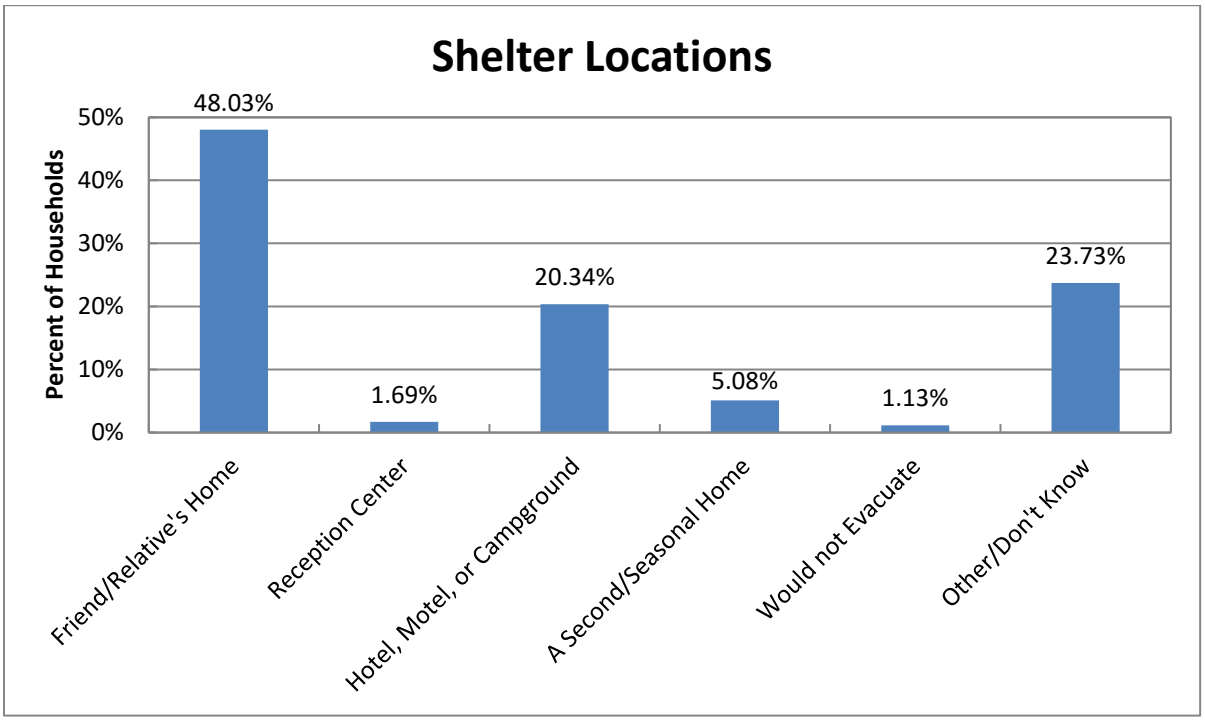


Figure F-11. Shelter Locations

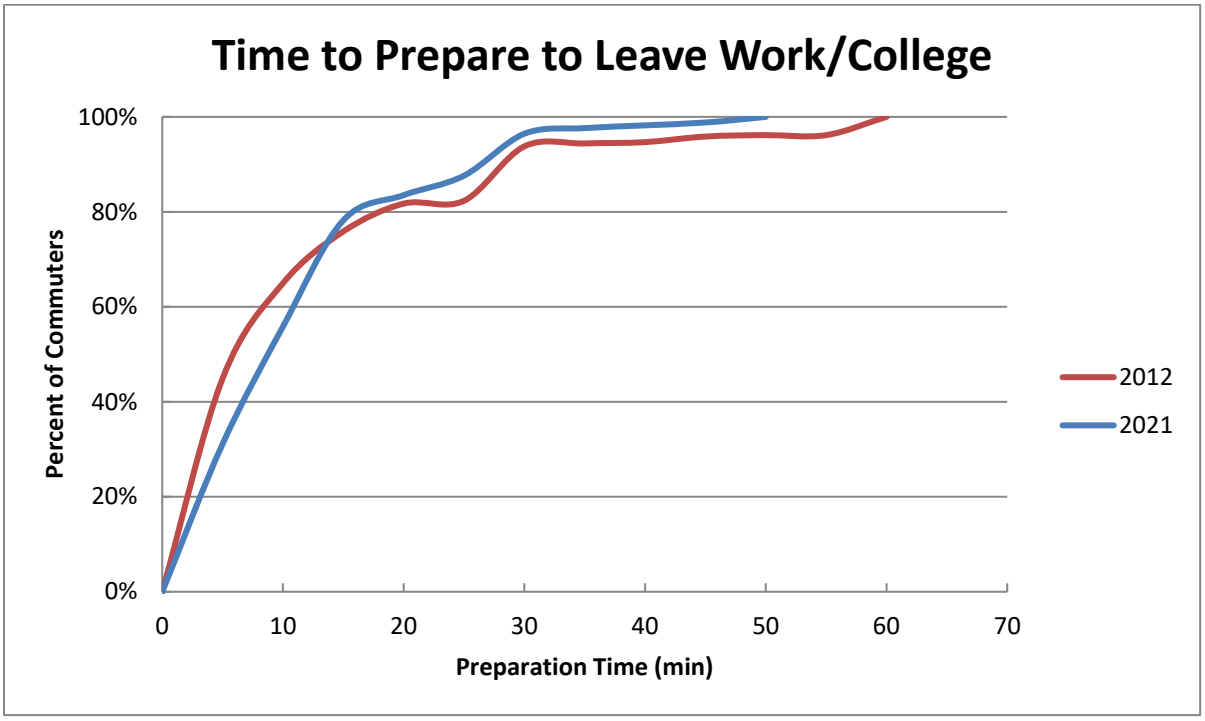


Figure F-12. Time Required to Prepare to Leave Work/School

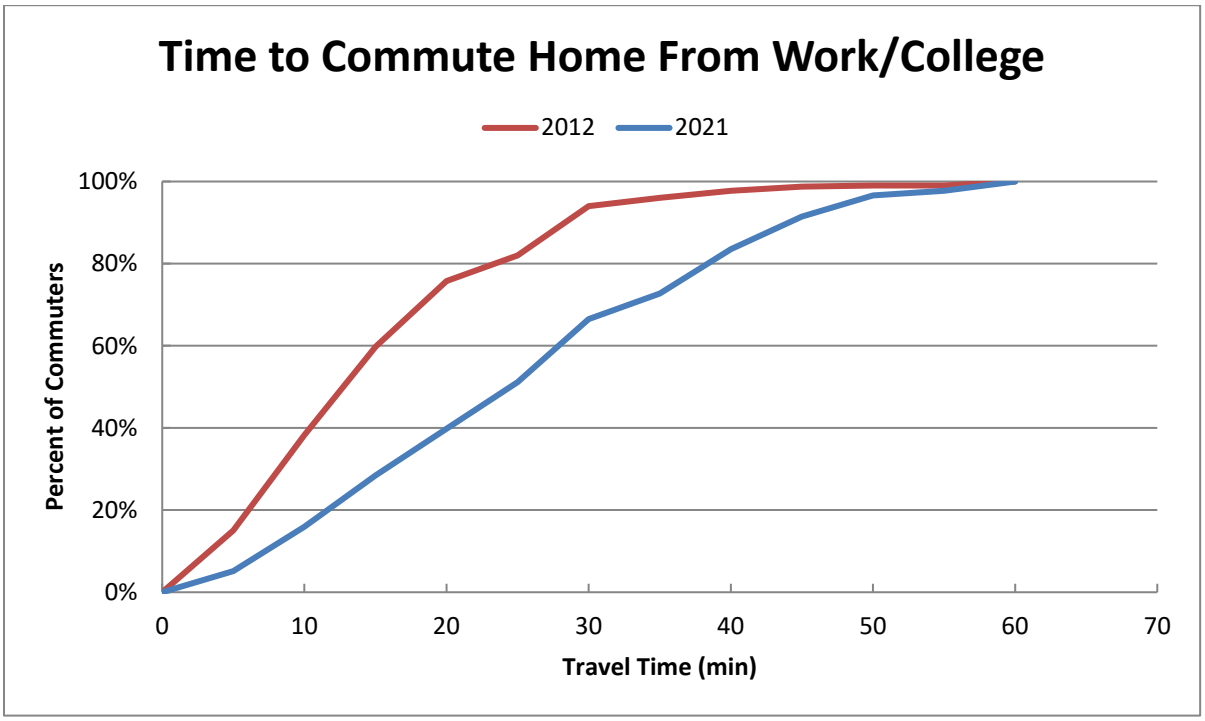


Figure F-13. Work to Home Travel Time

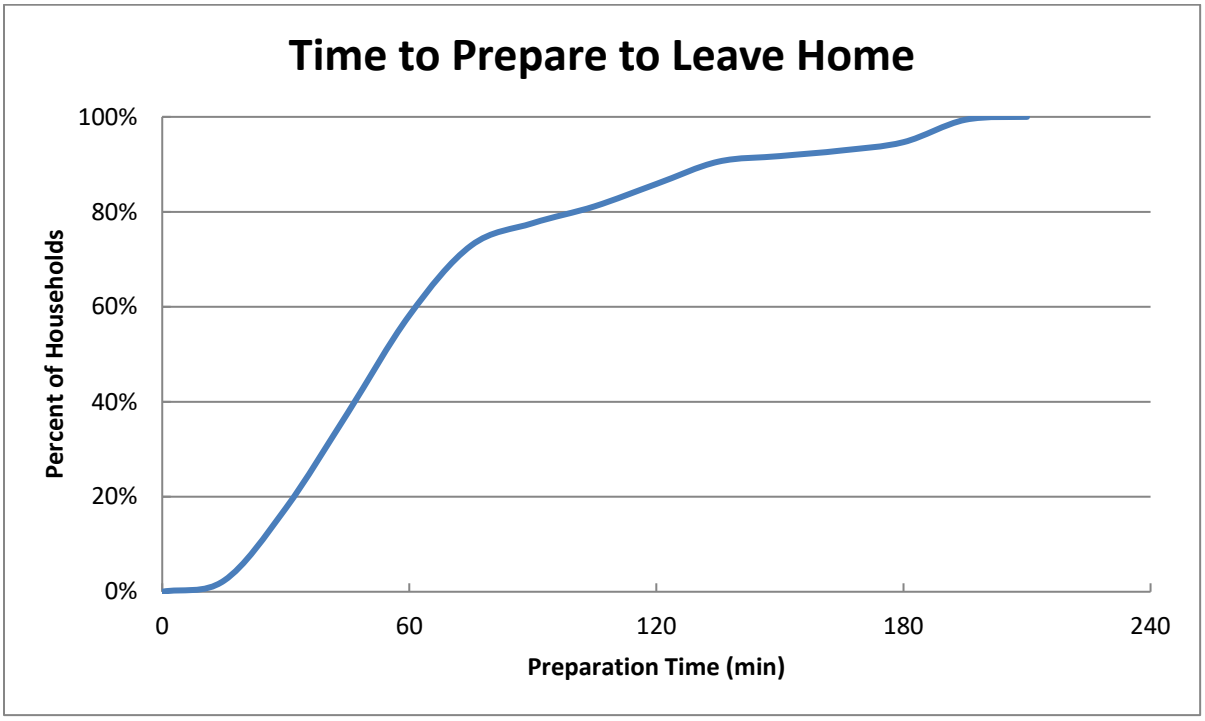


Figure F-14. Time to Prepare Home for Evacuation

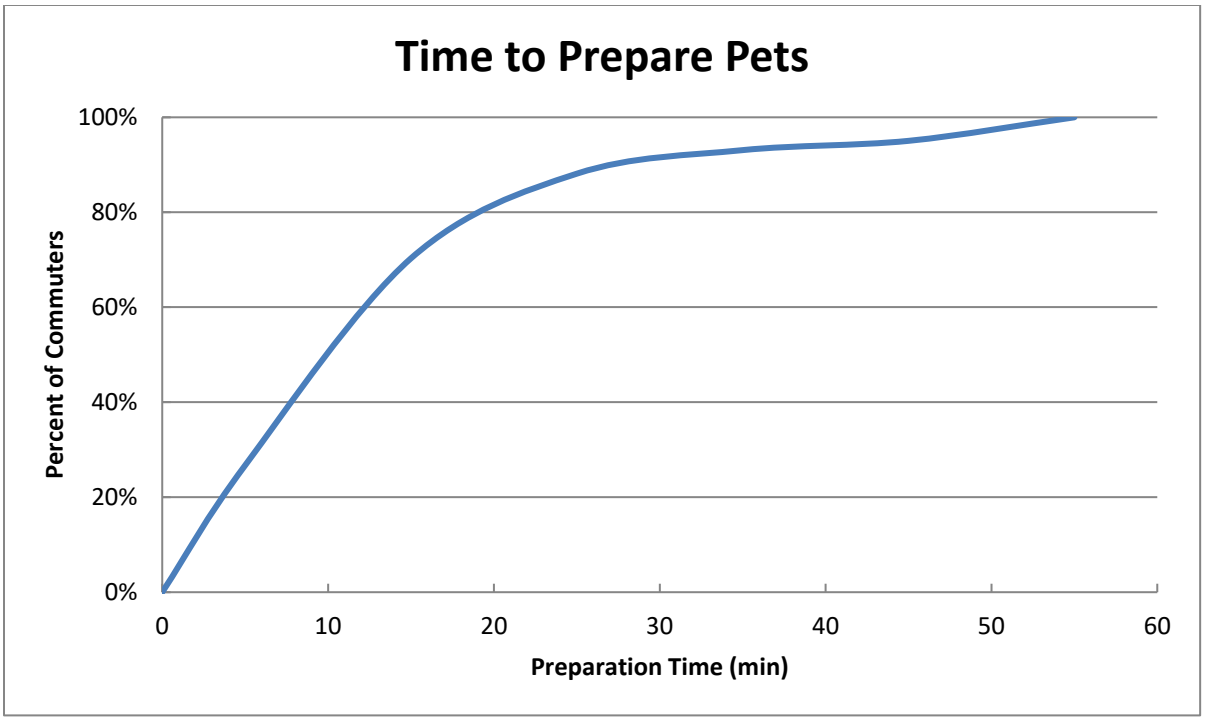


Figure F-15. Time to Prepare Pets for Evacuation

ATTACHMENT A

Demographic Survey Instrument

Diablo Canyon Power Plant Demographic Survey

* Required

Purpose

The purpose of this survey is to identify local behavior during emergency situations. The information gathered in this survey will be shared with local emergency planners to enhance emergency response plans in your area. Your responses will greatly contribute to local emergency preparedness. **Please only complete one survey per household**. **Please have the head of the household (18 years or older) complete the survey**. Do not provide your name or any personal information, and the survey will take less than 5 minutes to complete.

1. 1. What is your home zip code? *

_____

2. 2A. In total, how many running cars, or other vehicles are usually available to the household?

Mark only one oval.

- ONE
- TWO
- THREE
- FOUR
- FIVE
- SIX
- SEVEN
- EIGHT
- NINE OR MORE
- ZERO (NONE)
- DECLINE TO STATE

3. 2B. In an emergency, could you get a ride out of the area with a neighbor or friend?

Mark only one oval.

- YES
- NO
- DECLINE TO STATE

4. 3. How many vehicles would your household use during an evacuation?

Mark only one oval.

- ONE
- TWO
- THREE
- FOUR
- FIVE
- SIX
- SEVEN
- EIGHT
- NINE OR MORE
- ZERO (NONE)
- I WOULD EVACUATE BY BICYCLE
- I WOULD EVACUATE BY BUS
- DECLINE TO STATE

5. 4. How many people usually live in this household?

Mark only one oval.

- ONE
- TWO
- THREE
- FOUR
- FIVE
- SIX
- SEVEN
- EIGHT
- NINE
- TEN
- ELEVEN
- TWELVE
- THIRTEEN
- FOURTEEN
- FIFTEEN
- SIXTEEN
- SEVENTEEN
- EIGHTEEN
- NINETEEN OR MORE
- DECLINE TO STATE

6. 5. How many people in your household have a work and/or school commute that has been temporarily impacted due to the COVID-19 pandemic?

Mark only one oval.

- ZERO
- ONE
- TWO
- THREE
- FOUR OR MORE
- DECLINE TO STATE

7. 6. How many people in the household commute to a job, or to college on a daily basis? *

Mark only one oval.

- ZERO *Skip to question 52*
- ONE *Skip to question 8*
- TWO *Skip to question 9*
- THREE *Skip to question 10*
- FOUR OR MORE *Skip to question 11*
- DECLINE TO STATE *Skip to question 52*

Mode of Travel

8. 7. Thinking about each commuter, how does each person usually travel to work or college?

Mark only one oval per row.

	Drive Alone	Bus	Walk/Bicycle	Carpool-2 or more people	Rail	Don't know
Commuter 1						

Skip to question 12

Mode of Travel

9. 7. Thinking about each commuter, how does each person usually travel to work or college?

Mark only one oval per row.

	Drive Alone	Bus	Walk/Bicycle	Carpool-2 or more people	Rail	Don't know
Commuter 1						
Commuter 2						

Skip to question 14

Mode of Travel

10. 7. Thinking about each commuter, how does each person usually travel to work or college?

Mark only one oval per row.

	Drive Alone	Bus	Walk/Bicycle	Carpool-2 or more people	Rail	Don't know
Commuter 1						
Commuter 2						
Commuter 3						

Skip to question 18

Mode of Travel

11. 7. Thinking about each commuter, how does each person usually travel to work or college?

Mark only one oval per row.

	Drive Alone	Bus	Walk/Bicycle	Carpool-2 or more people	Rail	Don't know
Commuter 1						
Commuter 2						
Commuter 3						
Commuter 4						

Skip to question 24

Travel Home From Work/College

12. 8-1. How much time on average, would it take Commuter #1 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

13. If Over 2 Hours for Question 8-1, Specify Here

leave blank if your answer for Question 8-1, is under 2 hours.

_____

Skip to question 32

Travel Home From Work/College

14. 8-1. How much time on average, would it take Commuter #1 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

15. If Over 2 Hours for Question 8-1, Specify Here

leave blank if your answer for Question 8-1, is under 2 hours.

_____

16. 8-2. How much time on average, would it take Commuter #2 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

17. If Over 2 Hours for Question 8-2, Specify Here

leave blank if your answer for Question 8-2, is under 2 hours.

_____

Skip to question 34

Travel Home From Work/College

18. 8-1. How much time on average, would it take Commuter #1 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

19. If Over 2 Hours for Question 8-1, Specify Here

leave blank if your answer for Question 8-1, is under 2 hours.

_____

20. 8-2. How much time on average, would it take Commuter #2 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

21. If Over 2 Hours for Question 8-2, Specify Here

leave blank if your answer for Question 8-2, is under 2 hours.

_____

22. 8-3. How much time on average, would it take Commuter #3 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

23. If Over 2 Hours for Question 8-3, Specify Here

leave blank if your answer for Question 8-3, is under 2 hours.

_____

Skip to question 38

Travel Home From Work/College

24. 8-1. How much time on average, would it take Commuter #1 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

25. If Over 2 Hours for Question 8-1, Specify Here

leave blank if your answer for Question 8-1, is under 2 hours.

_____

26. 8-2. How much time on average, would it take Commuter #2 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

27. If Over 2 Hours for Question 8-2, Specify Here

leave blank if your answer for Question 8-2, is under 2 hours.

_____

28. 8-3. How much time on average, would it take Commuter #3 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

29. If Over 2 Hours for Question 8-3, Specify Here

leave blank if your answer for Question 8-3, is under 2 hours.

_____

30. 8-4. How much time on average, would it take Commuter #4 to travel home from work or college?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

31. If Over 2 Hours for Question 8-4, Specify Here

leave blank if your answer for Question 8-4, is under 2 hours.

_____

Skip to question 44

Preparation to leave Work/College

32. 9-1. Approximately how much time would it take Commuter #1 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

33. If Over 2 Hours for Question 9-1, Specify Here

leave blank if your answer for Question 9-1, is under 2 hours.

_____

Skip to question 52

Preparation to leave Work/College

34. 9-1. Approximately how much time would it take Commuter #1 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

35. If Over 2 Hours for Question 9-1, Specify Here

leave blank if your answer for Question 9-1, is under 2 hours.

_____

36. 9-2. Approximately how much time would it take Commuter #2 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

37. If Over 2 Hours for Question 9-2, Specify Here

leave blank if your answer for Question 9-2, is under 2 hours.

_____

Skip to question 52

Preparation to leave Work/College

38. 9-1. Approximately how much time would it take Commuter #1 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

39. If Over 2 Hours for Question 9-1, Specify Here

leave blank if your answer for Question 9-1, is under 2 hours.

_____

40. 9-2. Approximately how much time would it take Commuter #2 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

41. If Over 2 Hours for Question 9-2, Specify Here

leave blank if your answer for Question 9-2, is under 2 hours.

_____

42. 9-3. Approximately how much time would it take Commuter #3 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

43. If Over 2 Hours for Question 9-3, Specify Here

leave blank if your answer for Question 9-3, is under 2 hours.

_____

Skip to question 52

Preparation to leave Work/College

44. 9-1. Approximately how much time would it take Commuter #1 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

45. If Over 2 Hours for Question 9-1, Specify Here

leave blank if your answer for Question 9-1, is under 2 hours.

_____

46. 9-2. Approximately how much time would it take Commuter #2 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

47. If Over 2 Hours for Question 9-2, Specify Here

leave blank if your answer for Question 9-2, is under 2 hours.

_____

48. 9-3. Approximately how much time would it take Commuter #3 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

49. If Over 2 Hours for Question 9-3, Specify Here

leave blank if your answer for Question 9-3, is under 2 hours.

_____

50. 9-4. Approximately how much time would it take Commuter #4 to prepare to leave work or college prior to starting the trip home?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-10 MINUTES
- 11-15 MINUTES
- 16-20 MINUTES
- 21-25 MINUTES
- 26-30 MINUTES
- 31-35 MINUTES
- 36-40 MINUTES
- 41-45 MINUTES
- 46-50 MINUTES
- 51-55 MINUTES
- 56 - 1 HOUR
- OVER 1 HOUR, BUT LESS THAN 1 HOUR 15 MINUTES
- BETWEEN 1 HOUR 16 MINUTES AND 1 HOUR 30 MINUTES
- BETWEEN 1 HOUR 31 MINUTES AND 1 HOUR 45 MINUTES
- BETWEEN 1 HOUR 46 MINUTES AND 2 HOURS
- OVER 2 HOURS
- DECLINE TO STATE

51. If Over 2 Hours for Question 9-4, Specify Here

leave blank if your answer for Question 9-4, is under 2 hours.

_____

Skip to question 52

Additional Questions

52. 10. If you were directed by local authorities to evacuate, how much time would it take the household to pack clothing, pets, medications, secure the house, load the car, and complete preparations prior to evacuating the area?

Mark only one oval.

- LESS THAN 15 MINUTES
- 15-30 MINUTES
- 31-45 MINUTES
- 46 MINUTES - 1 HOUR
- 1 HOUR TO 1 HOUR 15 MINUTES
- 1 HOUR 16 MINUTES TO 1 HOUR 30 MINUTES
- 1 HOUR 31 MINUTES TO 1 HOUR 45 MINUTES
- 1 HOUR 46 MINUTES TO 2 HOURS
- 2 HOURS TO 2 HOURS 15 MINUTES
- 2 HOURS 16 MINUTES TO 2 HOURS 30 MINUTES
- 2 HOURS 31 MINUTES TO 2 HOURS 45 MINUTES
- 2 HOURS 46 MINUTES TO 3 HOURS
- 3 HOURS TO 3 HOURS 15 MINUTES
- 3 HOURS 16 MINUTES TO 3 HOURS 30 MINUTES
- 3 HOURS 31 MINUTES TO 3 HOURS 45 MINUTES
- 3 HOURS 46 MINUTES TO 4 HOURS
- 4 HOURS TO 4 HOURS 15 MINUTES
- 4 HOURS 16 MINUTES TO 4 HOURS 30 MINUTES
- 4 HOURS 31 MINUTES TO 4 HOURS 45 MINUTES
- 4 HOURS 46 MINUTES TO 5 HOURS
- 5 HOURS TO 5 HOURS 30 MINUTES
- 5 HOURS 31 MINUTES TO 6 HOURS
- OVER 6 HOURS
- WILL NOT EVACUATE
- DECLINE TO STATE

53. If Over 6 Hours for Question 10, Specify Here

leave blank if your answer for Question 10, is under 6 hours.

54. 11. Please specify the number of people in your household who require Special Transportation needs in an evacuation:

Mark only one oval per row.

	0	1	2	3	4	More than 4
Bus						
Medical Bus/Van						
Wheelchair Accessible Vehicle						
Ambulance						
Other						

55. Specify "Other" Transportation Need Below

56. 12. Please choose one of the following:

Mark only one oval.

- I would await the return of household members to evacuate together.
- I would evacuate independently and meet other household members later.
- Decline to State

57. 13A. During an emergency, officials direct you to stay off the roads and stay tuned for more information because you are not in the area of risk. Would you:

Mark only one oval.

- STAY OFF THE ROADS AND STAY TUNED
- EVACUATE
- DECLINE TO STATE

58. 13B. During an emergency, officials direct you to stay off the roads and stay tuned to allow other areas to evacuate. Would you:

Mark only one oval.

- STAY OFF THE ROADS AND STAY TUNED
- EVACUATE
- DECLINE TO STATE

59. 13C. Emergency officials direct you to evacuate due to an emergency. Where would you evacuate to?

Mark only one oval.

- A RELATIVE'S OR FRIEND'S HOME
- A RECEPTION CENTER OR SHELTER
- A HOTEL, MOTEL OR CAMPGROUND
- A SECOND/SEASONAL HOME
- WOULD NOT EVACUATE
- DON'T KNOW
- OTHER (Specify Below)
- DECLINE TO STATE

60. Fill in OTHER answers for question 13C

_____

Service Animals

61. 14A. Do you have any service animal(s)?

Mark only one oval.

- YES
- NO *Skip to question 63*
- DECLINE TO STATE *Skip to question 63*

Skip to question 63

Service Animals

62. 14B. Do you have sufficient room in your vehicle to evacuate with your service animal(s)?

Mark only one oval.

- YES
- NO
- I WOULD NEED ASSISTANCE
- DECLINE TO STATE
- Other: _____

Skip to question 63

Pet Questions

63. 15A. Outside of a service animal, do you have any other pet(s) and/or animal(s)?

Mark only one oval.

- YES
- NO *Skip to question 70*
- DECLINE TO STATE *Skip to question 70*

Skip to question 70

Pet Questions

64. 15B. What type of pet(s) and/or animal(s) do you have?

Check all that apply.

- [ ] DOG
- [ ] CAT
- [ ] BIRD
- [ ] REPTILE
- [ ] HORSE
- [ ] FISH
- [ ] CHICKEN
- [ ] GOAT
- [ ] PIG
- [ ] OTHER SMALL PETS/ANIMALS (Specify Below)
- [ ] OTHER LARGE PETS/ANIMALS (Specify Below)
- [ ] Other: _____

65.

Mark only one oval.

- DECLINE TO STATE

Pet Questions

66. 15C. What would you do with your pet(s) and/or animal(s) if you were directed to evacuate?

Mark only one oval.

- TAKE PET(S) WITH ME TO A SHELTER
- TAKE PET(S) WITH ME SOMEWHERE ELSE
- LEAVE PET(S) AT HOME *Skip to question 70*
- DECLINE TO STATE *Skip to question 70*

Pet Questions

67. 15D. Do you have sufficient room in your vehicle(s) to evacuate with your pet(s) and/or animal(s)?

Mark only one oval.

- YES
- NO
- YES WITH A TRAILER
- I WOULD NEED ASSISTANCE
- DECLINE TO STATE
- Other: _____

Pet Questions

68. 15E. How long would it take for you to pack up your pets?

Mark only one oval.

- 5 MINUTES OR LESS
- 6-15 MINUTES
- 16-25 MINUTES
- 26-35 MINUTES
- 36-45 MINUTES
- 46-55 MINUTES
- OVER 1 HOUR
- DECLINE TO STATE

69. If Over 1 Hour for Question 15E, Specify Here

leave blank if your answer for Question 15E is under 1 hour.

_____

2020 Census Validation

70. 16. What is your gender?

The purpose of this question is to crosscheck the validity of the survey responses against the 2020 U.S. Census.

Mark only one oval.

- Male
- Female
- Decline to State
- Other: _____

APPENDIX G

Traffic Management Plan

G. TRAFFIC MANAGEMENT PLAN

NUREG/CR-7002, Rev. 1 indicates that the existing traffic control points (TCPs) and access control points (ACPs) identified by the offsite agencies should be used in the evacuation simulation modeling. The traffic control plans for the EPZ were provided by San Luis Obispo County.

These traffic management plans (TMP) were reviewed and the TCPs were modeled accordingly. Figure **G-1** maps the existing TCPs .

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, in accordance with Section 3.3 of NUREG/CR-7002, Rev. 1. TCPs at existing actuated traffic signalized intersections were essentially left alone except where modifications to green time allocation were deemed necessary.

Table K-1 provides the number of nodes with each control type. If the existing control was changed due to the point being a TCP, the control type is indicated as a TCP in Table K-1. The TCPs within the study area are mapped as blue dots in Figure **G-1**.

G.2 Access Control Points (ACPs)

It is assumed that ACPs will be established within 60 minutes of the Evacuation Order to discourage through travelers from using major through routes which traverse the EPZ. As discussed in Section 3.11, external traffic was only considered on two routes which traverse the EPZ – US-101 and SH 1 – in this analysis. The generation of these external trips ceased at 60 minutes after the Evacuation Order in the simulation.

According to the county emergency plans, the California Highway Patrol is responsible for developing the traffic control strategy and for overall management of the traffic control function.

As discussed in Section 9, no additional TCPs or ACPs are deemed necessary as a result of this study.

G.3 Analysis of Key TCP Locations

TCPs are forms of manual traffic control (MTC). As discussed in Section 5.2 of NUREG/CR-7002, Rev. 1, MTC at intersections could benefit from ETE analysis. The TCP locations contained within the traffic management plan were analyzed to determine key locations where MTC would be most useful and can be readily implemented. As previously mentioned, signalized intersections that were actuated based on field data collection were essentially left as actuated traffic signals in the model, with modifications to green time allocation as needed. Other controlled

intersections (pre-timed signals, stop signs and yield signs) were changed to actuated traffic signals to represent the MTC that would be implemented according to the traffic management plan.

The majority of the TCPs identified in the TMP were located at intersections with actuated signals or intersections without control. Table G-1 shows a list of the controlled intersections that were identified as TCPs in the TMP that were not previously actuated signals, including the type of control that currently exists at each location. To determine the impact of MTC at these locations, a winter, midweek, midday, good weather scenario (Scenario 6) evacuation of the Full EPZ (Region R04) was simulated wherein these intersections were left as is (without MTC). The results were compared to the results presented in Section 7. Although localized congestion worsened, as shown in Table G-2, the ETE did not change at both the 90th and 100th percentile when MTC was not present at these intersections. The remaining TCPs were left as actuated signals in the model and, therefore, had no impact to ETE.

Most of the TCPs in the study area are located along US-101 and SH-1, as shown in Figure **G-1**. As discussed in Section 7.3, the main thoroughfare on US 101 and SH-1 are operating at LOS F for several hours, as shown in Figures 7-3 through 7-11. Positioning police officers at ramps and intersections to facilitate access to these roadways would have minimal benefit as the main thoroughfare is already heavily congested.

Although there is no reduction in ETE when MTC is implemented, traffic control can be beneficial in the reduction of localized congestion and driver confusion and can be extremely helpful for fixed point surveillance, amongst other things. Should there be a shortfall of personnel to staff the TCPs, the list of locations provided in Table G-1 could be considered as priority locations when implementing the TMP as all other TCPs already have actuated traffic signals which would mimic MTC.

Table G-1. List of Key TCP Locations

TCP #	Node #	Previous Control
NC-4	973	Stop Control
NC-10	174	Stop Control
NC-12	78	Stop Control
NC-15	839	Stop Control
NC-22	1233	Stop Control
SC-4	908	Stop Control
SC-9	1017	Stop Control
SC-10	409	Stop Control
SC-23	493 & 702	Stop Control
SC-24	229	Stop Control
SC-25	447	Stop Control
SC-28	216 & 217	Stop Control
SC-29	219	Stop Control
SC-30	347	Stop Control
SC-37	748	Stop Control
SLO-1	588	Stop Control
SLO-10	573	Stop Control
SLO-14	522	Stop Control
SLO-17	398	Stop Control
SLO-23	1090	Stop Control
SLO-25	1050	Stop Control

Table G-2. ETE with No MTC

Region	Scenario 6					
	90th Percentile ETE			100th Percentile ETE		
	Base	No MTC	Difference	Base	No MTC	Difference
R01 (2-Mile)	1:00	1:00	0:00	1:35	1:35	0:00
R02 (6-Mile)	1:15	1:15	0:00	4:50	4:50	0:00
R03 (10-Mile/FEMA EPZ)	3:00	3:00	0:00	4:55	4:55	0:00
R04 (Full EPZ)	9:10	9:10	0:00	11:05	11:05	0:00

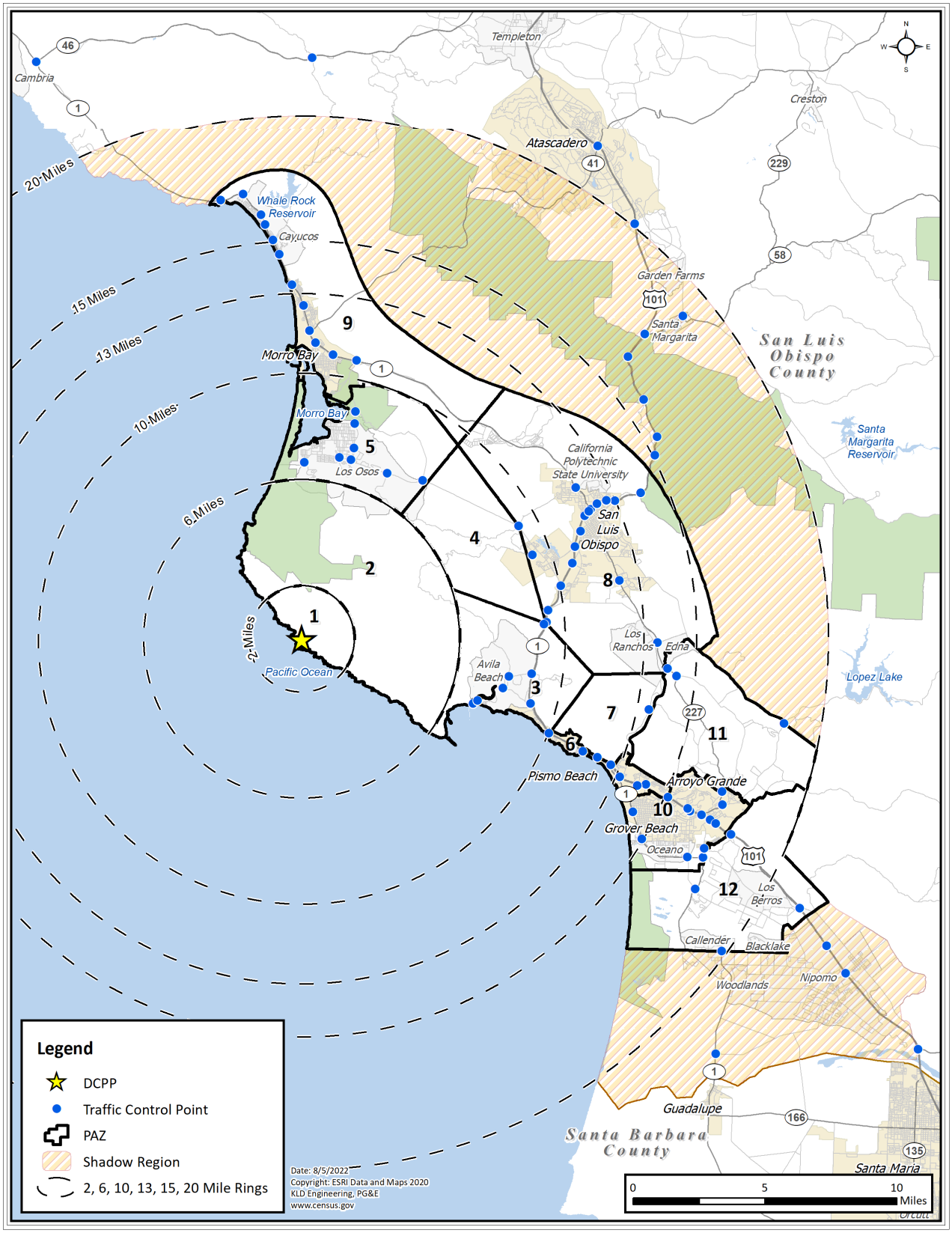


Figure G-1. Traffic Control Points for the DCPP Study Area

APPENDIX H

Evacuation Regions

H. EVACUATION REGIONS

This appendix presents the evacuation percentages for each Evacuation Region (Table H-1) and maps of all Evacuation Regions (Figure H-1 through Figure H-25). The percentages presented in Table H-1 are based on the methodology discussed in assumption 7 of Section 2.2 and shown in Figure 2-1. It should be noted that Region R18 involves the evacuation of PAZs 3 and 4 with a voluntary evacuation in all other PAZs except PAZ 1 and 2. Similarly, Region R19 involves the evacuation of PAZs 4 and 5 with a voluntary evacuation in all other PAZs except PAZ 1 and 2. For these regions, it is assumed that PAZs 1 and 2 have already evacuated prior to the Evacuation Order and therefore, no one is evacuating from within these PAZs.

Note the baseline ETE study assumes 20 percent of households will not comply with the monitor and prepare advisory, as per Section 2.5.2 of NUREG/CR-7002, Rev. 1.

Table H-1. Percent of PAZ Population Evacuating for Each Region

Region	Description	PAZ 1	2	3	4	5	6	7	8	9	10	11	12
R01	2-Mile Ring	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R02	6-Mile Ring (similar to the FEMA 5-mile ring)	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
R03	FEMA EPZ	100%	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%
R04	Full EPZ	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Evacuate 2-Mile Radius and Downwind to 6 Miles													
Region	**Wind Direction From:**	**PAZ 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
-	ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW	**Refer to Region R02**											
-	N, NNE, NE, ENE, E	**Refer to Region R01**											
Evacuate 6-Mile Radius and Downwind to 10 miles/FEMA EPZ[1]													
Region	**Wind Direction From:**	**PAZ 1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R05	SE, SSE, S	100%	100%	20%	20%	100%	20%	20%	20%	20%	20%	20%	20%
R06	SSW	100%	100%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%
-	SW, WSW	**Refer to Region R03**											
R07	W, WNW	100%	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%
R08	NW, NNW	100%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%
-	N, NNE, NE, ENE, E, ESE	**Refer to Region R02**											

[1] The land based portions of the DCPP EPZ are divided into 12 Protective Action Zones (PAZs) defined by local geographic boundaries. For the purposes of computing ETE's, PAZs 1-5 represent the FEMA 10-mile EPZ. The local geographic boundaries for PAZs 1-5 encompass the majority of land-based regions within approximately 10 miles of DCPP, excluding portions of PAZs 8 and 9 that are within 10 miles of DCPP. PAZs 6-12 cover the areas beyond 10 miles from DCPP. ETEs are computed for all regions within the EPZ boundary.

Evacuate 6-Mile Radius and Downwind to EPZ Boundary													
Region	Wind Direction From:	PAZ											
		1	2	3	4	5	6	7	8	9	10	11	12
R09	SE, SSE, S	100%	100%	20%	20%	100%	20%	20%	20%	100%	20%	20%	20%
R10	SSW	100%	100%	20%	100%	100%	20%	20%	100%	100%	20%	20%	20%
R11	SW	100%	100%	100%	100%	100%	20%	20%	100%	100%	20%	20%	20%
R12	WSW	100%	100%	100%	100%	100%	20%	100%	100%	100%	20%	100%	20%
R13	W, WNW	100%	100%	100%	100%	20%	100%	100%	100%	20%	100%	100%	100%
R14	NW	100%	100%	100%	20%	20%	100%	100%	20%	20%	100%	100%	100%
R15	NNW	100%	100%	100%	20%	20%	20%	20%	20%	20%	100%	20%	100%
-	N, NNE, NE, ENE, E, ESE	Refer to Region R02											
Site Specific Regions													
Region	Wind Direction From:	PAZ											
		1	2	3	4	5	6	7	8	9	10	11	12
R16	-	100%	100%	20%	100%	20%	20%	20%	20%	20%	20%	20%	20%
R17	-	100%	100%	100%	20%	20%	100%	20%	20%	20%	20%	20%	20%
R18	-	0%	0%	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%
R19	-	0%	0%	20%	100%	100%	20%	20%	20%	20%	20%	20%	20%
Advanced Emergency Classification, 100% of the PAZ(s) already evacuated					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 6 Miles													
Region	Wind Direction From:	PAZ											
		1	2	3	4	5	6	7	8	9	10	11	12
R20	ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, NNW	100%	100%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
-	N, NNE, NE, ENE, E	Refer to Region R01											
Shelter-in-Place until 90% ETE for **R01**, then Evacuate					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

Staged Evacuation - 6-Mile Radius Evacuates, then Evacuate Downwind to 10 Miles													
Region	**Wind Direction From:**	**PAZ**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
R21	SE, SSE, S	**100%**	**100%**	**20%**	**20%**	**100%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**
R22	SSW	**100%**	**100%**	**20%**	**100%**	**100%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**
R23	SW, WSW (% FEMA EPZ)	**100%**	**100%**	**100%**	**100%**	**100%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**
R24	W, WNW	**100%**	**100%**	**100%**	**100%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**
R25	NW, NNW	**100%**	**100%**	**100%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**	**20%**
-	N, NNE, NE, ENE, E, ESE	**Refer to Region R02**											
Shelter-in-Place until 90% ETE for **R02**, then Evacuate					PAZ(s) Monitor and Prepare						PAZ(s) Evacuate		

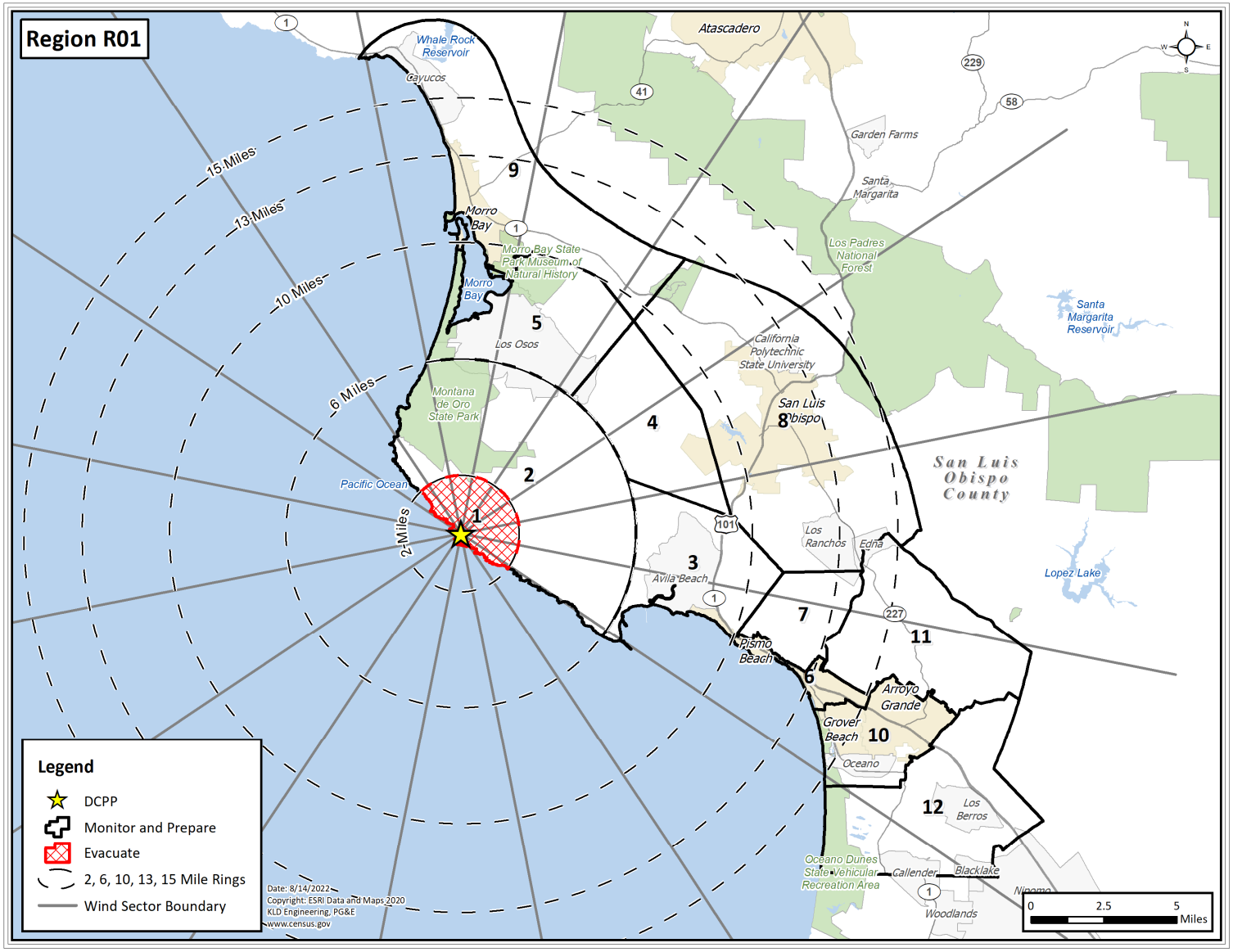


Figure H-1. Region R01

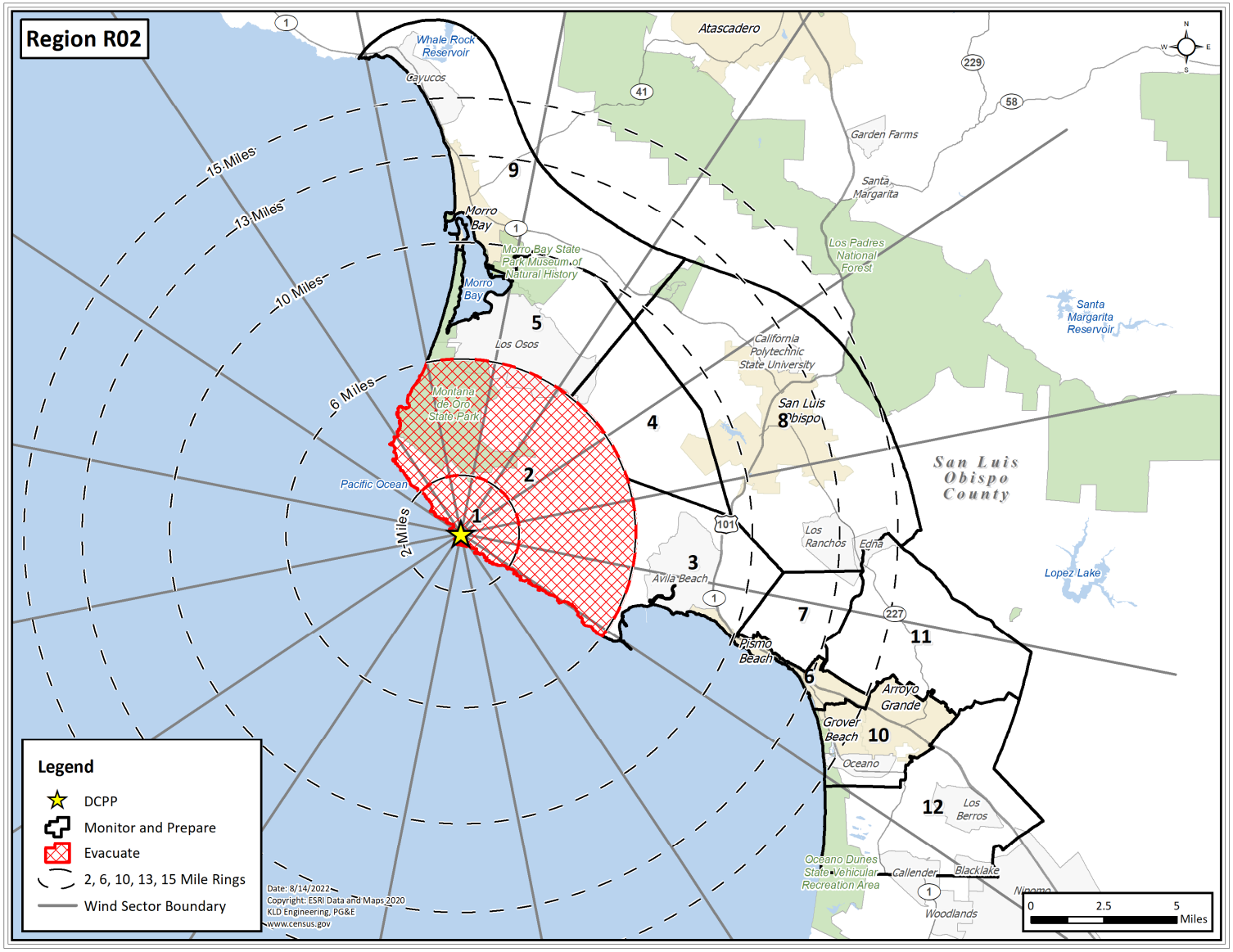


Figure H-2. Region R02

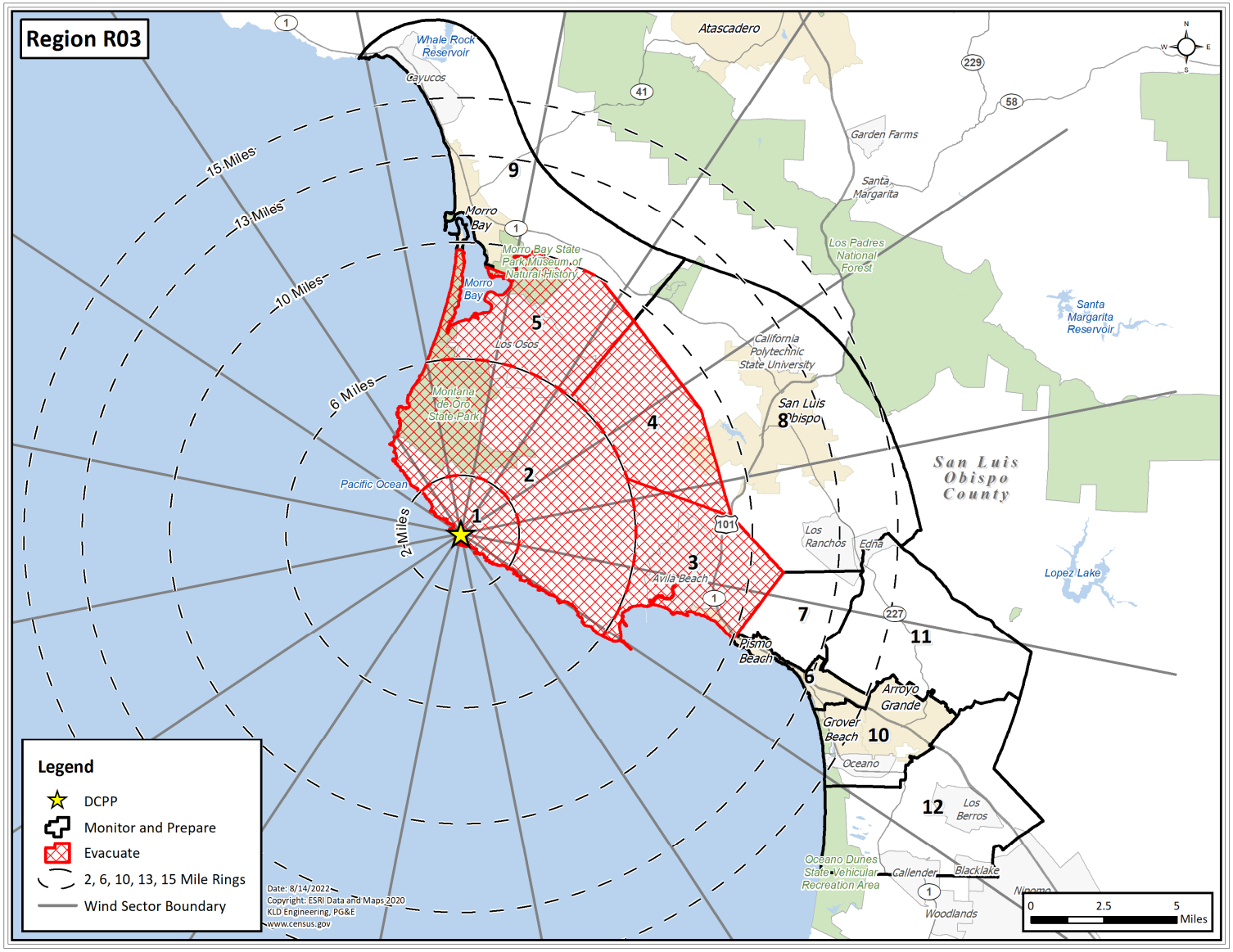


Figure H-3. Region R03

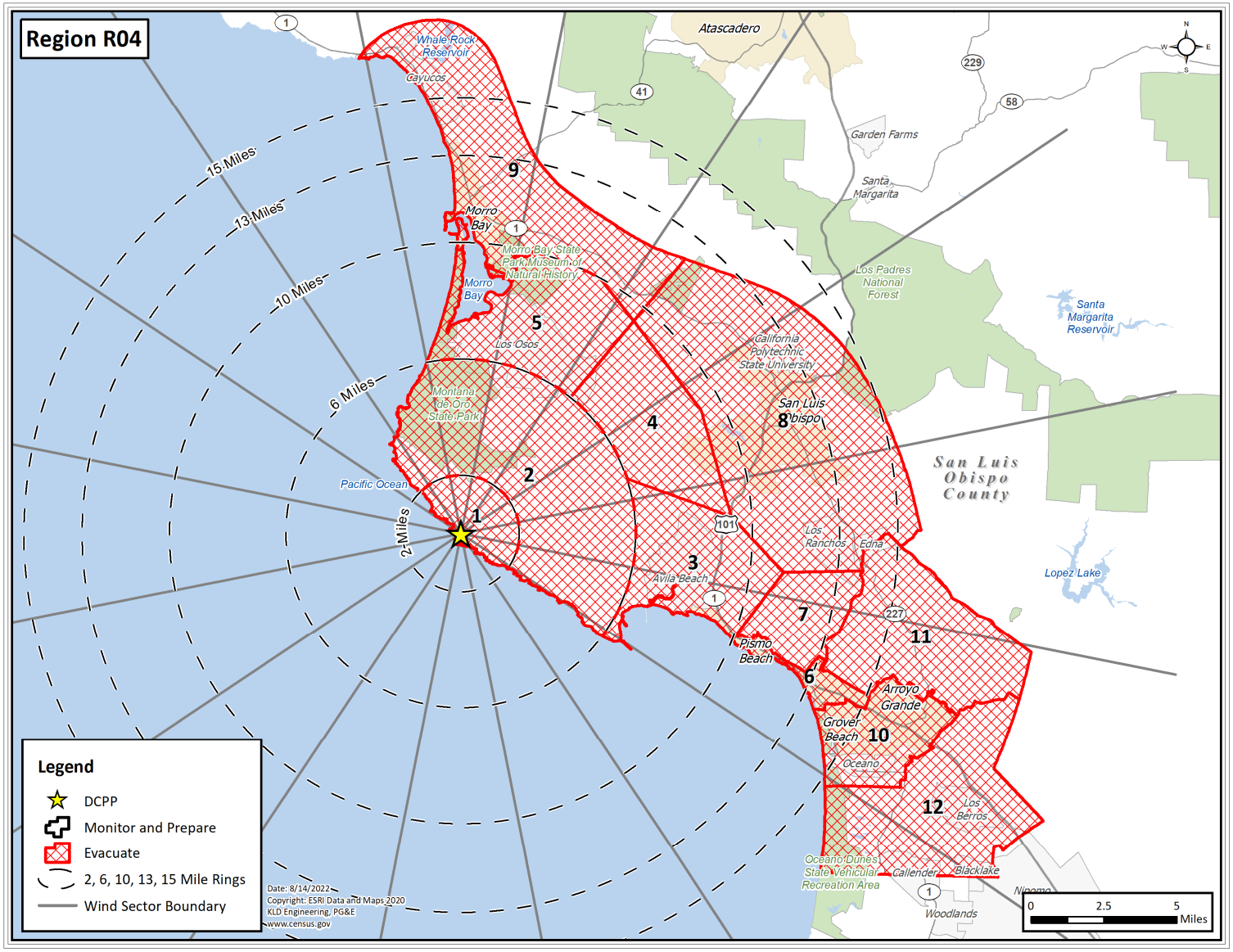


Figure H-4. Region R04

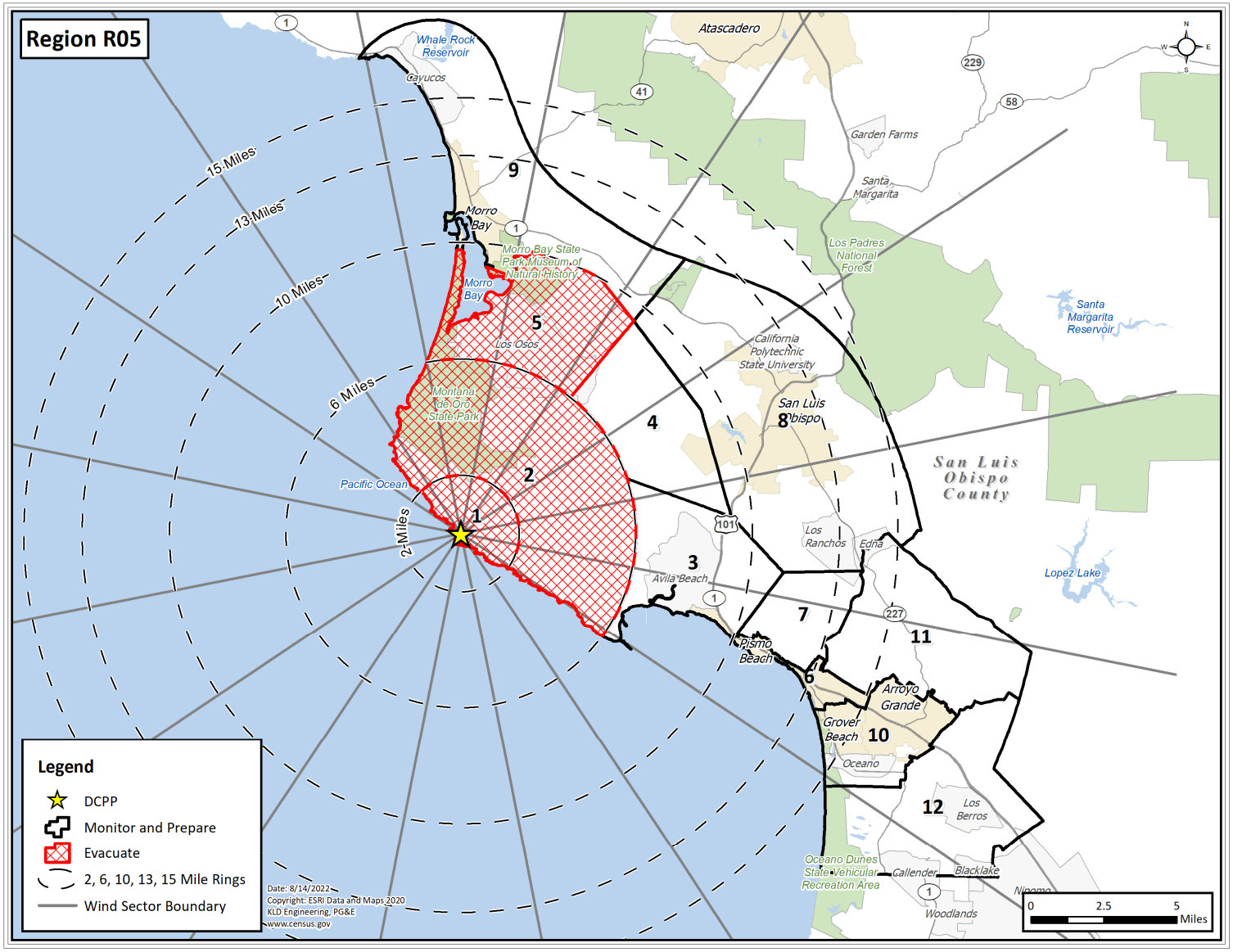


Figure H-5. Region R05

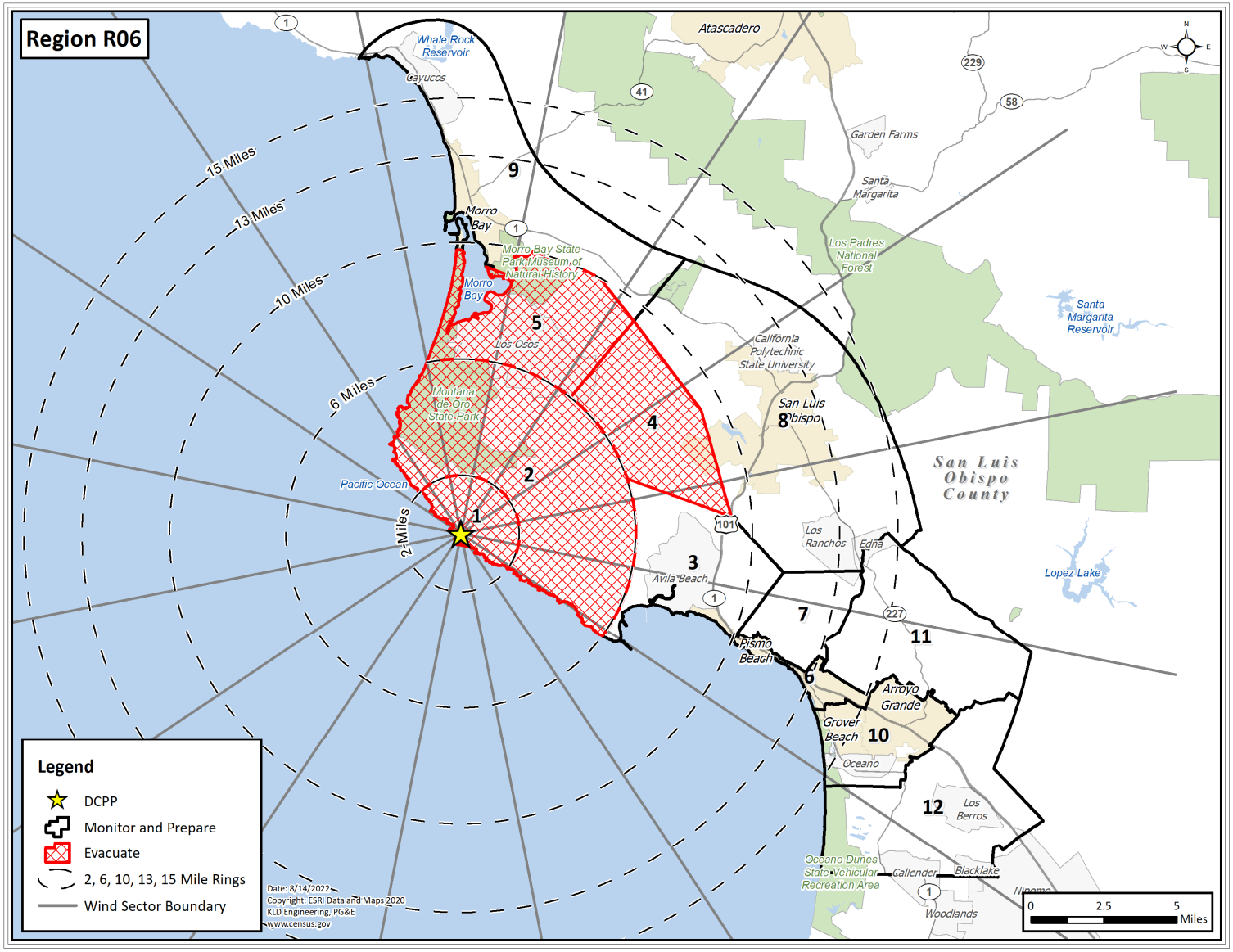


Figure H-6. Region R06

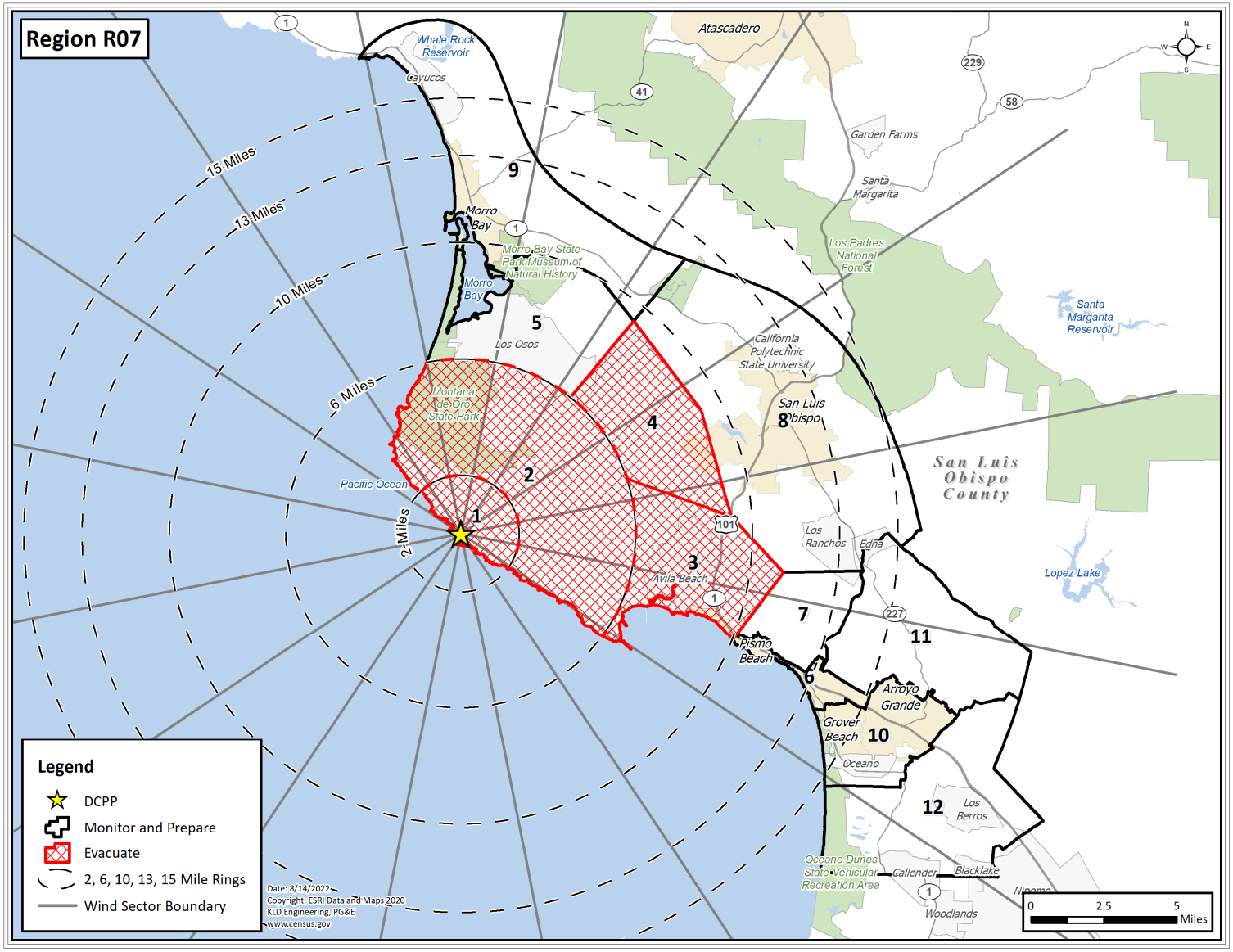


Figure H-7. Region R07

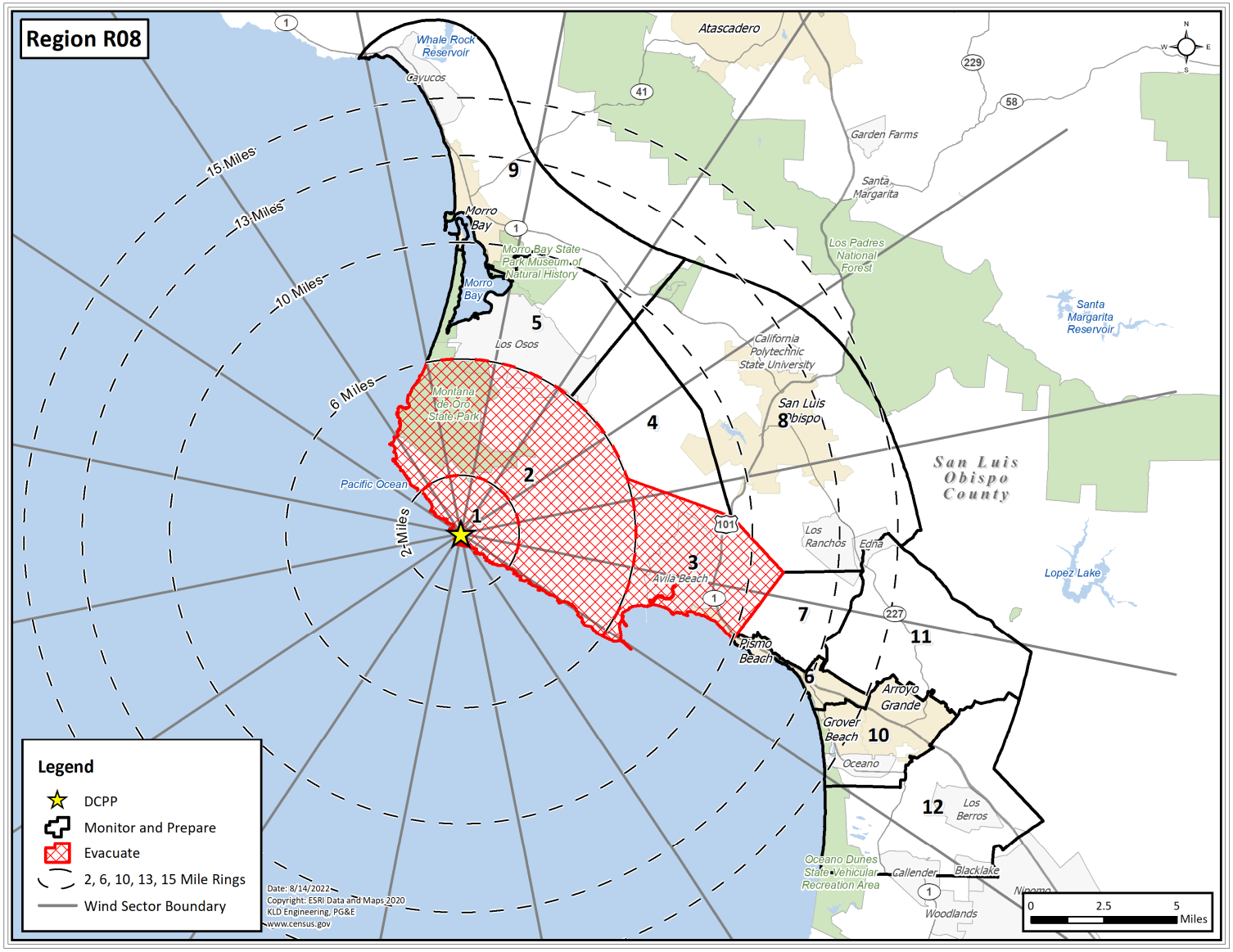


Figure H-8. Region R08

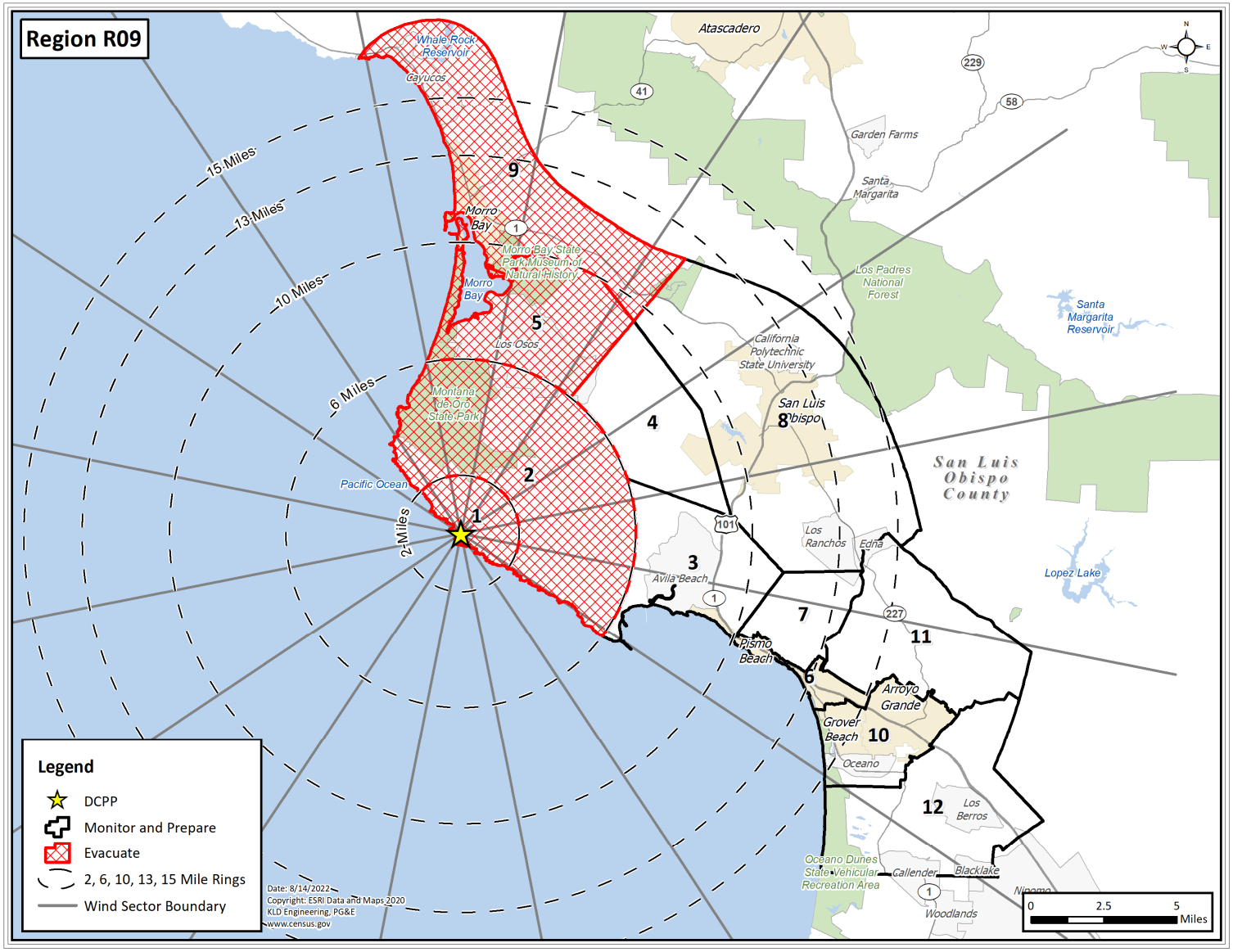


Figure H-9. Region R09

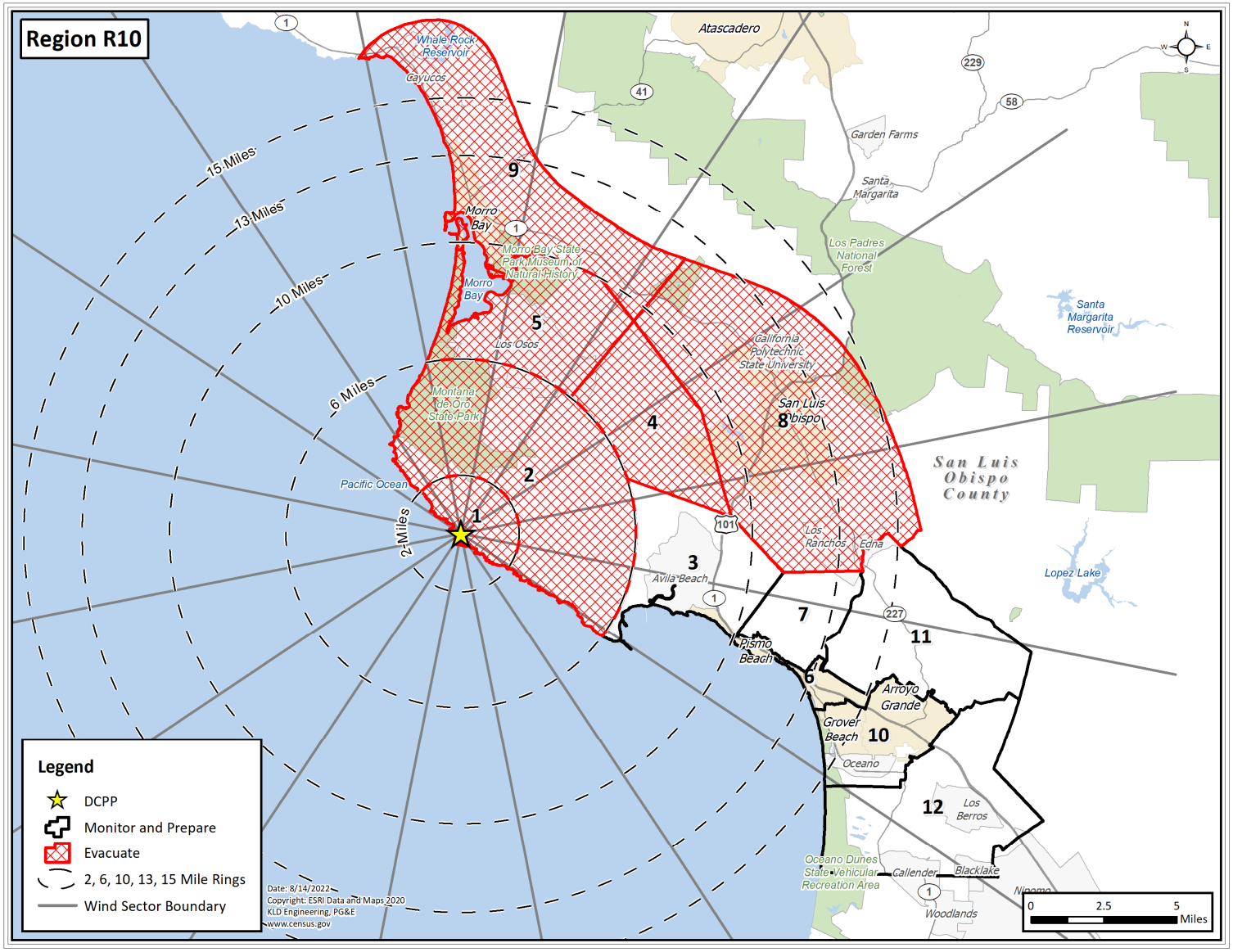


Figure H-10. Region R10

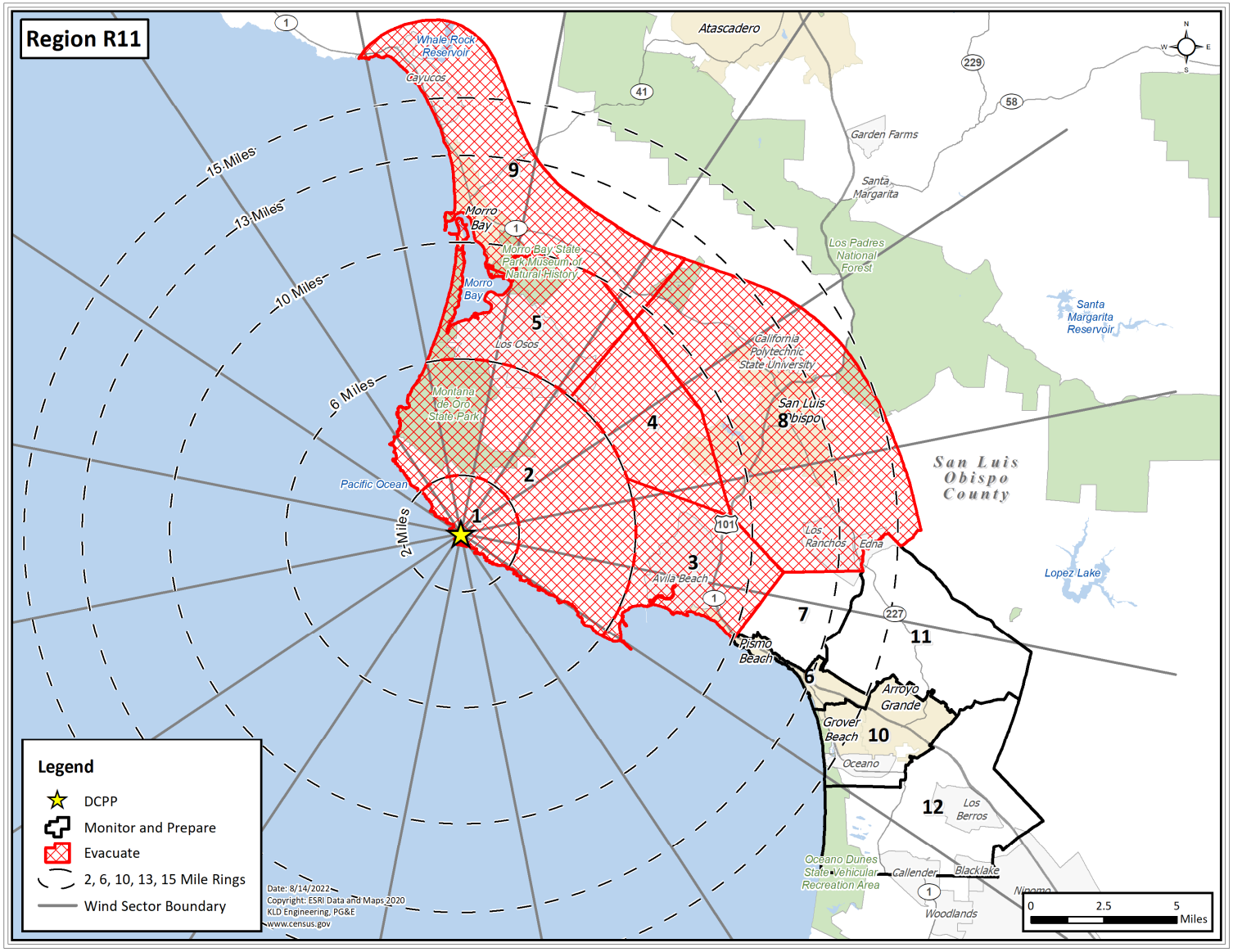


Figure H-11. Region R11

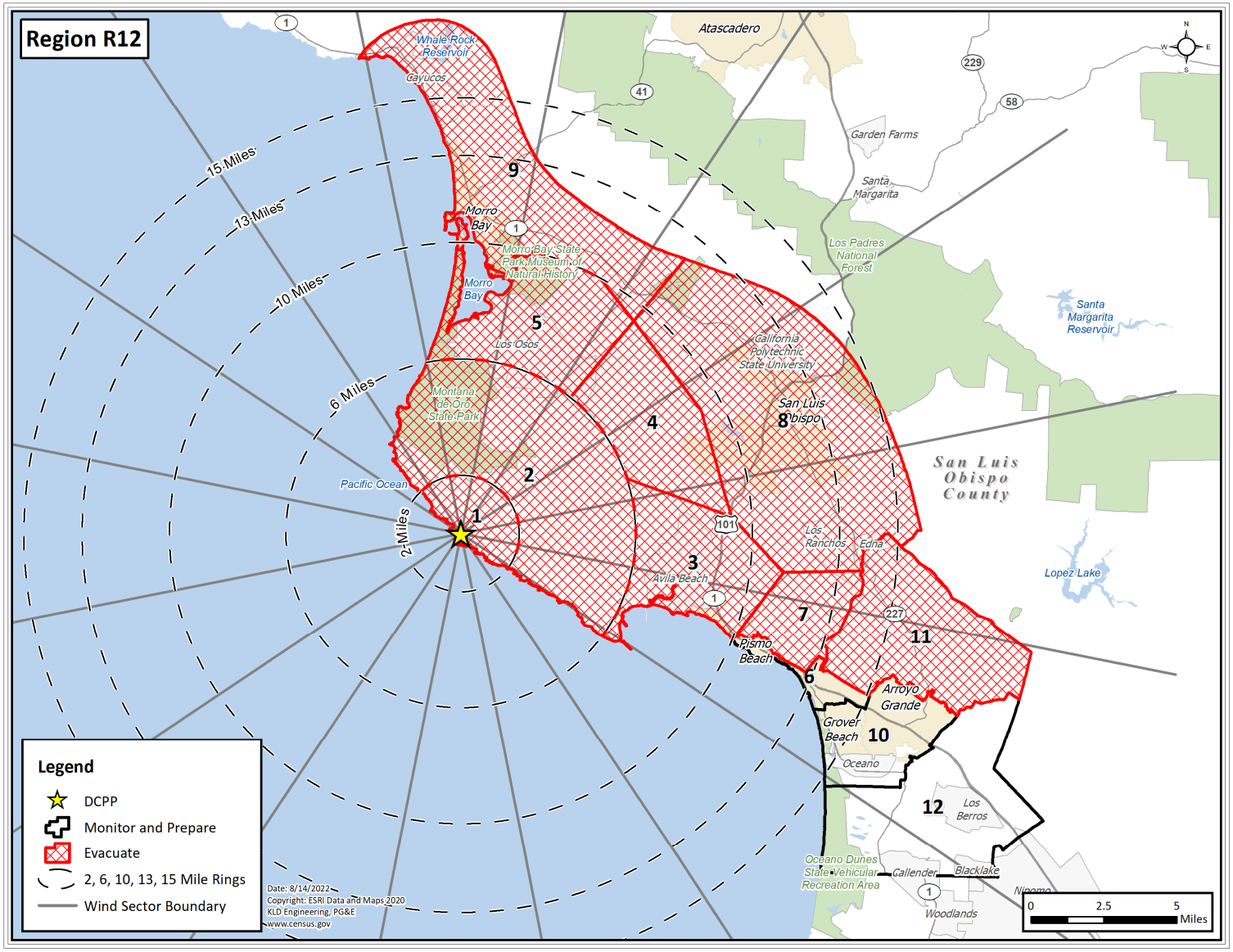


Figure H-12. Region R12

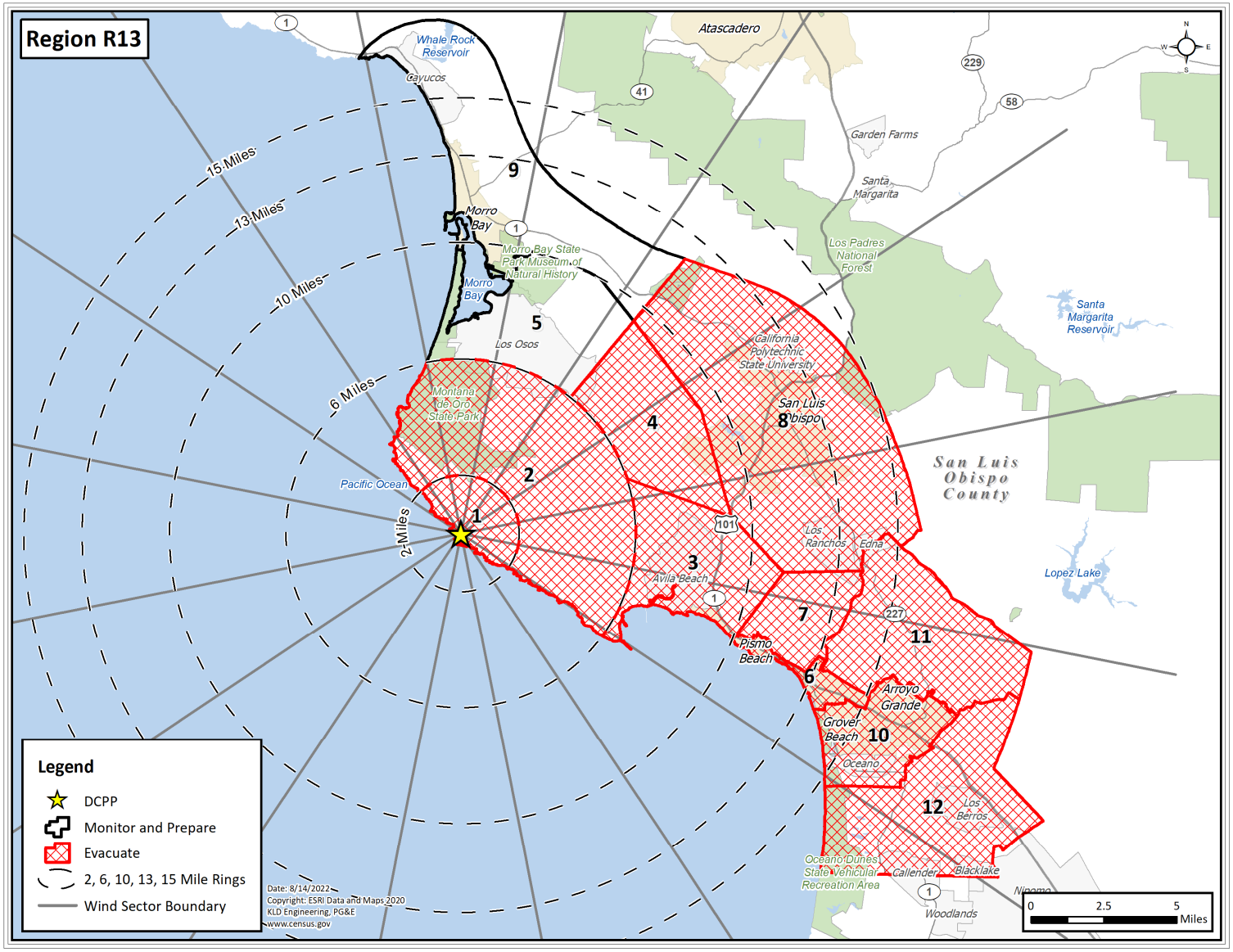


Figure H-13. Region R13

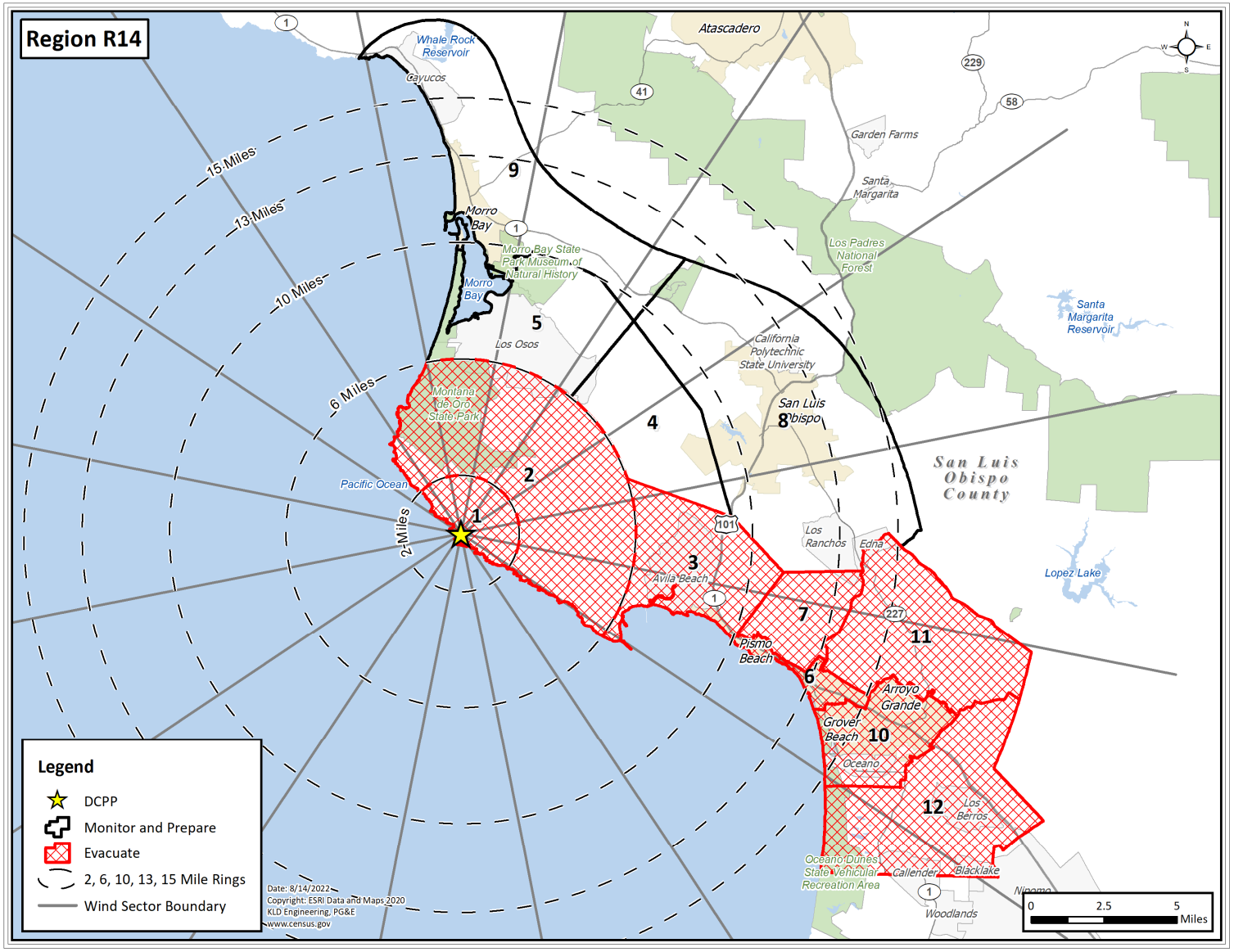


Figure H-14. Region R14

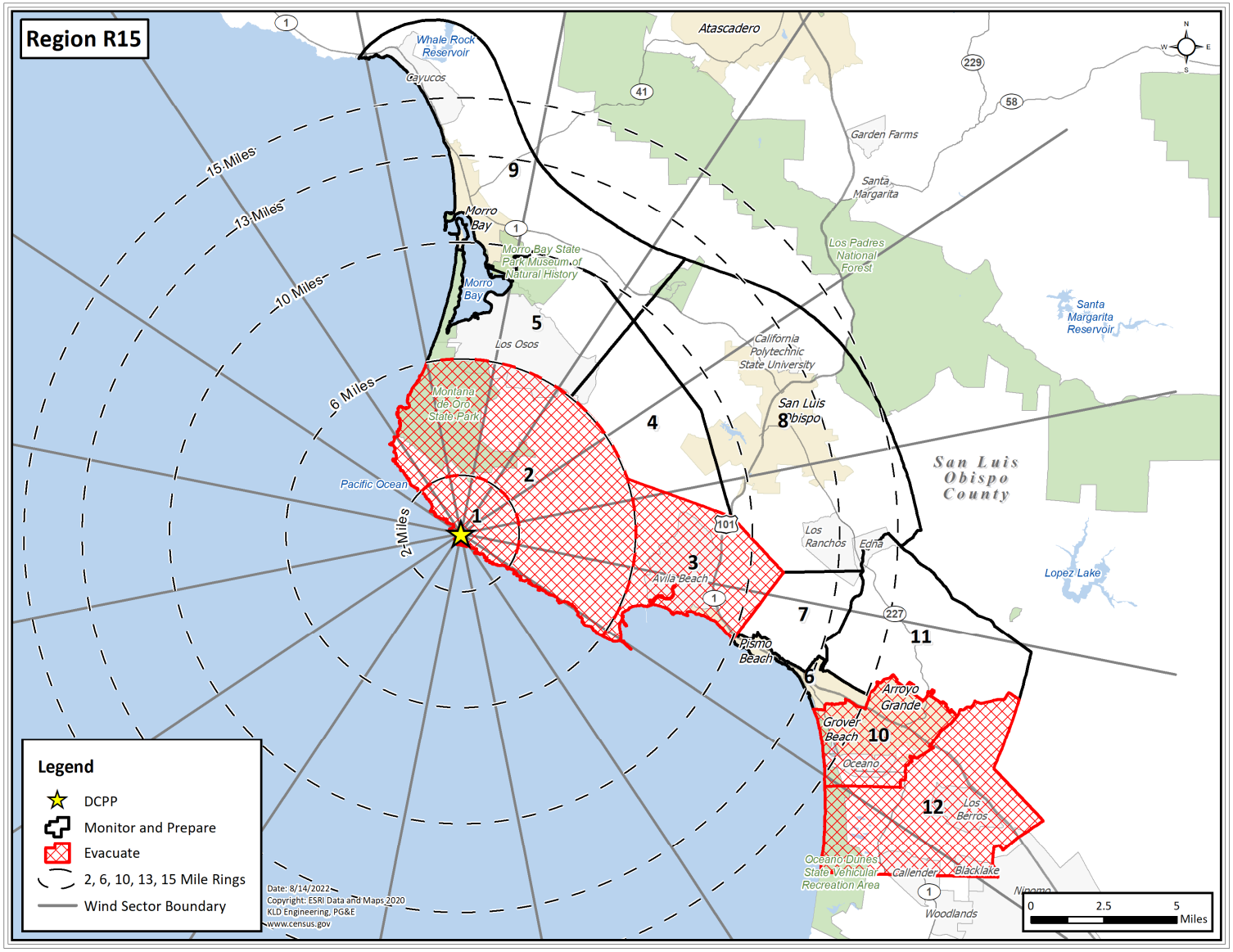


Figure H-15. Region R15

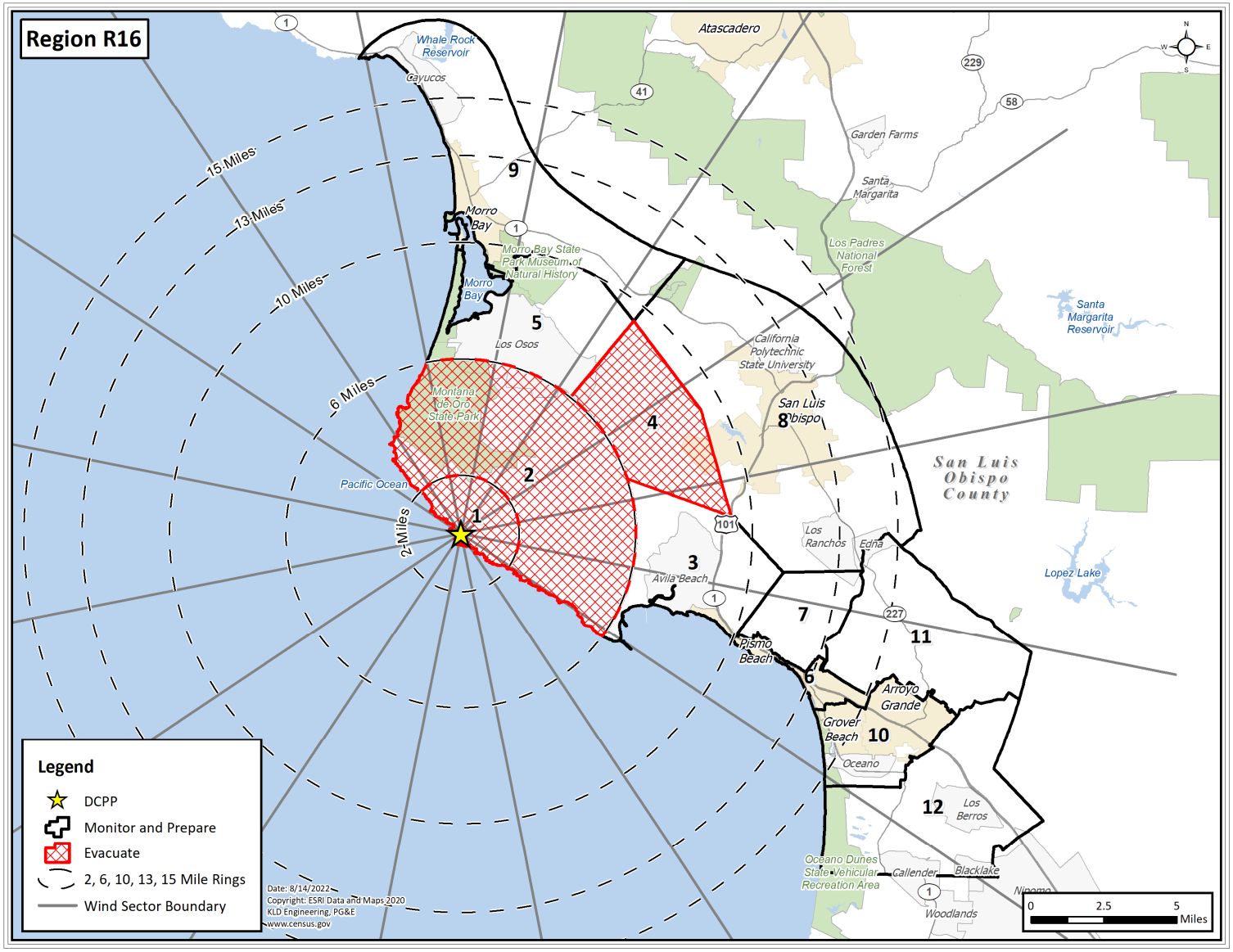


Figure H-16. Region R16

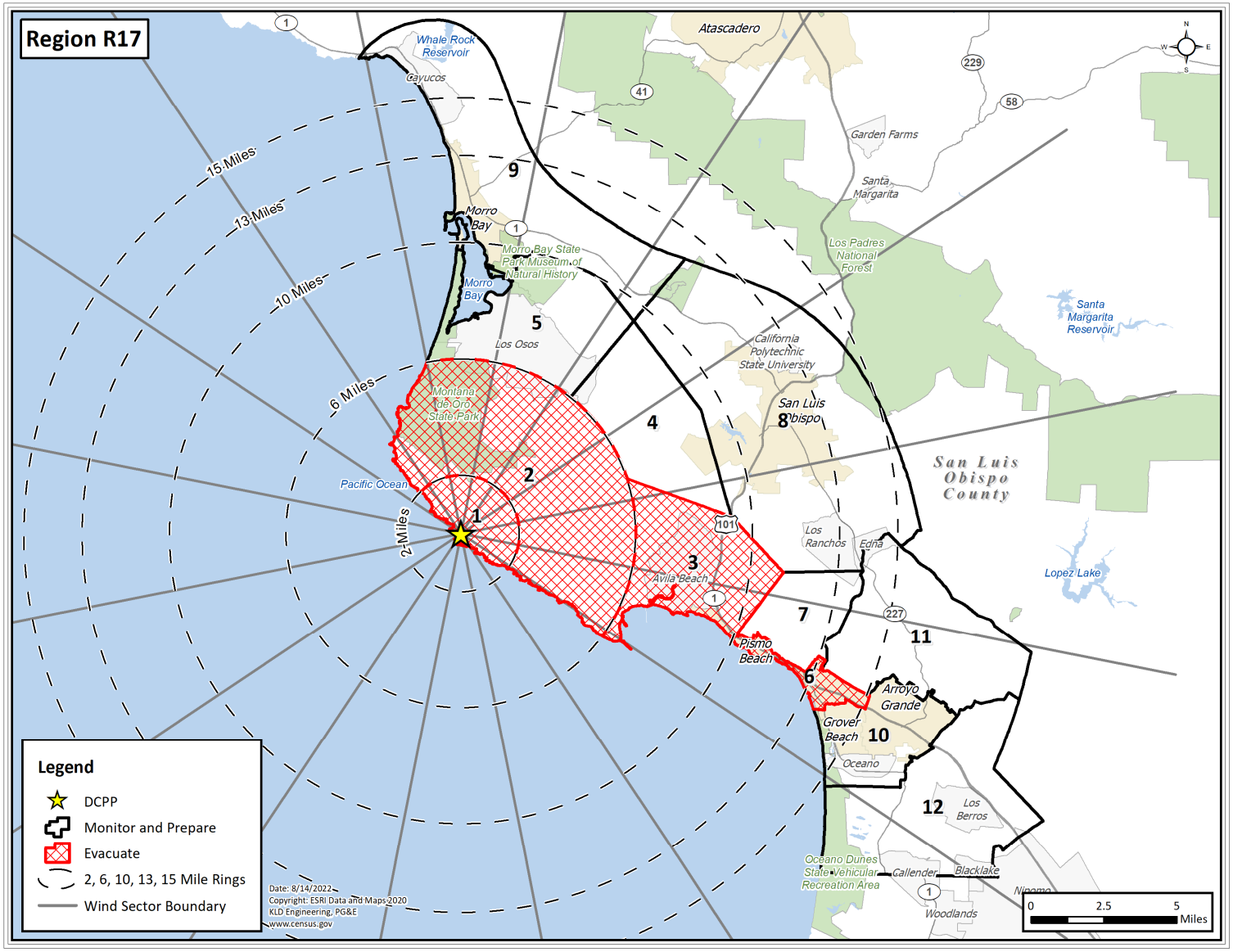


Figure H-17. Region R17

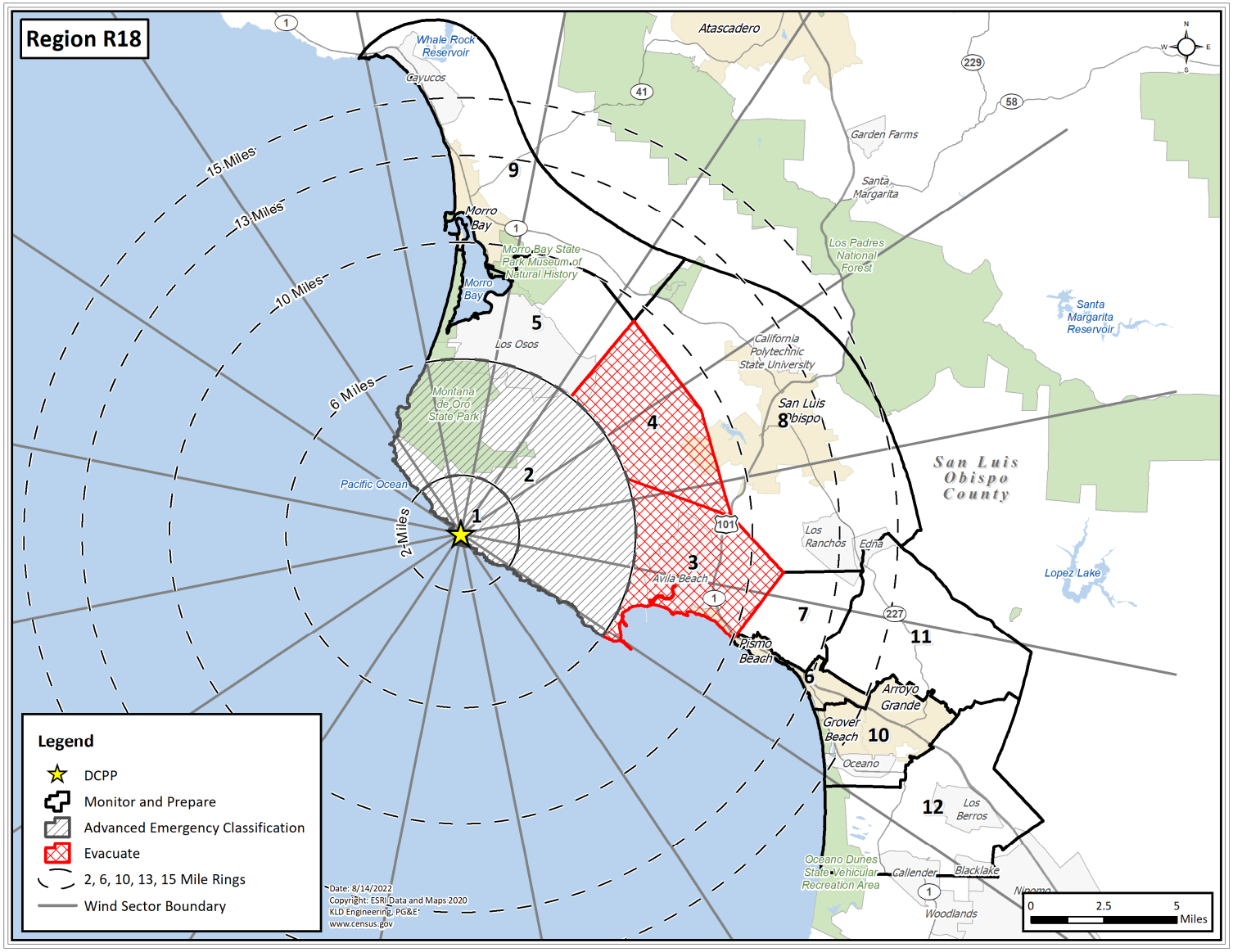


Figure H-18. Region R18

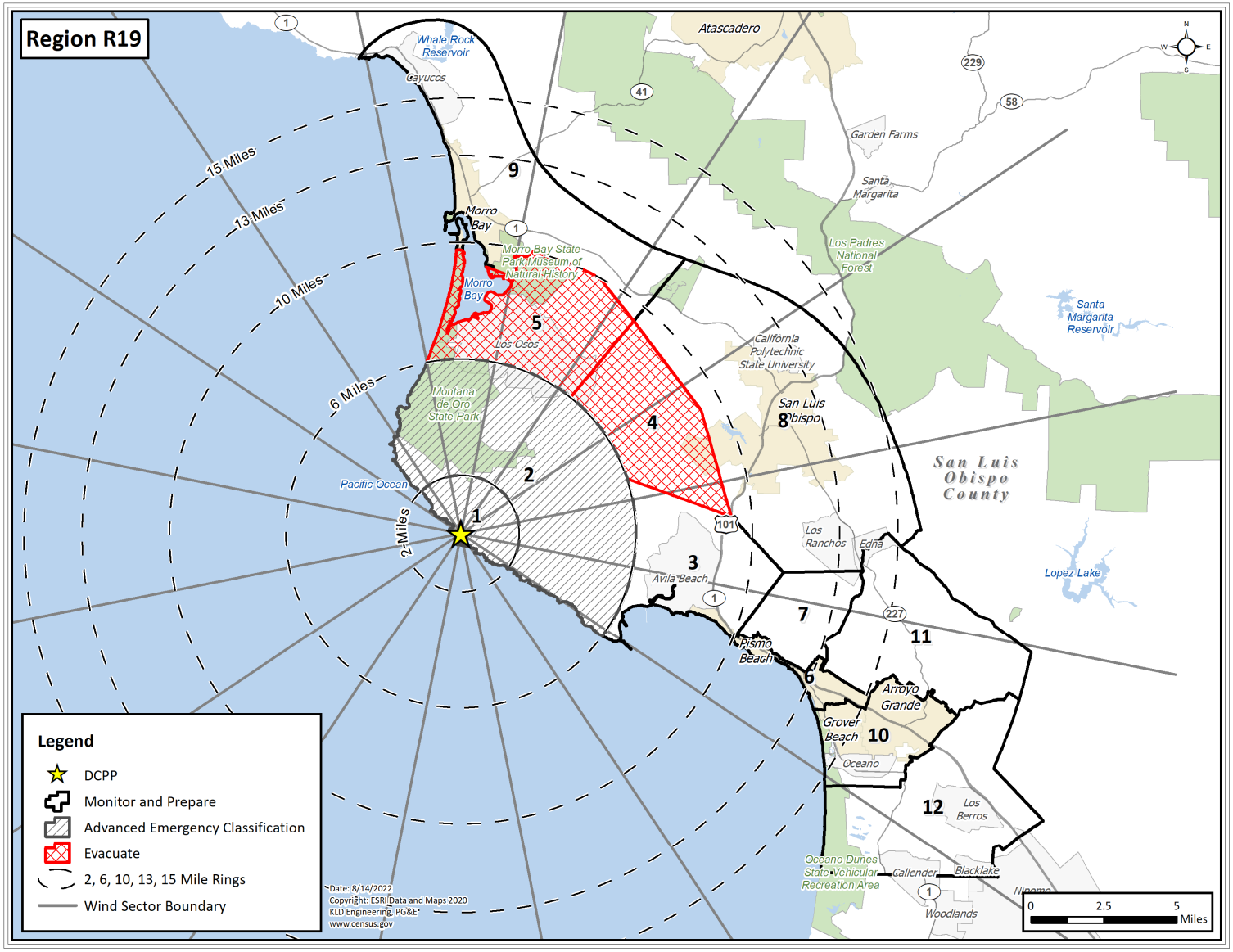


Figure H-19. Region R19

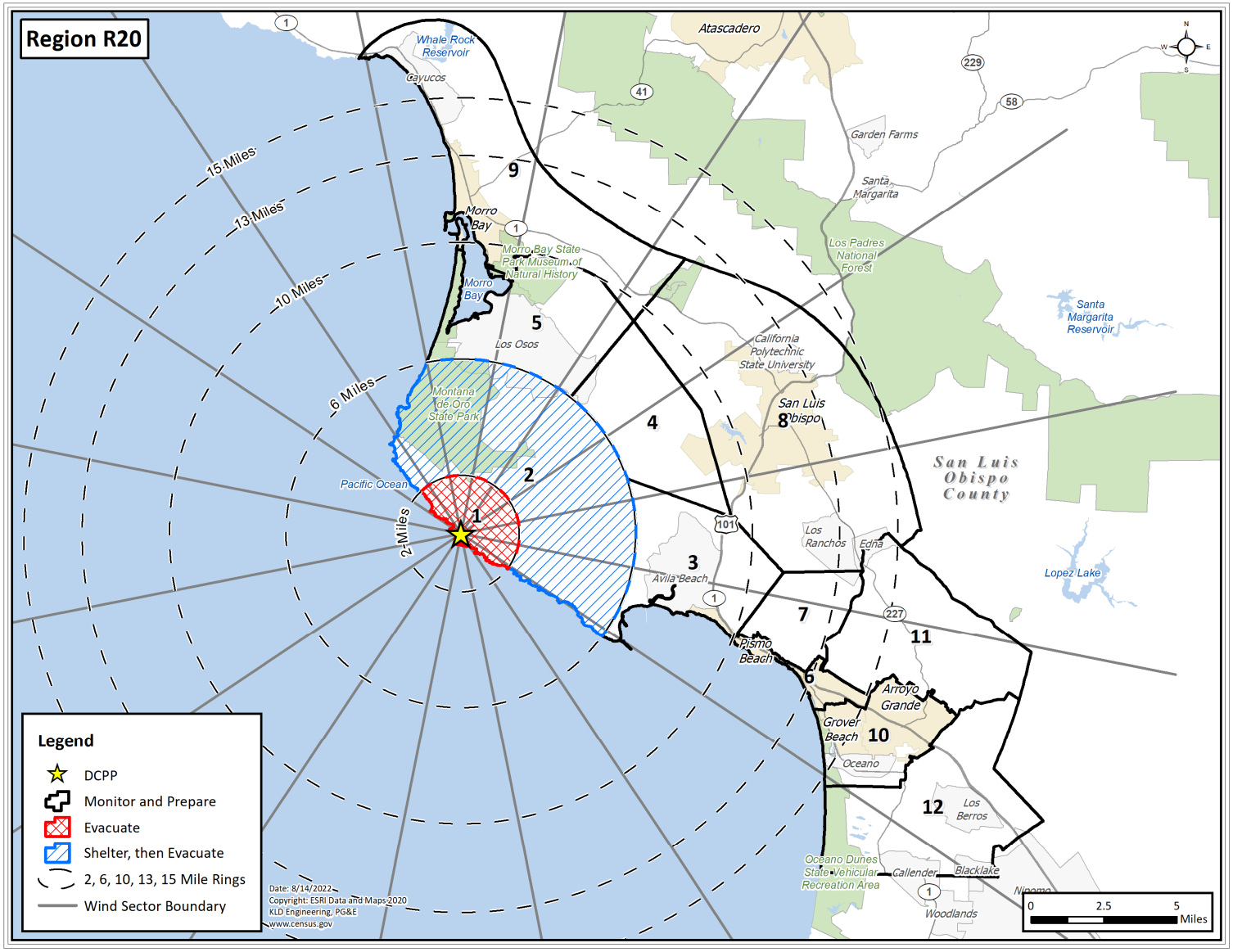


Figure H-20. Region R20

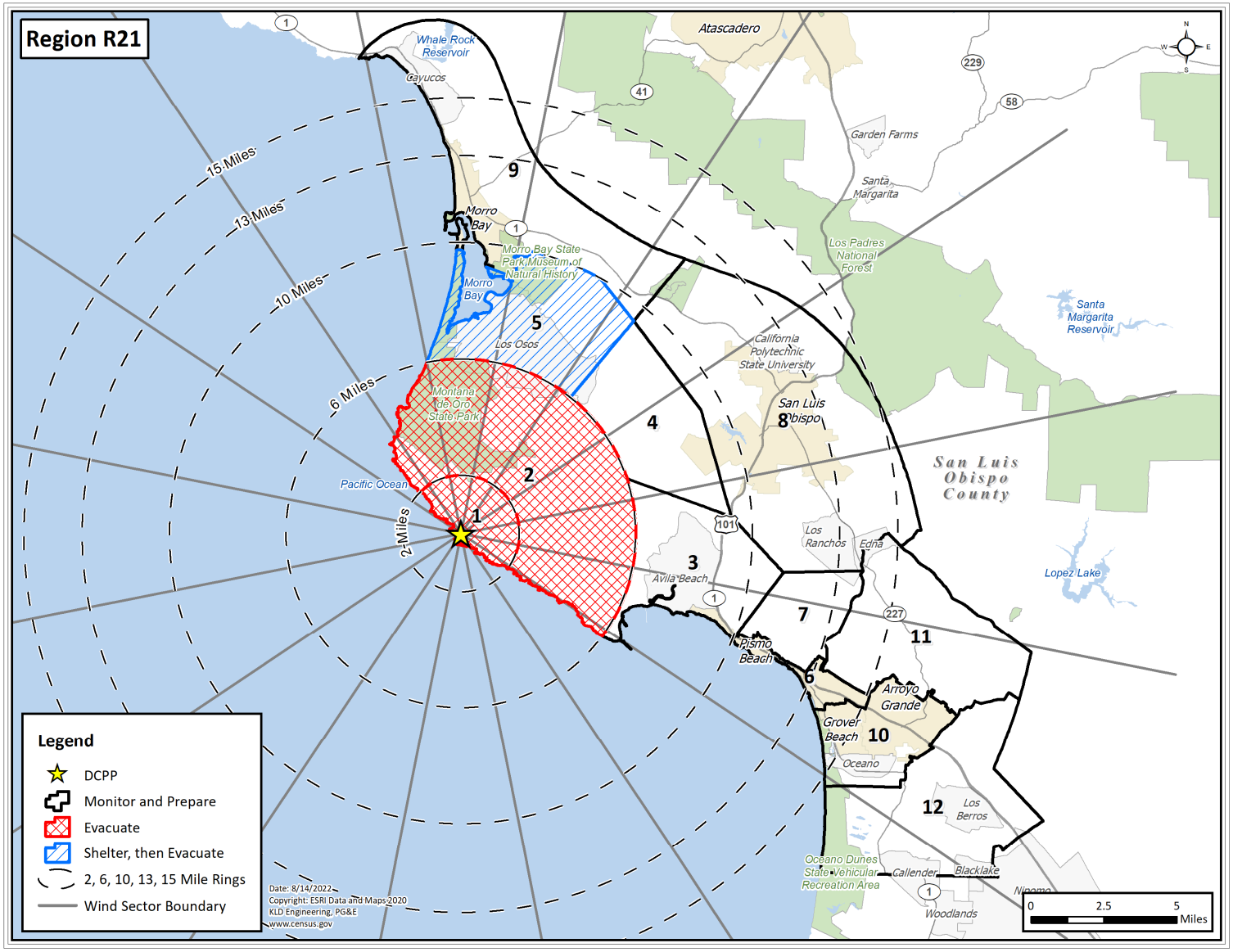


Figure H-21. Region R21

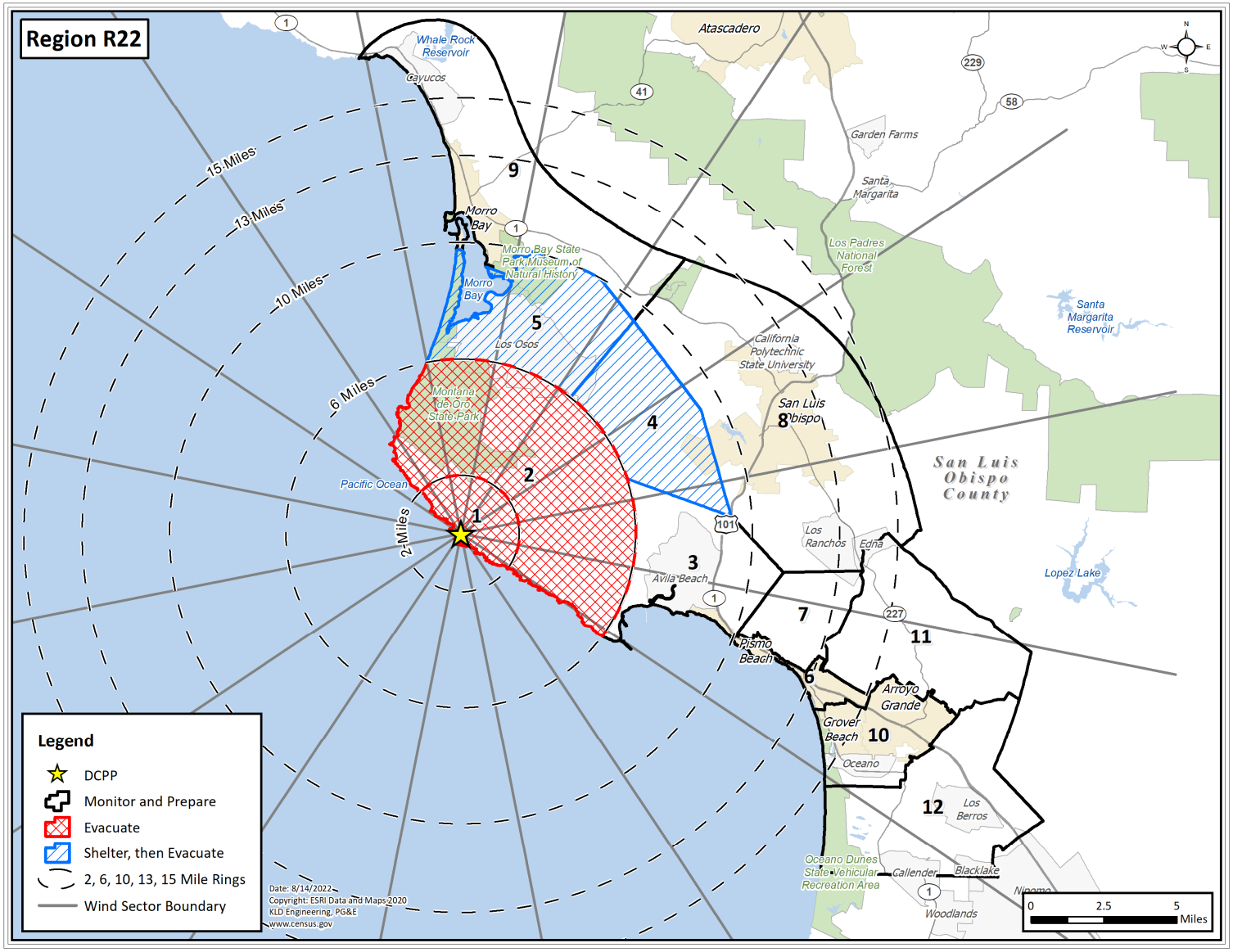


Figure H-22. Region R22

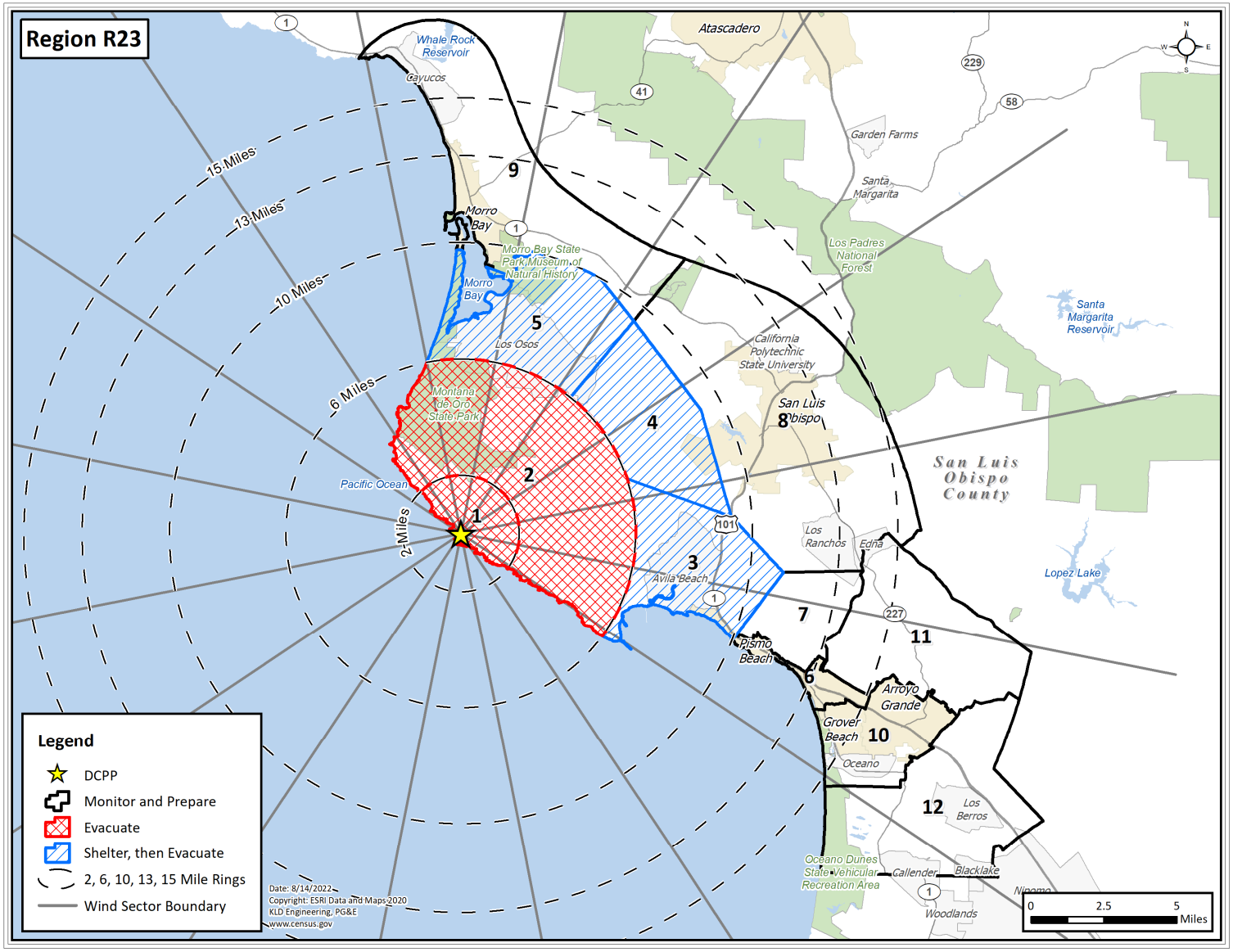


Figure H-23. Region R23

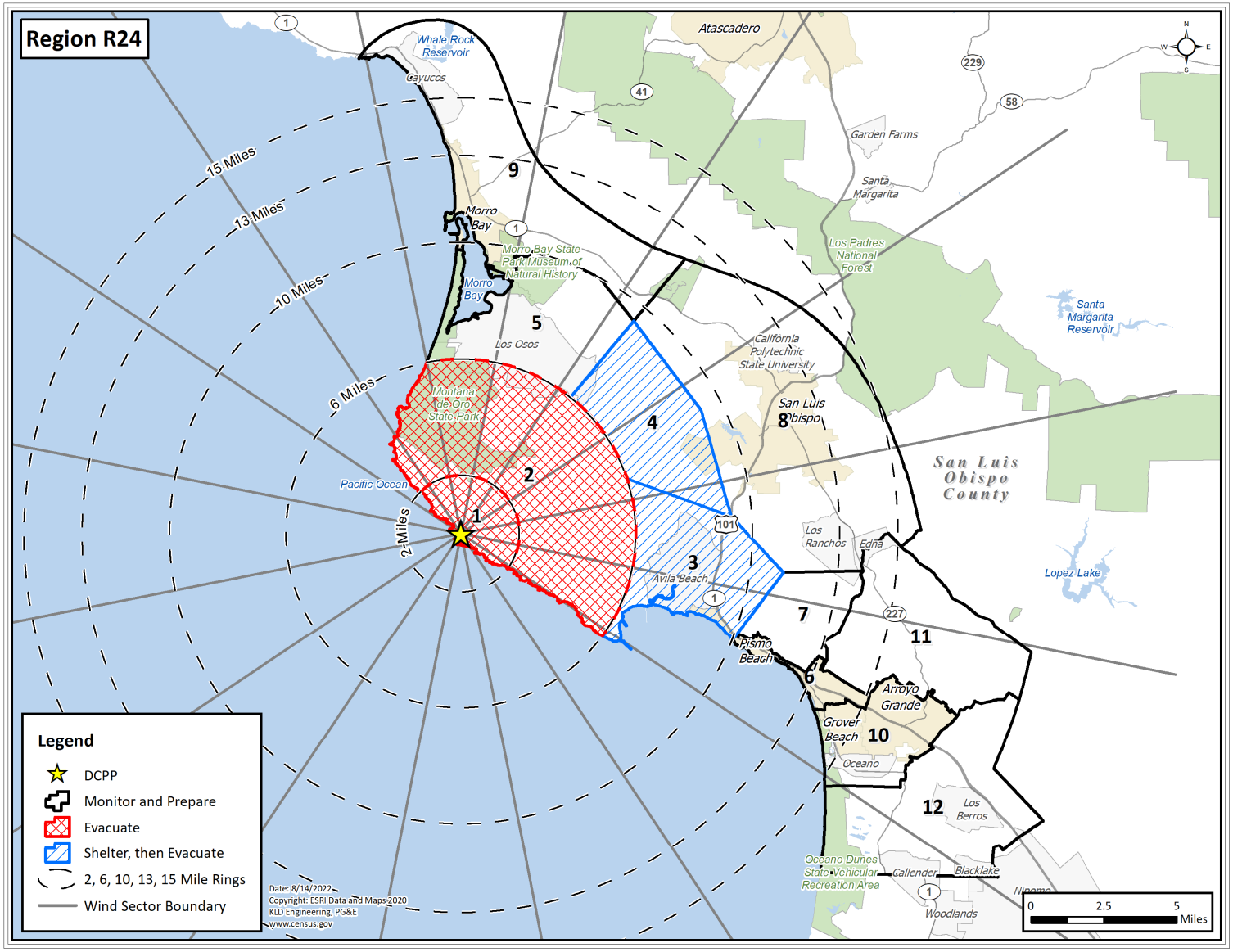


Figure H-24. Region R24

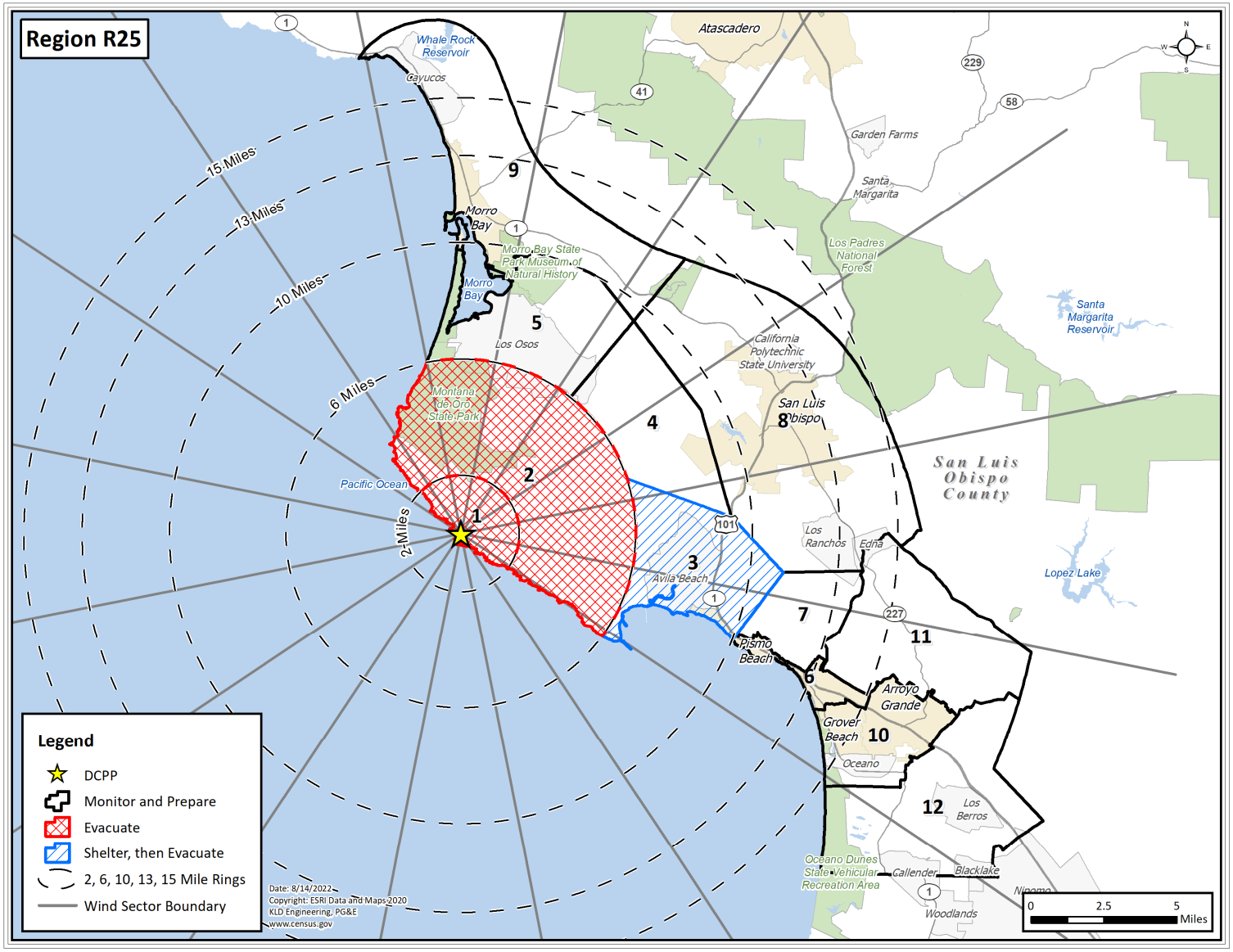


Figure H-25. Region R25

APPENDIX J

Representative Inputs to and Outputs from the DYNEV II System

J. REPRESENTATIVE INPUTS TO AND OUTPUTS FROM THE DYNEV II SYSTEM

This appendix presents data input to and output from the DYNEV II System.

Table J-1 provides source (vehicle loading) and destination information for several roadway segments (links) in the analysis network. In total, there are a total of 591 source links (origins) in the model. The source links are shown as centroid points in Figure J-1. On average, evacuees travel a straight-line distance of 7.77 miles to exit the study area.

Table J-2 provides network–wide statistics (average travel time, average speed and number of vehicles) for an evacuation of the Full EPZ (Region R04) for each scenario. As expected, rain scenarios (Scenarios 2, 4, 7 and 9) exhibit slower average speeds, higher delays and longer average travel times than good weather scenarios. When comparing scenario 11 (special event) and scenario 5, the additional vehicles the special event introduces lowers the average speeds, causes higher delays and increases the travel times. When comparing scenario 12 (roadway closure) and scenario 1, the lane closed on US-101 southbound lowers the average speeds, causes higher delays and increases the travel times.

Table J-3 provides statistics (average speed and travel time) for the major evacuation routes – US 101 and SH-1 – for an evacuation of the Full EPZ (Region R04) under Scenario 1 conditions. As discussed in Section 7.3 and shown in Figures 7-3 through 7-11, all of these roads are congested for most of the evacuation. As such, the average speeds start out high and then drop when the network becomes congested. Toward the end of the evacuation, the speeds on these roadways increase as congestion begins to clear.

Table J-4 provides the number of vehicles discharged and the cumulative percent of total vehicles discharged for each link exiting the analysis network, for an evacuation of the Full EPZ (Region R04) under Scenario 1 conditions.

Figure J-2 through Figure J-13 plot the trip generation time versus the ETE for each of the 12 Scenarios considered. The distance between the trip generation and ETE curves is the travel time. Plots of trip generation versus ETE are indicative of the level of traffic congestion during evacuation. For low population density sites, the curves are close together, indicating short travel times and minimal traffic congestion. For higher population density sites, the curves are farther apart indicating longer travel times and the presence of traffic congestion. As seen in Figure J-2 through Figure J-13 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. Sample Simulation Model Input

Link Number	Upstream Node	Downstream Node	Vehicles Entering Network on this Link	Directional Preference	Destination Nodes	Destination Capacity
1237	905	299	65	E	8246	1700
					8096	1700
					8046	6750
813	593	594	276	E	8246	1700
					8096	1700
					8046	6750
1396	1044	160	152	N	8246	1700
					8096	1700
					8046	6750
524	395	821	234	NE	8005	4500
					8096	1700
					8046	6750
1071	775	893	487	NE	8096	1700
					8046	6750
					8005	4500
1543	1158	1155	411	E	8246	1700
					8096	1700
					8046	6750
1203	874	752	158	N	8246	1700
					8096	1700
					8046	6750
891	642	641	130	E	8046	6750
					8246	1700
					8096	1700
1408	1052	466	142	SE	8246	1700
					8096	1700
					8046	6750
1251	919	458	73	SE	8246	1700
					8096	1700
					8046	6750

Table J-2. Selected Model Outputs for the Evacuation of the Full EPZ (Region R04)

Scenario	1	2	3	4	5	6
Network-Wide Average Travel Time (Min/Veh-Mi)	8.2	9.3	7.5	8.9	7.7	8.5
Network-Wide Average Delay Time (Min/Veh-Mi)	6.9	8.0	6.2	7.5	6.4	7.2
Network-Wide Average Speed (mph)	7.3	6.5	8.0	6.8	7.8	7.1
Total Vehicles Exiting Network	111,848	112,252	104,554	104,653	101,989	118,982
Scenario	**7**	**8**	**9**	**10**	**11**	**12**
Network-Wide Average Travel Time (Min/Veh-Mi)	9.6	7.4	8.6	7.7	9.0	9.5
Network-Wide Average Delay Time (Min/Veh-Mi)	8.2	6.1	7.3	6.4	7.7	8.2
Network-Wide Average Speed (mph)	6.3	8.1	7.0	7.8	6.7	6.3
Total Vehicles Exiting Network	119,448	99,326	100,100	97,905	161,387	110,983

Table J-3. Average Speed (mph) and Travel Time (min) for Major Evacuation Routes (Region R04, Scenario 1)

Route Name	Length (miles)	Elapsed Time (hours: minutes)									
		1:00		2:00		3:00		4:00		5:00	
		Speed (mph)	Travel Time (min)	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time
US-101 Northbound	57.2	14.7	233.6	8.5	402.3	8.5	404.0	9.1	375.6	8.6	398.7
US-101 Southbound	57.2	17.6	195.1	4.8	714.2	4.2	818.5	4.7	728.5	5.6	617.5
SH-1 Northbound	62.4	12.7	293.8	5.4	687.5	5.1	738.6	4.7	804.5	5.6	665.9
SH-1 Southbound	62.1	21.8	170.8	4.8	771.1	4.1	913.2	4.6	803.2	6.0	623.6
Route Name	Length (miles)	Elapsed Time (hours)									
		6:00		7:00		8:00		9:00		10:50	
		Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time	Speed	Travel Time
US-101 Northbound	57.2	10.3	332.6	8.9	383.8	18.8	182.3	36.7	93.5	67.1	51.1
US-101 Southbound	57.2	6.2	555.8	10.2	335.3	11.5	298.4	18.5	185.8	58.5	58.6
SH-1 Northbound	62.4	10.4	358.9	19.7	190.4	26.0	144.3	43.4	86.3	64.6	57.9
SH-1 Southbound	62.1	6.6	562.4	10.9	342.0	12.2	305.1	19.4	192.4	57.0	65.3

Table J-4. Simulation Model Outputs at Network Exit Links for Region R04, Scenario 1

Route Name	Upstream Node	Downstream Node	Elapsed Time (hours:minutes)									
			1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:50
			Cumulative Vehicles Discharged by the Indicated Time									
			Cumulative Percent of Vehicles Discharged by the Indicated Time Interval									
SH-58 Northbound	149	150	2	48	88	101	108	108	108	108	108	108
			0.03%	0.27%	0.32%	0.27%	0.22%	0.18%	0.15%	0.13%	0.12%	0.10%
SH-1 Northbound	1209	74	3	63	118	262	882	1,774	2,576	3,640	4,326	4,770
			0.04%	0.36%	0.42%	0.69%	1.81%	2.98%	3.67%	4.48%	4.71%	4.44%
US-101 Northbound	1263	5	3,330	7,480	11,587	15,655	19,705	23,783	27,862	31,930	35,990	40,038
			45.76%	42.63%	41.46%	41.10%	40.43%	39.94%	39.66%	39.30%	39.22%	37.27%
SH-1 Southbound	1272	245	396	1,051	1,781	2,488	3,212	3,965	4,703	5,395	6,090	7,421
			5.45%	5.99%	6.37%	6.53%	6.59%	6.66%	6.69%	6.64%	6.64%	6.91%
Simas Road Southbound	1274	1096	434	1,141	1,947	2,546	3,040	3,547	4,049	4,548	5,039	5,870
			5.97%	6.50%	6.97%	6.68%	6.24%	5.96%	5.76%	5.60%	5.49%	5.46%
US-101 Southbound	1284	46	3,111	7,765	12,424	17,043	21,794	26,374	30,951	35,621	40,215	49,213
			42.75%	44.25%	44.46%	44.74%	44.71%	44.29%	44.06%	43.85%	43.82%	45.81%

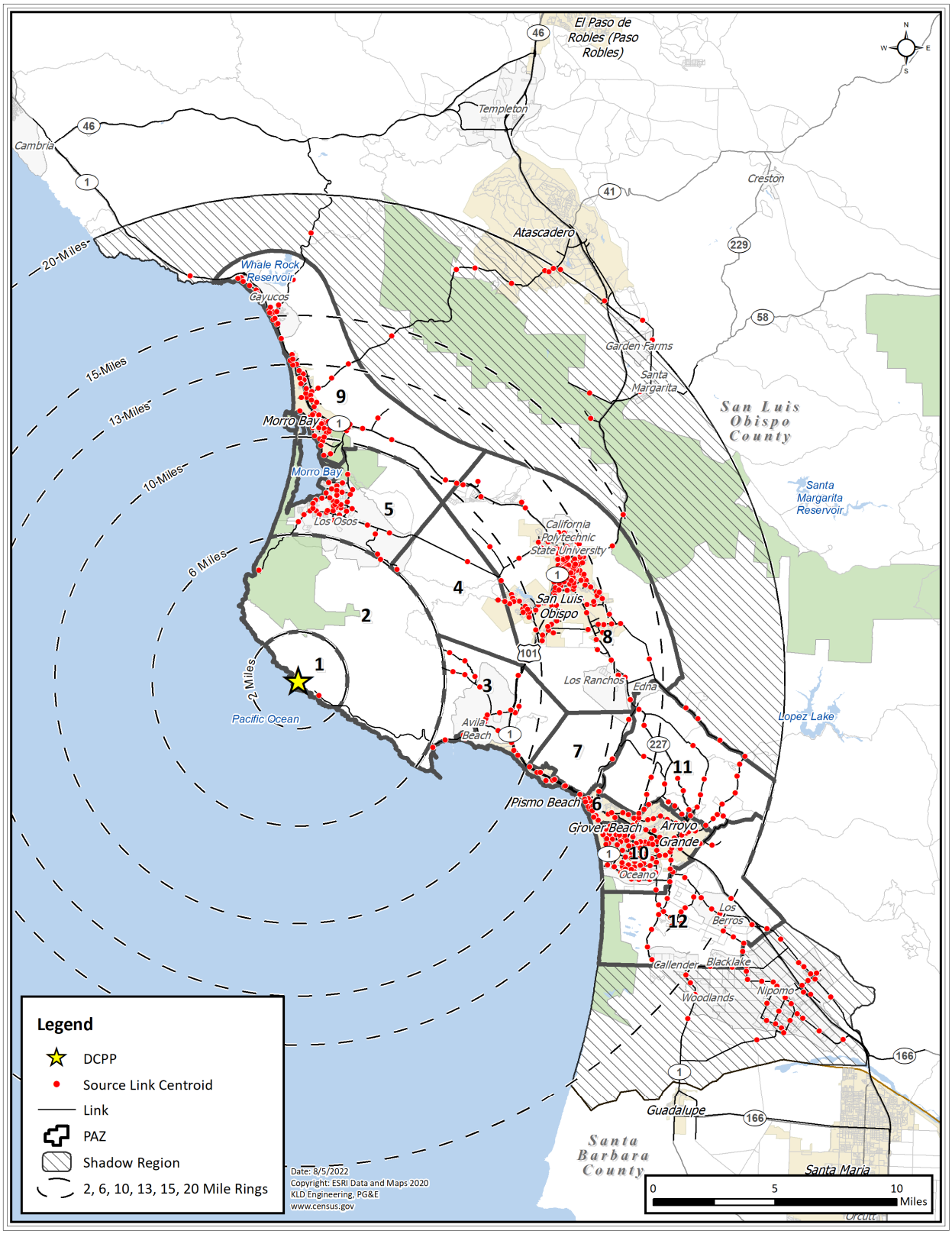


Figure J-1. Network Source/Origins

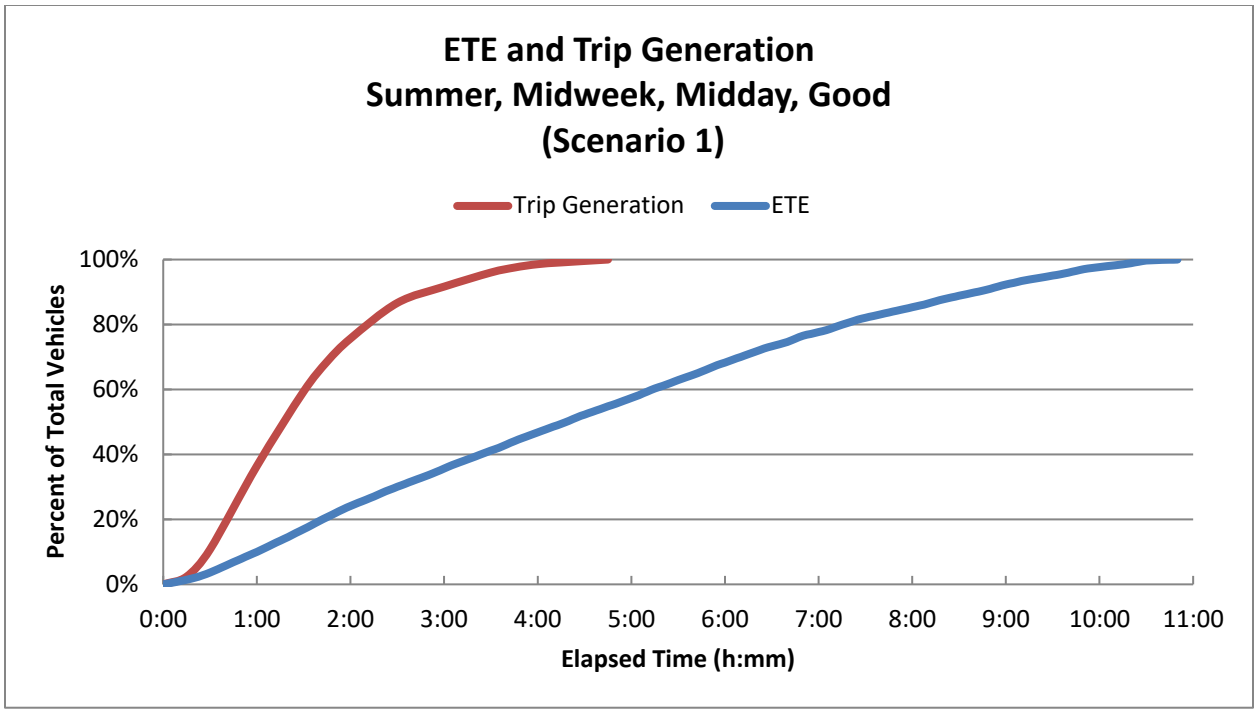


Figure J-2. ETE and Trip Generation: Summer, Midweek, Midday, Good Weather (Scenario 1)

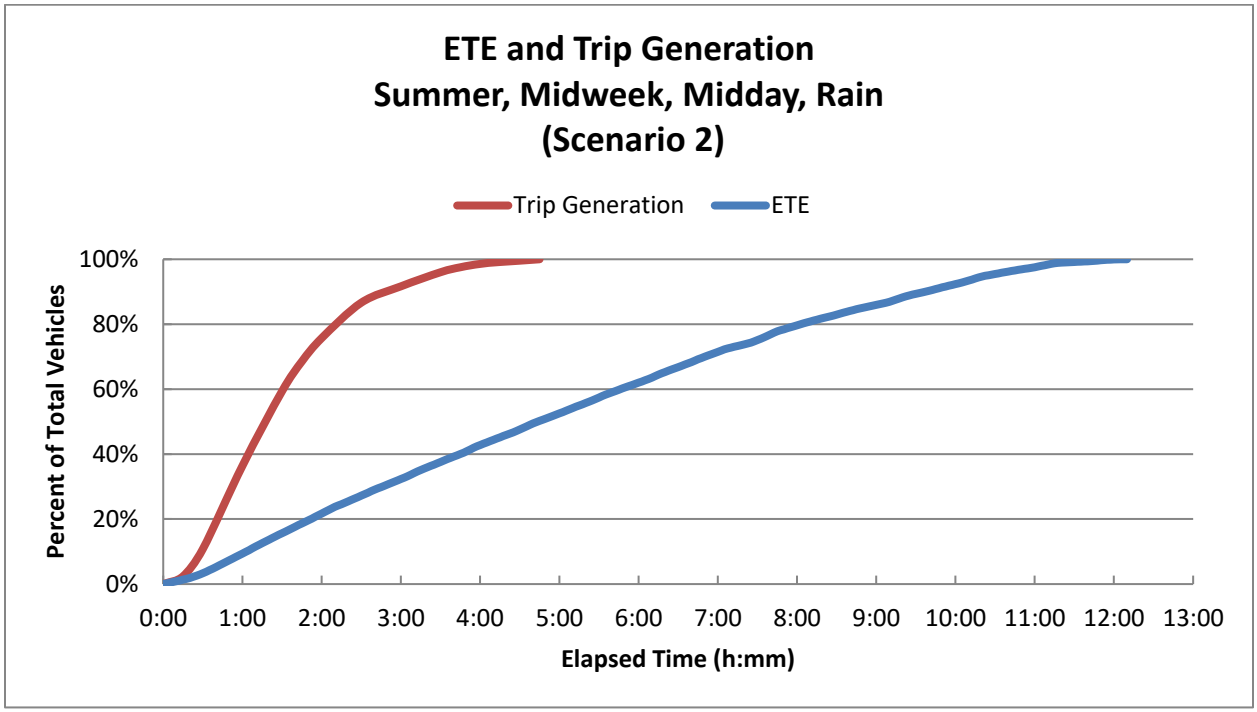


Figure J-3. ETE and Trip Generation: Summer, Midweek, Midday, Rain (Scenario 2)

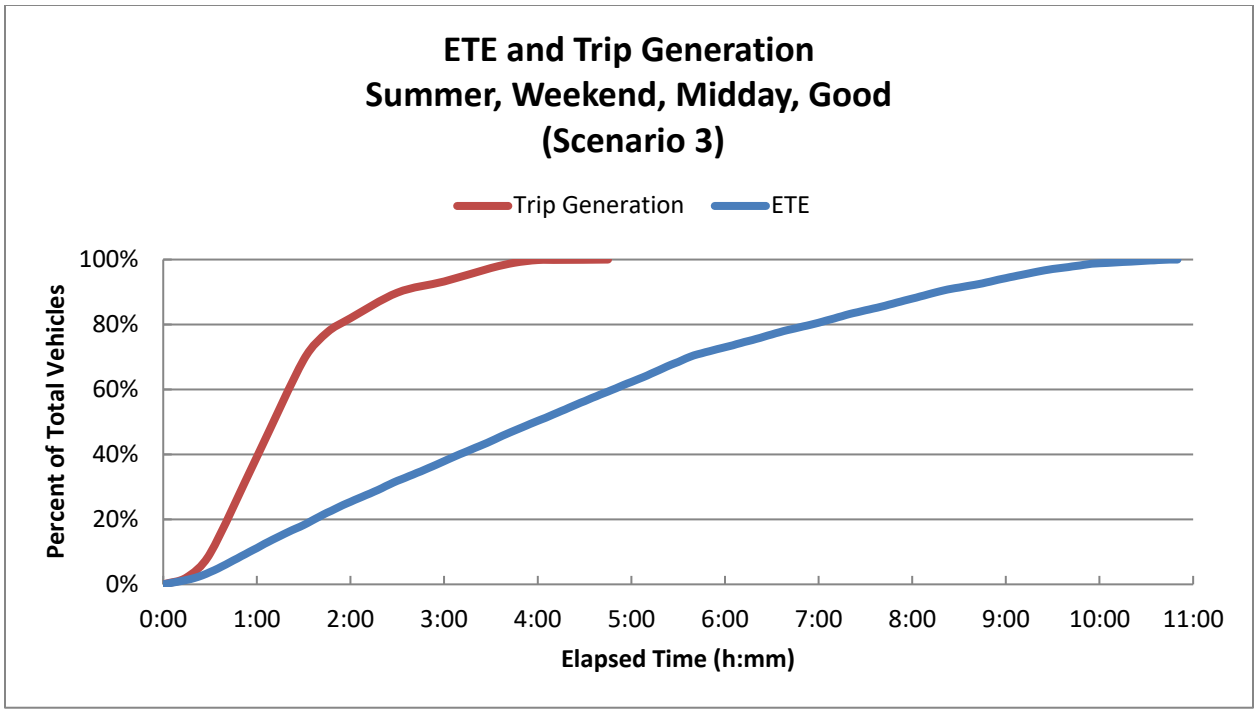


Figure J-4. ETE and Trip Generation: Summer, Weekend, Midday, Good Weather (Scenario 3)

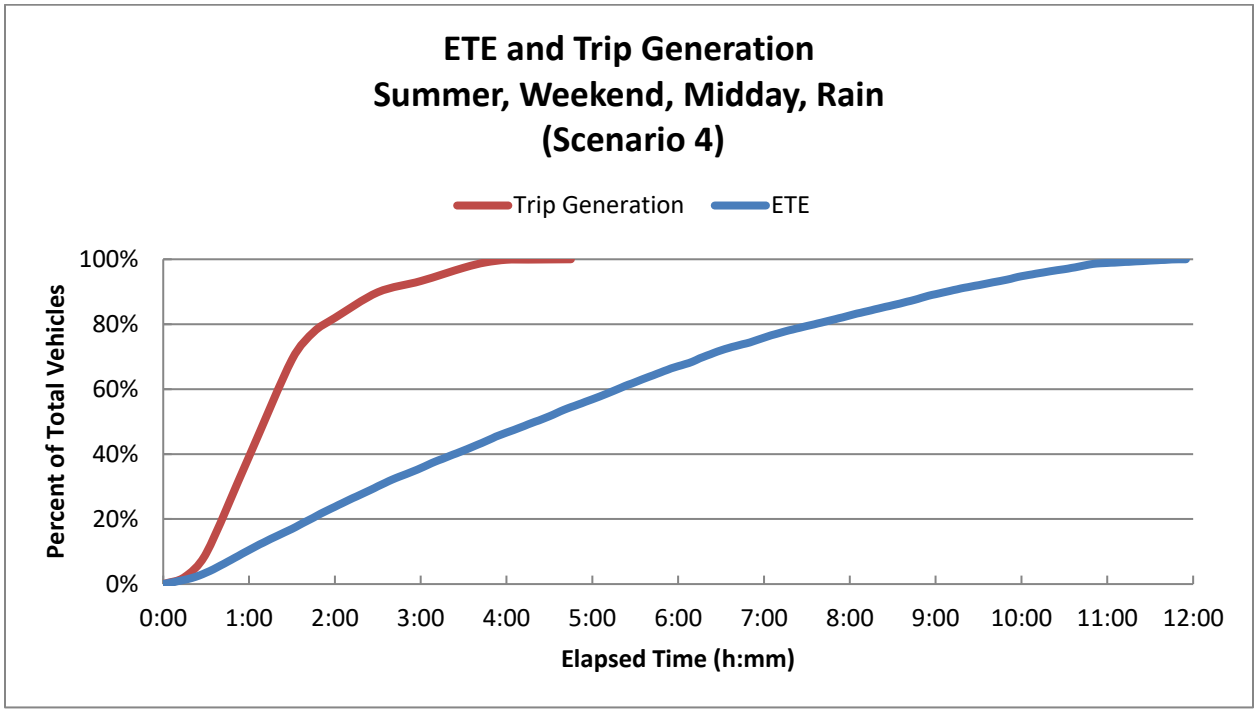


Figure J-5. ETE and Trip Generation: Summer, Weekend, Midday, Rain (Scenario 4)

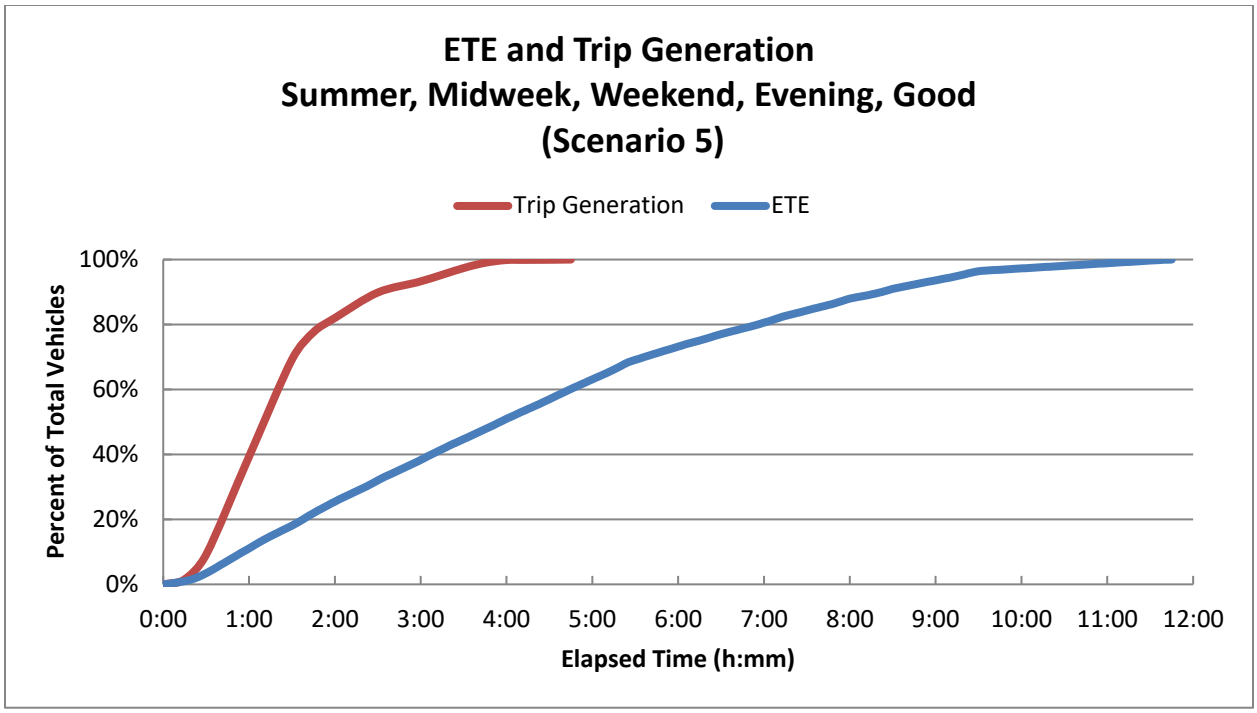


Figure J-6. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Good Weather (Scenario 5)

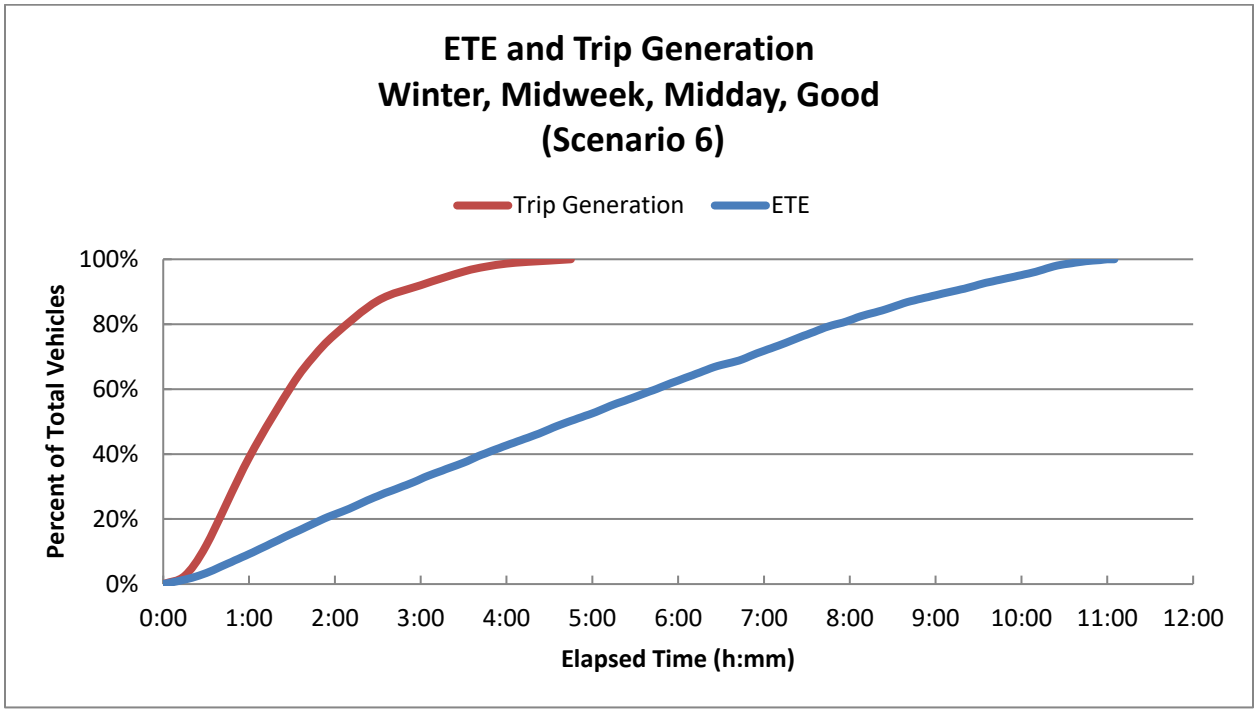


Figure J-7. ETE and Trip Generation: Winter, Midweek, Midday, Good Weather (Scenario 6)

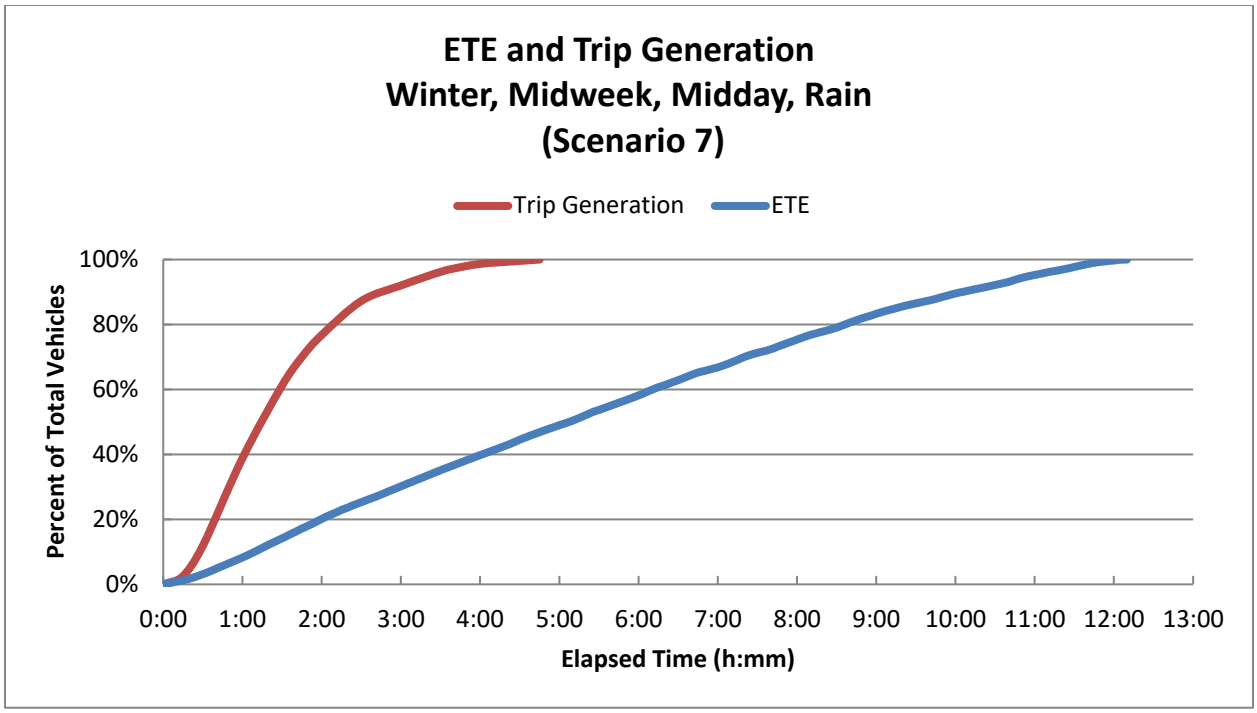


Figure J-8. ETE and Trip Generation: Winter, Midweek, Midday, Rain (Scenario 7)

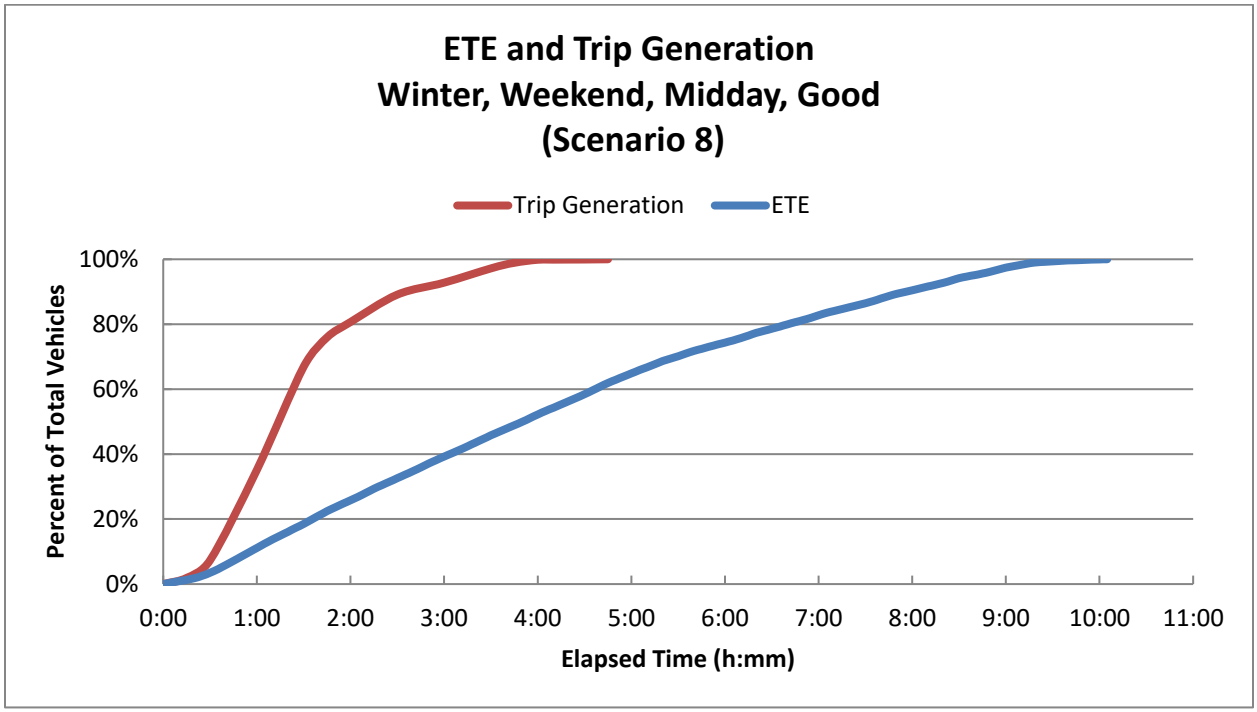


Figure J-9. ETE and Trip Generation: Winter, Weekend, Midday, Good Weather (Scenario 8)

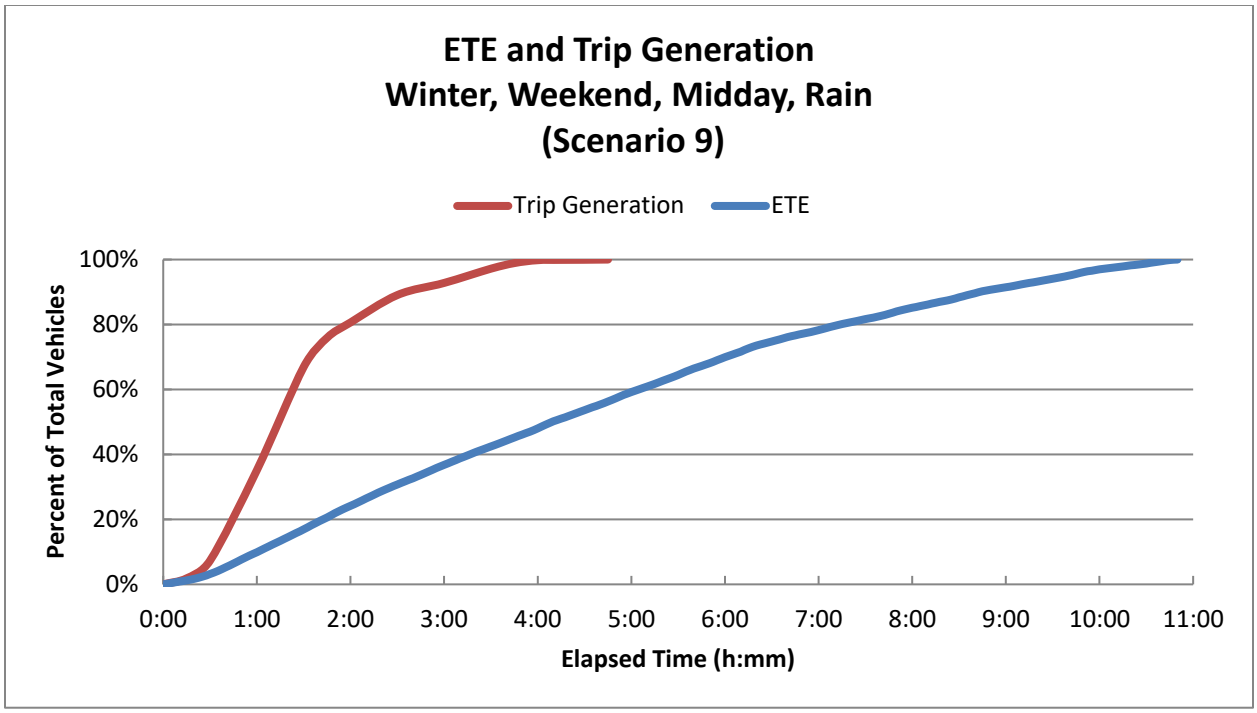


Figure J-10. ETE and Trip Generation: Winter, Weekend, Midday, Rain (Scenario 9)

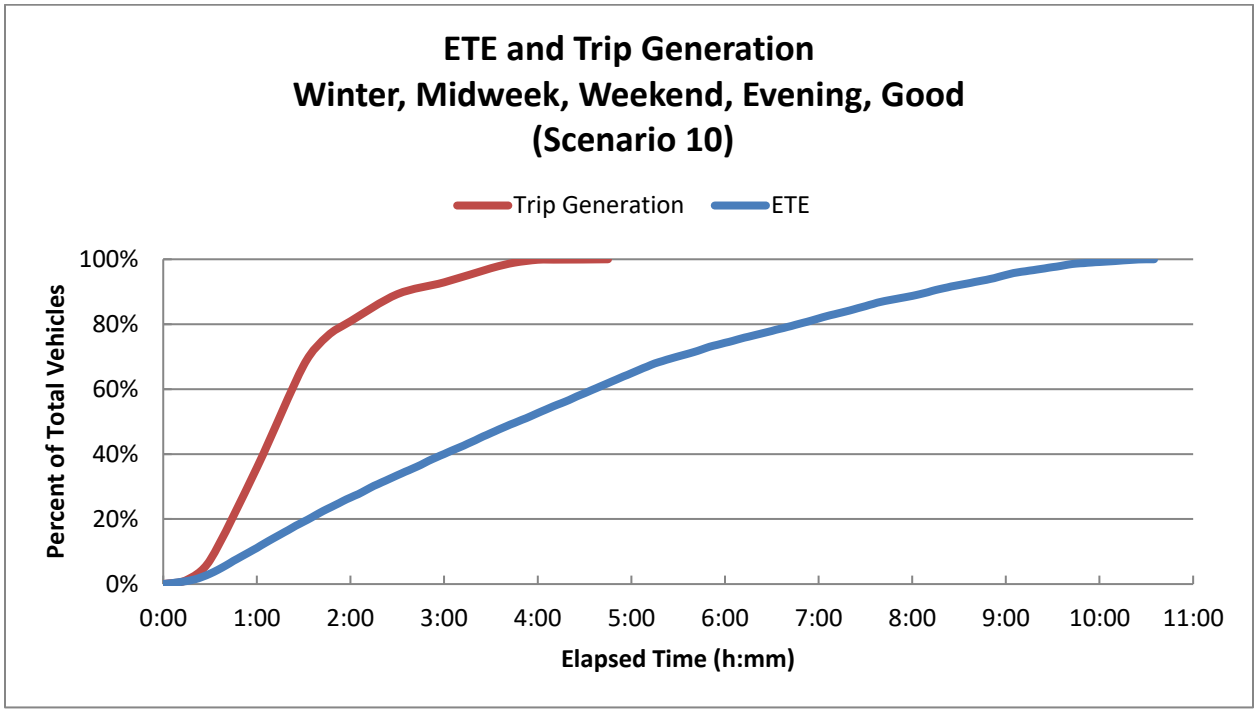


Figure J-11. ETE and Trip Generation: Winter, Midweek, Weekend, Evening, Good Weather (Scenario 10)

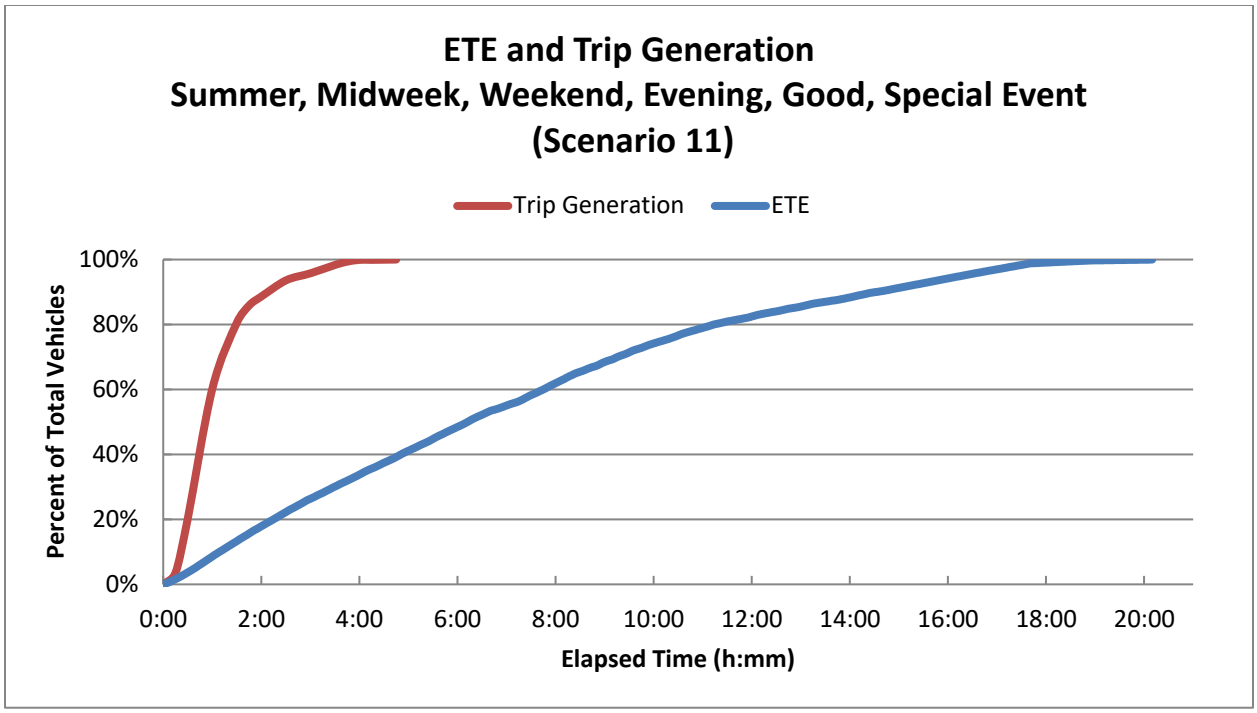


Figure J-12. ETE and Trip Generation: Summer, Midweek, Weekend, Evening, Special Event (Scenario 11)

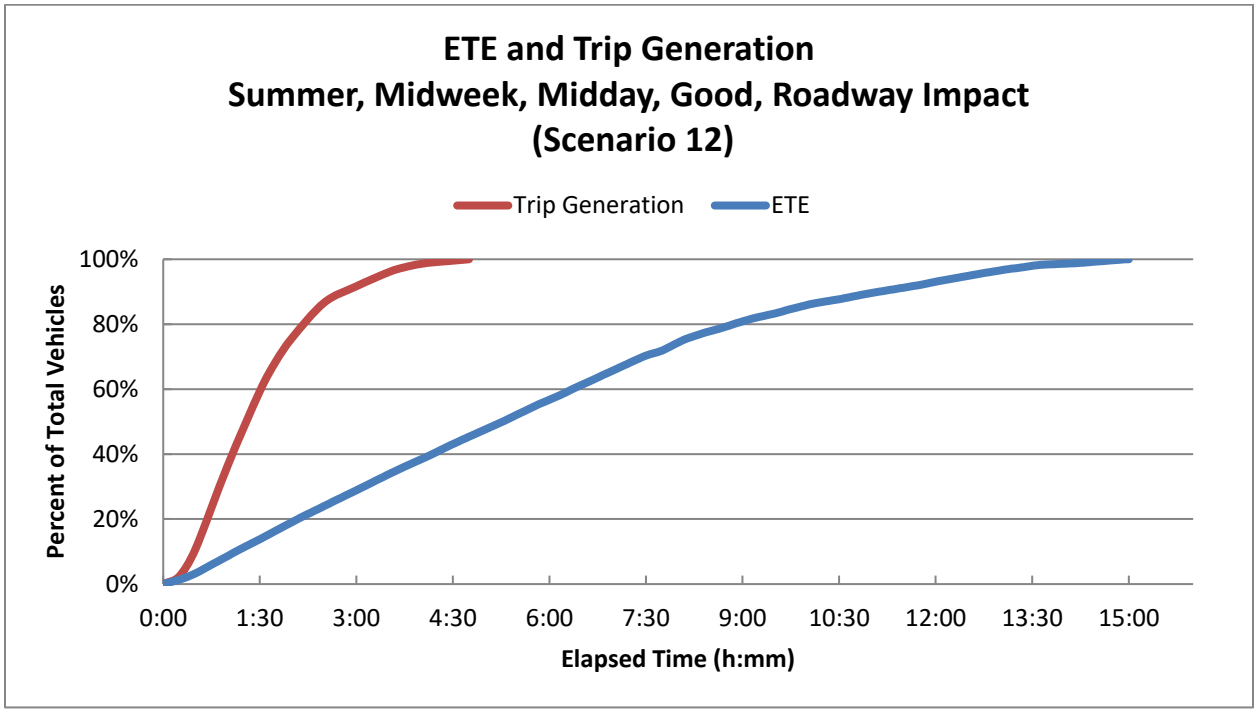


Figure J-13. ETE and Trip Generation: Summer, Midweek, Midday, Roadway Impact (Scenario 12)

APPENDIX K

Evacuation Roadway Network

K. EVACUATION ROADWAY NETWORK

As discussed in Section 1.3, a link-node analysis network was constructed to model the roadway network within the study area. Figure K-1 provides an overview of the link-node analysis network. The figure has been divided up into 65 more detailed figures (Figure K-2 through Figure K-66) which show each of the links and nodes in the network.

The analysis network was calibrated using the observations made during the field surveys conducted in October 2020.

Table K-1 summarizes the number of nodes by the type of control (stop sign, yield sign, pre-timed signal, actuated signal, traffic control point [TCP], uncontrolled).

Table K-1. Summary of Nodes by the Type of Control

Control Type	Number of Nodes
Uncontrolled Intersection	850
Pretimed Signal	17
Actuated Signal	115
Stop Sign	182
TCP	81
Yield Sign	9
Total:	**1,254**

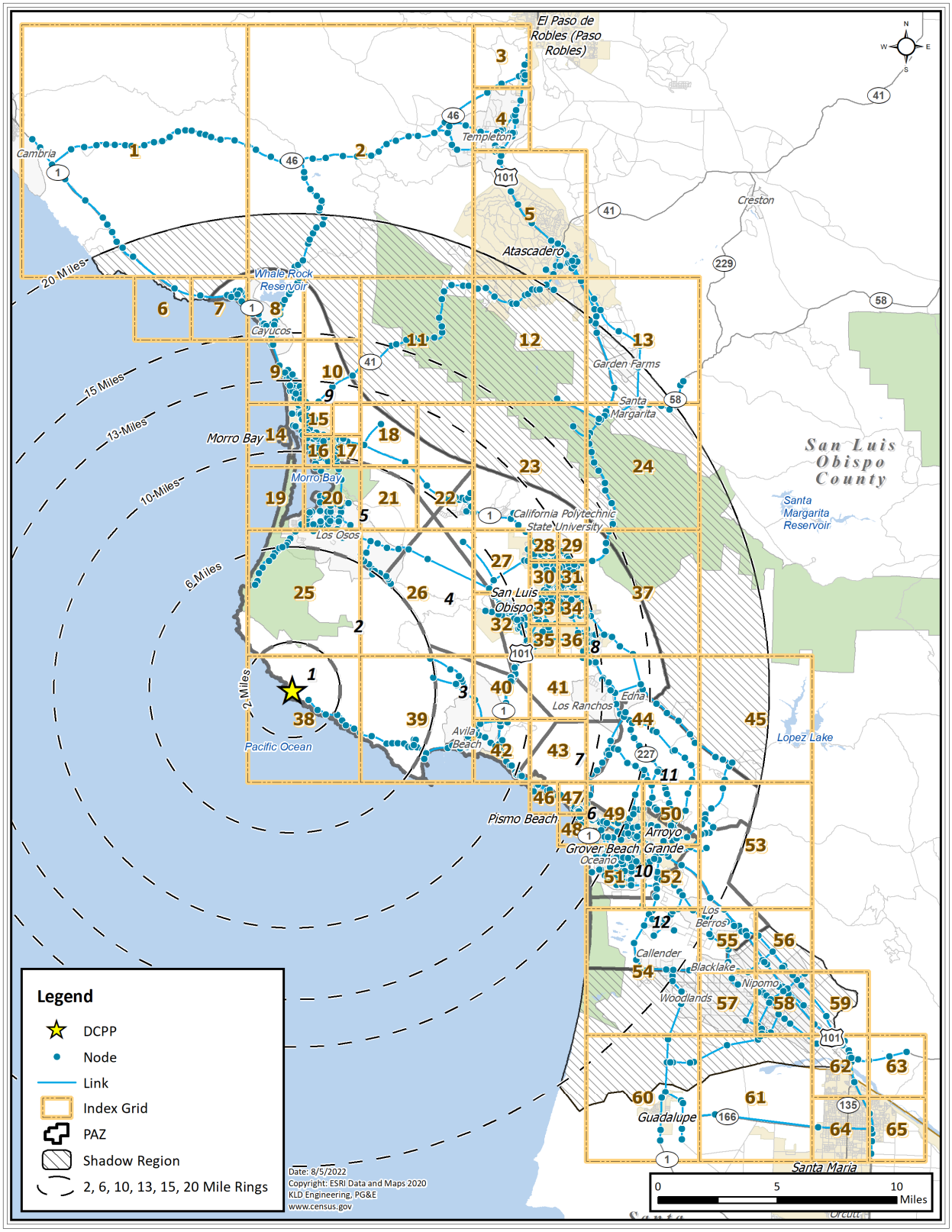


Figure K-1. DCPP Link-Node Analysis Network

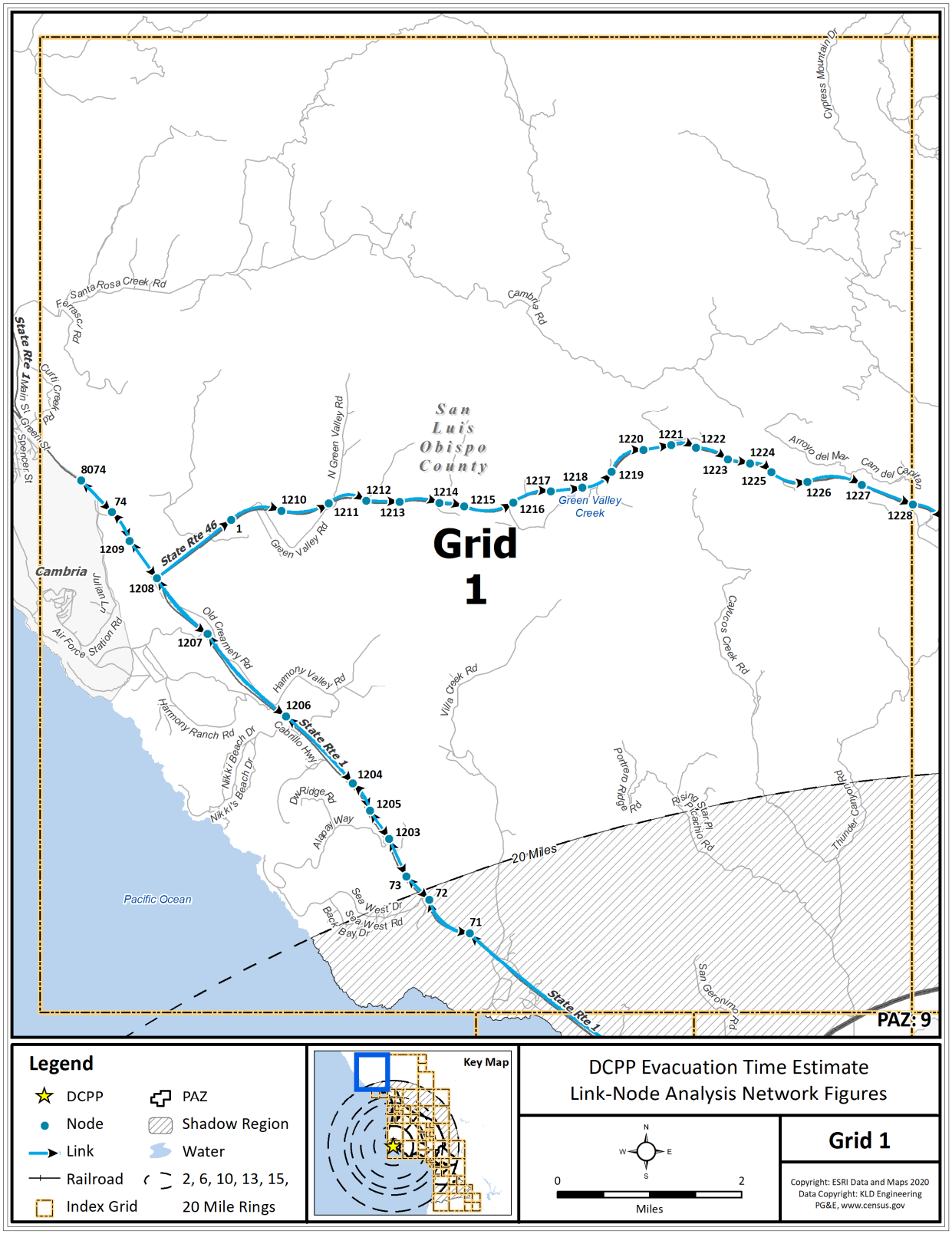


Figure K-2. Link-Node Analysis Network – Grid 1

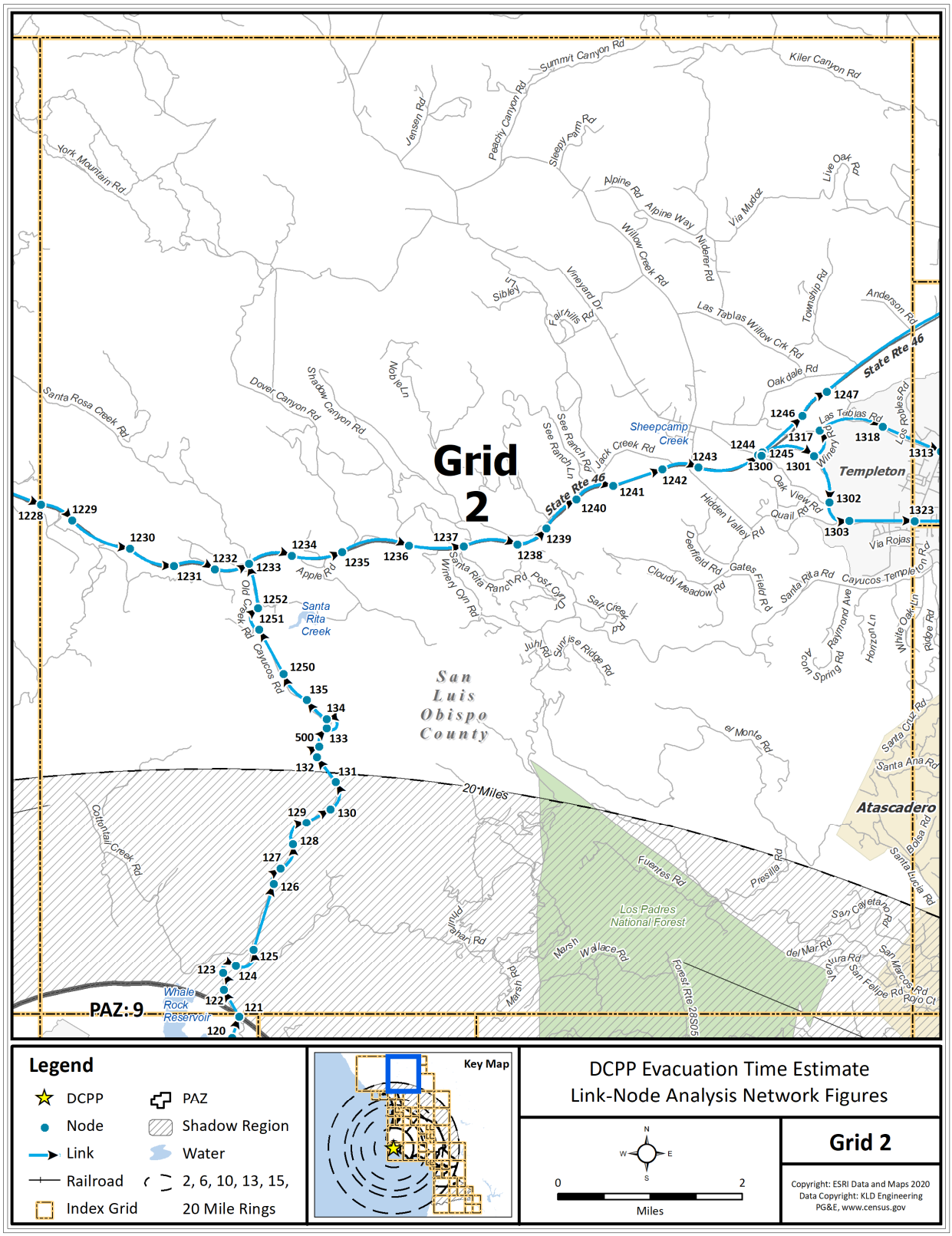


Figure K-3. Link-Node Analysis Network – Grid 2

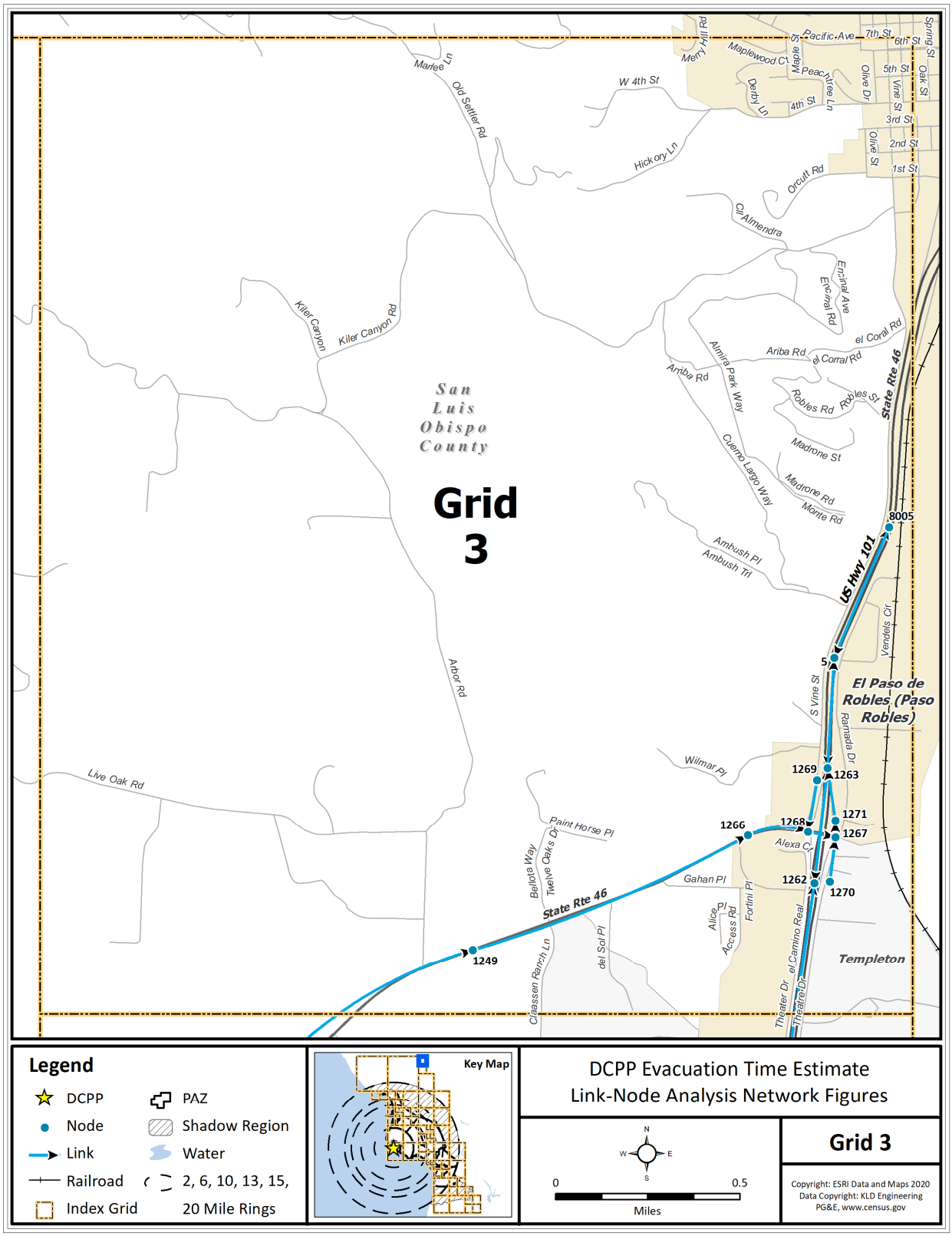


Figure K-4. Link-Node Analysis Network – Grid 3

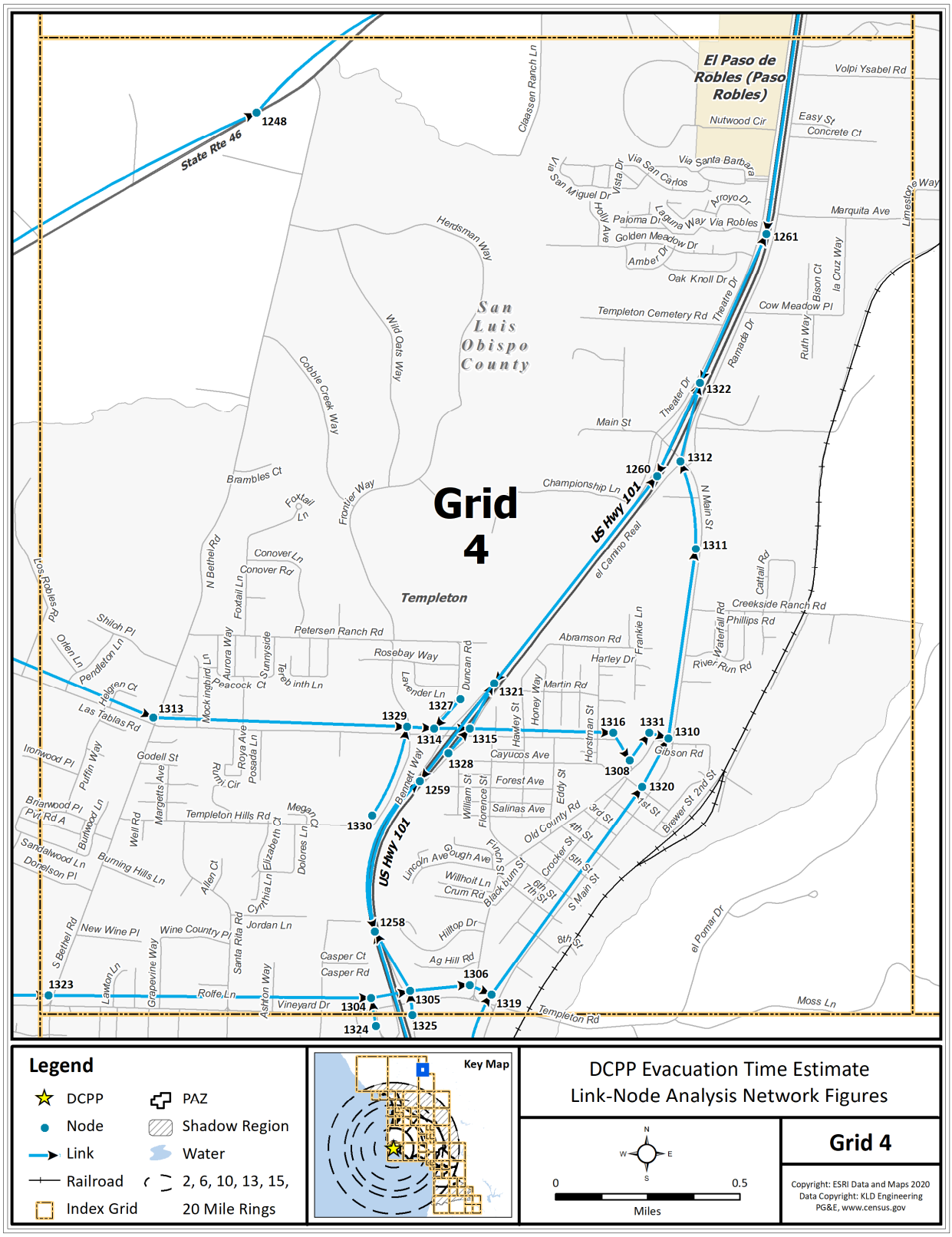


Figure K-5. Link-Node Analysis Network – Grid 4

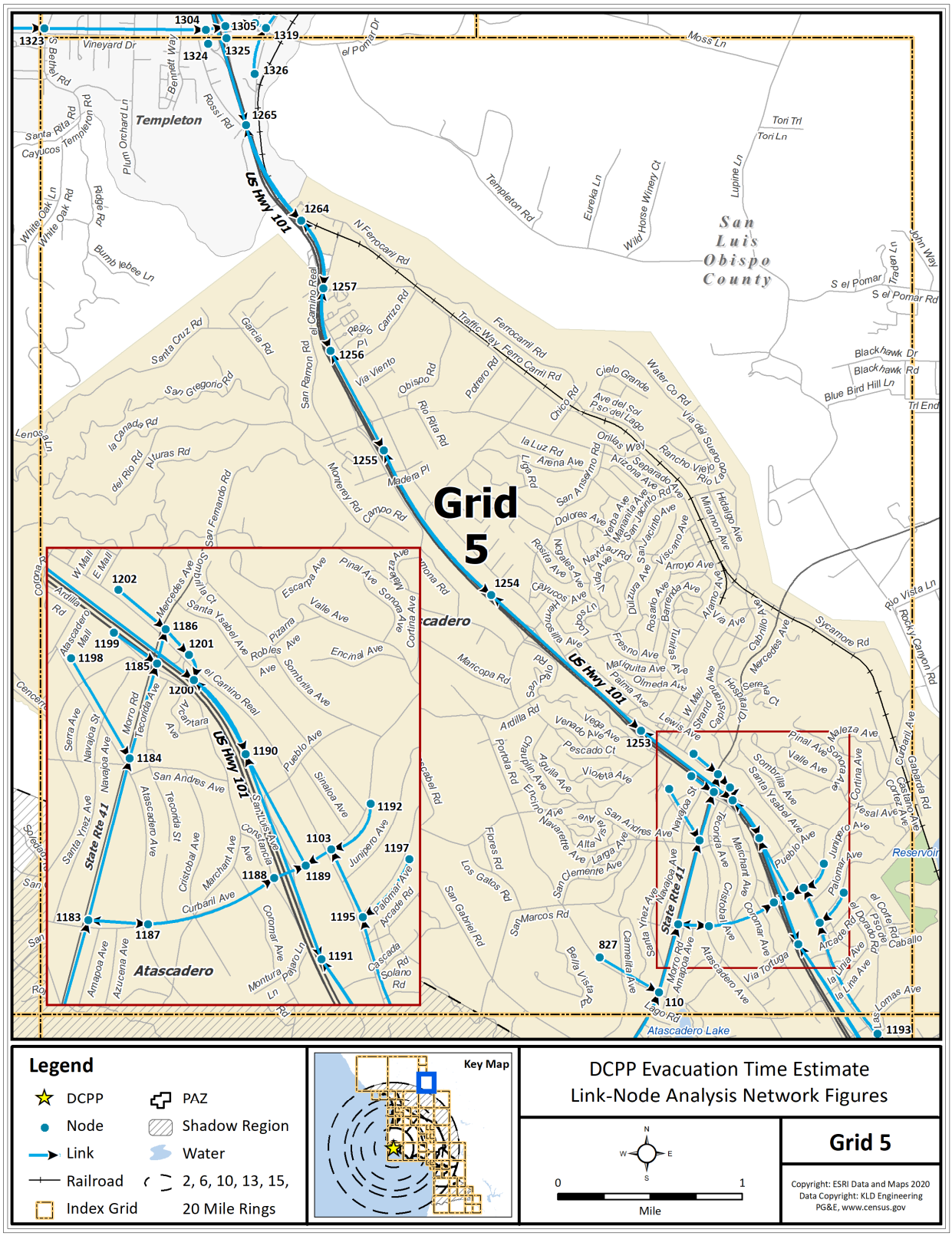


Figure K-6. Link-Node Analysis Network – Grid 5

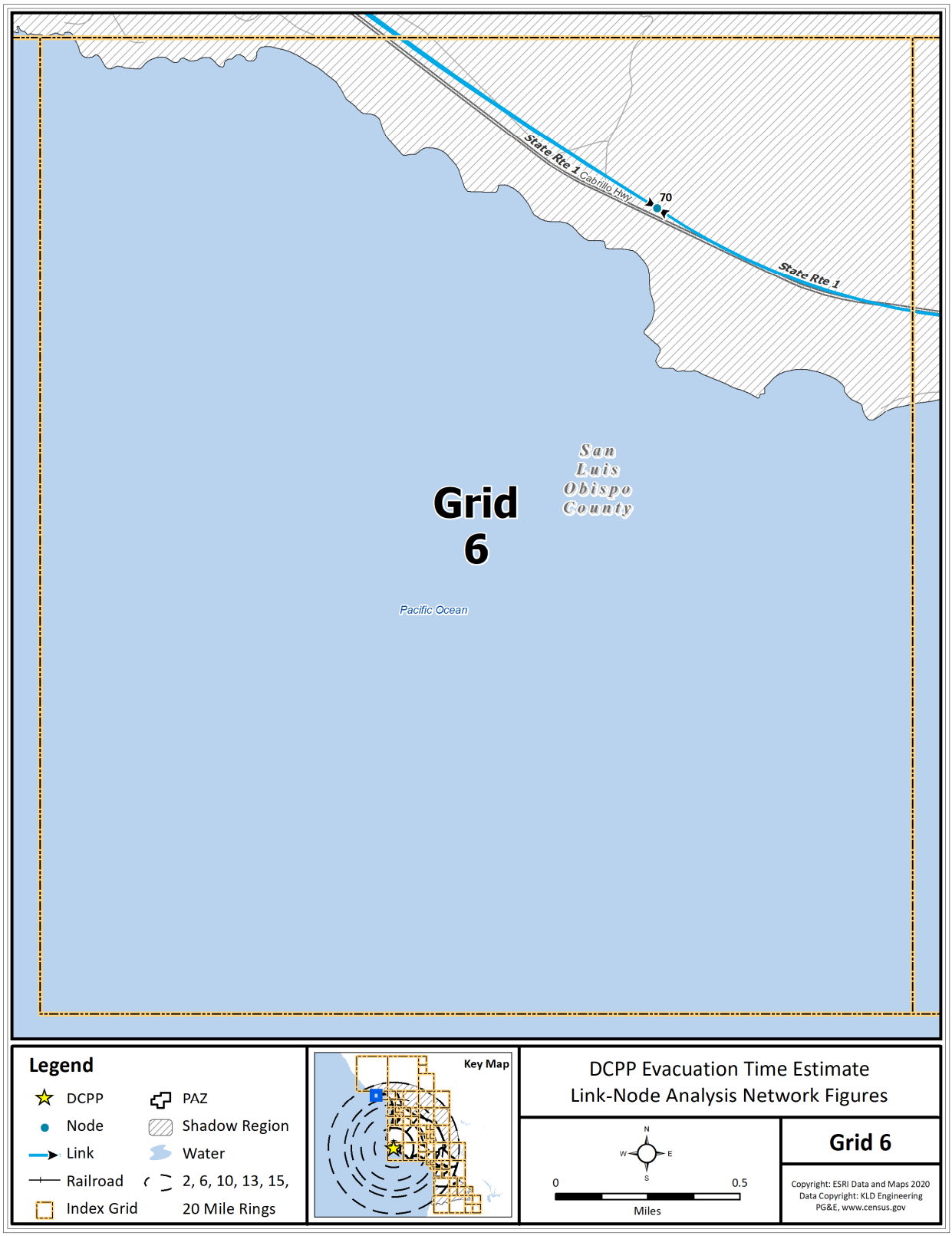


Figure K-7. Link-Node Analysis Network – Grid 6

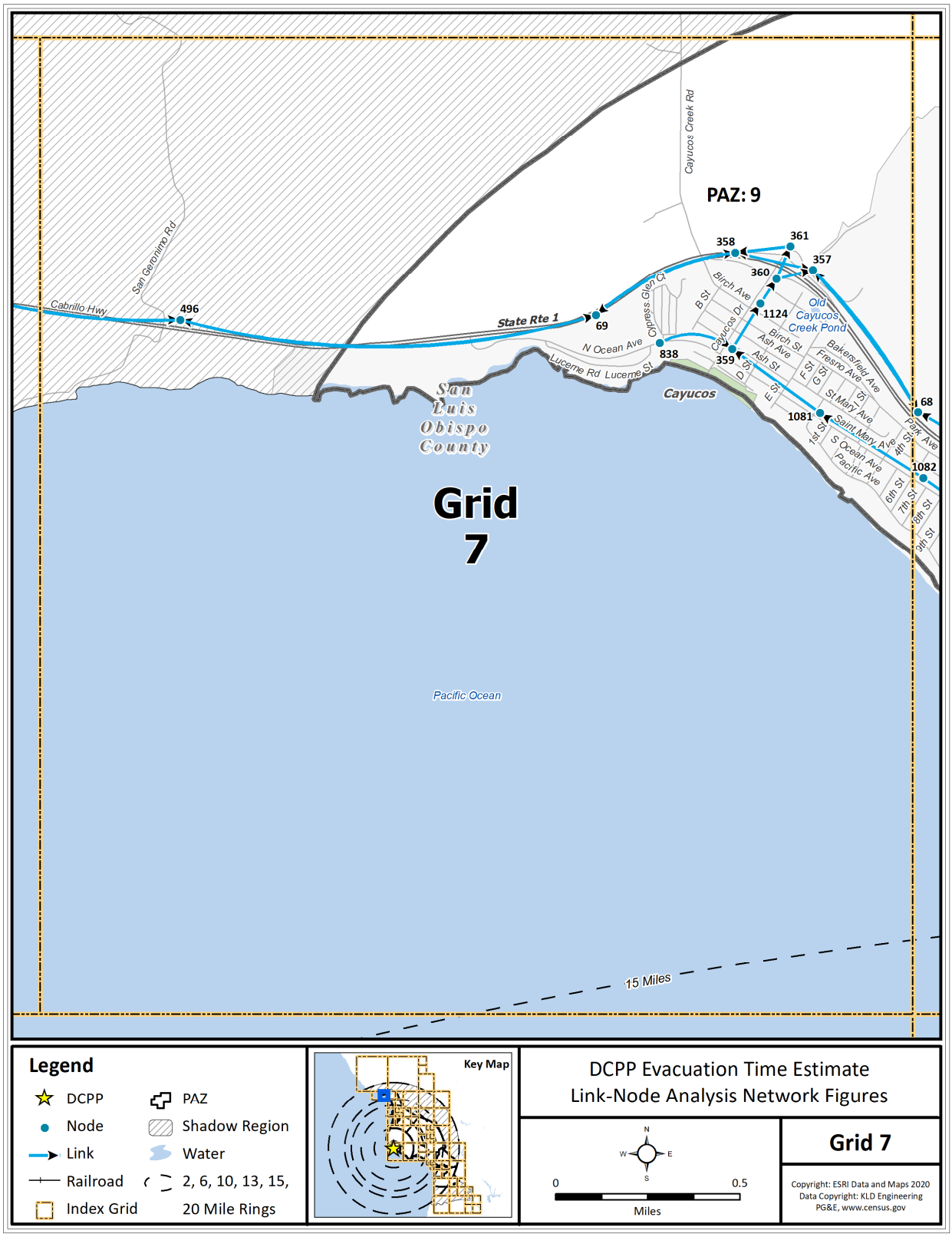


Figure K-8. Link-Node Analysis Network – Grid 7

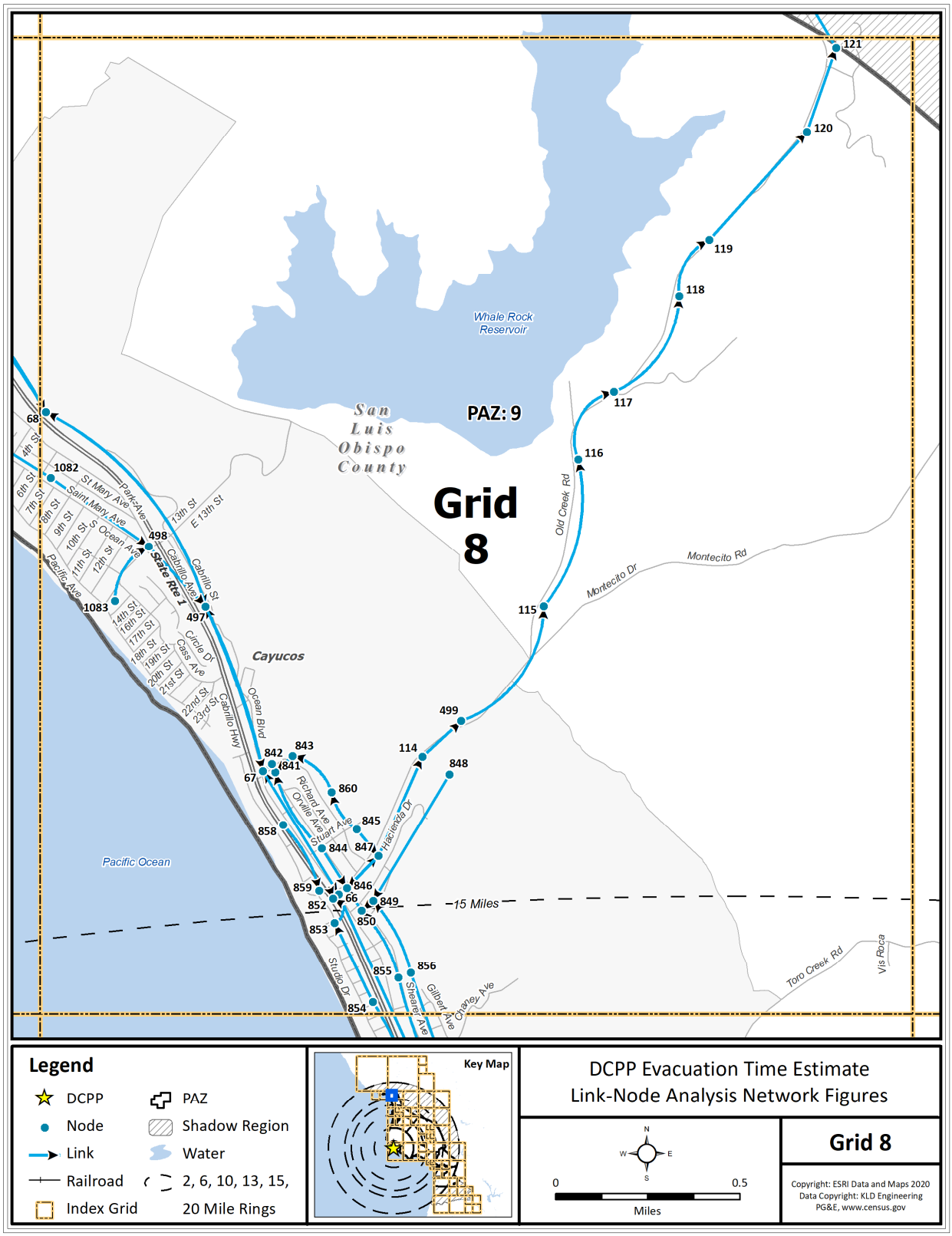


Figure K-9. Link-Node Analysis Network – Grid 8

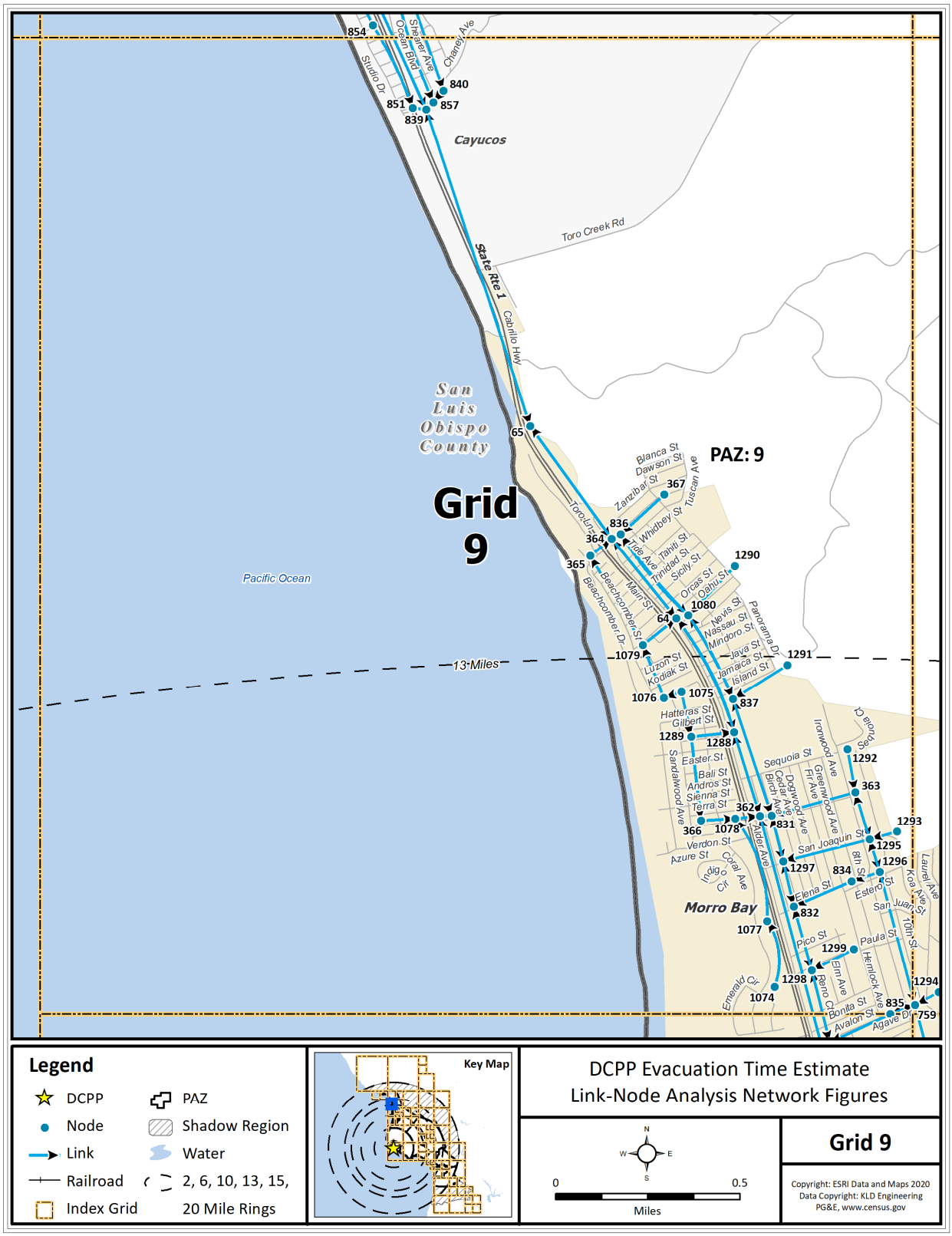


Figure K-10. Link-Node Analysis Network – Grid 9

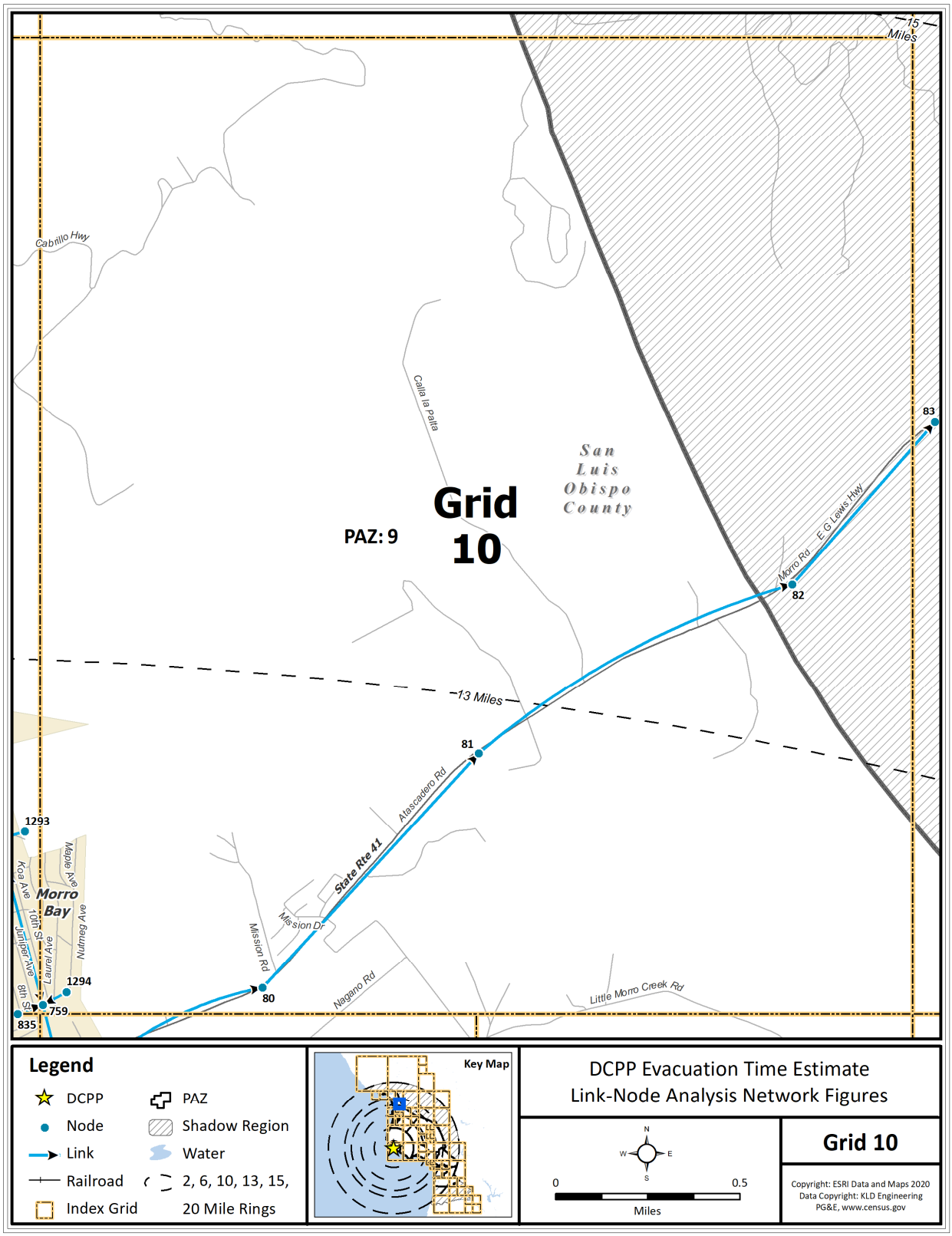


Figure K-11. Link-Node Analysis Network – Grid 10

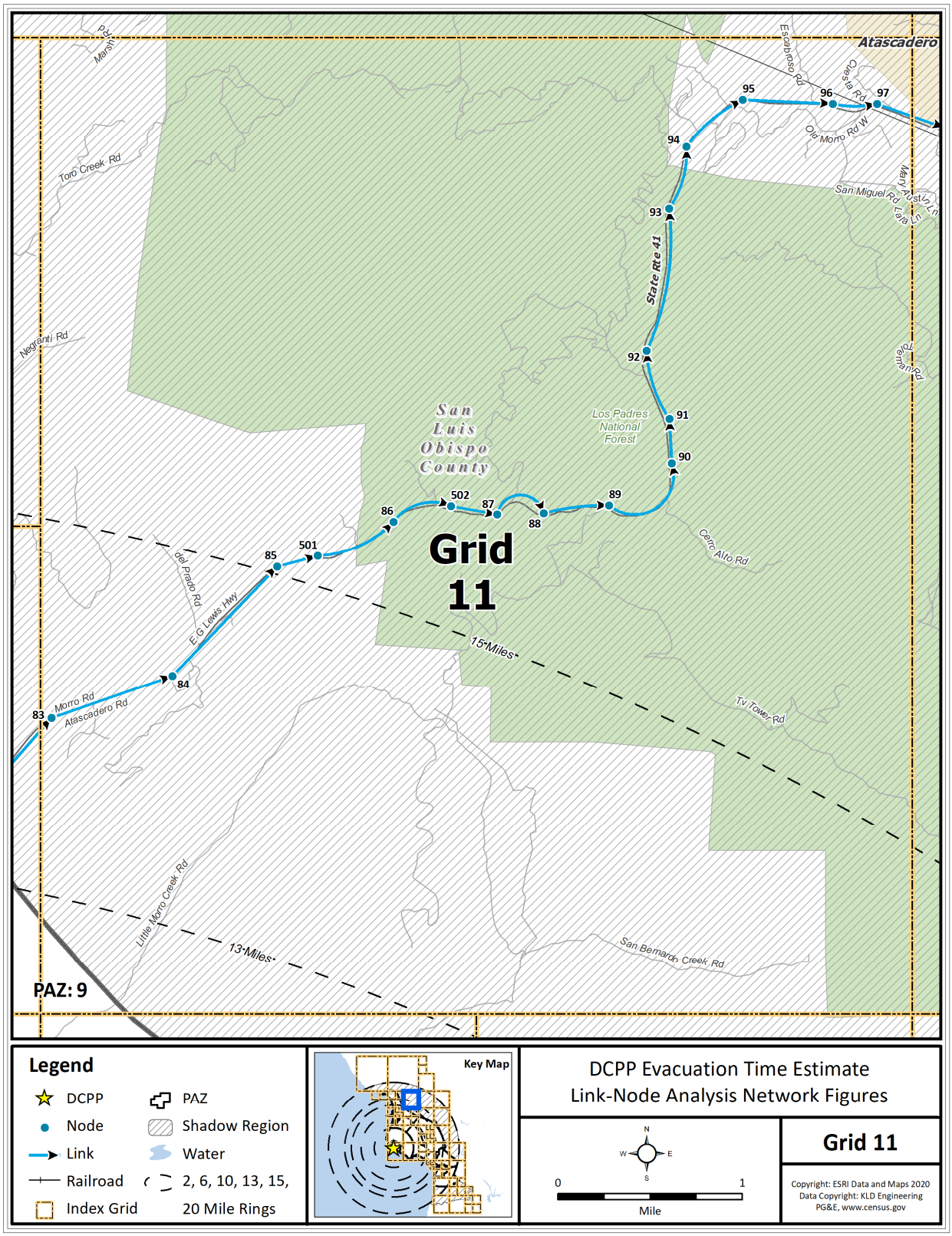


Figure K-12. Link-Node Analysis Network – Grid 11

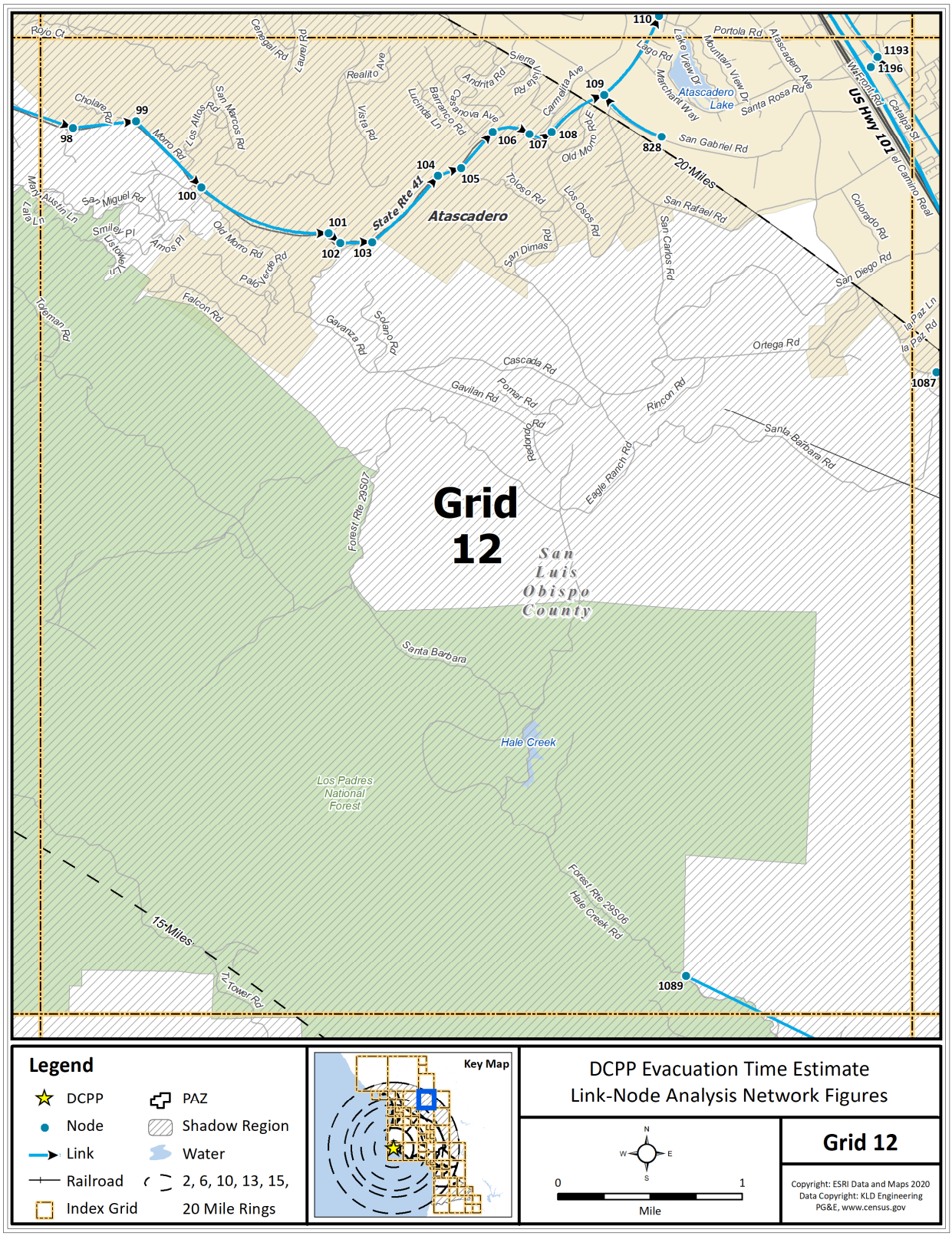
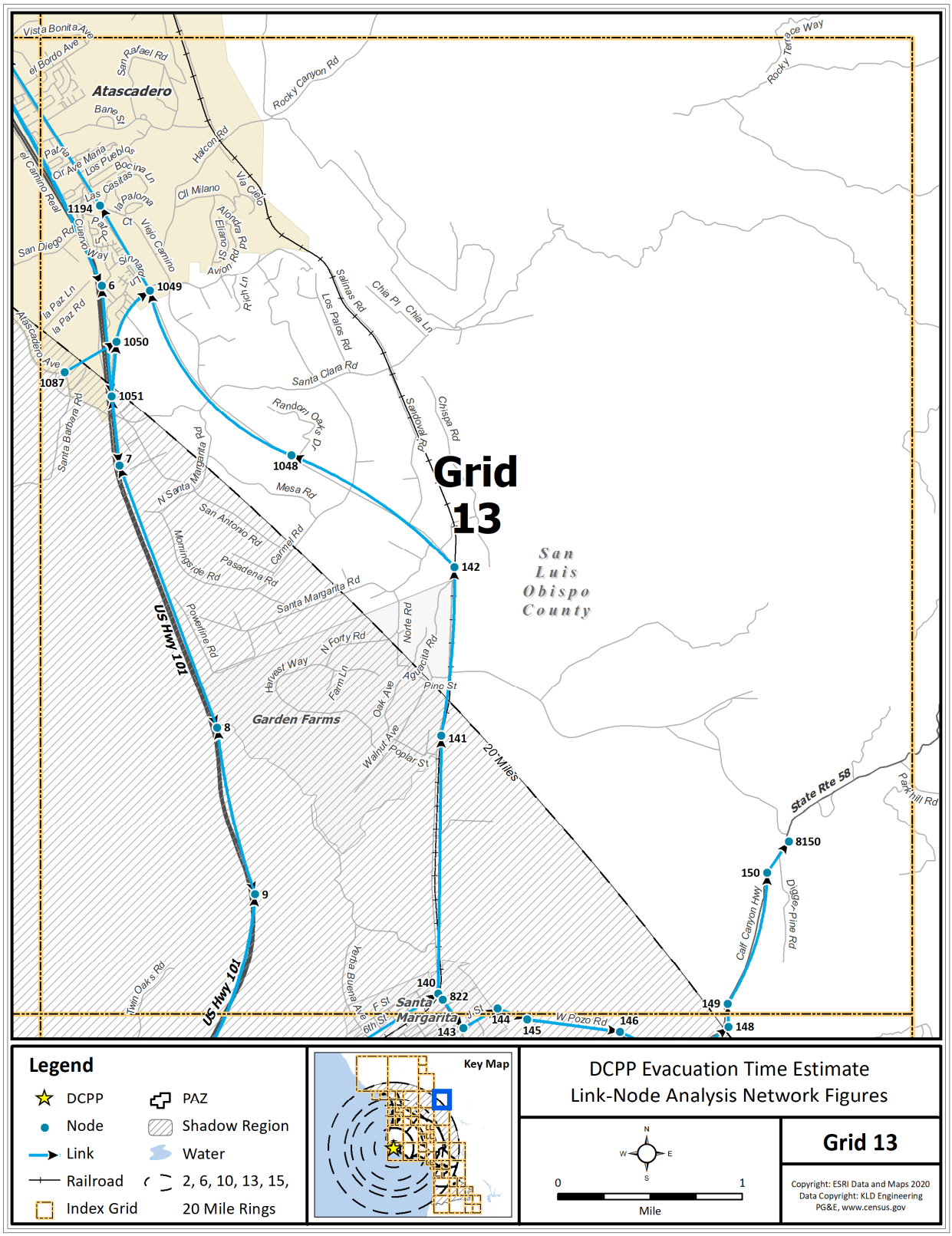


Figure K-13. Link-Node Analysis Network – Grid 12



Legend

- DCPP
- Node
- Link
- Railroad
- Index Grid
- PAZ
- Shadow Region
- Water
- 2, 6, 10, 13, 15, 20 Mile Rings

Key Map

DCPP Evacuation Time Estimate
Link-Node Analysis Network Figures

Grid 13

0 1
Mile

Copyright: ESRI Data and Maps 2020
Data Copyright: KLD Engineering
PG&E, www.census.gov

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

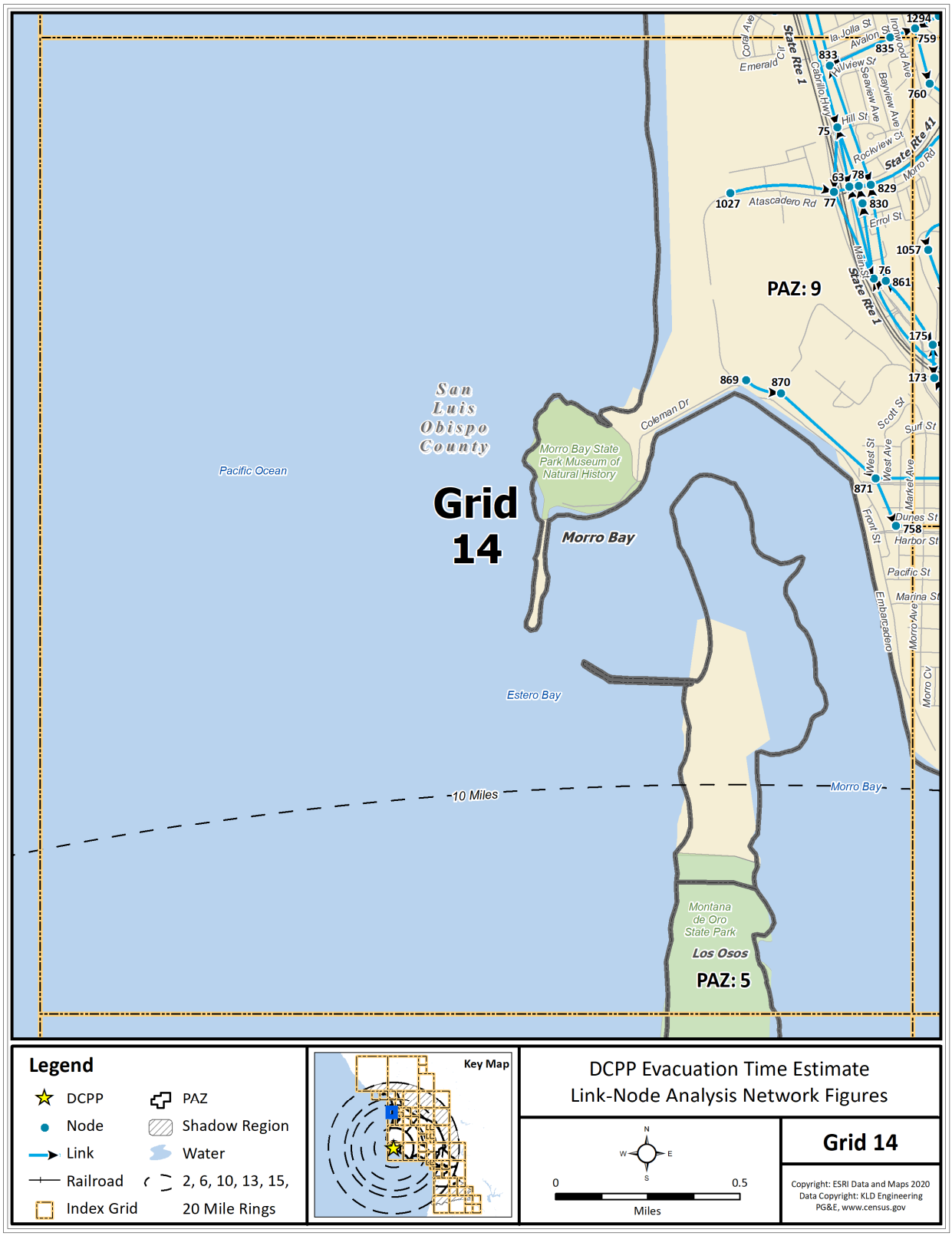


Figure K-15. Link-Node Analysis Network – Grid 14

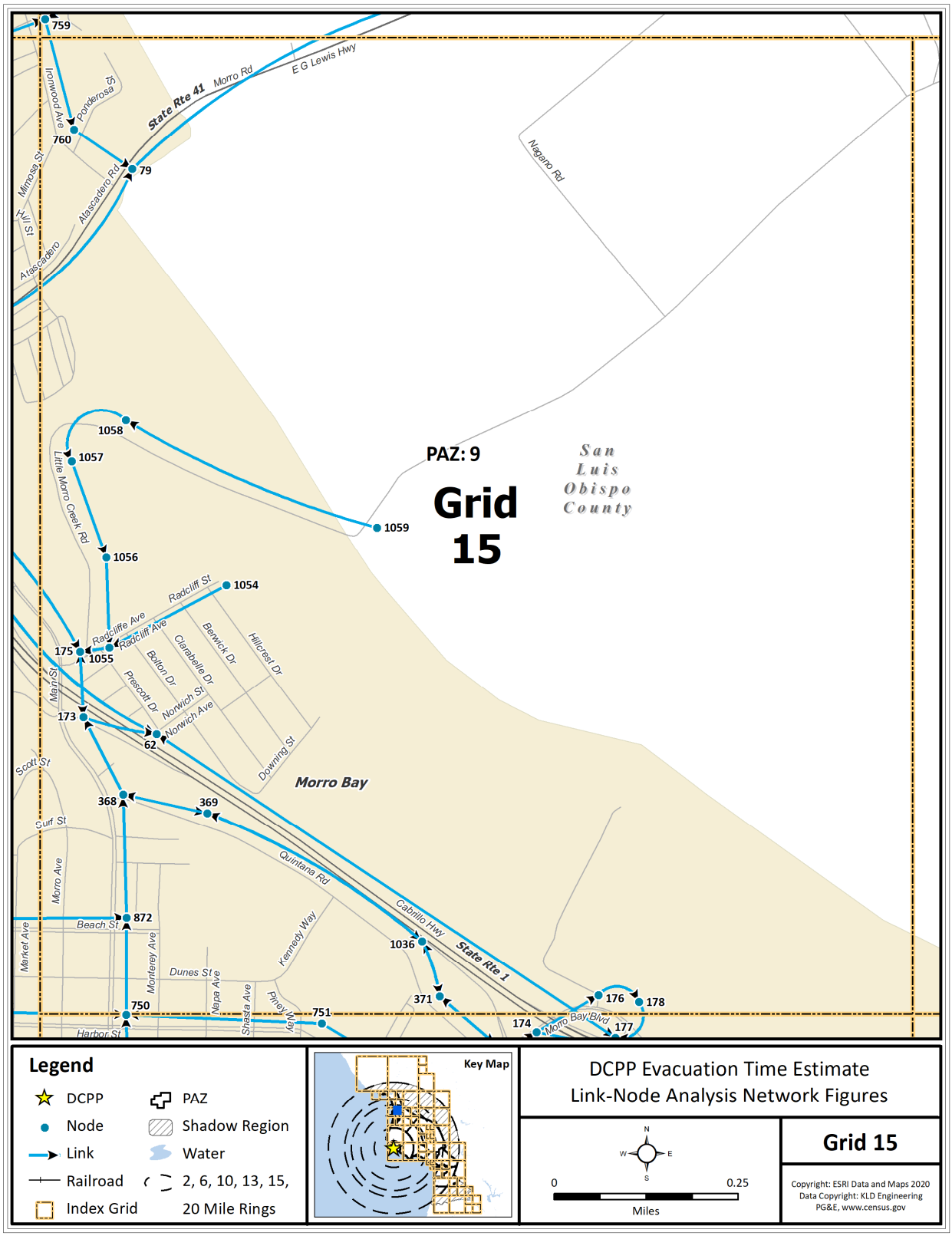


Figure K-16. Link-Node Analysis Network – Grid 15

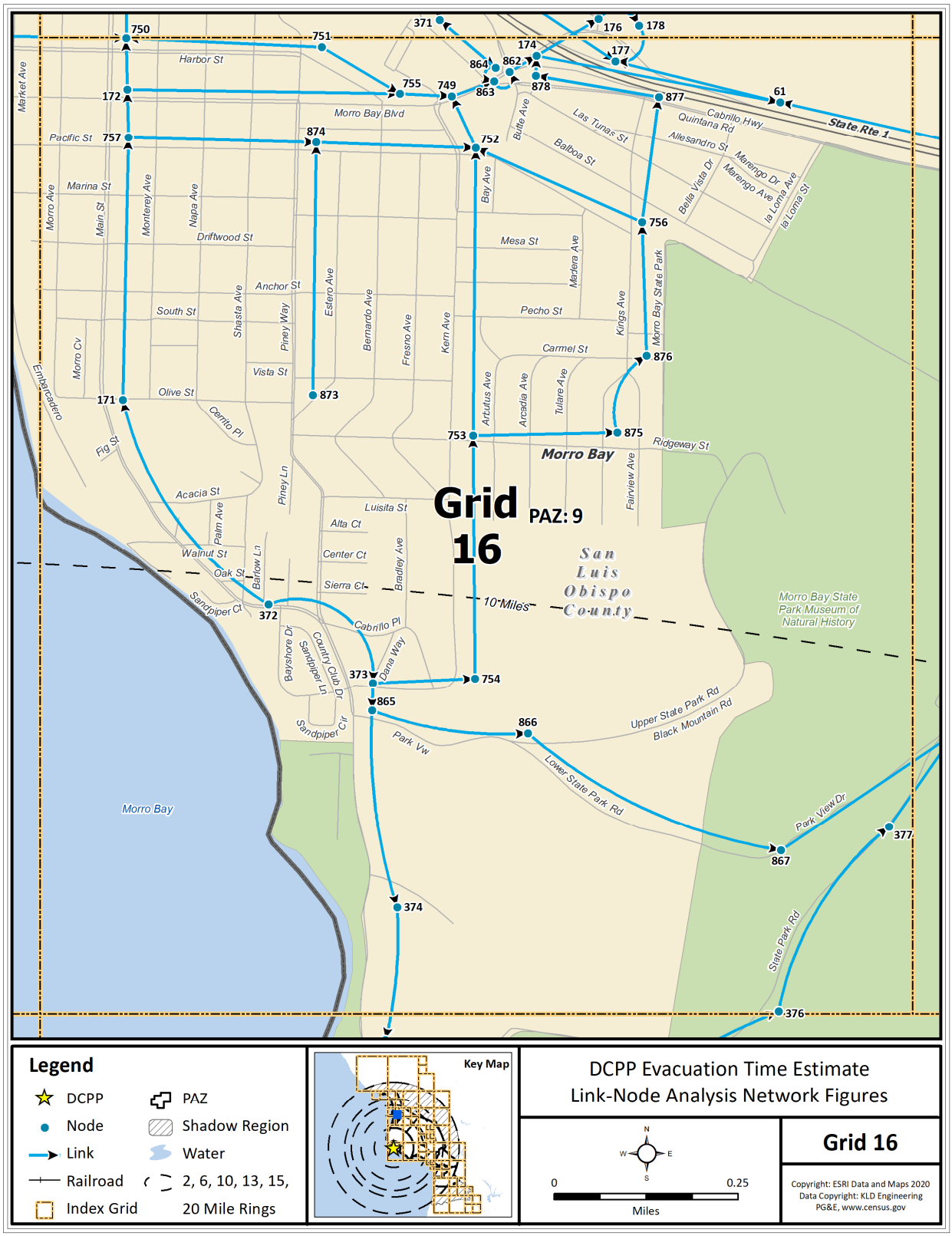


Figure K-17. Link-Node Analysis Network – Grid 16

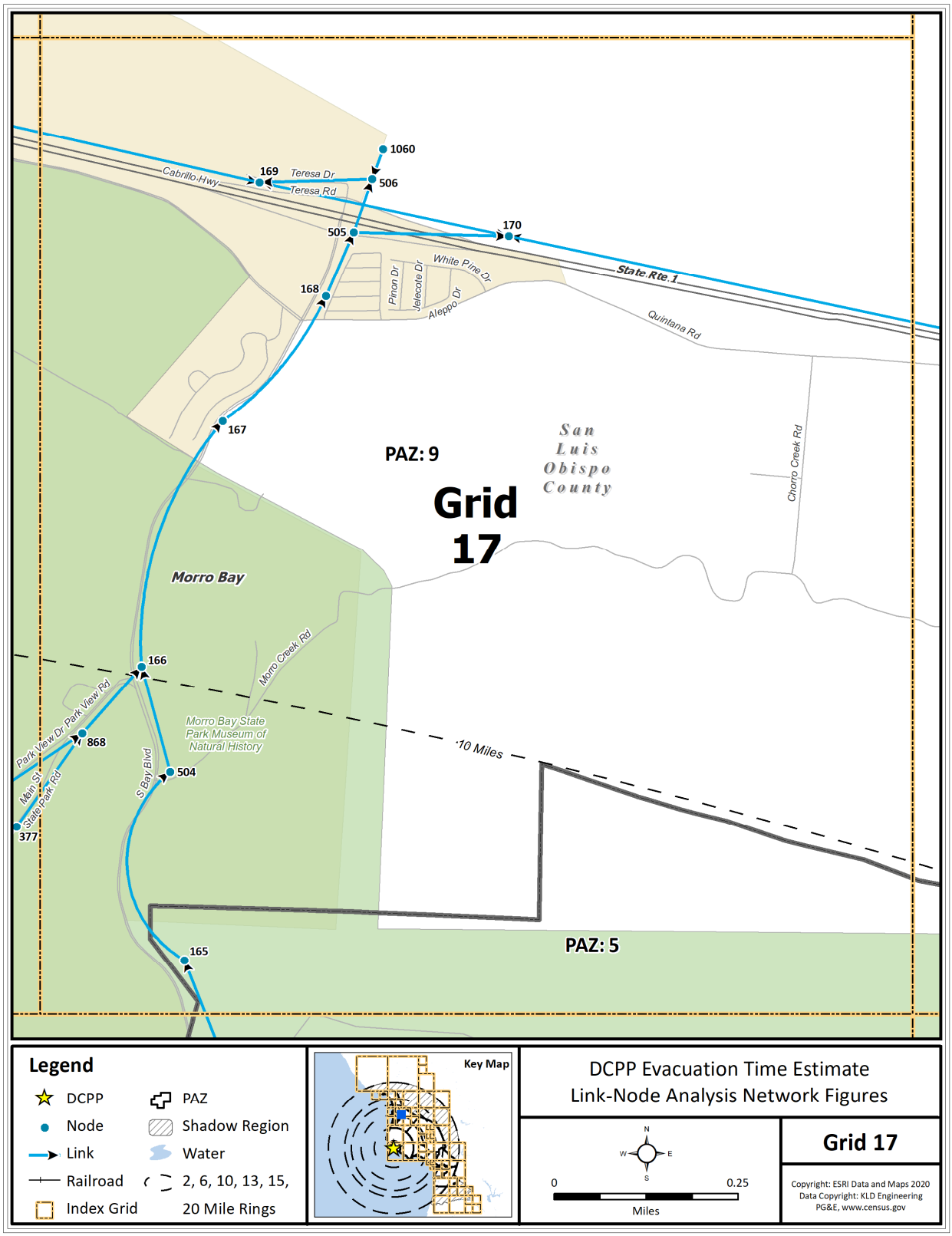


Figure K-18. Link-Node Analysis Network – Grid 17

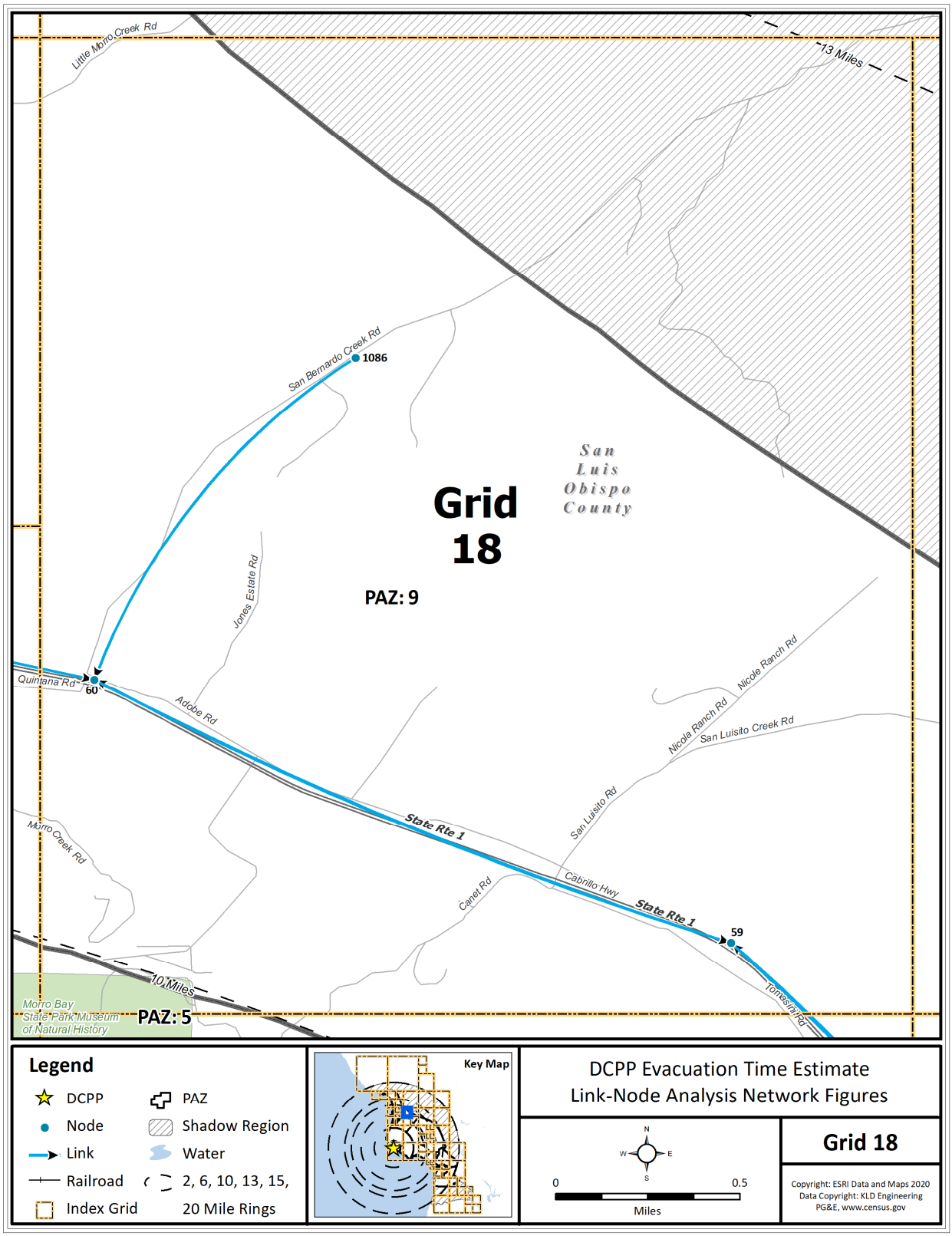


Figure K-19. Link-Node Analysis Network – Grid 18

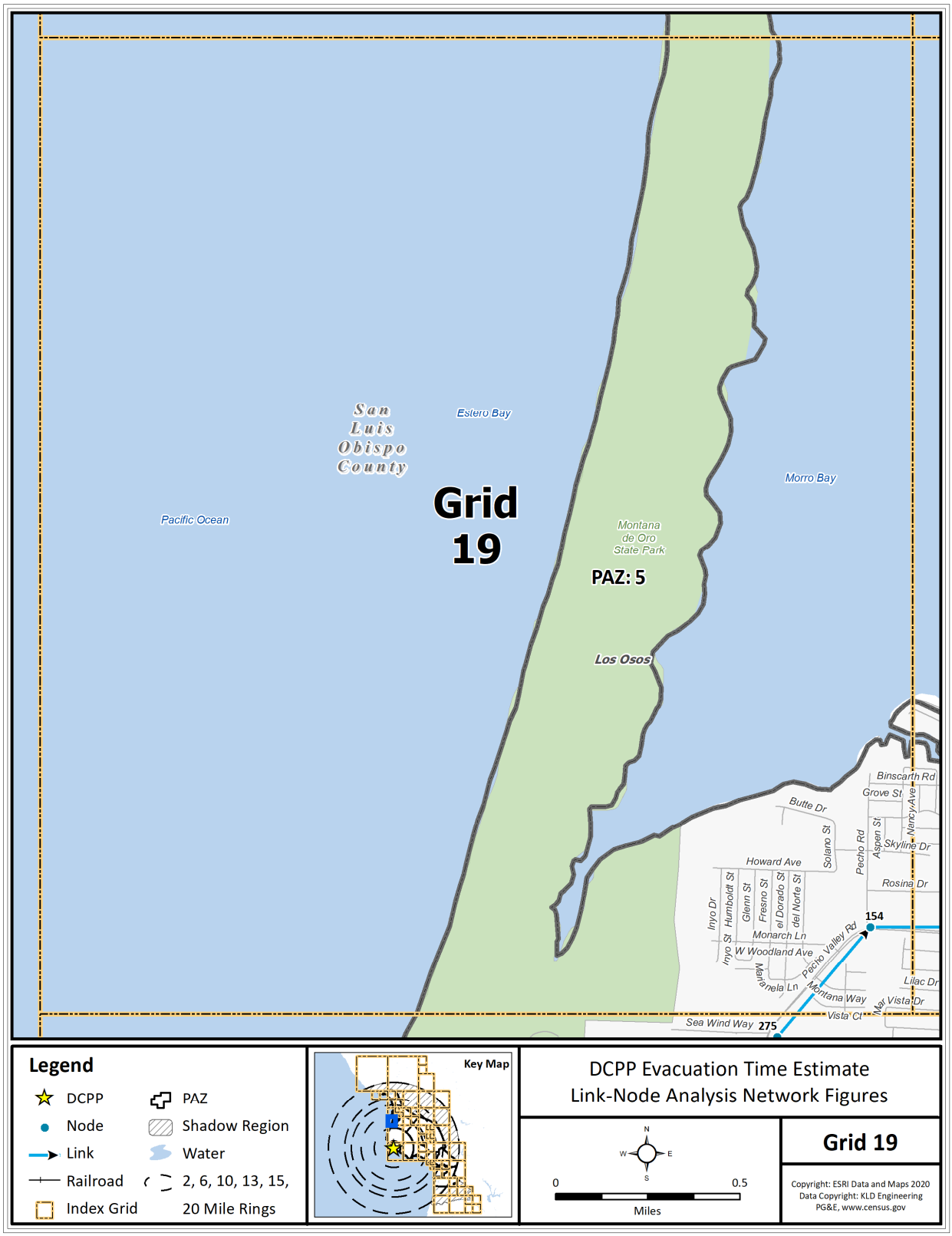


Figure K-20. Link-Node Analysis Network – Grid 19

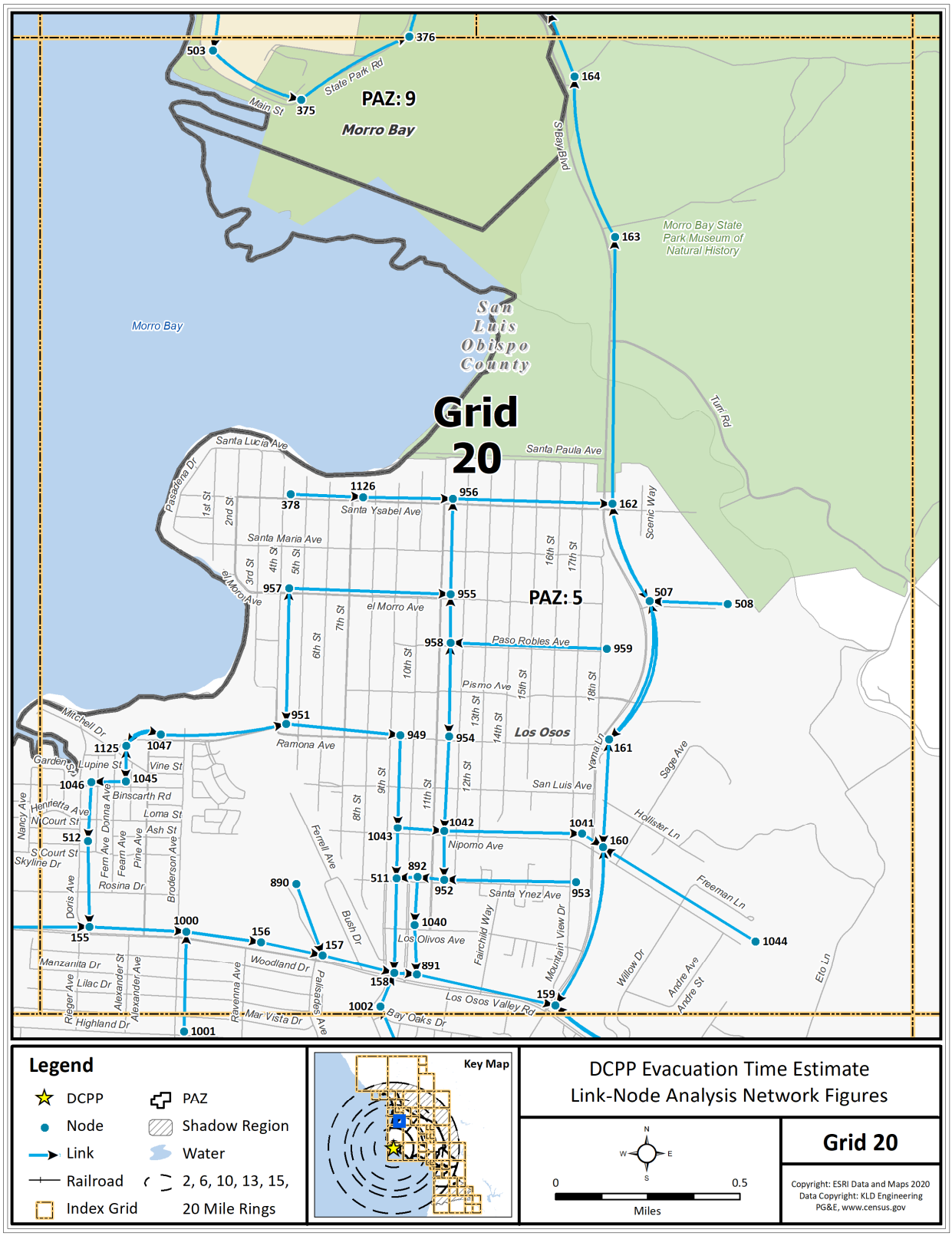


Figure K-21. Link-Node Analysis Network – Grid 20

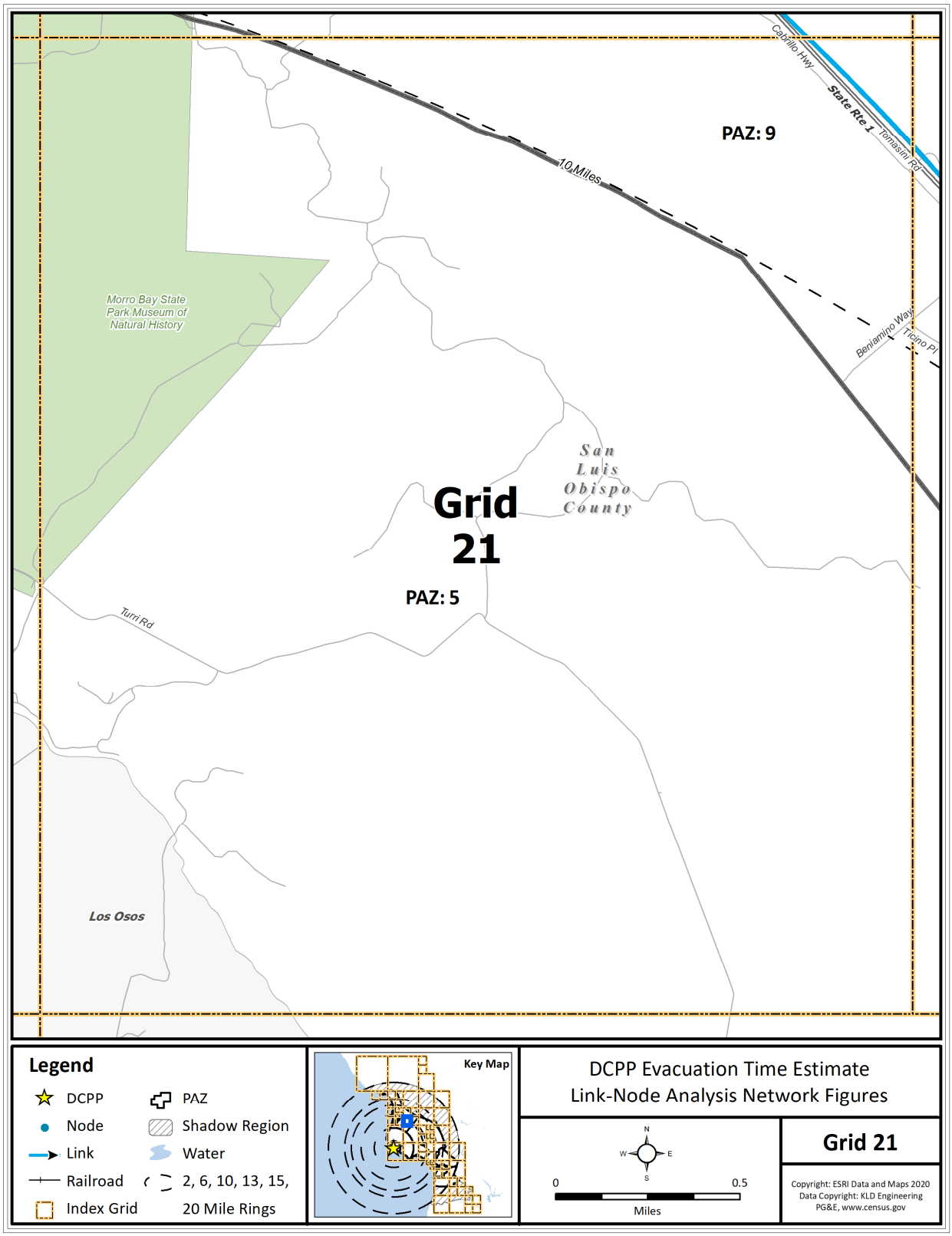


Figure K-22. Link-Node Analysis Network – Grid 21

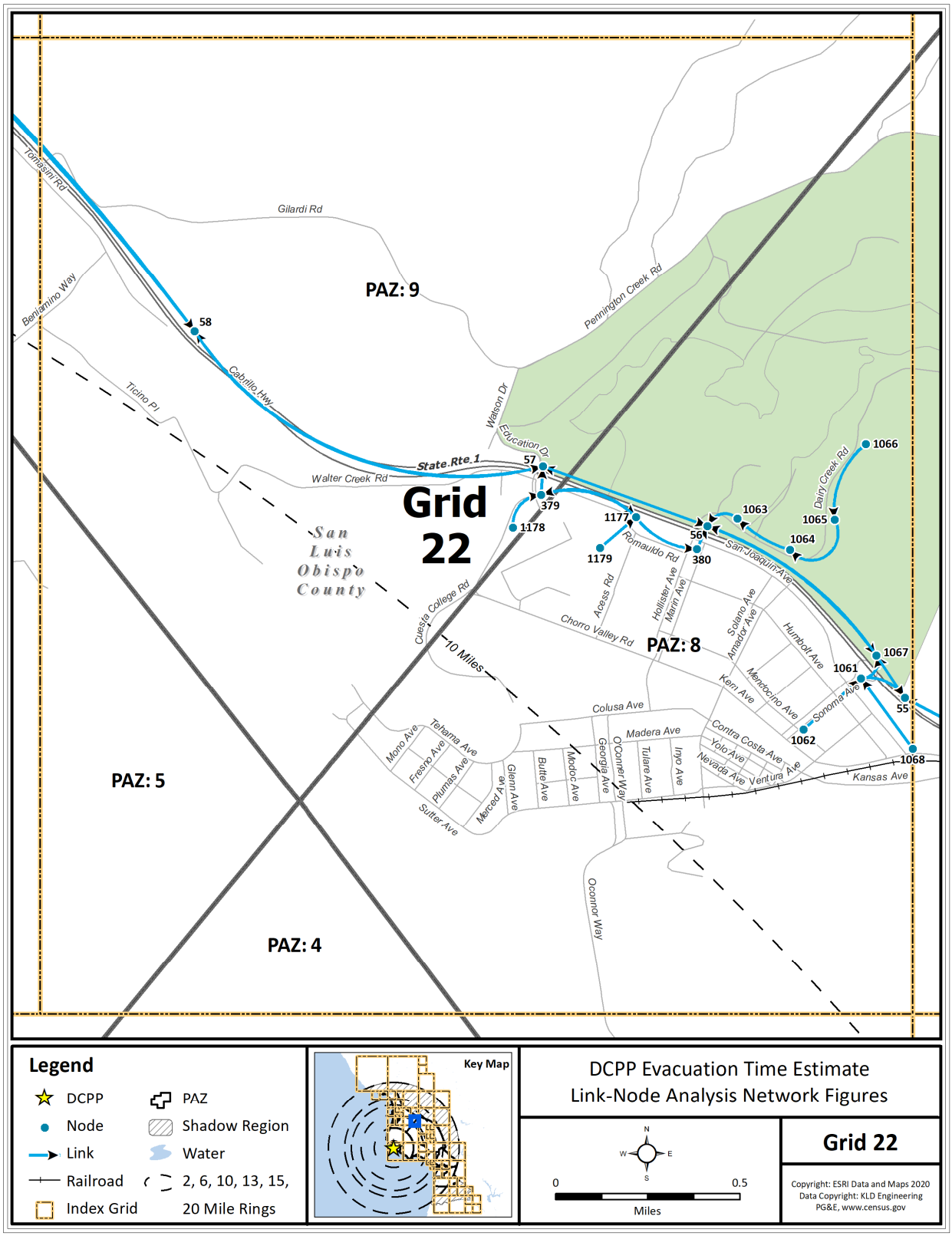


Figure K-23. Link-Node Analysis Network – Grid 22

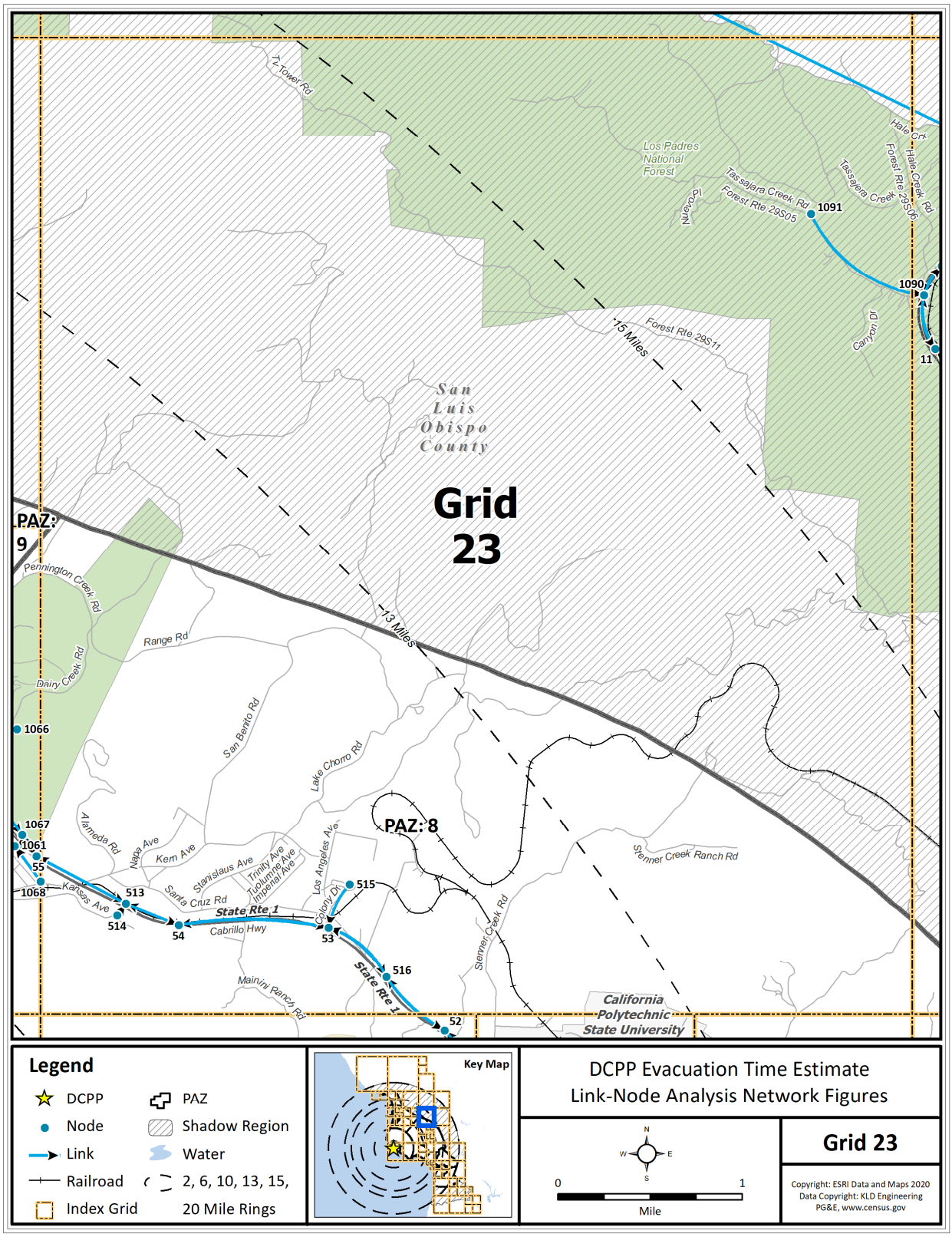


Figure K-24. Link-Node Analysis Network – Grid 23

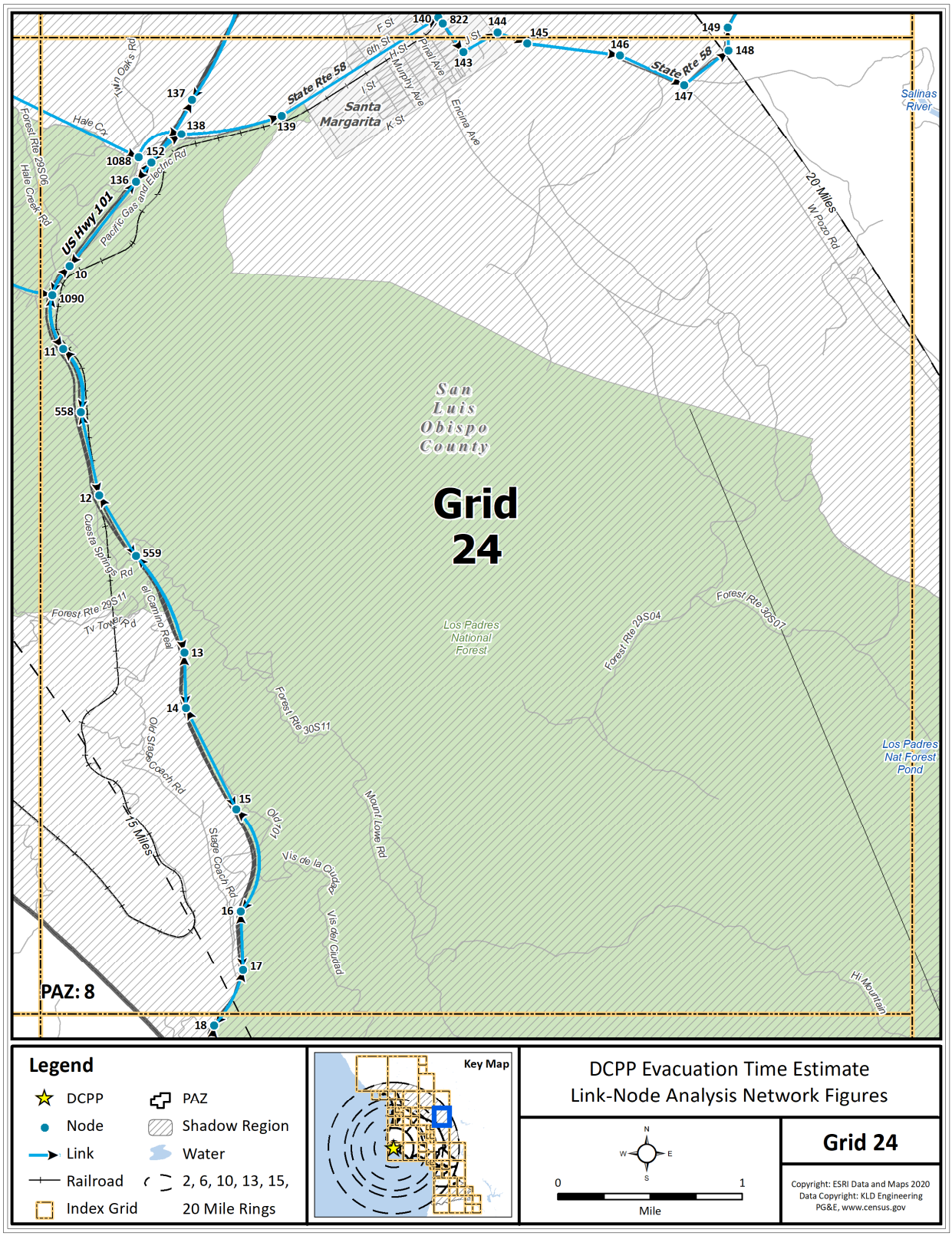


Figure K-25. Link-Node Analysis Network – Grid 24

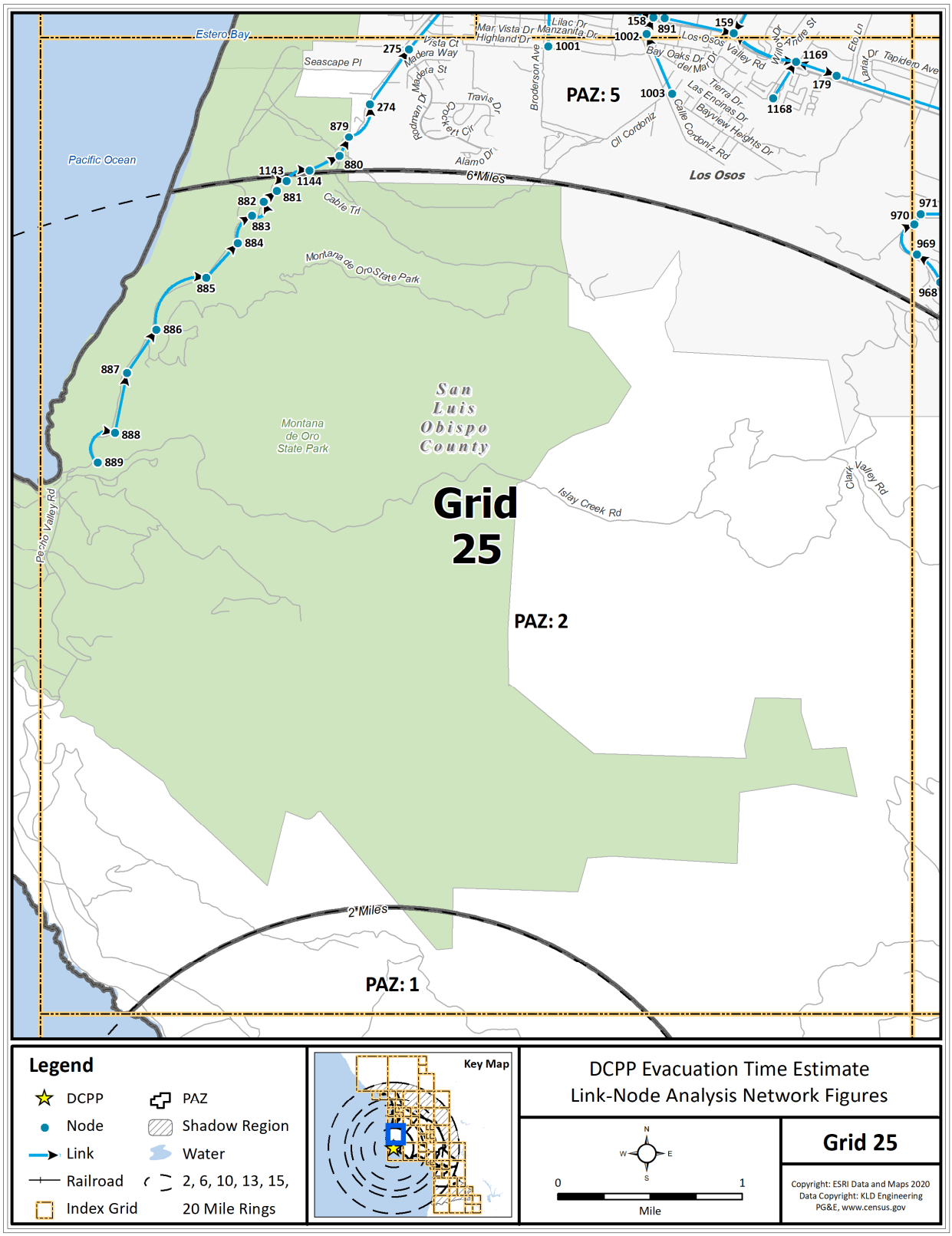


Figure K-26. Link-Node Analysis Network – Grid 25

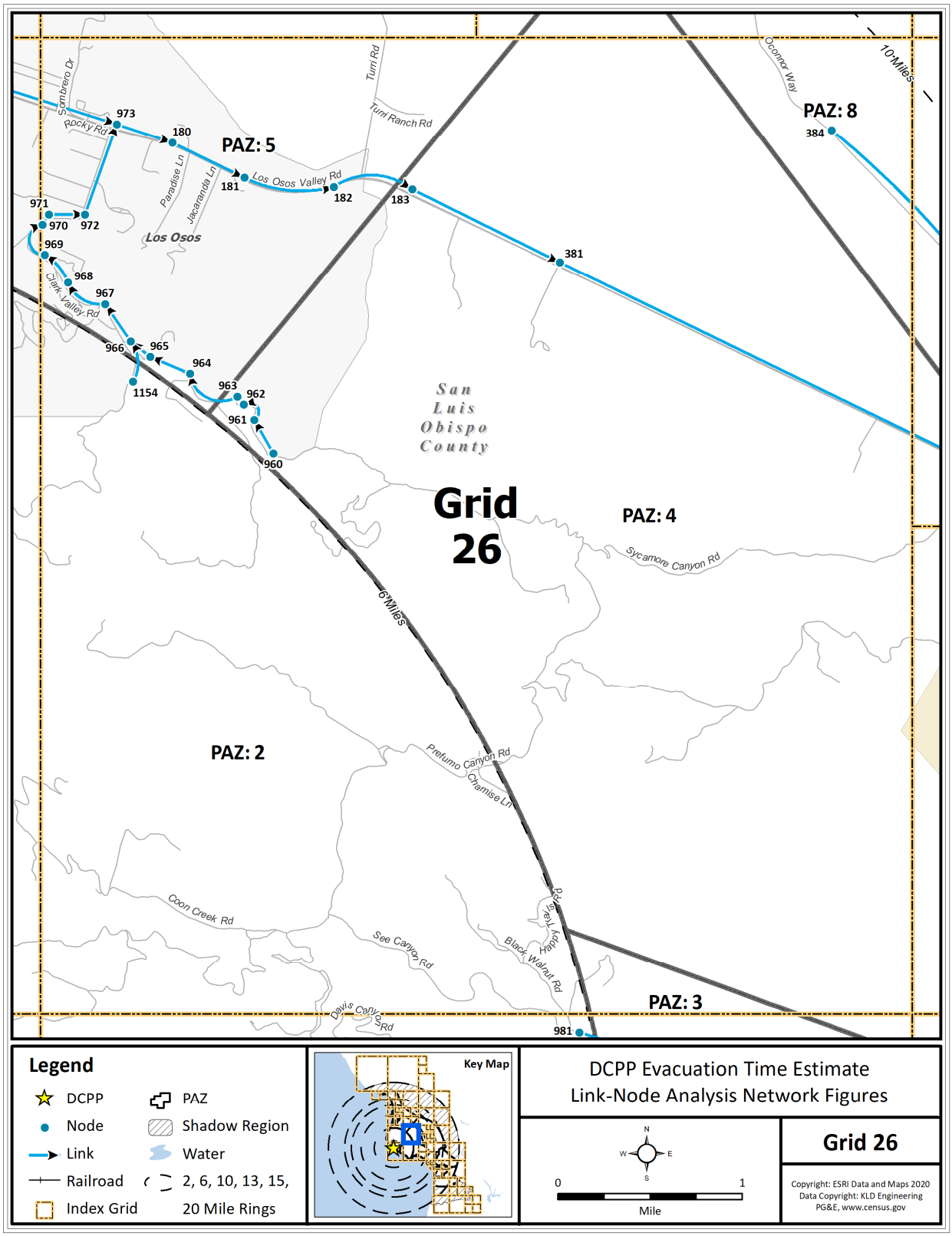


Figure K-27. Link-Node Analysis Network – Grid 26

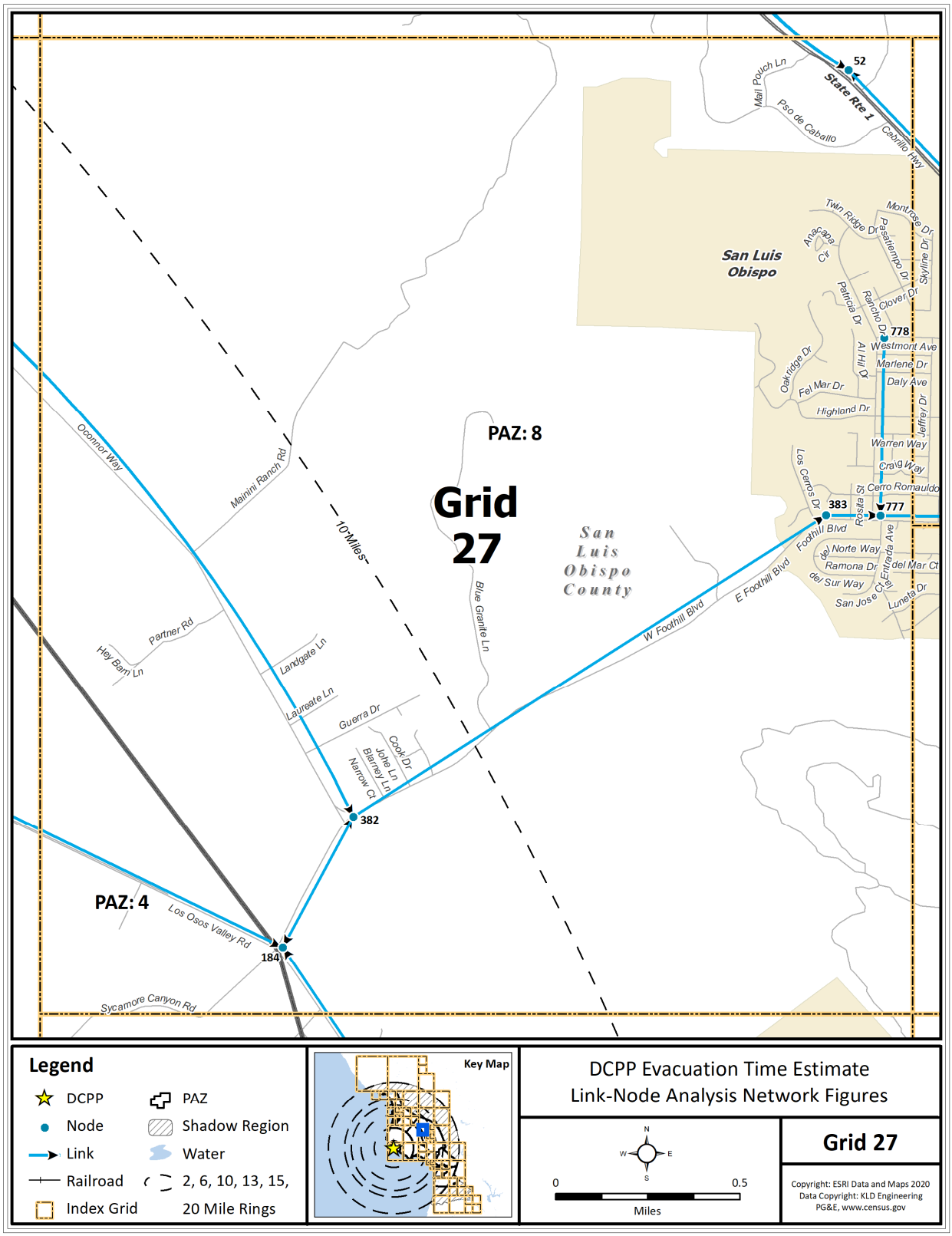


Figure K-28. Link-Node Analysis Network – Grid 27

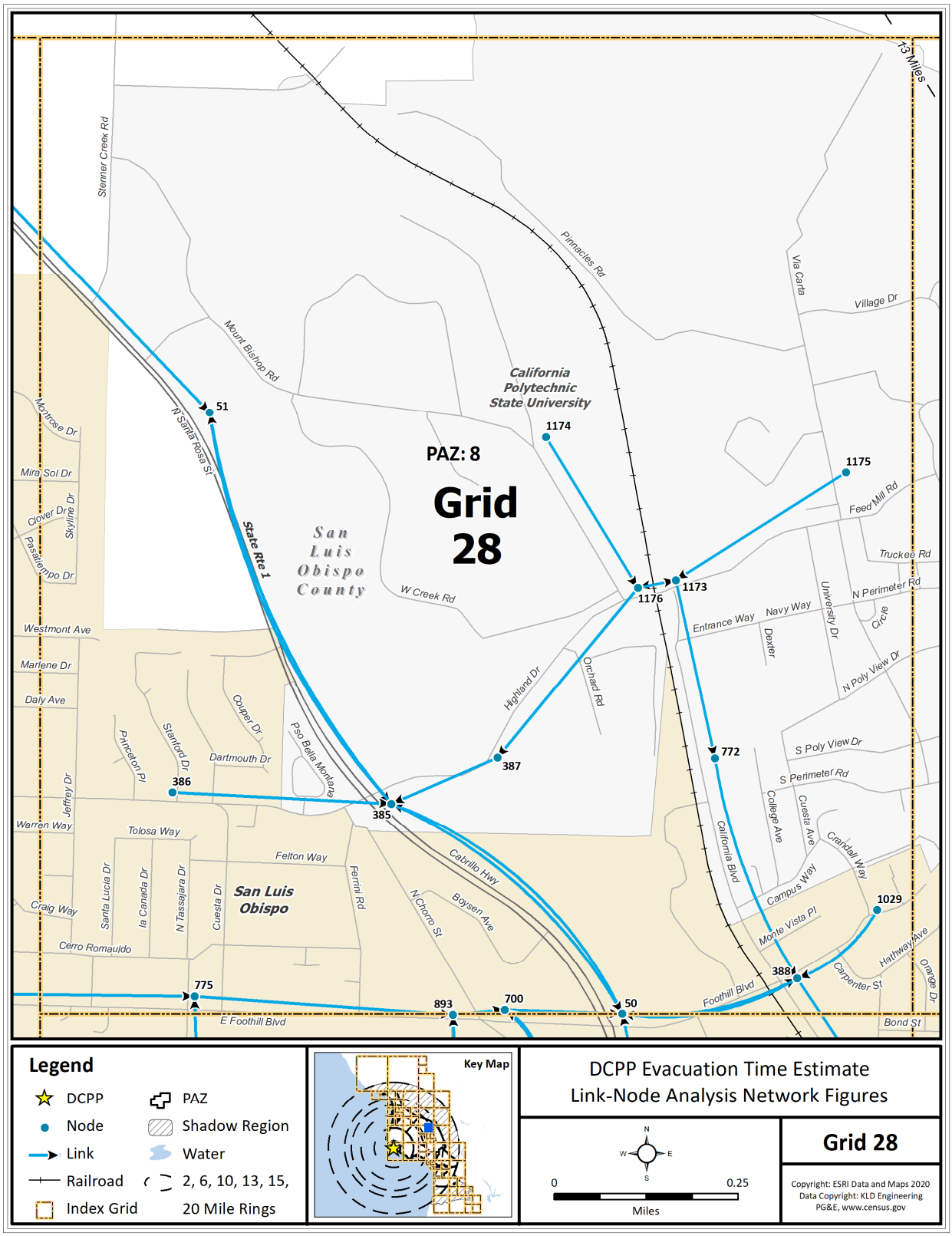


Figure K-29. Link-Node Analysis Network – Grid 28

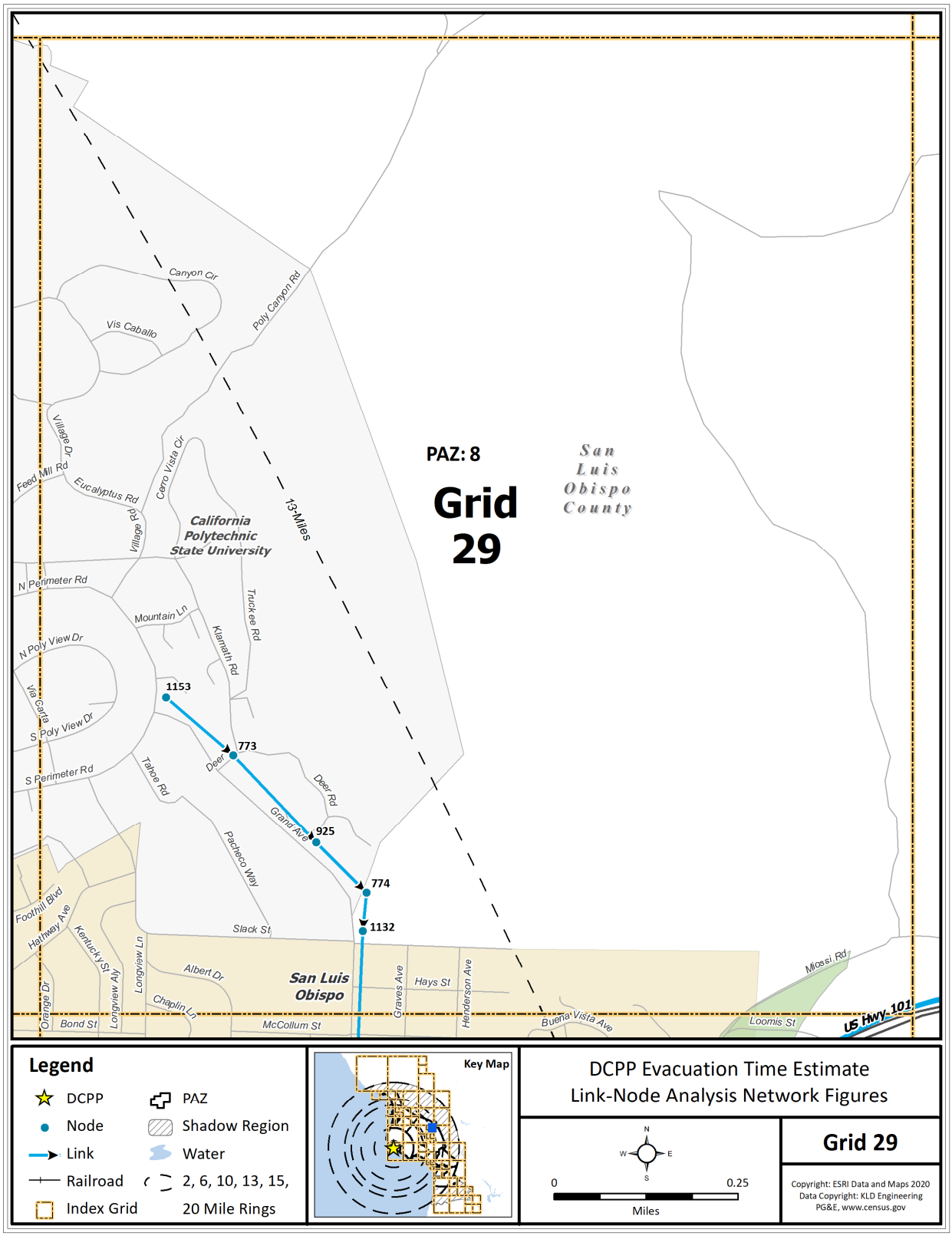


Figure K-30. Link-Node Analysis Network – Grid 29

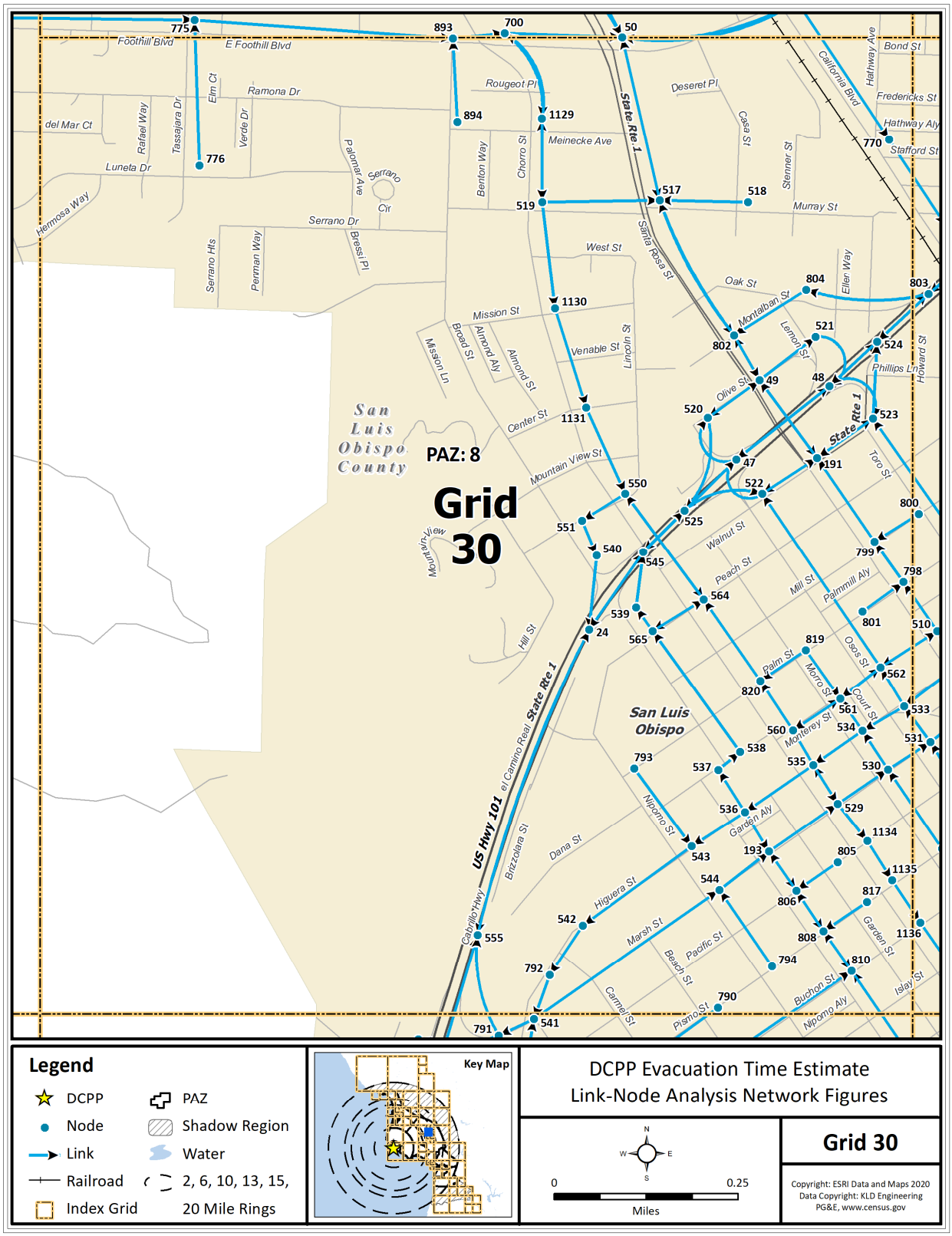


Figure K-31. Link-Node Analysis Network – Grid 30

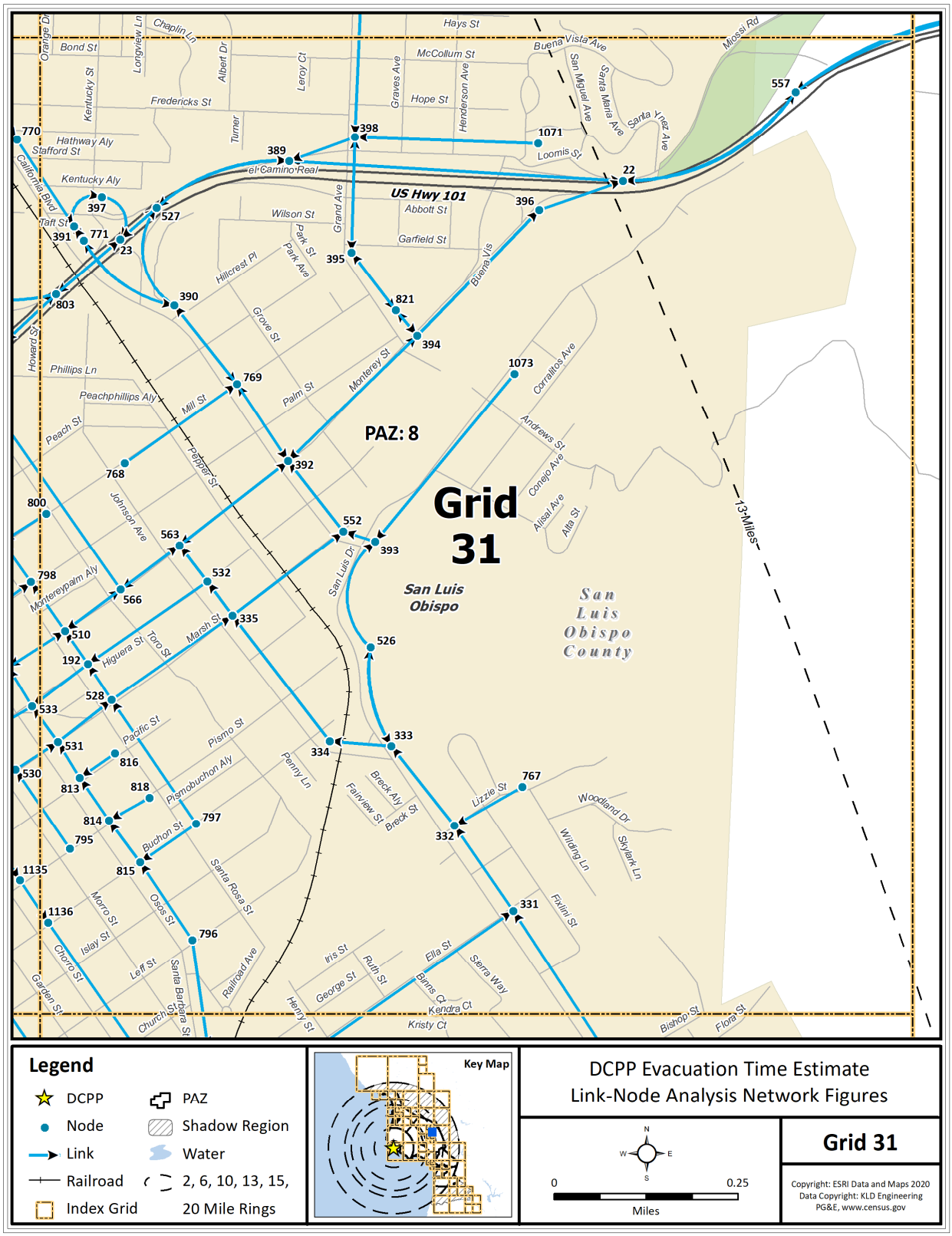


Figure K-32. Link-Node Analysis Network – Grid 31

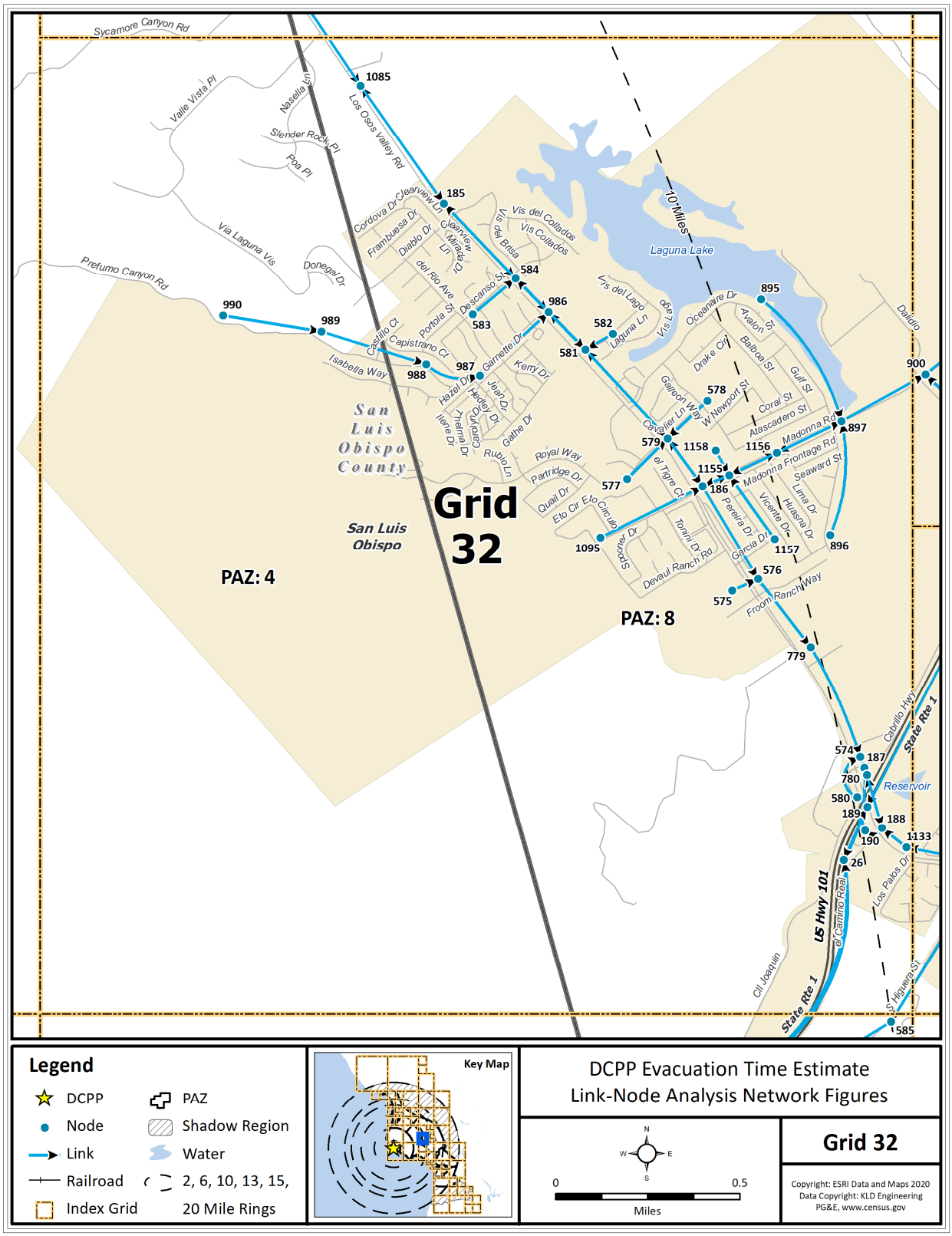


Figure K-33. Link-Node Analysis Network – Grid 32

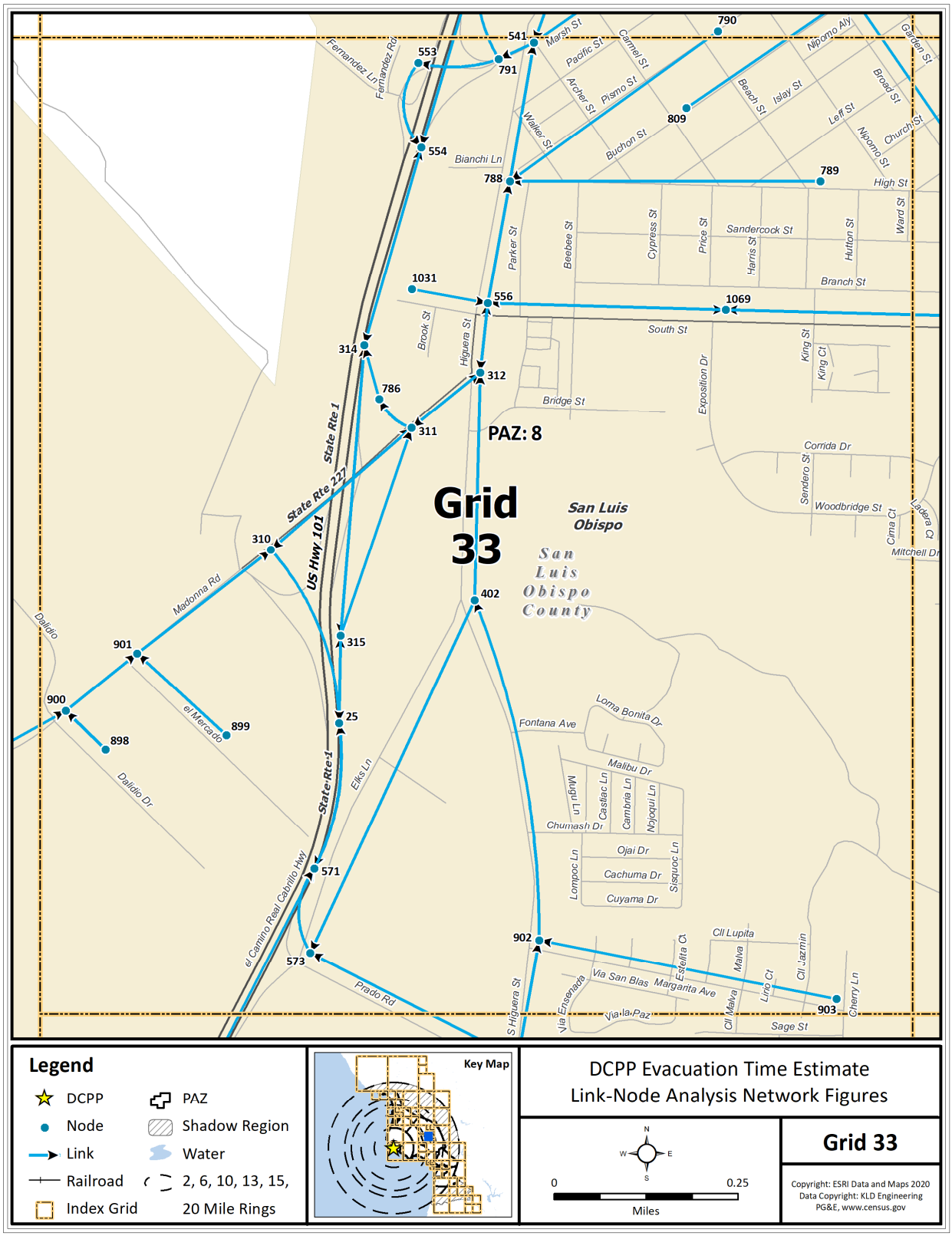


Figure K-34. Link-Node Analysis Network – Grid 33

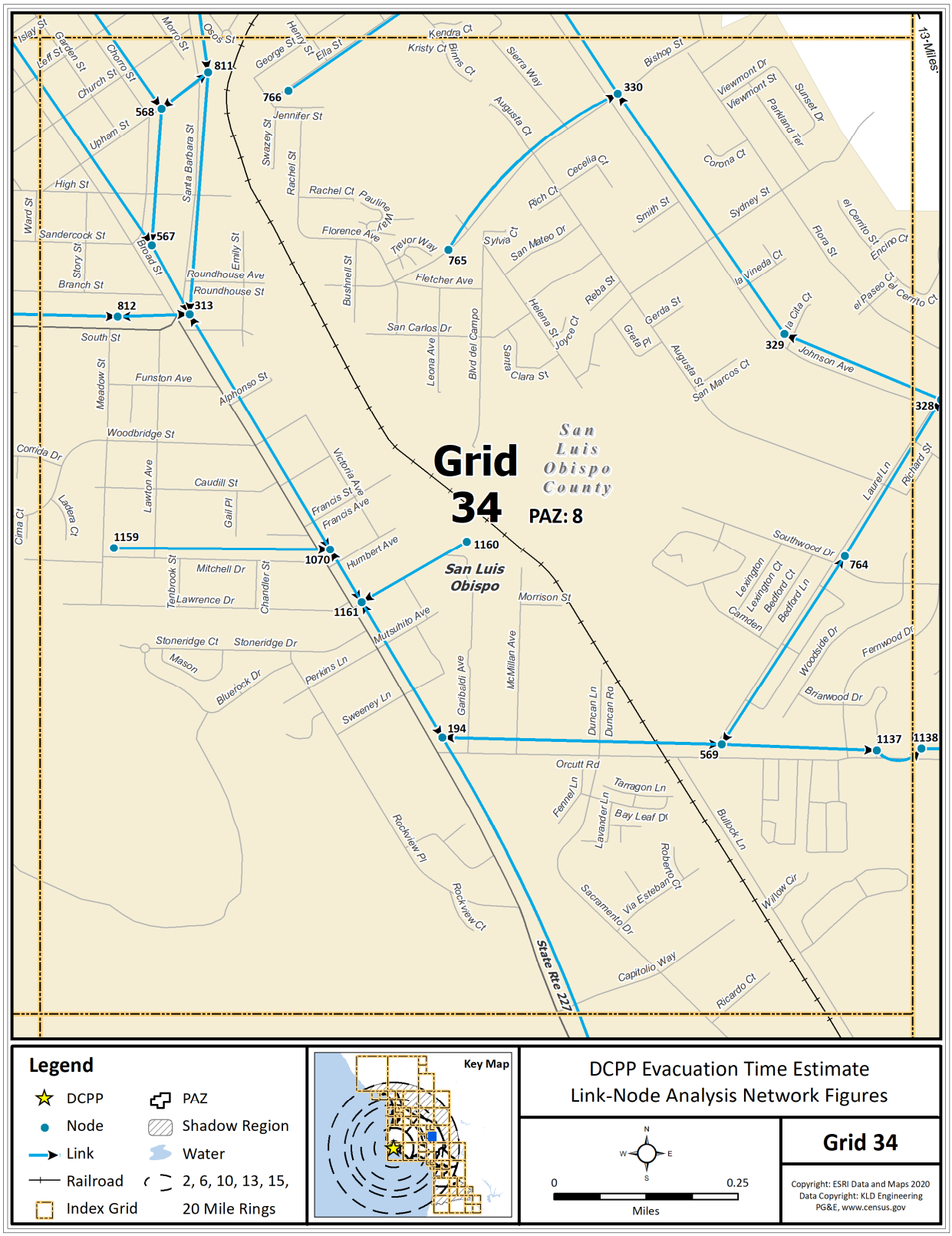


Figure K-35. Link-Node Analysis Network – Grid 34

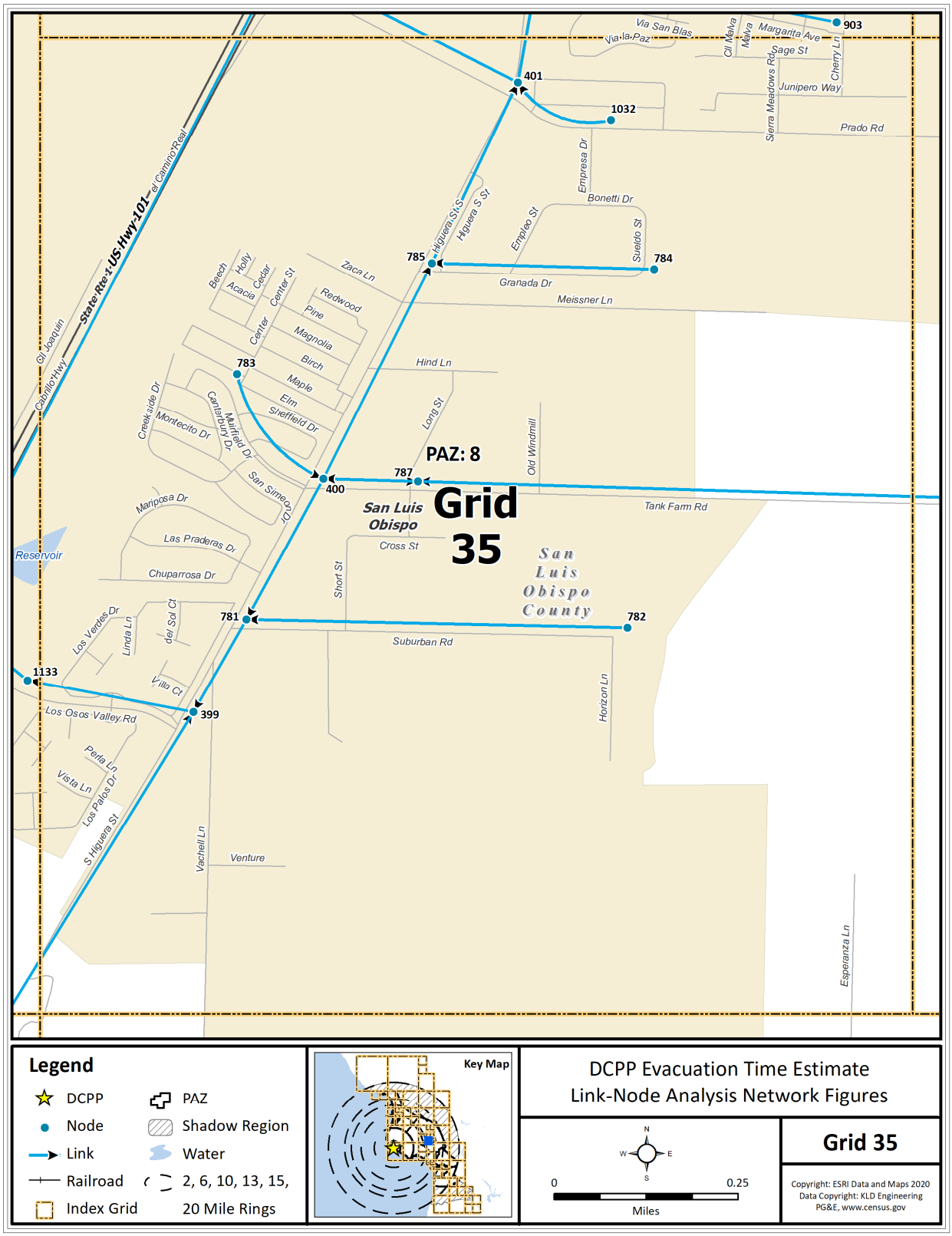


Figure K-36. Link-Node Analysis Network – Grid 35

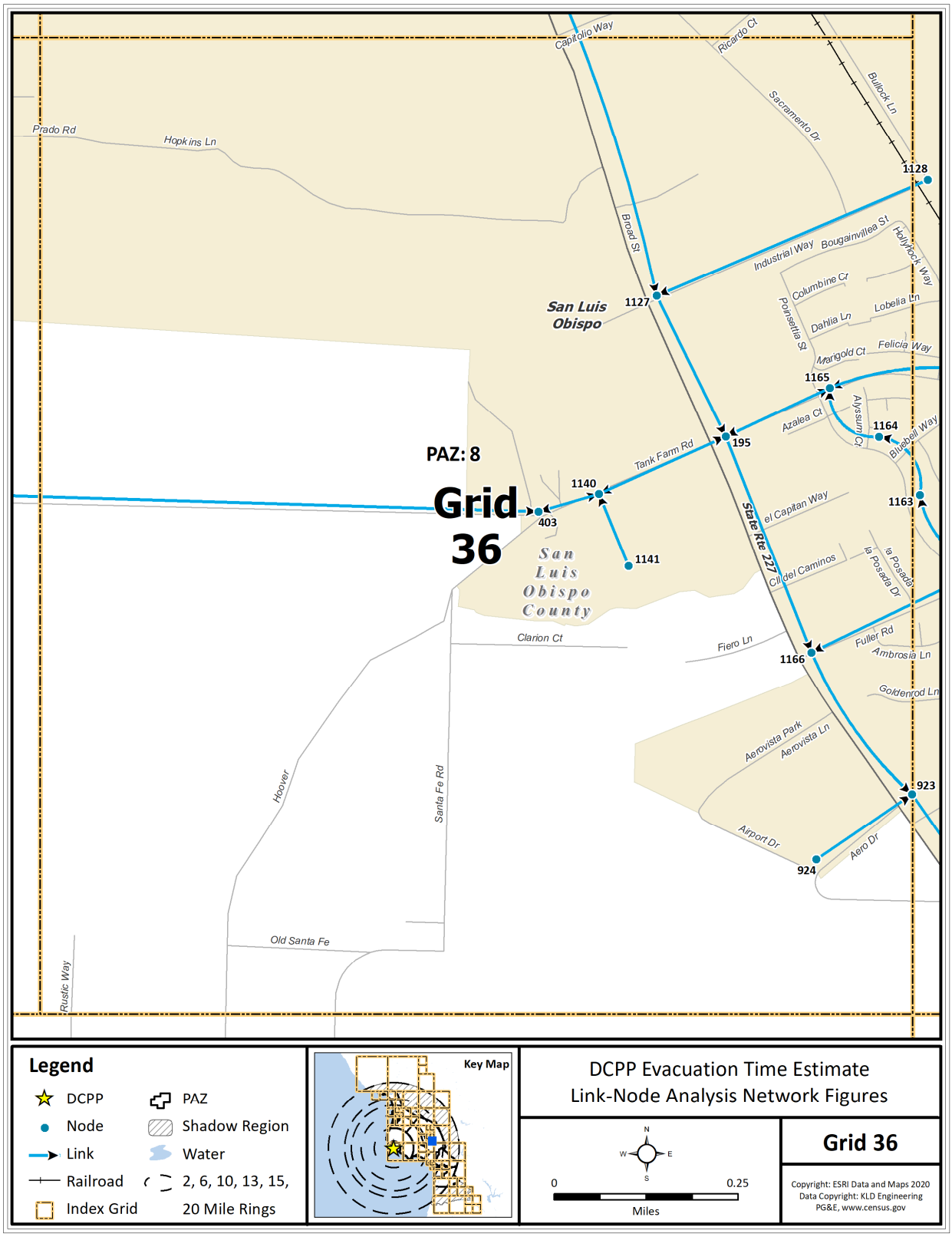


Figure K-37. Link-Node Analysis Network – Grid 36

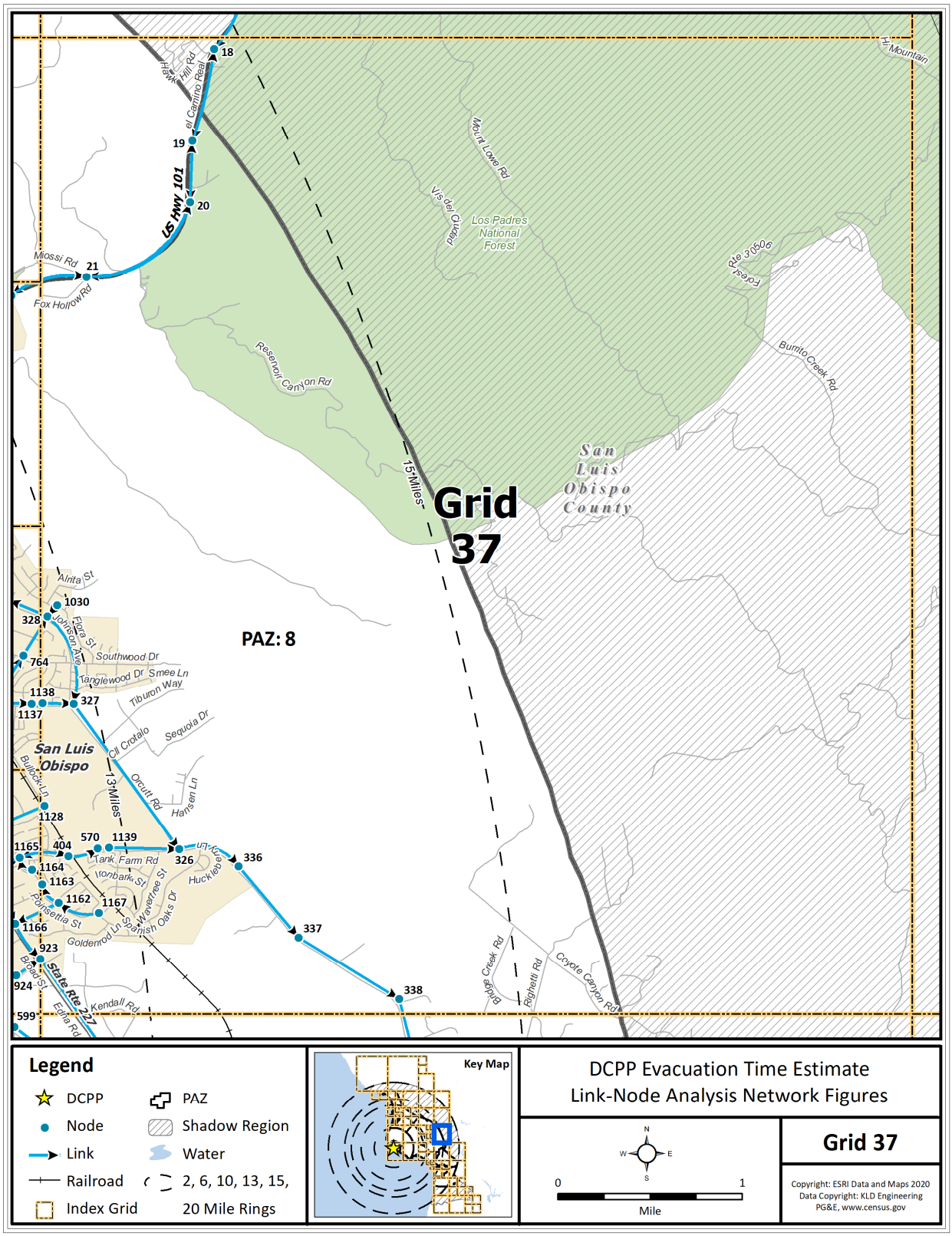


Figure K-38. Link-Node Analysis Network – Grid 37

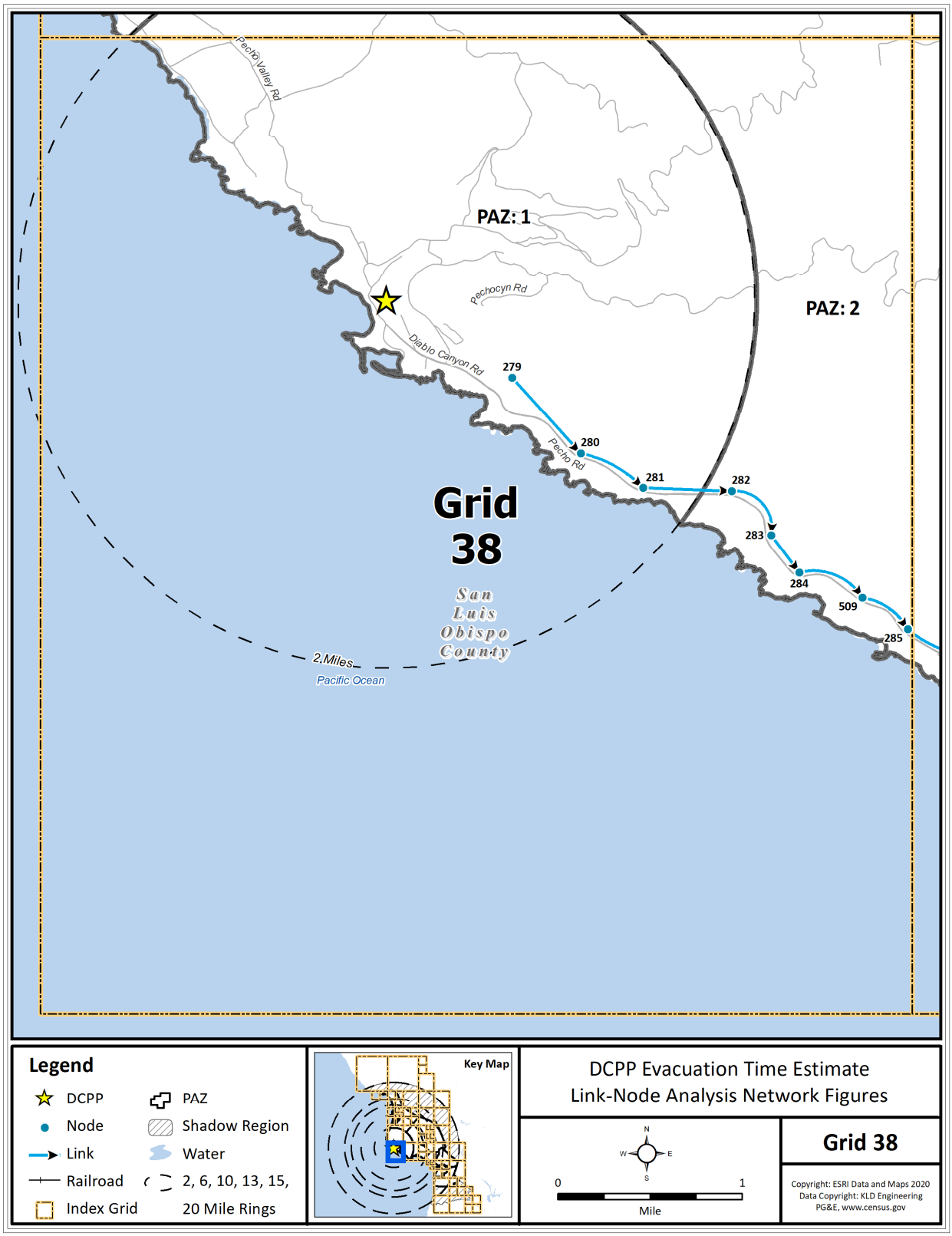


Figure K-39. Link-Node Analysis Network – Grid 38

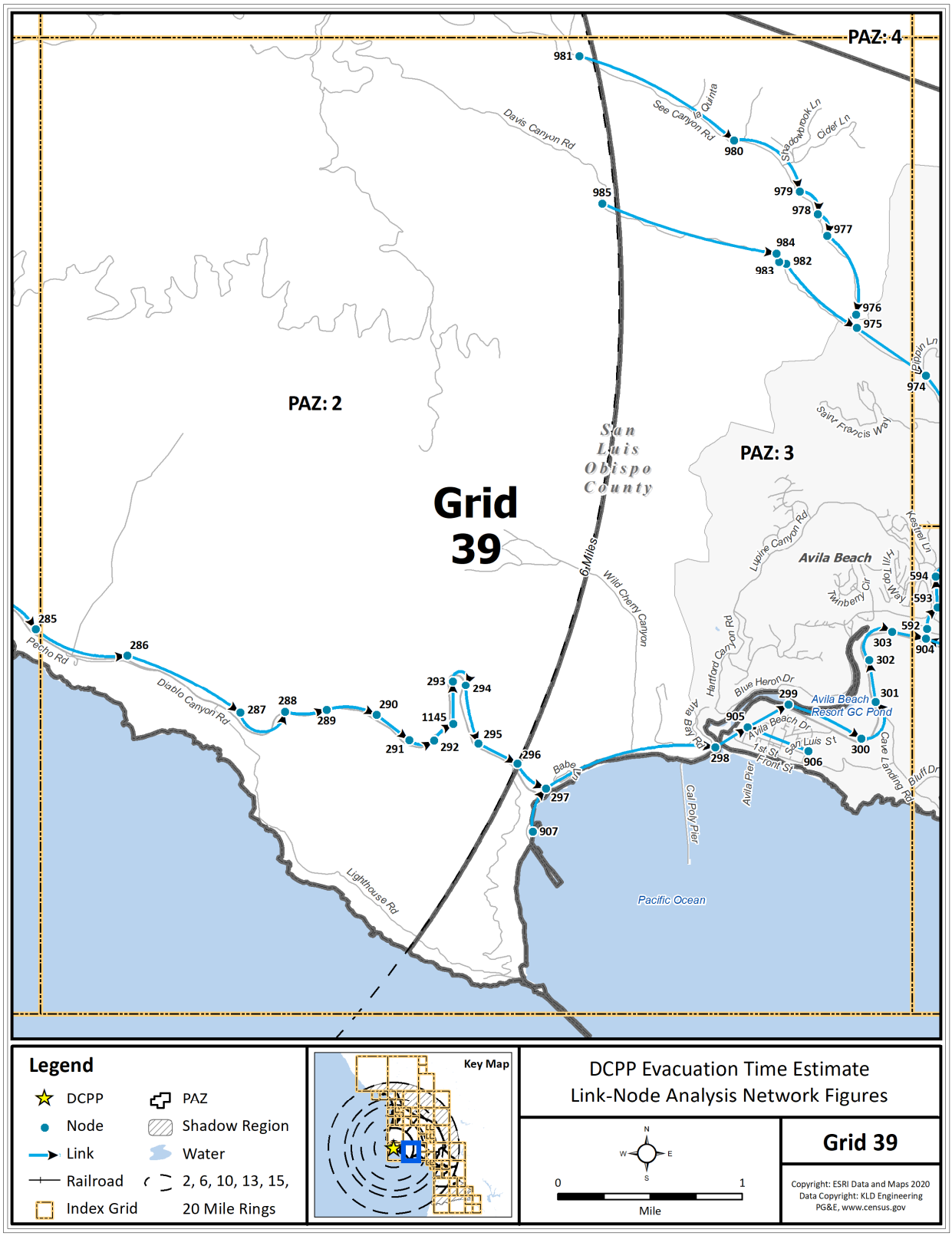
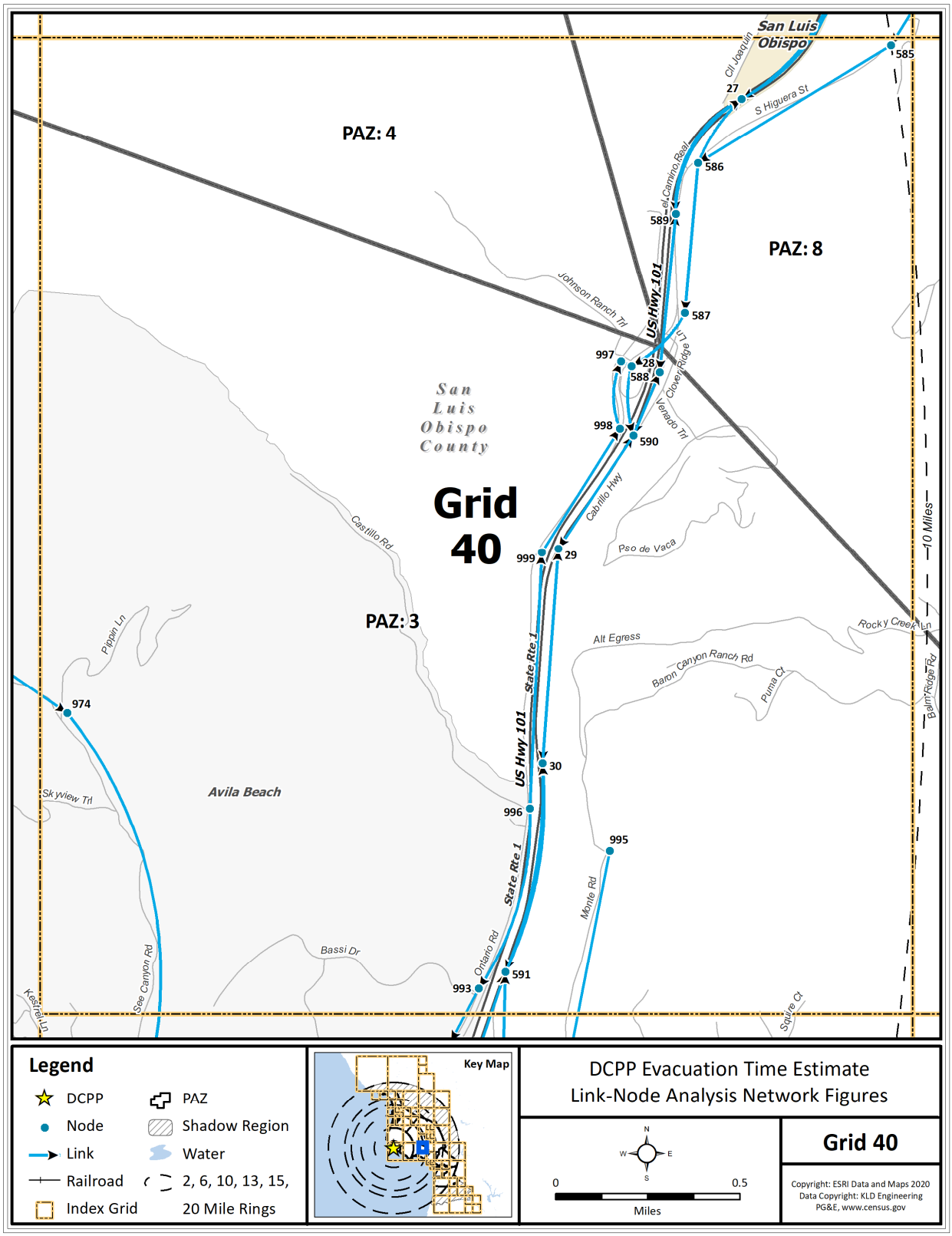


Figure K-40. Link-Node Analysis Network – Grid 39



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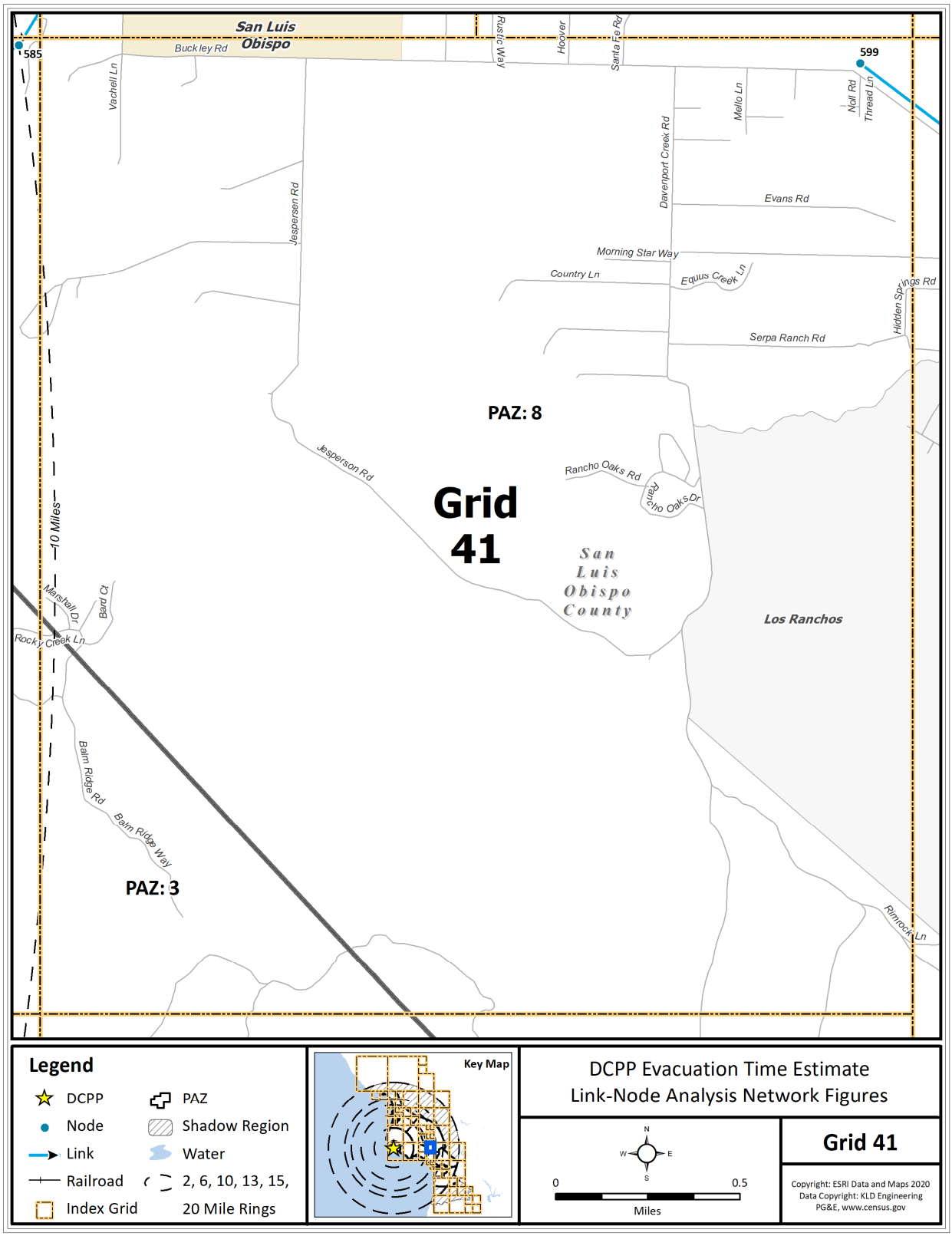

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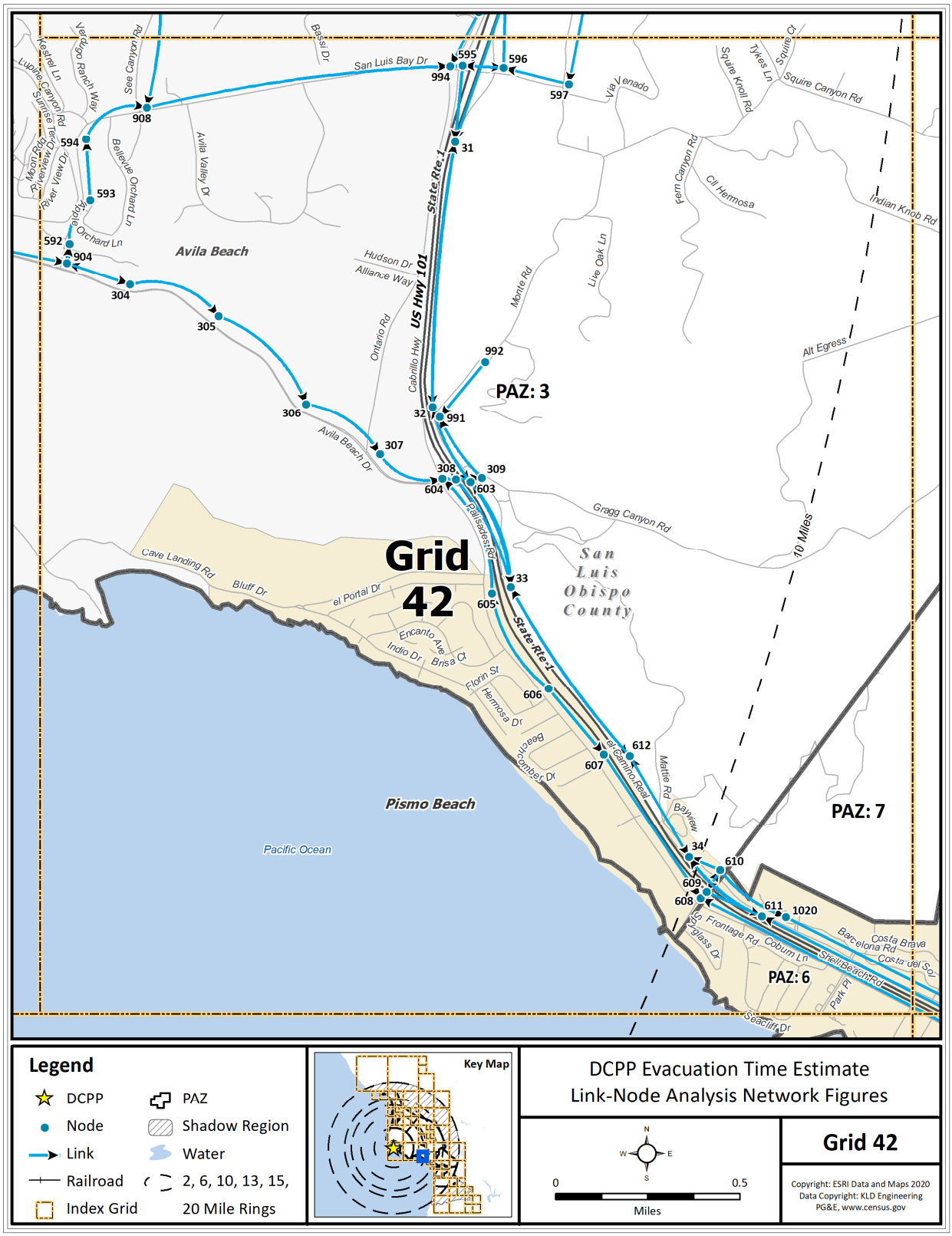

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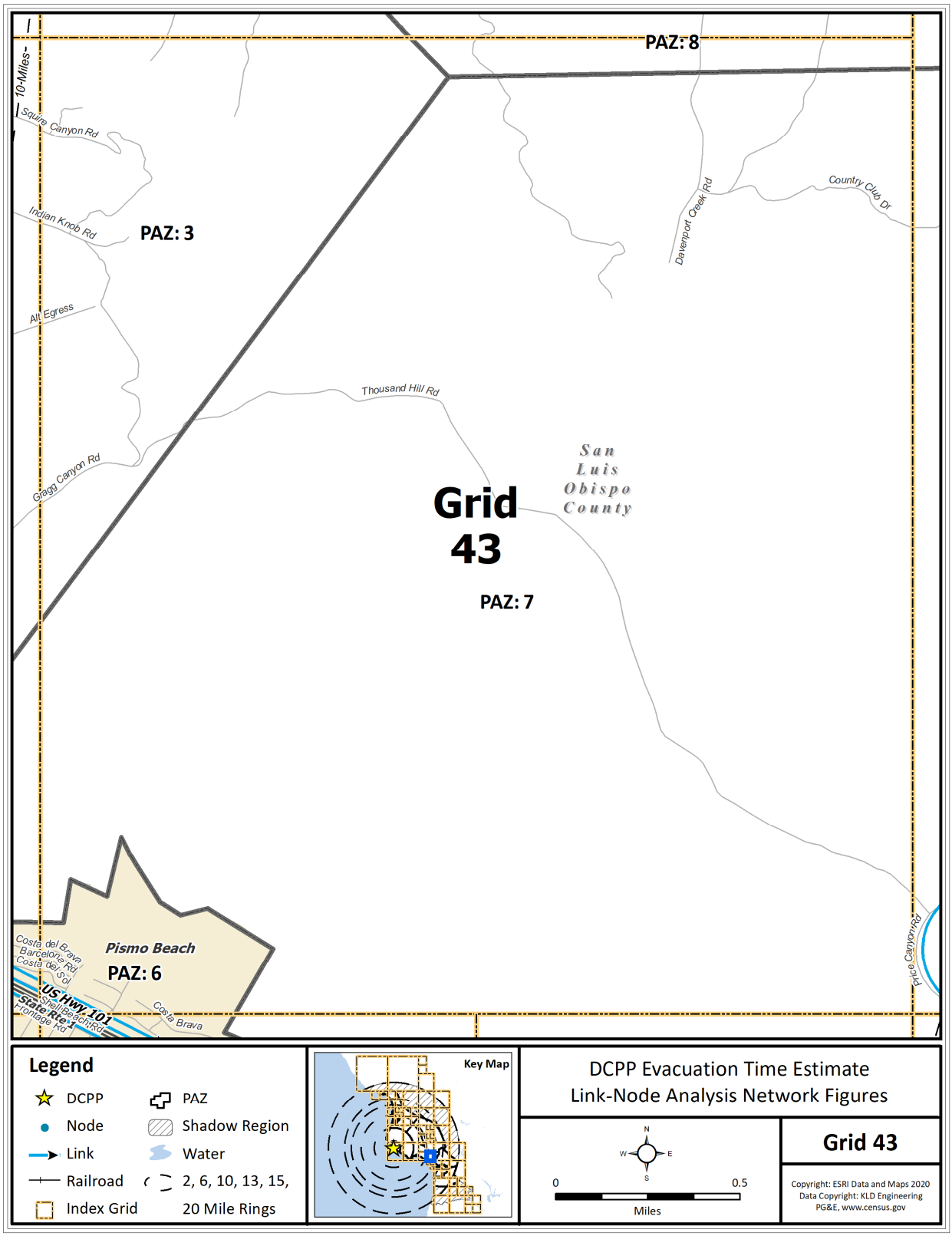

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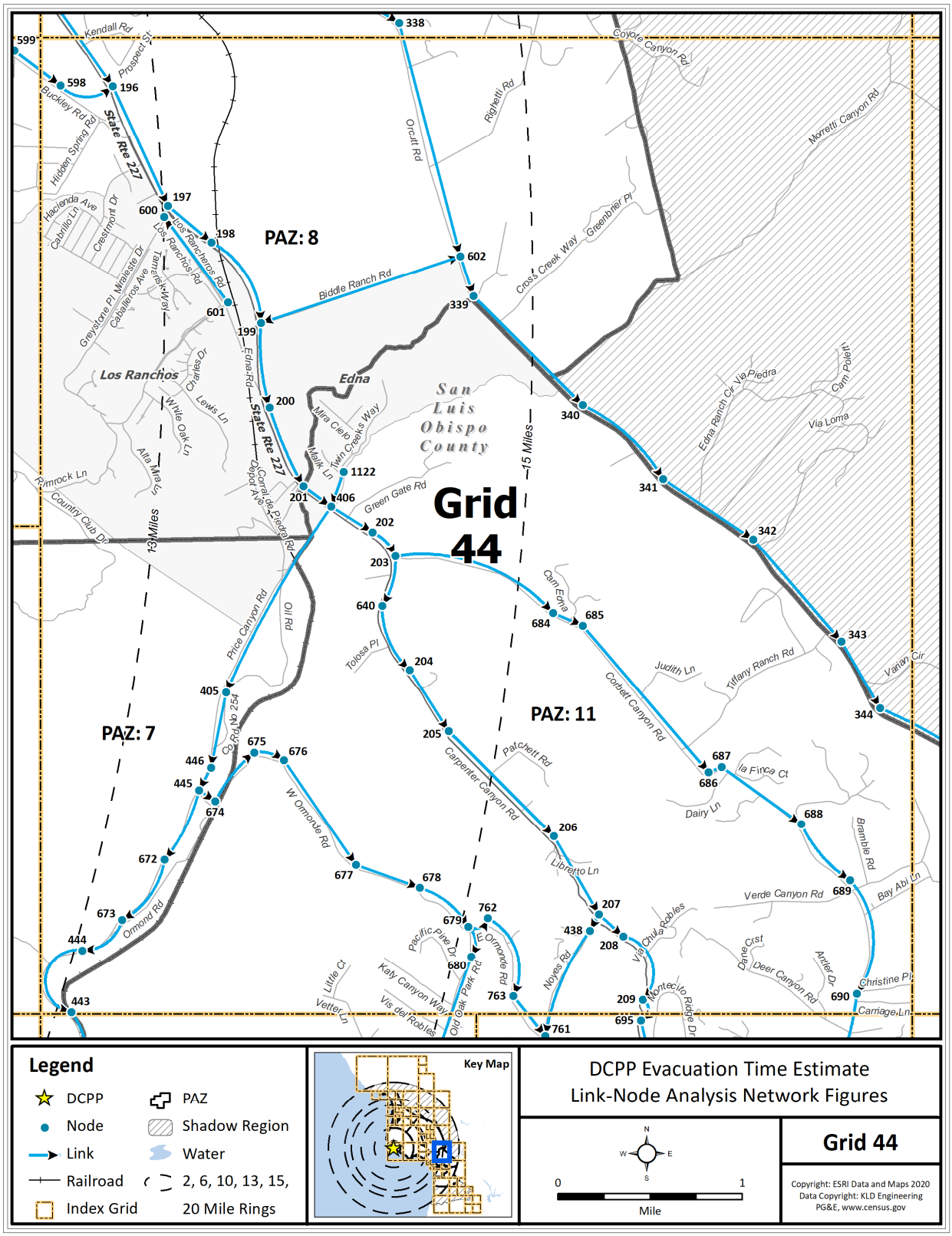

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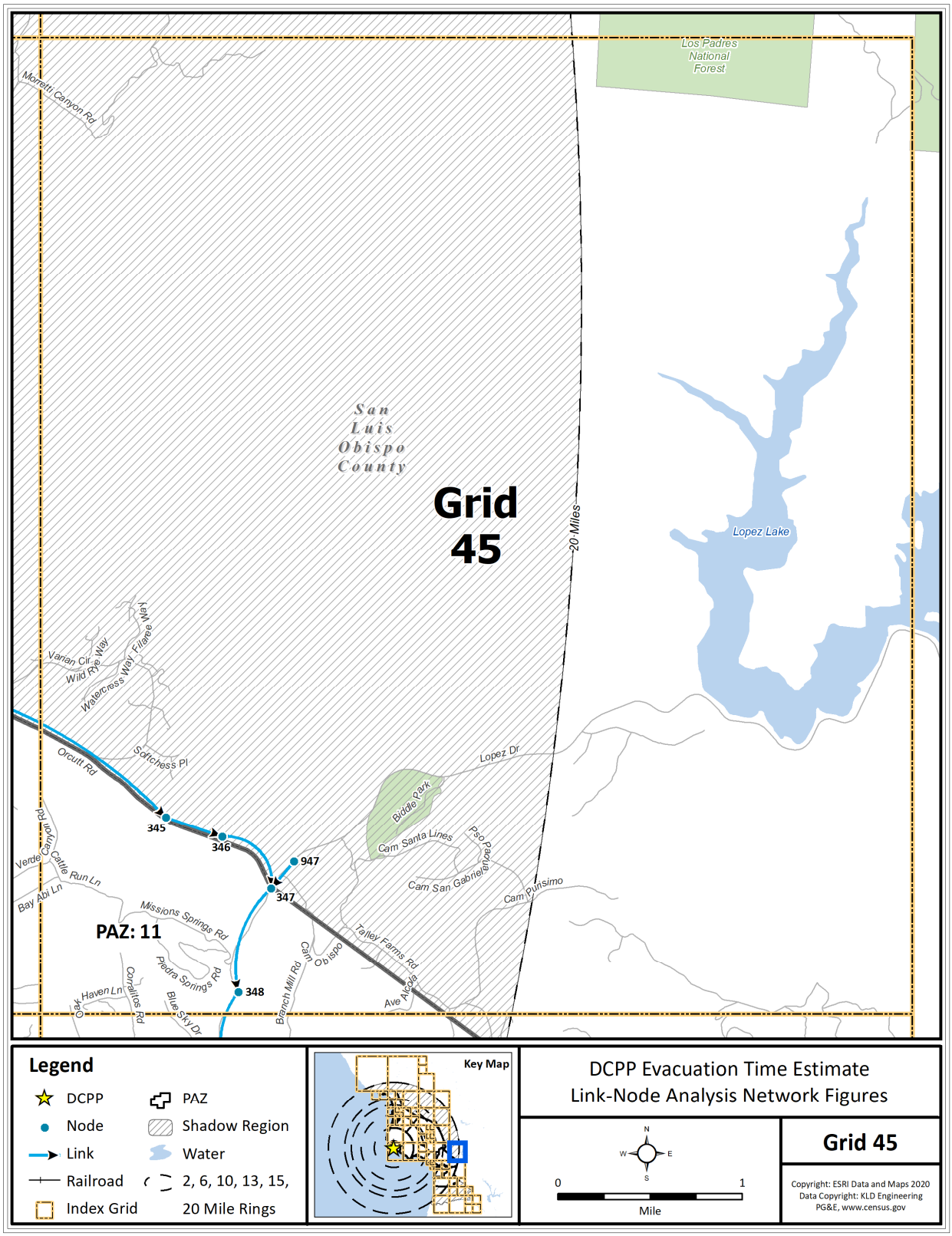

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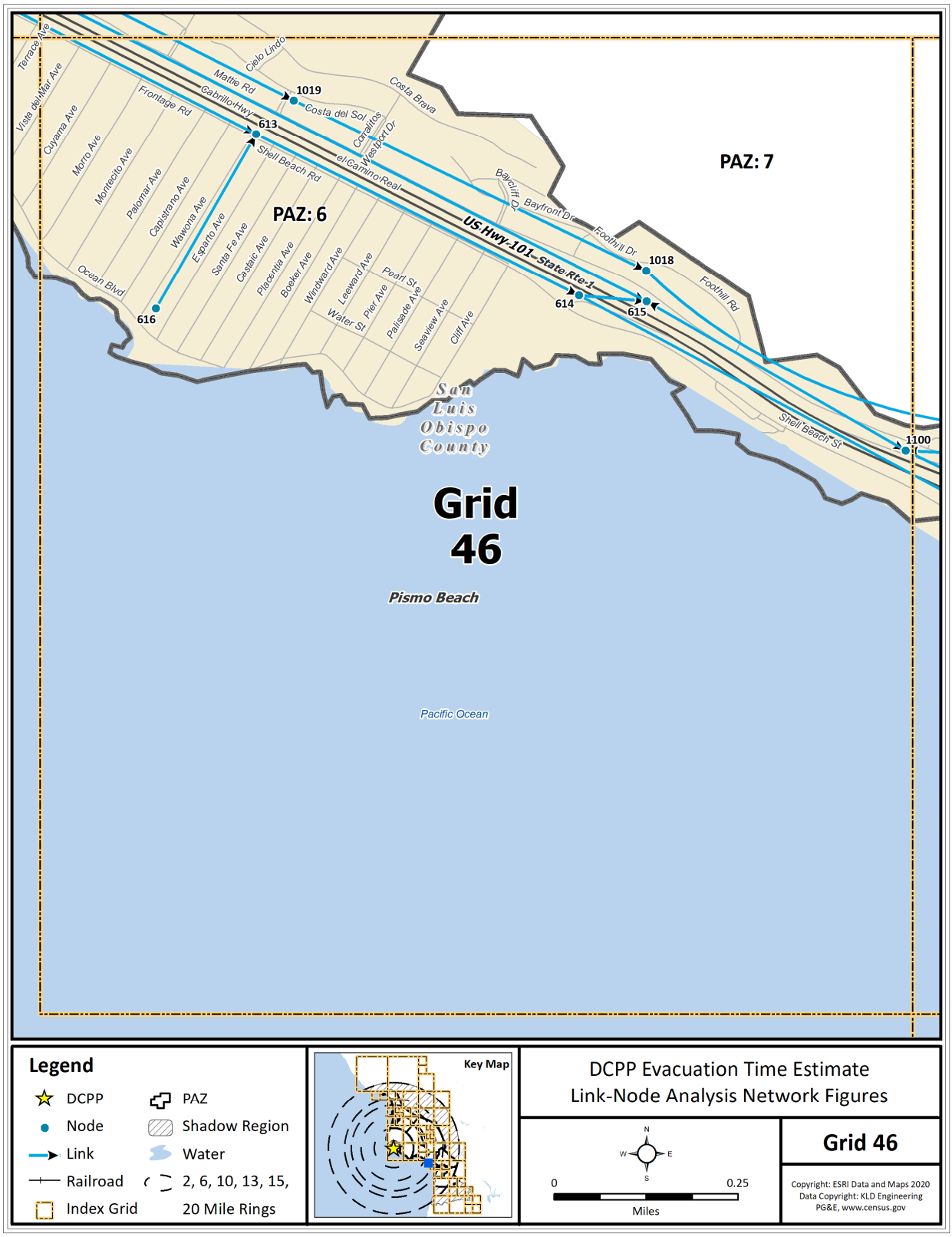

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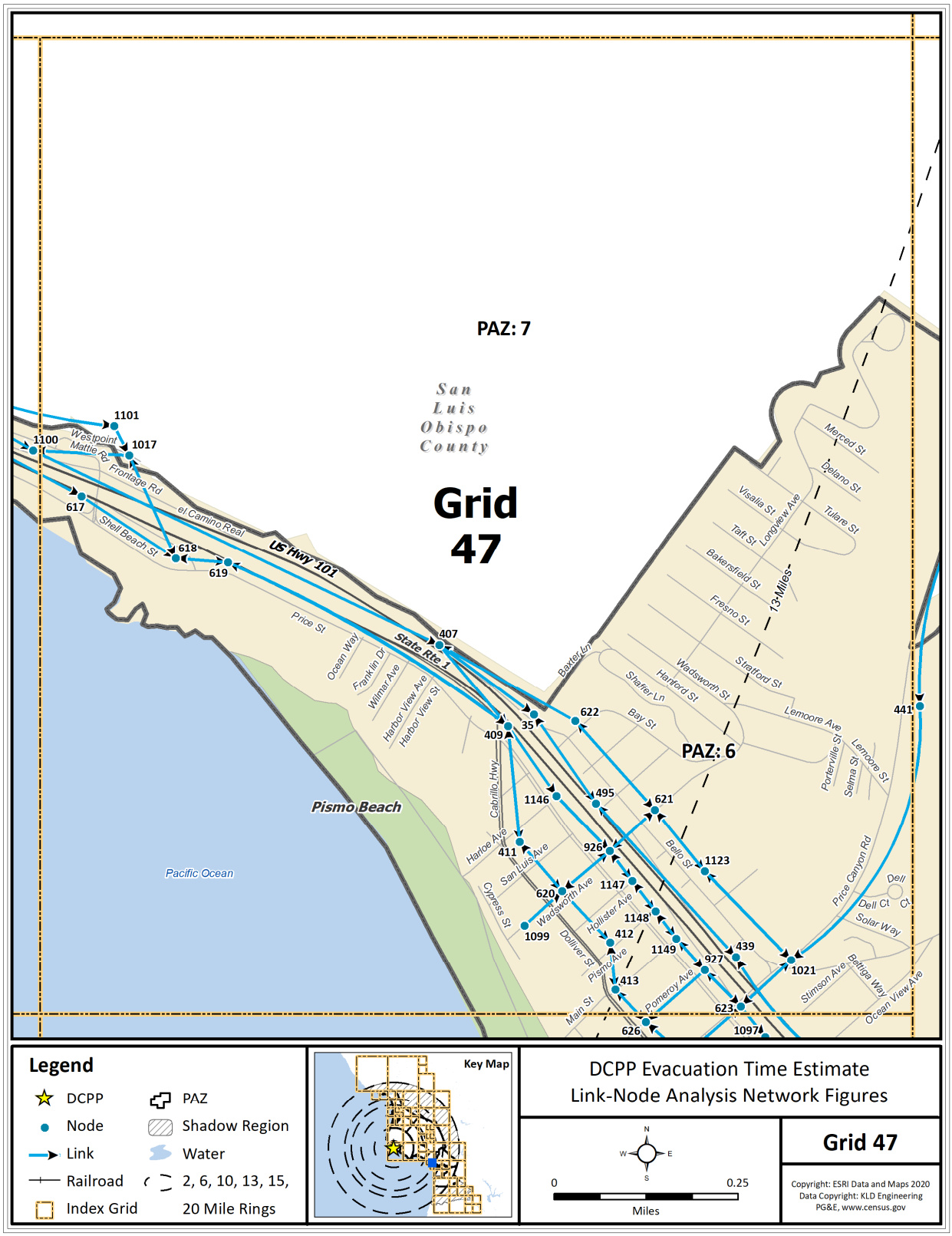

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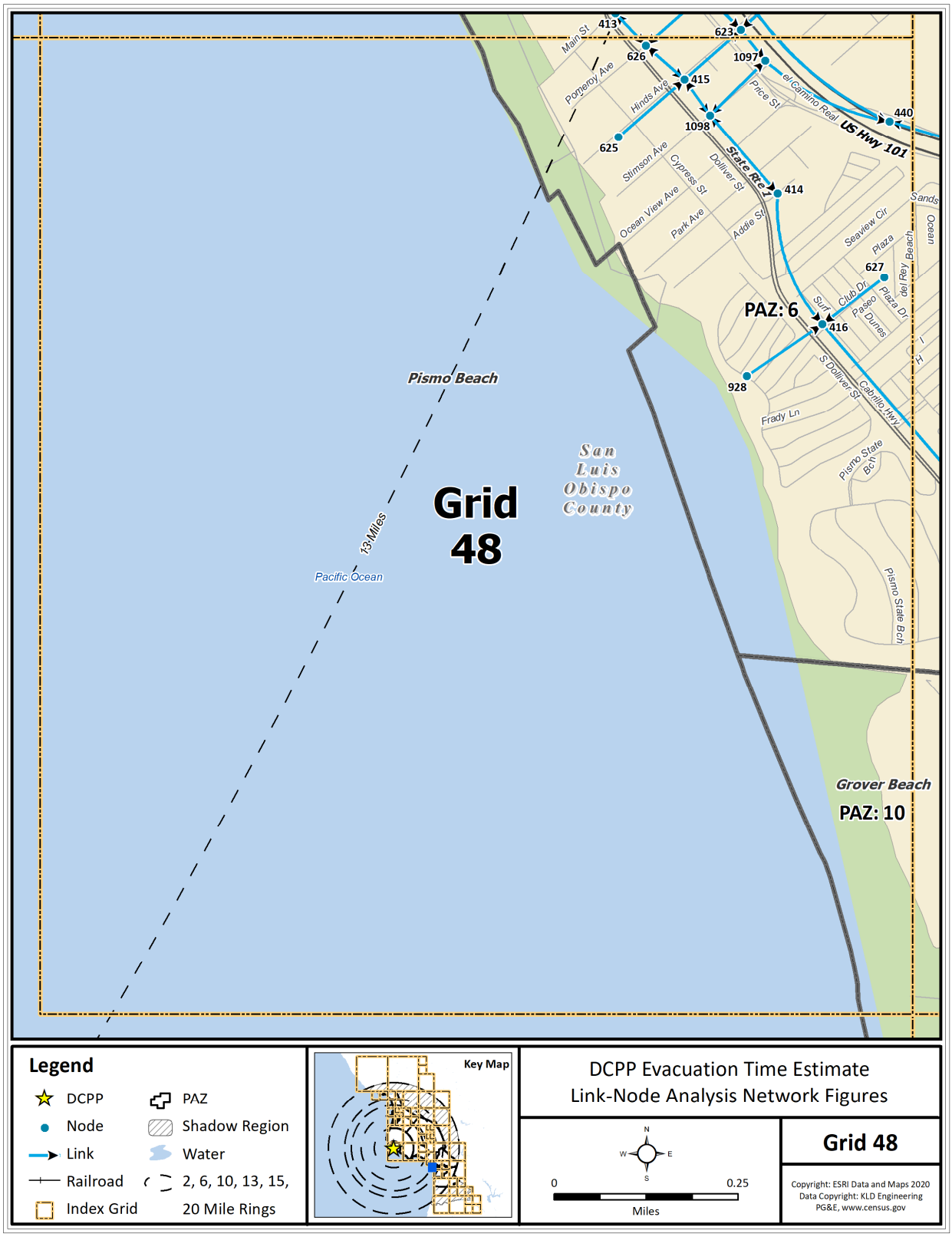

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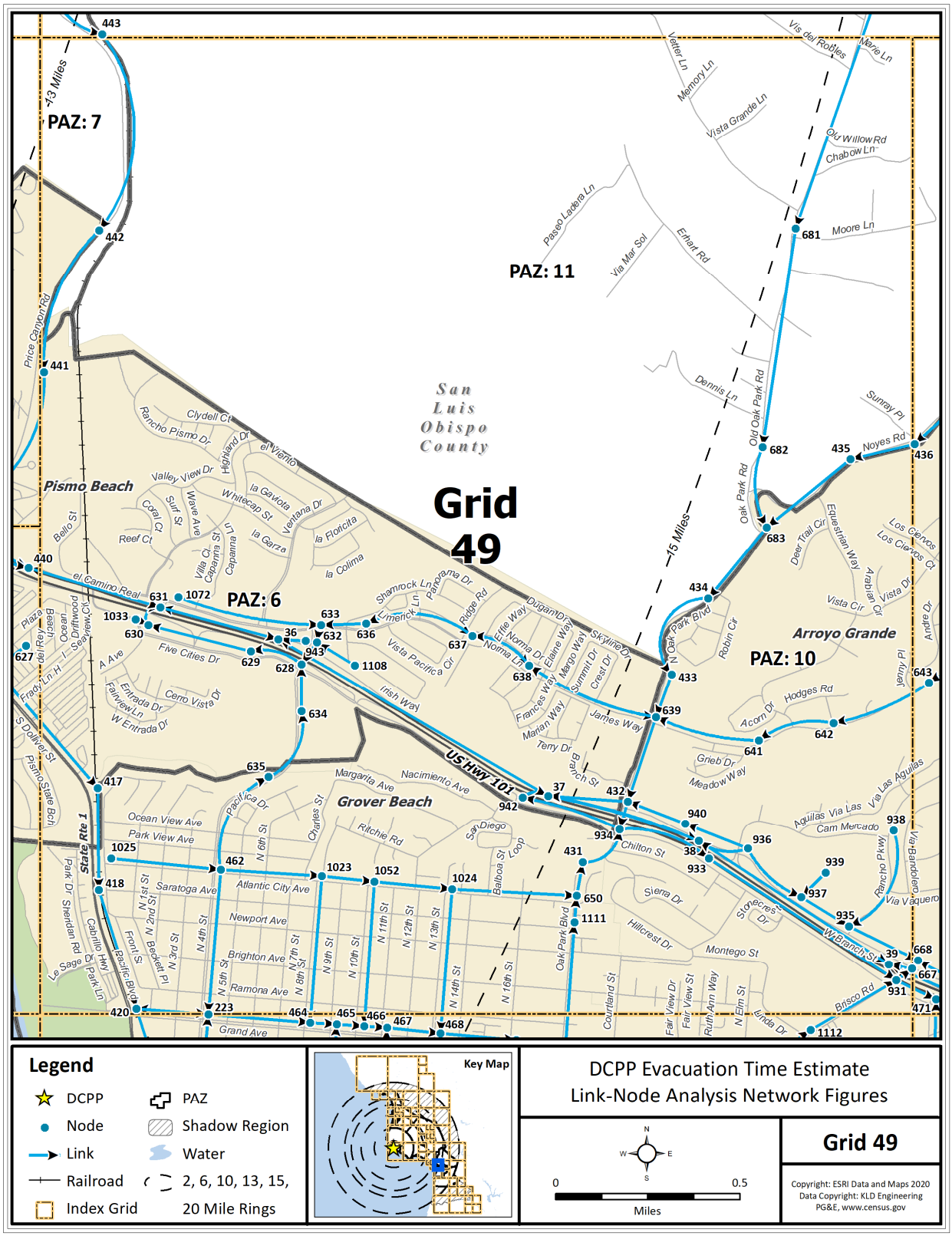

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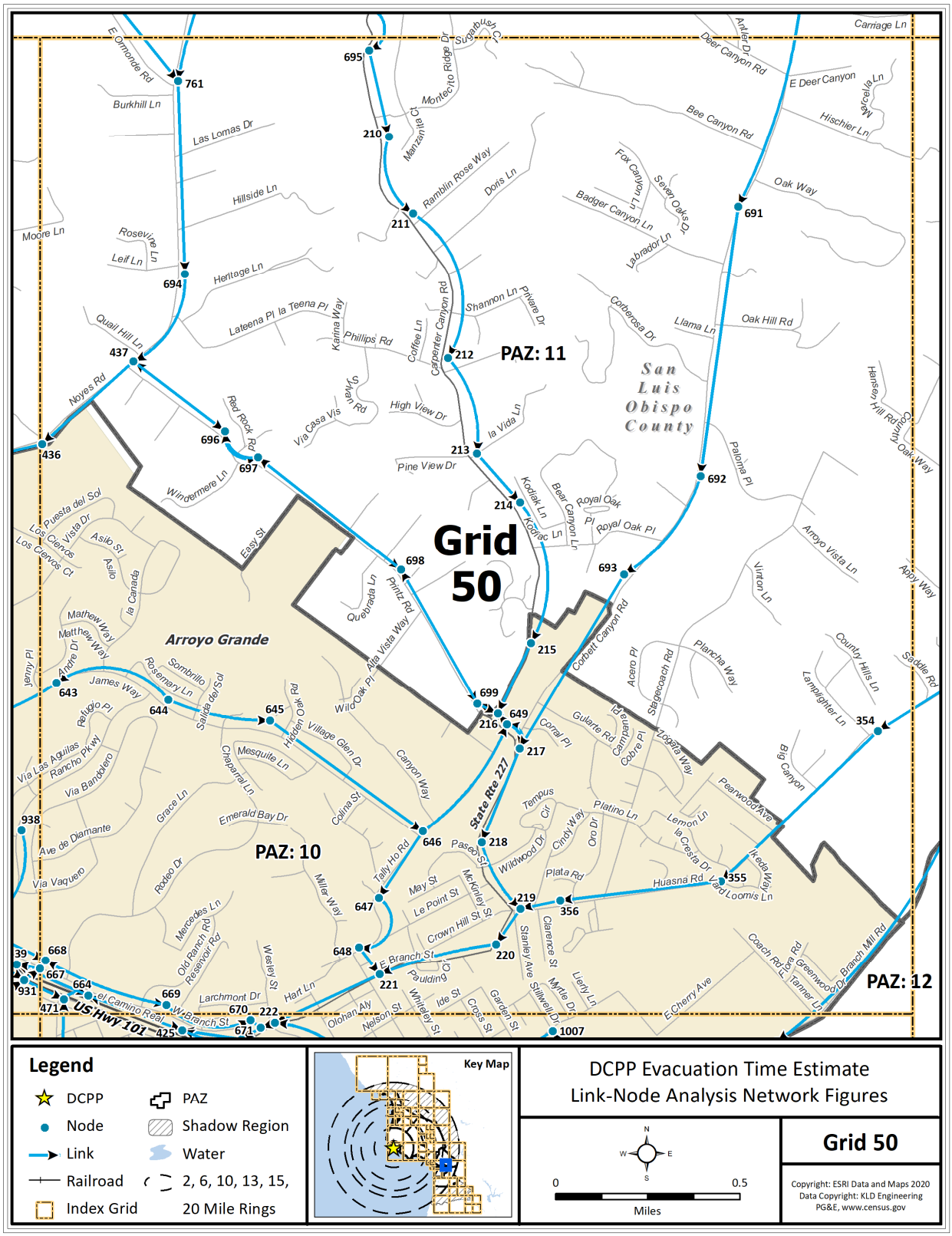

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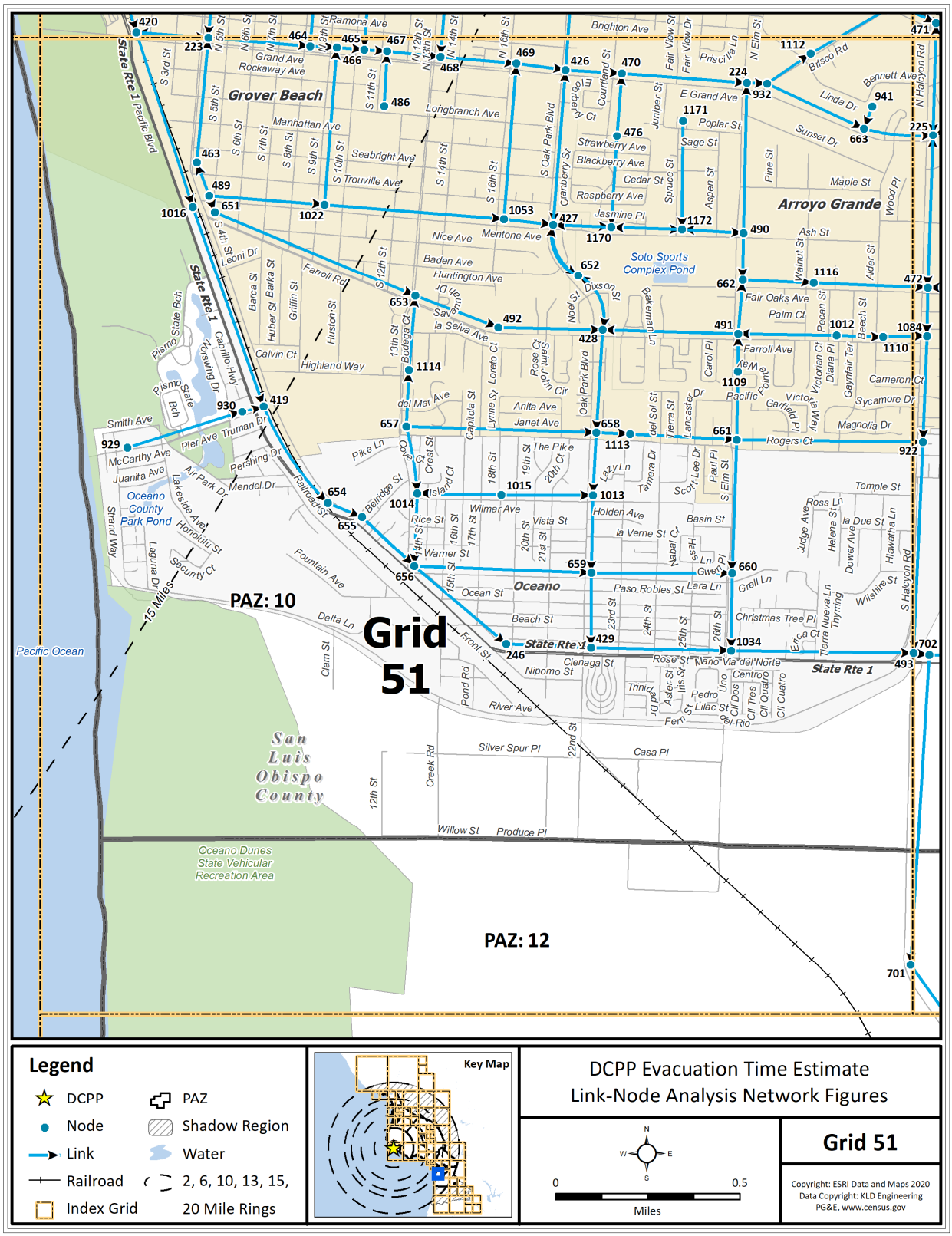

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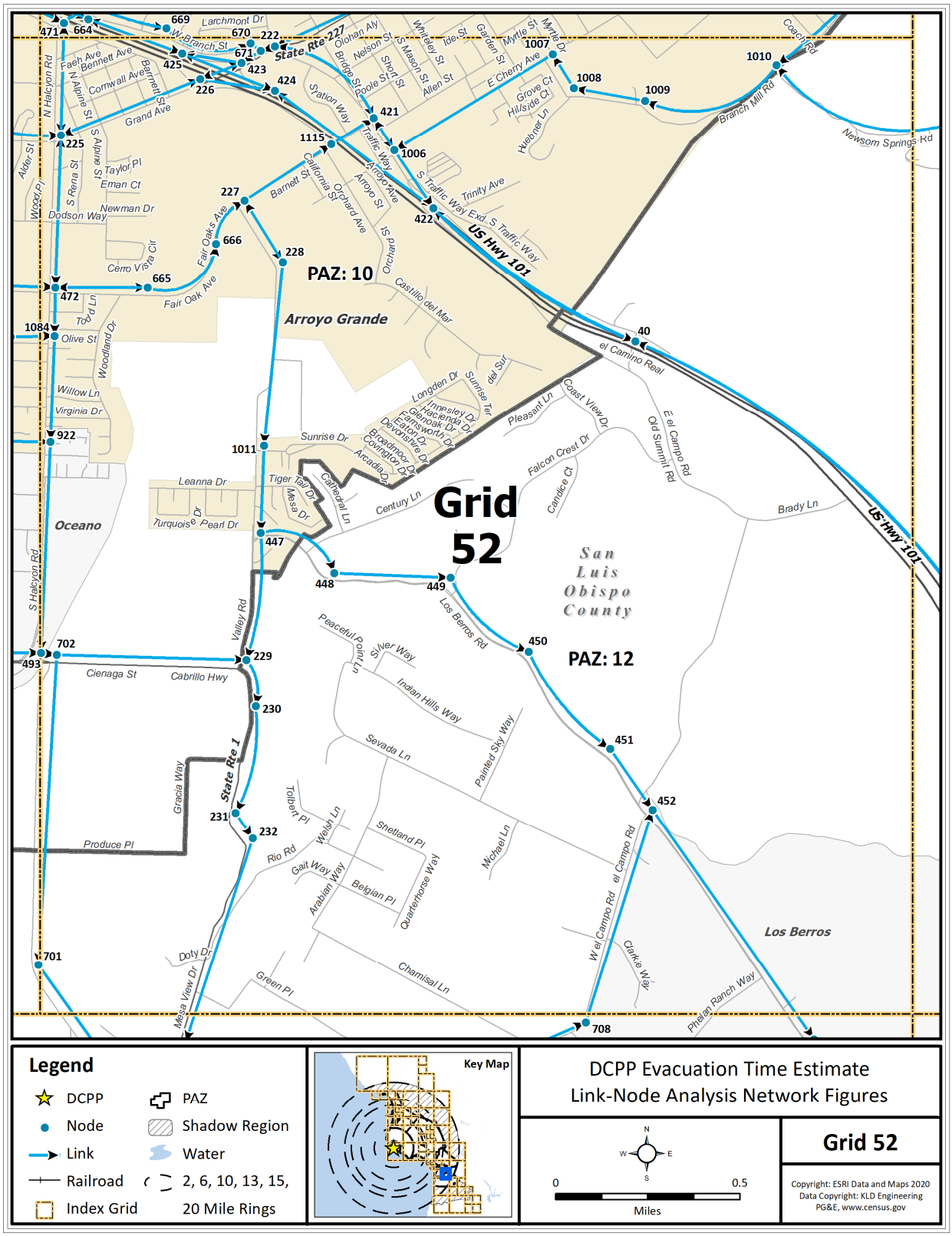

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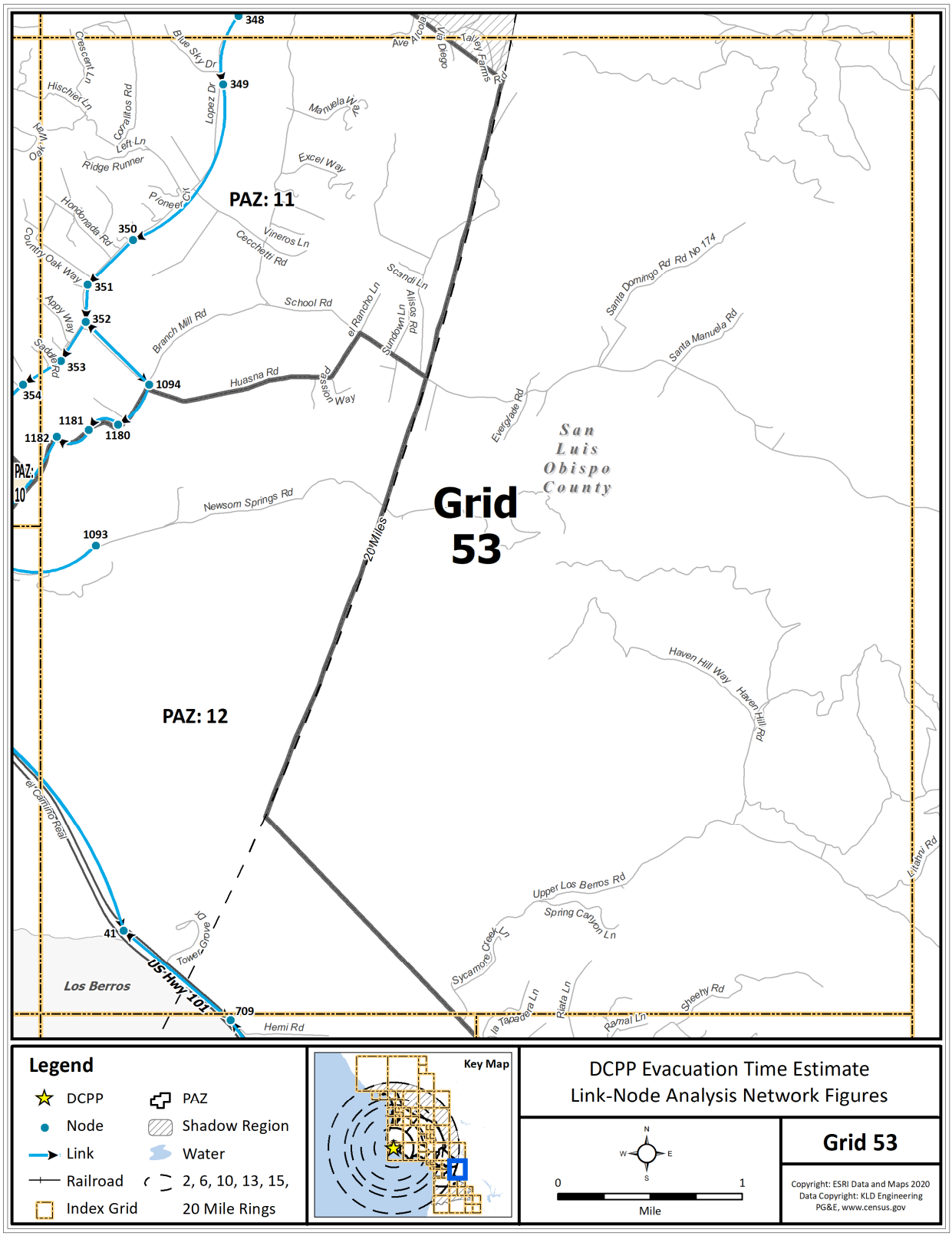

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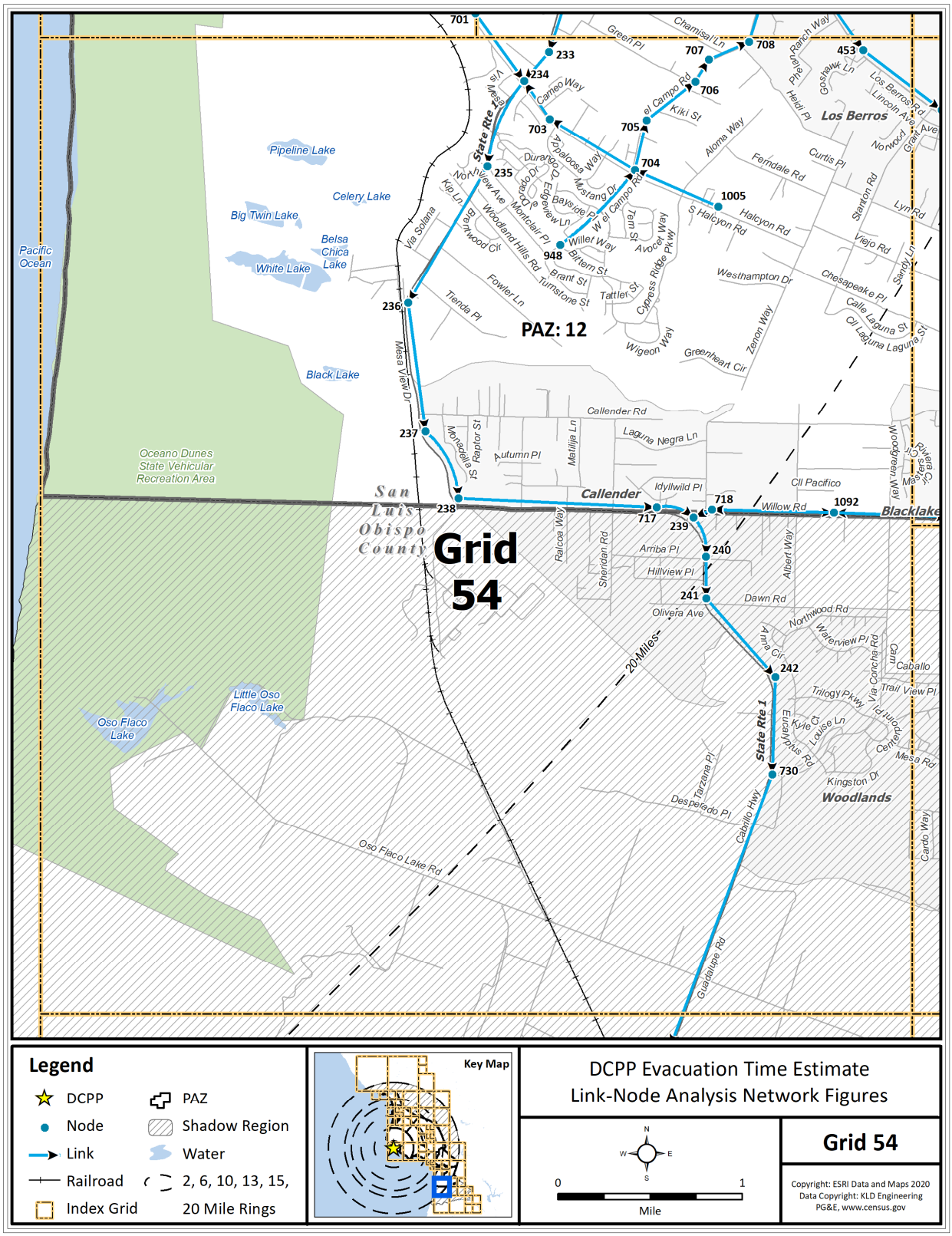

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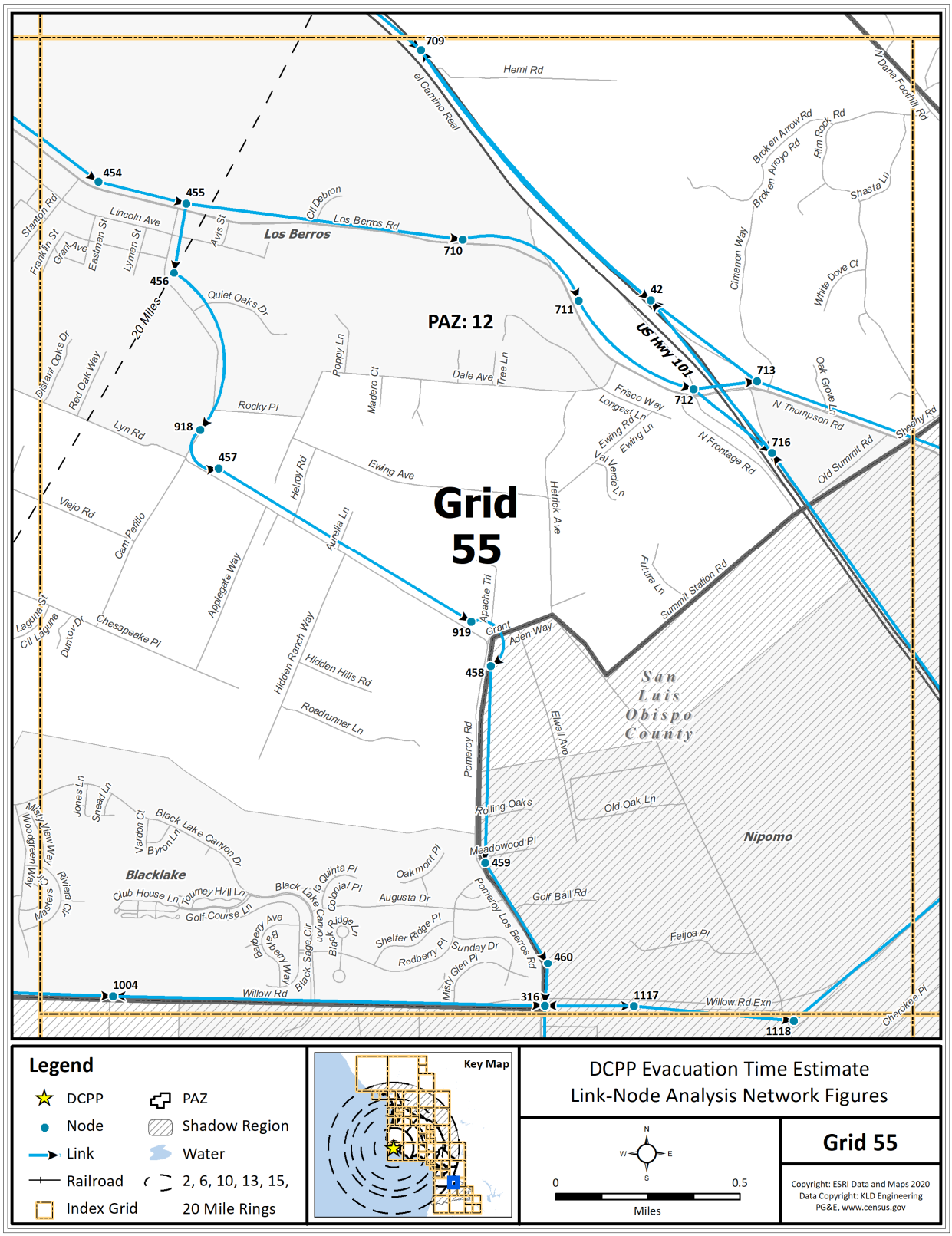

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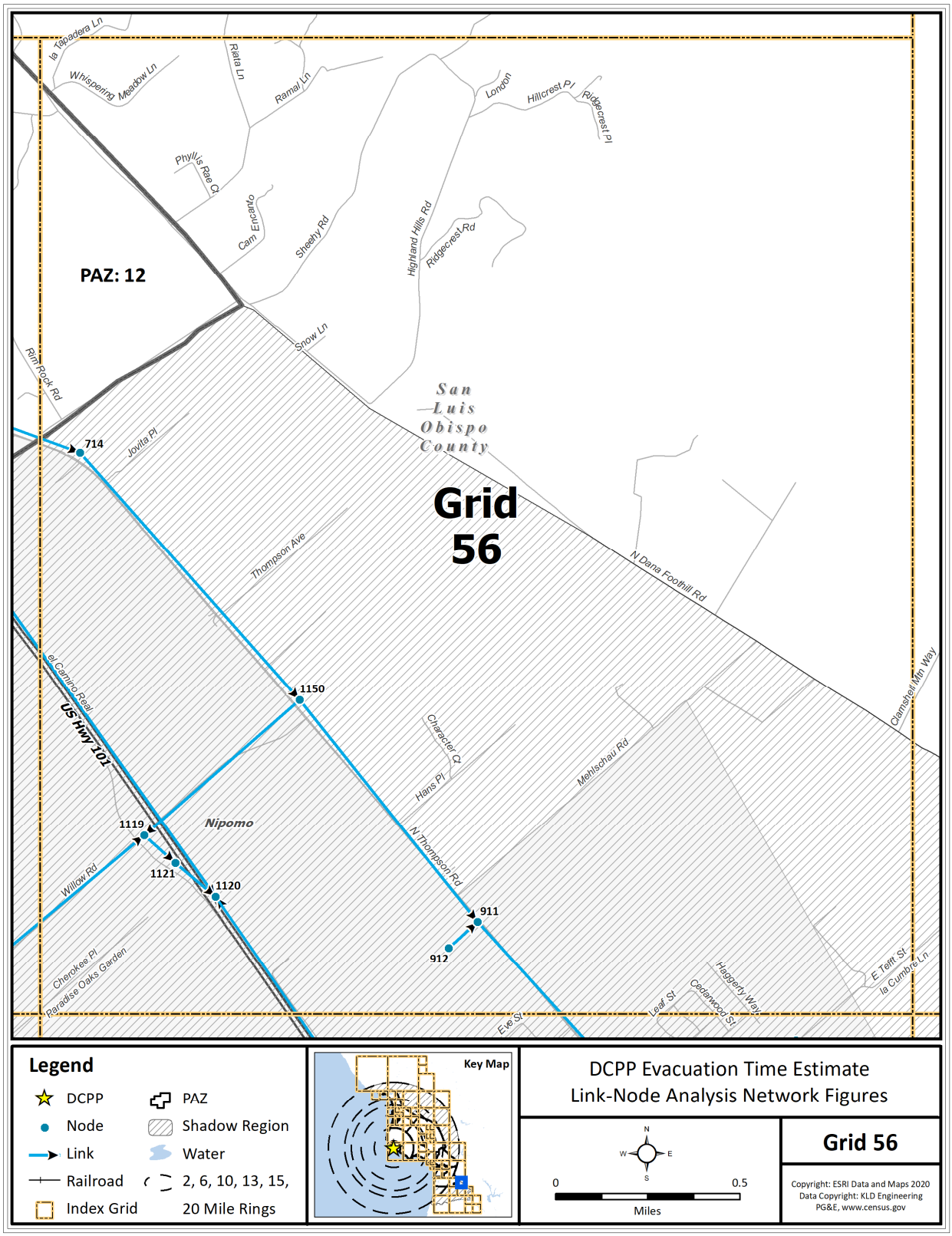
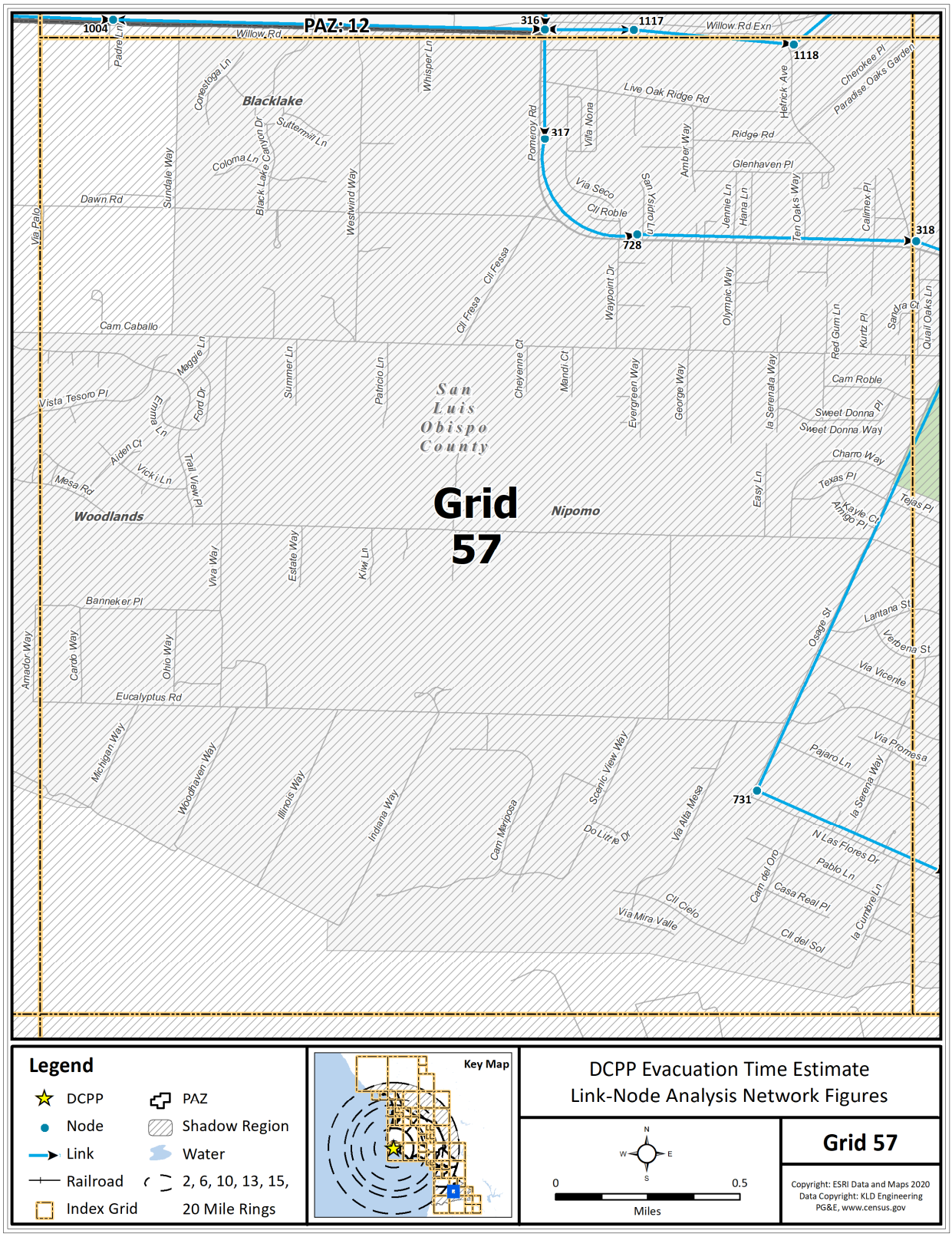


Figure K-57. Link-Node Analysis Network – Grid 56



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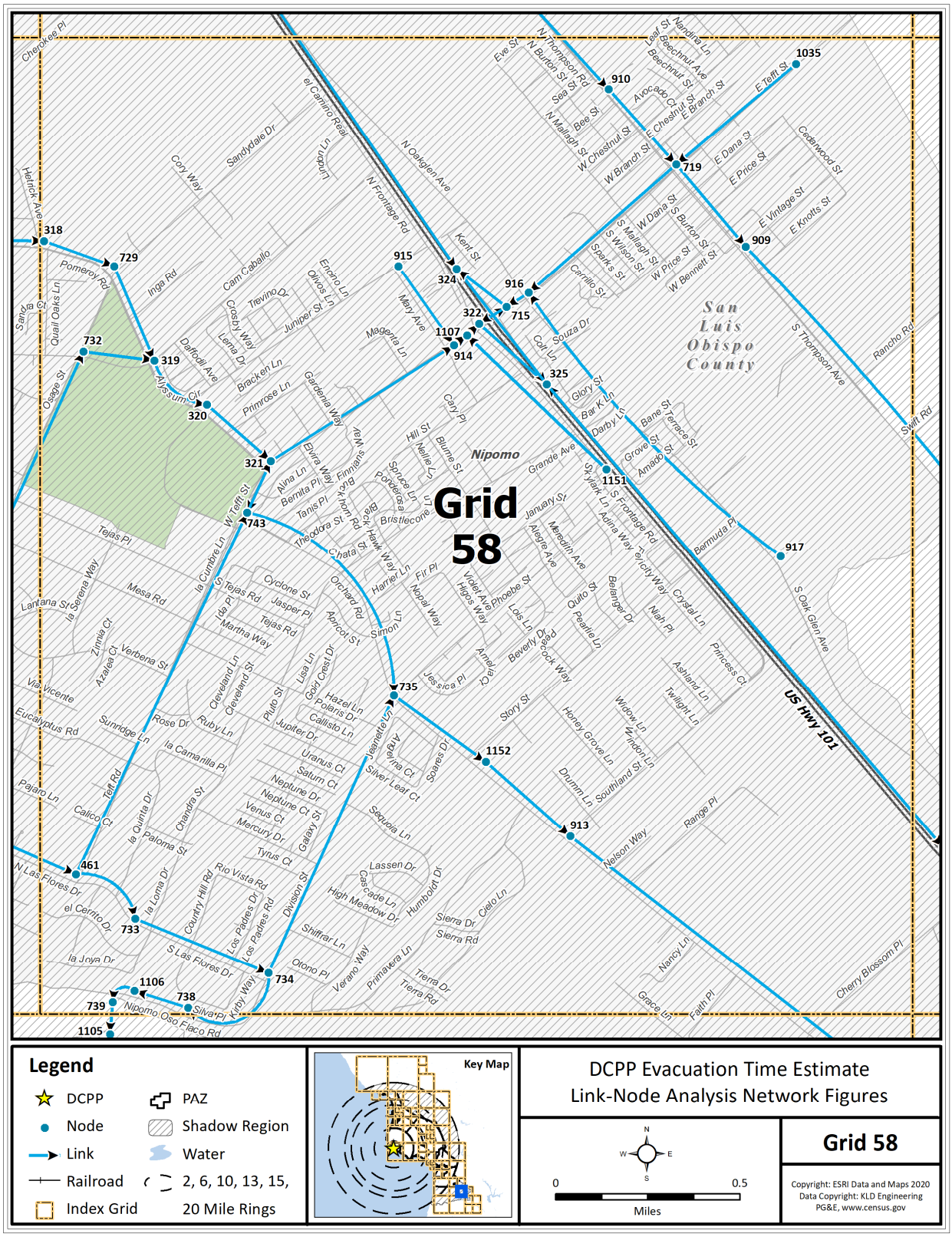

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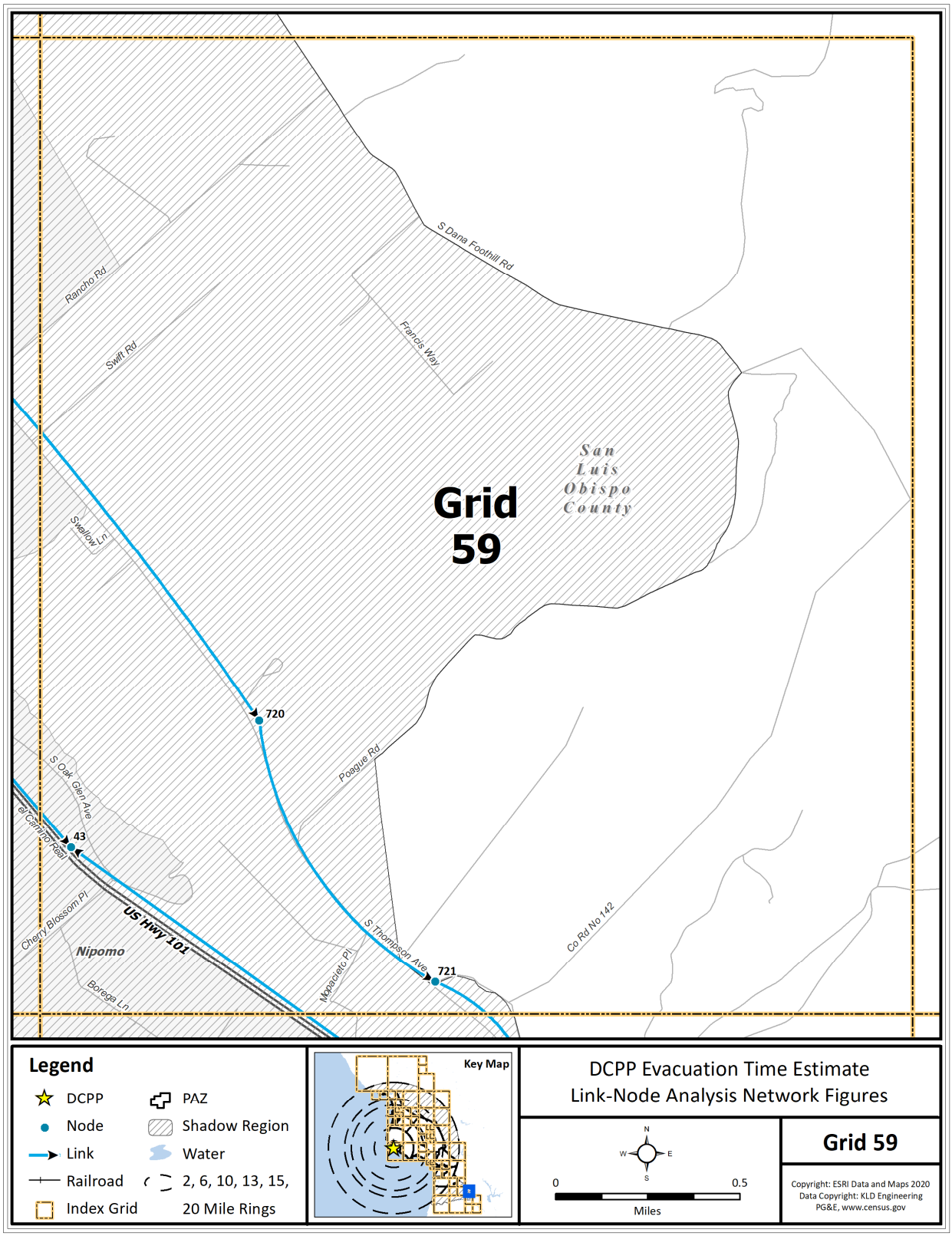

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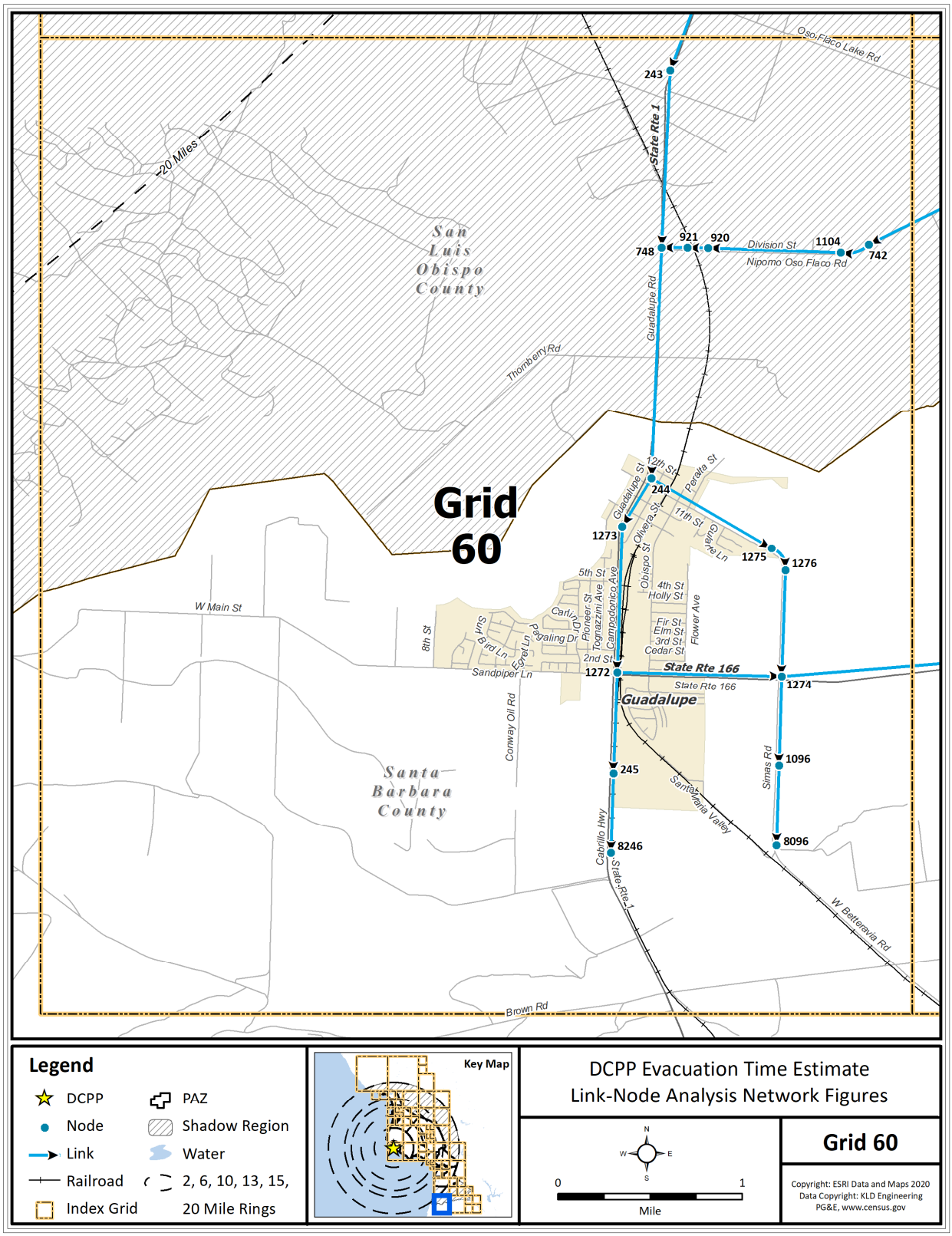

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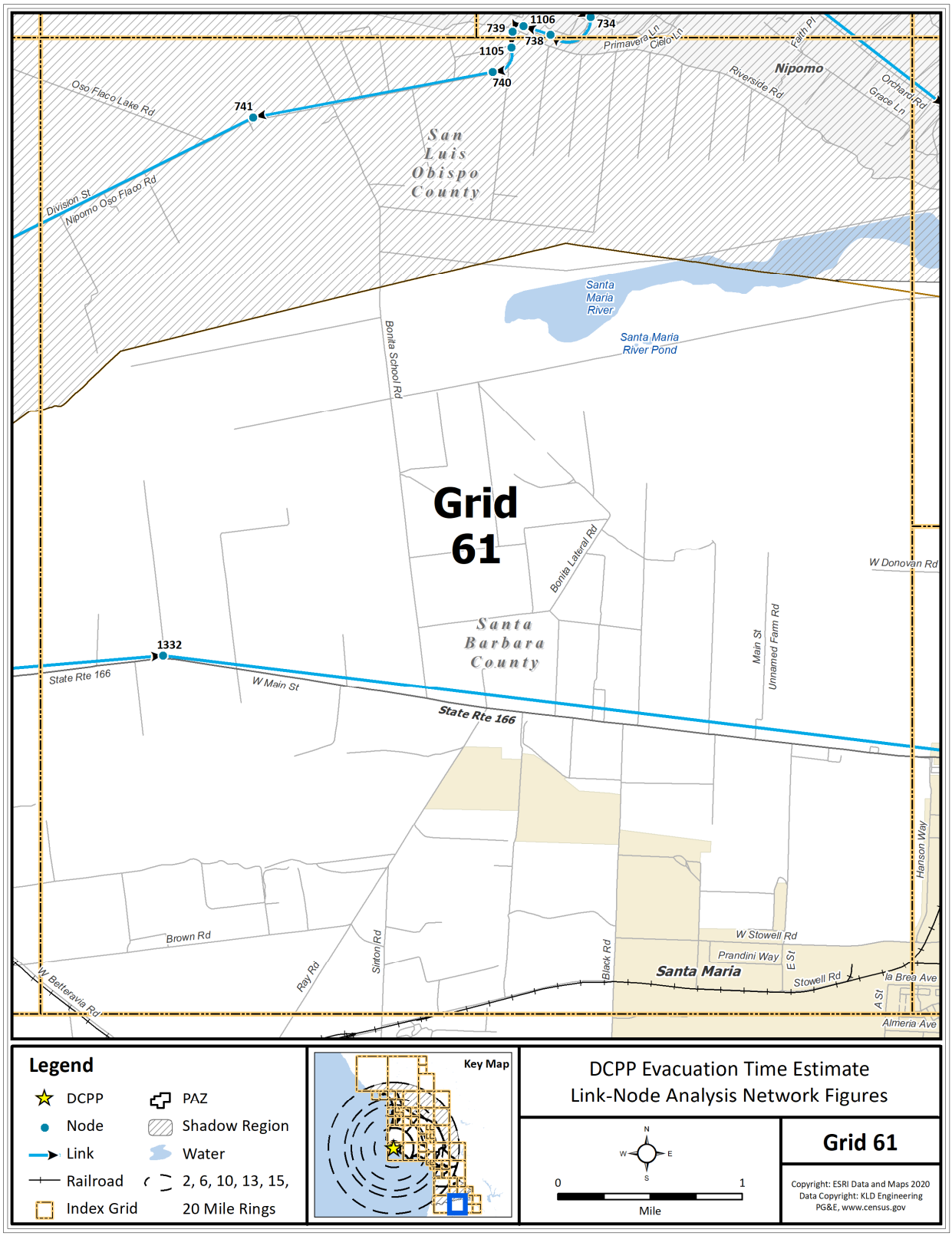

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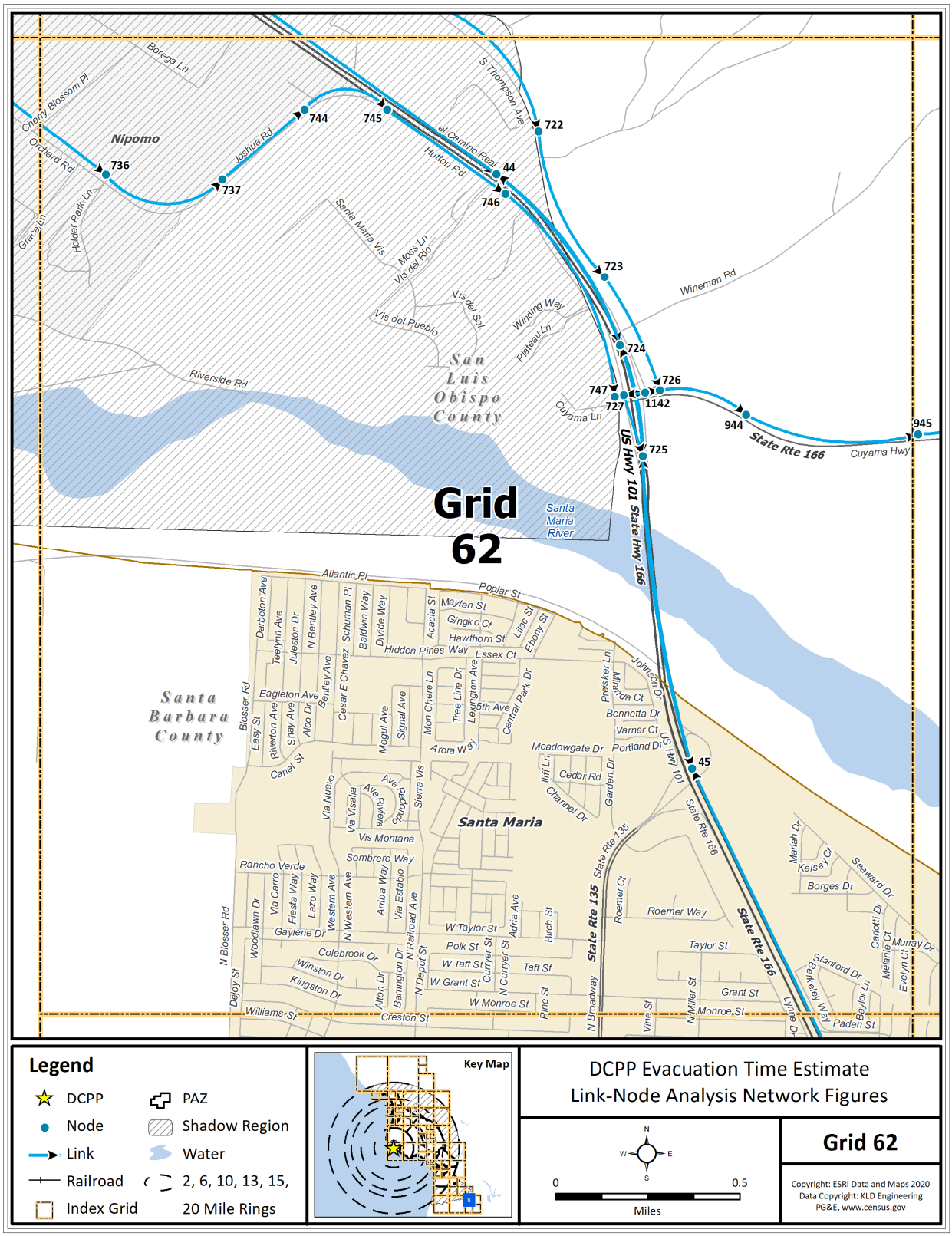

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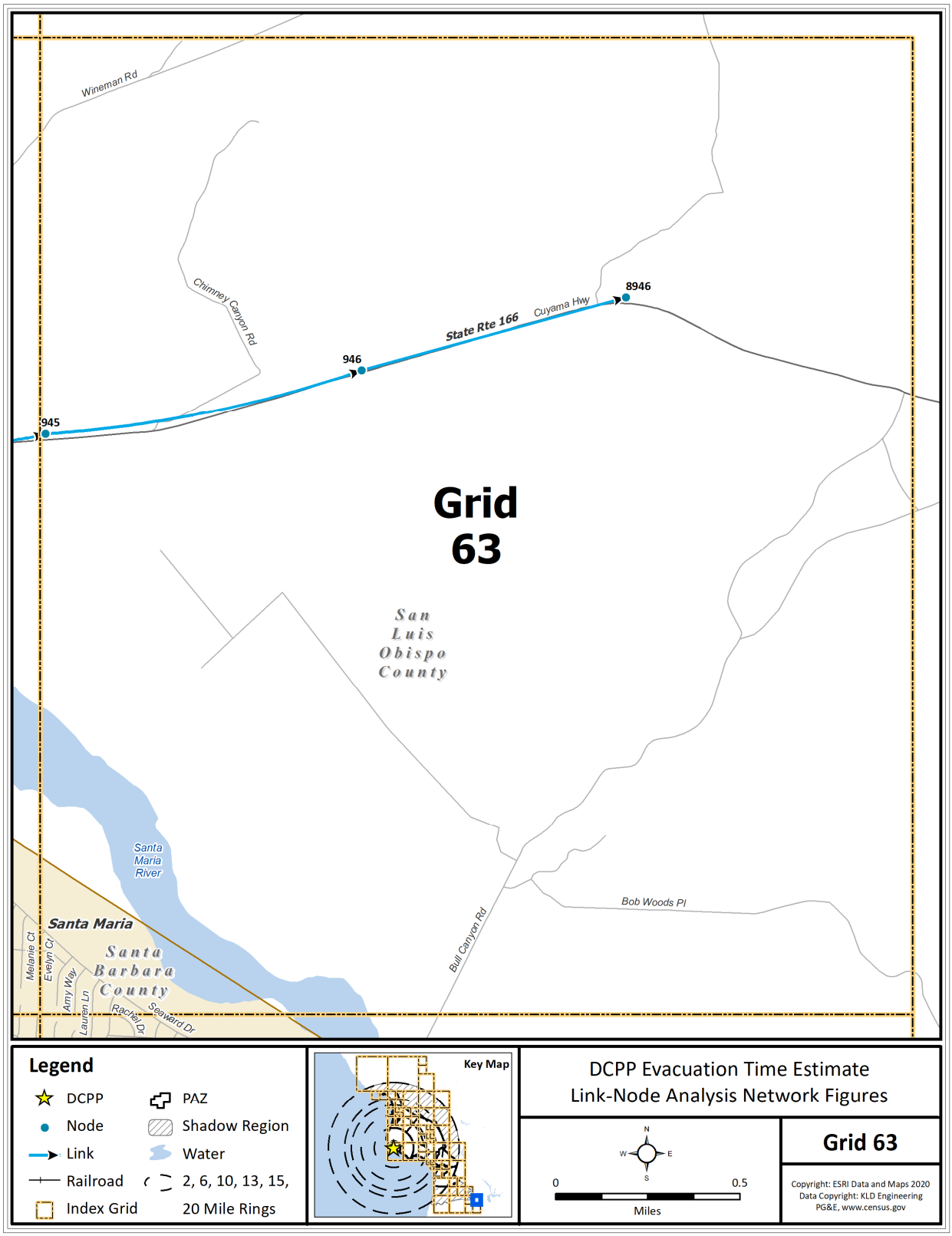

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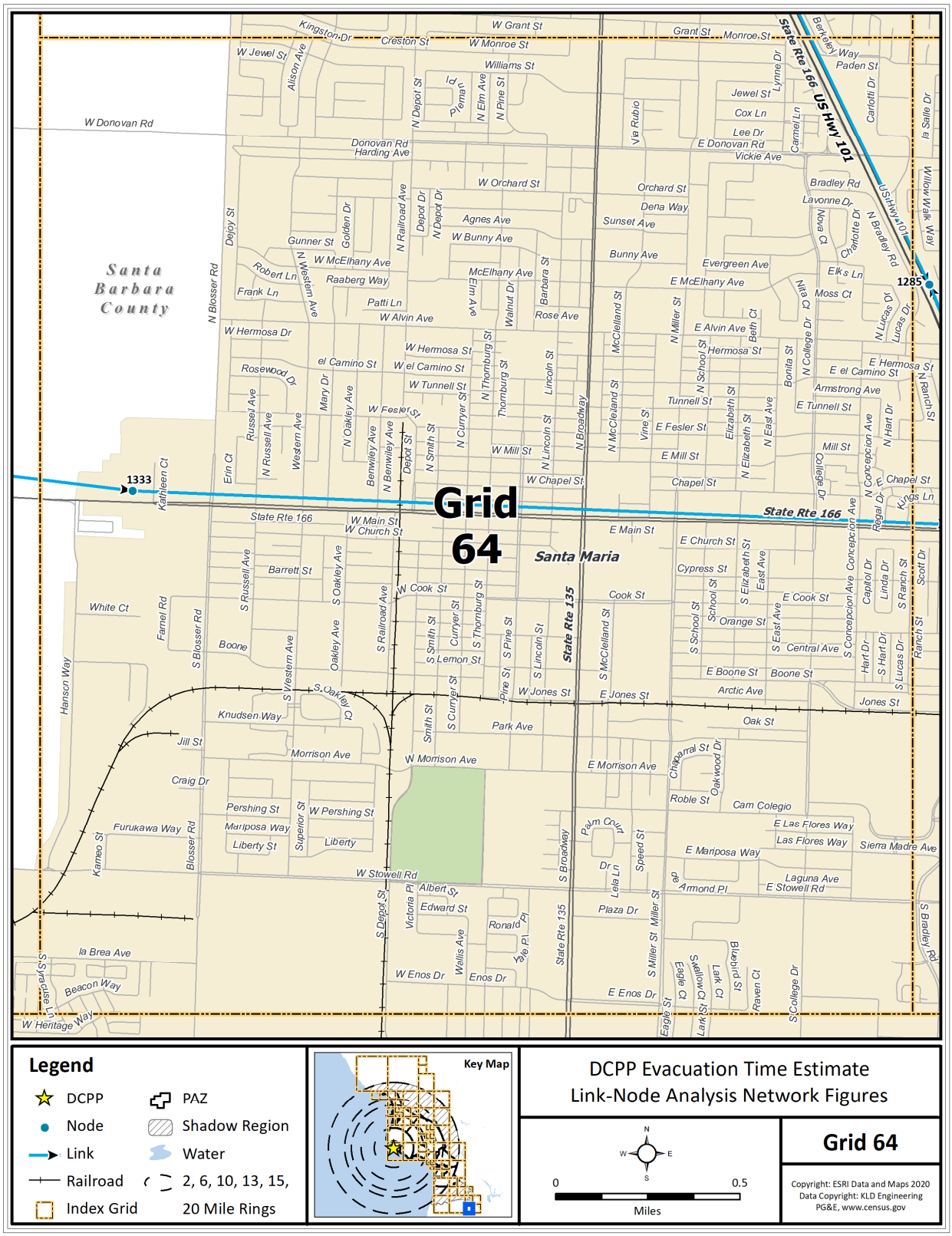

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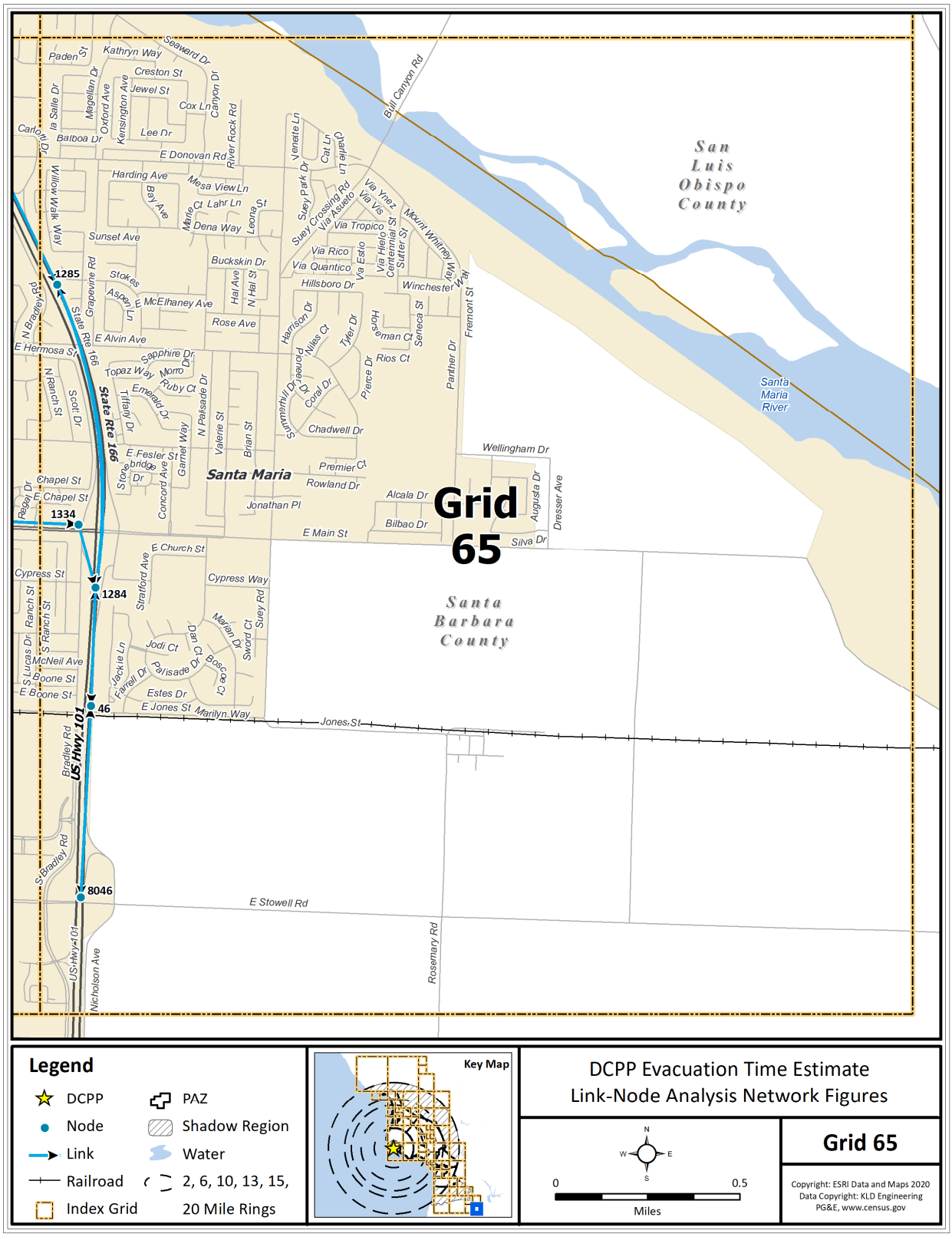

Figure K-66. Link-Node Analysis Network – Grid 65

APPENDIX L

PAZ Boundaries

L. PAZ BOUNDARIES

PAZ 1 Zone Area Name/Designation: 2-Mile Radius from Plant

Zone Description/PAZ Includes: Identified residences, isolated hill areas within a two-mile radius from the plant.

PAZ 2 Zone Area Name/Designation: 6-Mile Radius from Plant

Zone Description/PAZ Includes: Identified residences, plant access road, upper segments of See Canyon and Prefumo Canyon Road, Montaña de Oro State Park, isolated hill areas extending out to a six-mile radius from the plant.

PAZ 3 Zone Area Name/Designation: Avila/ San Luis Bay/ See Canyon/ Squire Canyon

Zone Description/PAZ Includes: Avila Beach, Port San Luis, Pirate's Cove, San Luis Bay Estates, Avila Road, San Luis Bay Drive, See Canyon Road outside the 6-mile limit. Squire and Gragg Canyons and Sunset Palisades/Shell Beach. North of Spyglass Drive.

PAZ 4 Zone Area Name/Designation: Prefumo Canyon/Los Osos Valley

Zone Description/PAZ Includes: Prefumo Canyon Road outside the 6-mile limit. Los Osos Valley Road between Turri Road and Foothill Boulevard extending out to approximately 10 miles from the plant.

PAZ 5 Zone Area Name/Designation: Baywood/Los Osos

Zone Description/PAZ Includes: Baywood Park, Los Osos, Turri Road, Los Osos Valley Road west of Turri Road, Clark Valley extending to the north approximately 10 miles from the plant.

PAZ 6 Zone Area Name/Designation: City of Pismo Beach

Zone Description/PAZ Includes: City of Pismo Beach (including beaches), Shell Beach south of Spyglass Drive (including adjacent beaches). This area is more than 10 miles from the plant.

PAZ 7 Zone Area Name/Designation: Indian Knob/Price Canyon

Zone Description/PAZ Includes: Price Canyon Road and isolated hill areas north of Pismo Beach. This area is more than 10 miles from the plant.

PAZ 8 Zone Area Name/Designation: San Luis Obispo Area

Zone Description/PAZ Includes: City of San Luis Obispo, California Polytechnic State University, California Men's Colony, Camp San Luis Obispo, Cuesta College, O'Connor Way, Orcutt Road north of East Corral de Piedra Creek, Edna, Country Club and Davenport Creek area. This area is more than 10 miles from the plant.

PAZ 9 Zone Area Name/Designation: Morro Bay/Cayucos

Zone Description/PAZ Includes: State Highway 1 west of Cuesta College, Morro Bay, Cayucos, and Whale Rock Reservoir area. This area is more than 10 miles from the plant.

PAZ 10 Zone Area Name/Designation: Five Cities (Southern Portion)

Zone Description/PAZ Includes: City of Arroyo Grande, Grover Beach, Oceano, Halcyon and Pismo State Beach. This area is more than 10 miles from the plant.

PAZ 11 Zone Area Name/Designation: Orcutt Road/Lopez Drive/ State Highway 227

Zone Description/PAZ Includes: Canyon area north of Five Cities (bounded by Price Canyon, Orcutt Road, Huasna Creek and northern limits of Arroyo Grande and Pismo Beach). This area is more than 10 miles from the plant.

PAZ 12 Zone Area Name/Designation: Nipomo north of Willow Road

Zone Description/PAZ Includes: Nipomo Mesa north of Willow Road, Cienega Valley, Pismo Dunes State Recreation Vehicle Area. This area is more than 10 miles from the plant.

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 Full EPZ. Specifically, if the tail of the mobilization distribution were truncated (i.e., if those who responded most slowly to the Evacuation Order, could be persuaded to respond much more rapidly), or if the tail were elongated (i.e. spreading out the departure of evacuees to limit the demand during peak times), how would the ETE be affected? The case considered was Scenario 6, Region R04; a winter, midweek, midday, good weather evacuation of the Full EPZ. Table M-1 presents the results of this study.

As discussed in Section 7.3, traffic congestion persists within the EPZ for approximately 10 hours. As such, the ETE at the 90th and 100th percentile are dictated by traffic congestion and not mobilization for an evacuation of the Full EPZ. Shortening the trip generation time by one hour reduces the 100th percentile ETE by 15 minutes. Elongating the trip generation time by one hour is insensitive to the 100th percentile ETE. The 90th percentile ETE is insensitive to truncating or elongating the tail of the mobilization time distribution and it is equal to 9 hours and 10 minutes for all cases.

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 R04; a winter, midweek, midday, good weather evacuation for the Full 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 reduced by 10 minutes both at the 90th and 100th percentile when the shadow evaluation is eliminated (zero percent) or reduced to eight percent[1].

Tripling the shadow percentage increases the ETE by 15 minutes and 30 minutes for the 90th and 100th percentiles, respectively – a moderate to significant change. Increasing the shadow percentage to 100 percent increases the ETE by 40 minutes and 1 hour and 25 minutes for the 90th and 100th percentiles, respectively - a significant change. The increase in ETE is due to the shadow region being highly populated, especially to the south of the EPZ. This area includes Nipomo, which houses approximately 20,000 residents (see Table 3-3).

[1] Note that the demographic survey results presented in Appendix F, indicate that 8% of households would elect to evacuate if advised to monitor and prepare, which is nearly half the base assumption of 20% non-compliance suggested in the NUREG/CR-7002, Rev. 1.

An increase in the precent of people who relocate in the Shadow Region can significantly impact the ETE. Care should be given on the evacuation shadow percentage during an emergency. The general public should be educated to only evacuate if they are told to do so.

M.3 Effect of Changes in Resident Population

A sensitivity study was conducted to determine the effect on ETE of changes in the resident population within the study area (EPZ plus Shadow Region). As population in the study area changes over time, the time required to evacuate the public may increase, decrease, or remain the same. Since the ETE is related to the demand to capacity ratio present within the study area, changes in population will cause the demand side of the equation to change and could impact ETE.

As per the NRC's response to the Emergency Planning Frequently Asked Question (EPFAQ) 2013-001, the ETE population sensitivity study must be conducted to determine what percentage increase in permanent resident population causes an increase in the 90th percentile ETE of 25% or 30 minutes, whichever is less. The sensitivity study must use the scenario with the longest 90th percentile ETE (excluding the roadway impact scenario and the special event scenario if it is a one day per year special event).

Thus, the sensitivity study was conducted using the following planning assumptions:

1. The percent change in population within the study area was increased by up to 8%. Changes in population were applied to permanent residents only (as per federal guidance), in both the EPZ area and the Shadow Region.
2. The transportation infrastructure remained fixed (as presented in Appendix K); the presence of future proposed roadway changes and/or highway capacity improvements were not considered.
3. The study was performed for the 2-Mile Region (R01), the 6-Mile Region (R02), the 10-Mile Region/FEMA EPZ (R03), and the Full EPZ (R04).
4. The scenario (excluding roadway impact and special event) which yielded the highest 90th percentile ETE values for the Full EPZ was selected as the case to be considered in this sensitivity study (Scenario 7 – Winter, Midweek, Midday with Rain).

Table M-3 presents the results of the sensitivity study. Section IV of Appendix E to 10 CFR Part 50, and NUREG/CR-7002, Rev. 1 Section 5.4, require licensees to provide an updated ETE analysis to the NRC when a population increase within the EPZ causes ETE values (for the 2-Mile Region, 6-Mile Region, 10-mile Region/FEMA EPZ or Full EPZ) to increase by 25 percent or 30 minutes, whichever is less. Note that the base 90th percentile ETE values for the 2-Mile Region (R01) and 6-Mile Region (R02) is less than 2 hours; R01 and R02 criterion for updating is 15 minutes (60 minutes multiplied by 25%) and 19 minutes (75 minutes multiplied by 25%), respectively. The 90th percentile ETE values for FEMA EPZ (R03) and the Full EPZ (R04) are greater than 2 hours; therefore, the criterion for updating is 30 minutes.

Those percent population changes which result in a 90th percentile ETE greater than the respective criterion for each region are highlighted in red in Table M-3 – a 7% or greater

increase in the permanent resident population. PG&E will have to estimate the EPZ population on an annual basis. If the EPZ population increases by 7% or more, an updated ETE analysis will be needed.

M.4 Event at Avila Beach Golf Resort

Emergency management personnel from San Luis Obispo County indicated that the Avila Beach Golf Resort, located in PAZ 3, hosts events that could attract up to 5,000 people. A sensitivity study was considered to quantify the effects of the additional traffic that these events bring to the EPZ in the event there is an emergency at DCPP at the same time. Population estimates of 1,000, 3,000, and 5,000 were tested for this sensitivity study.

It was conservatively assumed that all people that attend the event at the golf resort are non-EPZ residents and all travel from outside of the EPZ to attend the event. It was further assumed that there are two people per vehicle; thus, there are total of 500, 1,500, and 2,500 additional vehicles in PAZ 3 attending the event at the golf resort. Based on the event schedule published on the facility's website, it was assumed the peak event would occur for a summer, weekend, midday, good weather scenario. To bound the impact to ETE, an evacuation of the 2-Mile Region (R01), the 6-Mile Region (R02), the 10-Mile Region/FEMA EPZ (R03), and the Full EPZ (R04) was simulated for this scenario.

Table M-4 represents the 90th and the 100th percentile ETE results for this sensitivity study. The 90th and the 100th percentile ETEs for these regions are not affected when there are 1,000 people attending this event. However, when there are 3,000 or 5,000 people attending the event, the Full EPZ ETE increases by 5 minutes and 25 minutes for the 90th and 100th percentile ETE respectively. Region R01, R02 and R03 ETE are unchanged from the additional vehicles. The bottlenecks that exist beyond 10 miles, and the resulting congestion, are exacerbated by the additional transients from the golf resort resulting in worse congestion and more delay prolonging the ETE for the Full EPZ. Care should be given when there are extra transients present inside PAZ 3 and an evacuation order of the Full EPZ is given.

M.5 Enhancements in Evacuation Time

This appendix documents sensitivity studies on critical variables that could potentially impact ETE. Possible improvements to ETE are further discussed below:

- Reducing or prolonging the trip generation time by an hour has no impact on the 90th percentile ETE and impact the 100th percentile ETE by at most 15 minutes, since congestion within the EPZ dictates ETE (Section M.1). Public outreach encouraging evacuees to mobilize more quickly or in a timely manner will decrease ETE.
- Increasing the shadow evacuation percent can impact the 90th percentile ETE by up to 40 minutes and 85 minutes at the 100th percentile ETE (Section M.2). Public outreach could be considered to inform those people within the EPZ (and potentially beyond the EPZ) that if they are not advised to evacuate, they should not.
- Population growth results in more evacuating vehicles, which could increase ETE (Section

M.3). Public outreach to inform people within the EPZ to evacuate as a family in a single vehicle would reduce the number of evacuating vehicles and could reduce ETE or offset the impact of population growth.

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

Trip Generation Period	Evacuation Time Estimate for Full EPZ	
	90th Percentile	100th Percentile
3 hours and 45 minutes	9:10	10:50
4 hours and 45 minutes (Base)	9:10	11:05
5 hours and 45 minutes	9:10	11:05

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

Percent Shadow Evacuation	Evacuating Shadow Vehicles[2]	Evacuation Time Estimate for Full EPZ	
		90th Percentile	100th Percentile
0	0	9:00	10:55
8	1,335	9:00	10:55
20 (Base)	3,337	9:10	11:05
40	6,674	9:15	11:35
60	10,011	9:25	11:35
80	13,348	9:35	12:00
100	16,686	9:50	12:30

[2] The Evacuating Shadow Vehicles, in Table M-2, represent the residents and employees who will spontaneously decide to relocate during the evacuation. The basis, for the base values shown, is a 20% relocation of shadow residents along with a proportional percentage of shadow employees. See Section 6 for further discussion.

Table M-3. ETE Variation with Population Change

EPZ and 20% Shadow Permanent Resident Population	Base	Population Change		
		6%	7%	8%
	157,502	166,952	168,527	170,102
ETE (hrs:mins) for the 90th Percentile				
Region	**Base**	**Population Change**		
		6%	**7%**	**8%**
2-MILE	1:00	1:00	1:00	1:00
6-MILE	1:15	1:15	1:15	1:15
FEMA EPZ	3:10	3:20	3:20	3:20
Full EPZ	10:05	10:30	**10:40**	**10:40**
ETE (hrs:mins) for the 100th Percentile				
Region	**Base**	**Population Change**		
		6%	**7%**	**8%**
2-MILE	1:35	1:35	1:35	1:35
6-MILE	4:50	4:50	4:50	4:50
FEMA EPZ	4:55	4:55	4:55	5:20
Full EPZ	12:10	12:35	12:45	12:55

Table M-4. Event at Avila Beach Golf Resort

ETE (hrs:mins) for the 90th Percentile				
Region	**Base**	**Avila Beach Golf Resort (1,000 Visitors)**	**Avila Beach Golf Resort (3,000 Visitors)**	**Avila Beach Golf Resort (5,000 Visitors)**
2-MILE	1:00	1:00	1:00	1:00
5-MILE	1:30	1:30	1:30	1:30
FEMA EPZ	2:50	2:50	2:50	2:50
Full EPZ	8:15	8:15	8:20	8:20
ETE (hrs:mins) for the 100th Percentile				
Region	**Base**	**Avila Beach Golf Resort (1,000 Visitors)**	**Avila Beach Golf Resort (3,000 Visitors)**	**Avila Beach Golf Resort (5,000 Visitors)**
2-MILE	1:30	1:30	1:30	1:30
5-MILE	4:50	4:50	4:50	4:50
FEMA EPZ	4:55	4:55	4:55	4:55
Full EPZ	10:50	10:50	11:15	11:15

APPENDIX N

ETE Criteria Checklist

N. ETE CRITERIA CHECKLIST

Table N-1. ETE Review Criteria Checklist

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
1.0 Introduction		
a. The emergency planning zone (EPZ) and surrounding area is described.	Yes	Section 1
b. A map is included that identifies primary features of the site including major roadways, significant topographical features, boundaries of counties, and population centers within the EPZ.	Yes	Figures 1-1, 3-1, 6-1
c. A comparison of the current and previous ETE is provided including information similar to that identified in Table 1-1, "ETE Comparison."	Yes	Table 1-3
1.1 Approach		
a. The general approach is described in the report as outlined in Section 1.1, "Approach."	Yes	Section 1.1, Section 1.3, Appendix D, Table 1-1
1.2 Assumptions		
a. Assumptions consistent with Table 1-2, "General Assumptions," of NUREG/CR-7002 are provided and include the basis to support use.	Yes	Section 2
1.3 Scenario Development		
a. The scenarios in Table 1-3, "Evacuation Scenarios," are developed for the ETE analysis. A reason is provided for use of other scenarios or for not evaluating specific scenarios.	Yes	Section 6, Table 6-2

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
1.4 Evacuation Planning Areas		
a. A map of the EPZ with emergency response planning areas (ERPAs) is included.	Yes	Figure 3-1, Figure 6-1
1.4.1 Keyhole Evacuation		
a. A table similar to Table 1-4 "Evacuation Areas for a Keyhole Evacuation", is provided identifying the ERPAs considered for each ETE calculation by downwind direction.	Yes	Table 6-1, Table 7-5, Table H-1
1.4.2 Staged Evacuation		
a. The approach used in development of a staged evacuation is discussed.	Yes	Section 7.2
b. A table similar to Table 1-5, "Evacuation Areas for a Staged Evacuation," is provided for staged evacuations identifying the ERPAs considered for each ETE calculation by downwind direction.	Yes	Table 6-1, Table 7-5, Table H-1
2.0 Demand Estimation		
a. Demand estimation is developed for the four population groups (permanent residents of the EPZ, transients, special facilities, and schools).	Yes	Section 3
2.1 Permanent Residents and Transient Population		
a. The U.S. Census is the source of the population values, or another credible source is provided.	Yes	Section 3.1
b. The availability date of the census data is provided.	Yes	Section 3.1
c. Population values are adjusted as necessary for growth to reflect population estimates to the year of the ETE.	Yes	N/A – 2020 Census used as the base year of the analysis

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
d. A sector diagram, similar to Figure 2-1, "Population by Sector," is included showing the population distribution for permanent residents.	Yes	Figure 3-2
2.1.1 Permanent Residents with Vehicles		
a. The persons per vehicle value is between 1 and 3 or justification is provided for other values.	Yes	Section 3.1
2.1.2 Transient Population		
a. A list of facilities that attract transient populations is included, and peak and average attendance for these facilities is listed. The source of information used to develop attendance values is provided.	Yes	Section 3.3, Table E-4 through Table E-7
b. Major employers are listed.	Yes	Section 3.4, Table E-3
c. The average population during the season is used, itemized and totaled for each scenario.	Yes	Table 3-4, Table 3-5 and Appendix E itemize the peak transient population and employee estimates. These estimates are multiplied by the scenario specific percentages provided in Table 6-3 to estimate average transient population by scenario – see Table 6-4.
d. The percentage of permanent residents assumed to be at facilities is estimated.	Yes	Section 3.3 and Section 3.4
e. The number of people per vehicle is provided. Numbers may vary by scenario, and if so, reasons for the variation are discussed.	Yes	Section 3.3 and Section 3.4

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
f. A sector diagram is included, similar to Figure 2-1, "Population by Sector", is included showing the population distribution for the transient population.	Yes	Figure 3-6 (transients) and Figure 3-8 (employees)
2.2 Transit Dependent Permanent Residents		
a. The methodology (e.g., surveys, registration programs) used to determine the number of transit dependent residents is discussed.	Yes	Section 3.6
b. The State and local evacuation plans for transit dependent residents are used in the analysis.	Yes	Section 8.1
c. The methodology used to determine the number of people with disabilities and those with access and functional needs who may need assistance and do not reside in special facilities is provided. Data from local/county registration programs are used in the estimate.	Yes	Section 3.9
d. Capacities are provided for all types of transportation resources. Bus seating capacity of 50 percent is used or justification is provided for higher values.	Yes	Item 3 of Section 2.4
e. An estimate of the transit dependent population is provided.	Yes	Section 3.6, Table 3-7, Table 3-10
f. A summary table showing the total number of buses, ambulances, or other transport assumed available to support evacuation is provided. The quantification of resources is detailed enough to ensure that double counting has not occurred.	Yes	Table 3-11, Table 8-1

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
2.3 Special Facility Residents		
a. Special facilities, including the type of facility, location, and average population, are listed. Special facility staff is included in the total special facility population.	Yes	Table E-2 and Table E-8 lists all medical facilities and correctional facilities, respectively, by facility name, location, and average population. Staff estimates were not provided.
b. The method of obtaining special facility data is discussed.	Yes	Section 3.5
c. An estimate of the number and capacity of vehicles assumed available to support the evacuation of the facility is provided.	Yes	Table 3-6
d. The logistics for mobilizing specially trained staff (e.g., medical support or security support for prisons, jails, and other correctional facilities) are discussed when appropriate.	Yes	Section 8.1 – under Evacuation of Medical Facilities Correctional Facilities Shelter-in-Place
2.4 Schools		
a. A list of schools including name, location, student population, and transportation resources required to support the evacuation, is provided. The source of this information should be identified.	Yes	Table 3-8, Table E-1, Section 3.7
b. Transportation resources for elementary and middle schools are based on 100 percent of the school capacity.	Yes	Section 3.7
c. The estimate of high school students who will use personal vehicle to evacuate is provided and a basis for the values used is given.	Yes	Section 3.7
d. The need for return trips is identified.	Yes	Section 8.1

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
2.5 Other Demand Estimate Considerations		
2.5.1 Special Events		
a. A complete list of special events is provided including information on the population, estimated duration, and season of the event.	Yes	Section 3.8
b. The special event that encompasses the peak transient population is analyzed in the ETE.	Yes	Section 3.8
c. The percentage of permanent residents attending the event is estimated.	Yes	Section 3.8
2.5.2 Shadow Evacuation		
a. A shadow evacuation of 20 percent is included consistent with the approach outlined in Section 2.5.2, "Shadow Evacuation".	Yes	Item 7 of Section 2.2, Figure 2-1 and Figure 7-1, Section 3.2
b. Population estimates for the shadow evacuation in the shadow region beyond the EPZ are provided by sector.	Yes	Section 3.2, Table 3-3, Figure 3-4
c. The loading of the shadow evacuation onto the roadway network is consistent with the trip generation time generated for the permanent resident population.	Yes	Section 5 – Table 5-8 (footnote)
2.5.3 Background and Pass Through Traffic		
a. The volume of background traffic and pass-through traffic is based on the average daytime traffic. Values may be reduced for nighttime scenarios.	Yes	Section 3.11 and Section 3.12

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
b. The method of reducing background and pass-through traffic is described.	Yes	Section 2.2 – Assumptions 9 and 10 Section 2.5 Section 3.11 and Section 3.12 Table 6-3 – External Through Traffic footnote
c. Pass-through traffic is assumed to have stopped entering the EPZ about two (2) hours after the initial notification.	Yes	Section 2.5
2.6 Summary of Demand Estimation		
a. A summary table is provided that identifies the total populations and total vehicles used in the analysis for permanent residents, transients, transit dependent residents, special facilities, schools, shadow population, and pass-through demand in each scenario.	Yes	Table 3-10, Table 3-11, and Table 6-4
3.0 Roadway Capacity		
a. The method(s) used to assess roadway capacity is discussed.	Yes	Section 4
3.1 Roadway Characteristics		
a. The process for gathering roadway characteristic data is described including the types of information gathered and how it is used in the analysis.	Yes	Section 1.3, Appendix D
b. Legible maps are provided that identify nodes and links of the modeled roadway network similar to Figure A-1, "Roadway Network Identifying Nodes and Links," and Figure A-2, "Grid Map Showing Detailed Nodes and Links."	Yes	Appendix K

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
3.2 Model Approach		
a. The approach used to calculate the roadway capacity for the transportation network is described in detail, and the description identifies factors that are expressly used in the modeling.	Yes	Section 4
b. Route assignment follows expected evacuation routes and traffic volumes.	Yes	Appendix B and Appendix C
c. A basis is provided for static route choices if used to assign evacuation routes.	N/A	Static route choices are not used to assign evacuation routes. Dynamic traffic assignment is used.
d. Dynamic traffic assignment models are described including calibration of the route assignment.	Yes	Appendix B and Appendix C
3.3 Intersection Control		
a. A list that includes the total numbers of intersections modeled that are unsignalized, signalized, or manned by response personnel is provided.	Yes	Table K-1
b. The use of signal cycle timing, including adjustments for manned traffic control, is discussed.	Yes	Section 4, Appendix G
3.4 Adverse Weather		
a. The adverse weather conditions are identified.	Yes	Assumption 2 and 3 of Section 2.6
b. The speed and capacity reduction factors identified in Table 3-1, “Weather Capacity Factors,” are used or a basis is provided for other values, as applicable to the model.	Yes	Table 2-2
c. The calibration and adjustment of driver behavior models for adverse weather conditions are described, if applicable.	N/A	Driver behavior is not adjusted for adverse weather conditions.

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
d. The effect of adverse weather on mobilization is considered and assumptions for snow removal on streets and driveways are identified, when applicable.	Yes	Table 2-2
4.0 Development of Evacuation Times		
4.1 Traffic Simulation Models		
a. General information about the traffic simulation model used in the analysis is provided.	Yes	Section 1.3, Table 1-3, Appendix B, Appendix C
b. If a traffic simulation model is not used to perform the ETE calculation, sufficient detail is provided to validate the analytical approach used.	N/A	Not applicable since a traffic simulation model was used.
4.2 Traffic Simulation Model Input		
a. Traffic simulation model assumptions and a representative set of model inputs are provided.	Yes	Section 2, Appendix J
b. The number of origin nodes and method for distributing vehicles among the origin nodes are described.	Yes	Appendix J, Appendix C
c. A glossary of terms is provided for the key performance measures and parameters used in the analysis.	Yes	Appendix A
4.3 Trip Generation Time		
a. The process used to develop trip generation times is identified.	Yes	Section 5
b. When surveys are used, the scope of the survey, area of the survey, number of participants, and statistical relevance are provided.	Yes	Appendix F
c. Data used to develop trip generation times are summarized.	Yes	Appendix F, Section 5

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
d. The trip generation time for each population group is developed from site-specific information.	Yes	Section 5
e. The methods used to reduce uncertainty when developing trip generation times are discussed, if applicable.	N/A	Appendix F
4.3.1 Permanent Residents and Transient Population		
a. Permanent residents are assumed to evacuate from their homes but are not assumed to be at home at all times. Trip generation time includes the assumption that a percentage of residents will need to return home before evacuating.	Yes	Section 5 discusses trip generation for households with and without returning commuters. Table 6-3 presents the percentage of households with returning commuters and the percentage of households either without returning commuters or with no commuters. Appendix F presents the percent households who will await the return of commuters. Section 2.3, Assumption 3
b. The trip generation time accounts for the time and method to notify transients at various locations.	Yes	Section 5
c. The trip generation time accounts for transients potentially returning to hotels before evacuating.	Yes	Section 5, Figure 5-1
d. The effect of public transportation resources used during special events where a large number of transients are expected is considered.	Yes	Section 3.8 Public Transportation is not provided for the special event and was therefore not considered.

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
4.3.2 Transit Dependent Permanent Residents		
a. If available, existing and approved plans and bus routes are used in the ETE analysis.	N/A	Established bus routes do not exist. Created bus routes based on existing carless collection points. Section 8.1 under Evacuation of Transit-Dependent People
b. The means of evacuating ambulatory and non-ambulatory residents are discussed.	Yes	Section 8.1 under Evacuation of Transit-Dependent People, Section 8.2
c. Logistical details, such as the time to obtain buses, brief drivers and initiate the bus route are used in the analysis.	Yes	Section 8.1, Figure 8-1
d. The estimated time for transit dependent residents to prepare and then travel to a bus pickup point, including the expected means of travel to the pickup point, is described.	Yes	Section 8.1 under Evacuation of Transit-Dependent People
e. The number of bus stops and time needed to load passengers are discussed.	Yes	Section 8.1, Table 8-4 and Table 8-5
f. A map of bus routes is included.	Yes	Figure 10-2
g. The trip generation time for non-ambulatory persons including the time to mobilize ambulances or special vehicles, time to drive to the home of residents, time to load, and time to drive out of the EPZ, is provided.	Yes	Section 8.2
h. Information is provided to support analysis of return trips, if necessary.	Yes	Section 8.1 and 8.2

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
4.3.3 Special Facilities		
a. Information on evacuation logistics and mobilization times is provided.	Yes	Section 2.4, Section 8.1, Table 8-6 and Table 8-7
b. The logistics of evacuating wheelchair and bed bound residents are discussed.	Yes	Section 8.1, Table 8-6 and Table 8-7
c. Time for loading of residents is provided.	Yes	Section 2.4, Section 8.1, Table 8-6 and Table 8-7
d. Information is provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed.	Yes	Section 8.1
e. Discussion is provided on whether special facility residents are expected to pass through the reception center before being evacuated to their final destination.	Yes	Section 8.1
f. Supporting information is provided to quantify the time elements for each trip, including destinations if return trips are needed.	Yes	Section 8.1
4.3.4 Schools		
a. Information on evacuation logistics and mobilization times is provided.	Yes	Section 2.4, Section 8.1, Table 8-2 and Table 8-3
b. Time for loading of students is provided.	Yes	Section 2.4, Section 8.1, Table 8-2 and Table 8-3
c. Information is provided that indicates whether the evacuation can be completed in a single trip or if additional trips are needed.	Yes	Section 8.1

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
d. If used, reception centers should be identified. A discussion is provided on whether students are expected to pass through the reception center before being evacuated to their final destination.	Yes	Section 8.1, Table 10-3
e. Supporting information is provided to quantify the time elements for each trip, including destinations if return trips are needed.	Yes	Section 8.1, Table 8-2 and Table 8-3
4.4 Stochastic Model Runs		
a. The number of simulation runs needed to produce average results is discussed.	N/A	DYNEV does not rely on simulation averages or random seeds for statistical confidence. For DYNEV/DTRAD, it is a mesoscopic simulation and uses dynamic traffic assignment model to obtain the "average" (stable) network work flow distribution. This is different from microscopic simulation, which is monte-carlo random sampling by nature relying on different seeds to establish statistical confidence. Refer to Appendix B for more details
b. If one run of a single random seed is used to produce each ETE result, the report includes a sensitivity study on the 90 percent and 100 percent ETE using 10 different random seeds for evacuation of the full EPZ under Summer, Midweek, Daytime, Normal Weather conditions.	N/A	

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
4.5 Model Boundaries		
a. The method used to establish the simulation model boundaries is discussed.	Yes	Section 4.5
b. Significant capacity reductions or population centers that may influence the ETE and that are located beyond the evacuation area or shadow region are identified and included in the model, if needed.	Yes	Section 4.5
4.6 Traffic Simulation Model Output		
a. A discussion of whether the traffic simulation model used must be in equilibration prior to calculating the ETE is provided.	Yes	Appendix B
b. The minimum following model outputs for evacuation of the entire EPZ are provided to support review: 1. Evacuee average travel distance and time. 2. Evacuee average delay time. 3. Number of vehicles arriving at each destination node. 4. Total number and percentage of evacuee vehicles not exiting the EPZ. 5. A plot that provides both the mobilization curve and evacuation curve identifying the cumulative percentage of evacuees who have mobilized and exited the EPZ. 6. Average speed for each major evacuation route that exits the EPZ.	Yes	1. Appendix J, Table J-2 2. Table J-2 3. Table J-4 4. None and 0%. 100 percent ETE is based on the time the last vehicle exits the evacuation zone 5. Figures J-2 through J-13 (one plot for each scenario considered) 6. Table J-3
c. Color coded roadway maps are provided for various times (e.g., at 2, 4, 6 hrs.) during a full EPZ evacuation scenario, identifying areas where congestion exists.	Yes	Figure 7-4 through Figure 7-11

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
4.7 Evacuation Time Estimates for the General Public		
a. The ETE includes the time to evacuate 90 percent and 100 percent of the total permanent resident and transient population.	Yes	Table 7-1 and Table 7-2
b. Termination criteria for the 100 percent ETE are discussed, if not based on the time the last vehicle exits the evacuation zone.	N/A	100 percent ETE is based on the time the last vehicle exits the evacuation zone.
c. The ETE for 100 percent of the general public includes all members of the general public. Any reductions or truncated data is explained.	Yes	Section 5.4.1 – truncating survey data to eliminate statistical outliers Table 7-2 – 100th percentile ETE for general population
d. Tables are provided for the 90 and 100 percent ETEs similar to Table 4-3, "ETEs for a Staged Evacuation," and Table 4-4, "ETEs for a Keyhole Evacuation."	Yes	Table 7-3 and Table 7-4
e. ETEs are provided for the 100 percent evacuation of special facilities, transit dependent, and school populations.	Yes	Section 8
5.0 Other Considerations		
5.1 Development of Traffic Control Plans		
a. Information that responsible authorities have approved the traffic control plan used in the analysis are discussed.	Yes	Section 9, Appendix G
b. Adjustments or additions to the traffic control plan that affect the ETE is provided.	Yes	Section 9, Appendix G
5.2 Enhancements in Evacuation Time		
a. The results of assessments for enhancing evacuations are provided.	Yes	Appendix M

NRC Review Criteria	Addressed in ETE Analysis (Yes/No/NA)	Comments
5.3 State and Local Review		
a. A list of agencies contacted is provided and the extent of interaction with these agencies is discussed.	Yes	Table 1-1
b. Information is provided on any unresolved issues that may affect the ETE.	Yes	Results of the ETE study were formally presented to state and local agencies at the final project meeting. Comments on the draft report were provided and were addressed in the final report. There are no unresolved issues.
5.4 Reviews and Updates		
a. The criteria for when an updated ETE analysis is required to be performed and submitted to the NRC is discussed.	Yes	Appendix M, Section M.3
5.4.1 Extreme Conditions		
a. The updated ETE analysis reflects the impact of EPZ conditions not adequately reflected in the scenario variations.	N/A	This ETE is being updated as a result of the availability of US Census Bureau decennial census data.
5.5 Reception Centers and Congregate Care Center		
a. A map of congregate care centers and reception centers is provided.	Yes	Figure 10-3