EVACUATION TRAVEL TIME ESTIMATES
FOR THE JAMES A. FITZPATRICK/NINE MILE POINT
EMERGENCY PLANNING ZONE

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(Supersedes May 1982 Draft Report)

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I. INTRODUCTION

I. INTRODUCTION

In Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants (NUREG-0654, FEMA-REP-1: Rev. 1, November 1980; hereafter referred to as NUREG-0654), the U.S. Nuclear Regulatory Commission (NRC) and the Federal Emergency Management Agency (FEMA) called upon power plant licensees and state and local agencies to prepare evacuation time estimates for the population within a 10-mile radius plume exposure pathway Emergency Planning Zone (EPZ). The approach for preparing the evacuation time estimates is included in Appendix 4 of NUREG-0654.

This report is prepared in response to Appendix 4 of NUREG-0654, and presents estimates of the evacuation travel time for the 10-mile EPZ surrounding the Nine Mile Point site in Oswego County, New York. This report is an update of a draft evacuation time estimate report prepared in May 1982 for the same nuclear power facilities.

Since the May 1982 travel time estimates were prepared, several factors affecting evacuation time have changed, including:

1. Availability of 1980 Census Data. The earlier travel time estimates were primarily based on two sources of demographic data: the 1976 Census projections of 1980 population, and Oswego County Planning Department projections. However, more accurate and detailed Census data is now available to update population data and evacuation travel time estimates.

2. Construction On-Site. The Nine Mile Point Unit 2 Power Plant is presently under construction, utilizing an approximately 6,000-person work force. The level of construction activity was significantly lower when the earlier time estimate study was prepared, and therefore did not warrant special consideration. However, this existing construction activity is specifically evaluated in terms of its impact on the evacuation routes and corresponding travel time estimates in this report.

3. Changes to the Oswego County Radiological Emergency Preparedness Plan (REPP). Under the current REPP, bus evacuation routes no longer go to Jefferson County. Reception center assignments and procedures have been modified. Emergency vehicle availability and local bus company preferences have changed. These revisions are considered in this update of evacuation travel time estimates to reflect the current plan provisions.

The evacuation travel time estimates included herein are based on the emergency response implementation procedures in the REPP. The population data, special facility information, evacuation routes, vehicle inventories, and other parameters necessary to determine evacuation time are consistent with the most recent version of the plan. As such, this report is an integral component of the Oswego County REPP, and provides valuable information to be used by decision makers in the event of an incident at the Nine Mile Point site.

A. Site Location

The Nine Mile Point nuclear power site is located on the shore of Lake Ontario in the Town of Scriba, Oswego County, New York. The site consists of the James A. FitzPatrick Nuclear Power Plant (JAFNPP) and the Nine Mile Point Nuclear Stations (NMPNS), Units 1 and 2. Unit 2 is currently under construction and is scheduled for completion in October 1986. The JAFNPP is located adjacent to and east of the NMPNS. The site is located approximately 7 miles northeast of the City of Oswego; 36 miles northwest of Syracuse; 55 miles east of Rochester, and 135 miles east of Buffalo. Throughout this report, the acronym JAF/NMP refers to the site of all three nuclear facilities, not to a particular power plant. The location of JAF/NMP is shown in Figure 1.

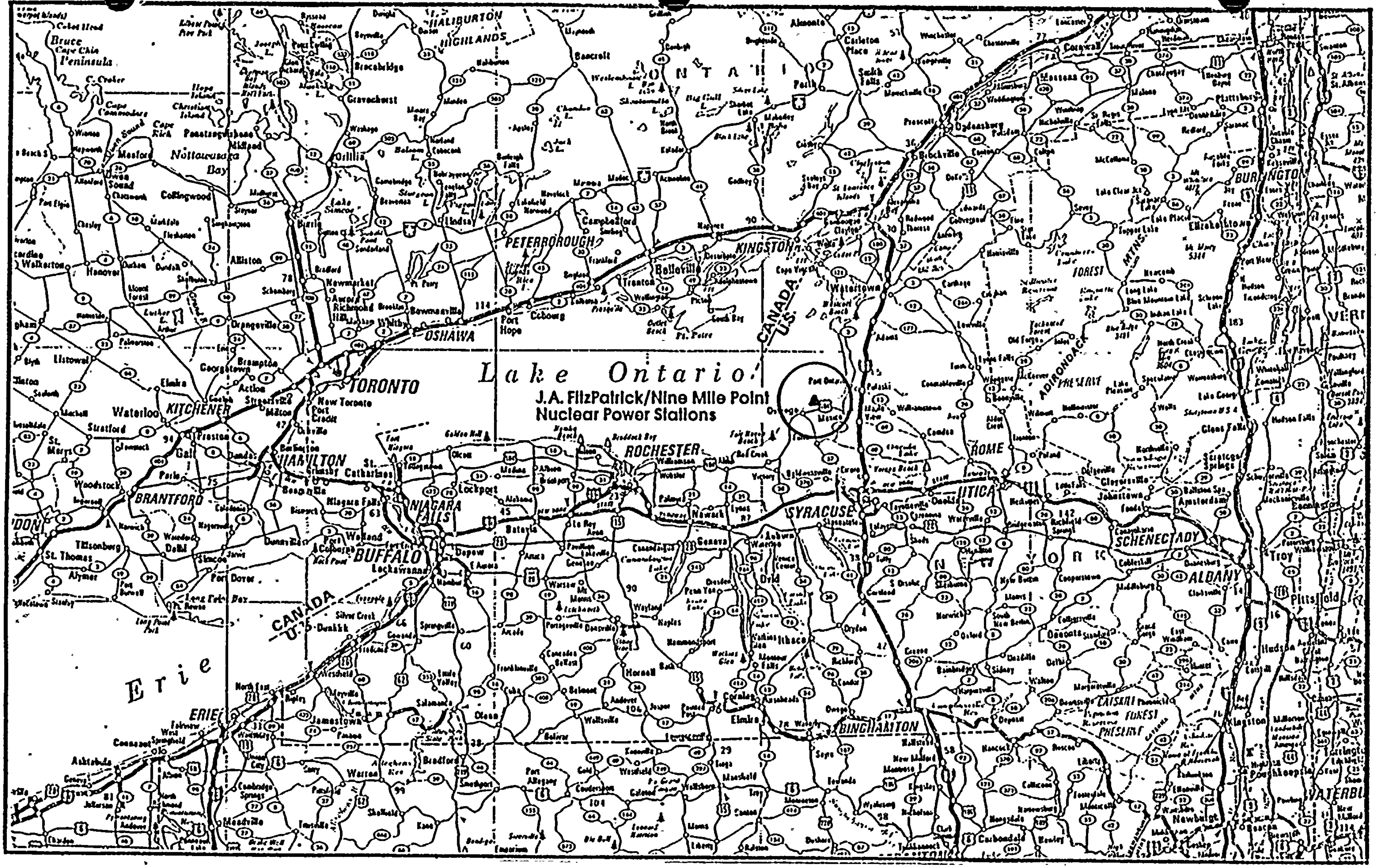
B. General Assumptions and Methodology

Both the general assumptions and methodologies used to prepare these evacuation travel time estimates are detailed in the relevant sections of this report or in its appendixes. For example, population information is summarized in Section II. Demand Estimation. Roadway capacity information and vehicle availability are summarized in Section III. Transportation Facilities. The actual evacuation travel times are presented in two formats and summarized in two different report locations:

1. By Sector, for the longest and shortest evacuation time scenarios, in Section IV. Analysis of Evacuation Travel Times; and

2. By Emergency Response Planning Area (ERPA), for seven different evacuation scenarios, in Appendix F.

The computer model used to calculate roadway travel times during an evacuation is described in Appendix G.



Scale in Miles
25 0 25 50

Fig. 1 Location Map

Parsons
Brinckerhoff

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

II. DEMAND ESTIMATION

II. DEMAND ESTIMATION

This section of the report discusses the demographic analysis performed for the JAF/NMP EPZ. The basic objective of the analysis is to determine the number, location, and temporal characteristics of the population to be evacuated. Three population categories have been considered: permanent residents, transients, and persons in special facilities, as specified in NUREG-0654.

The population categories have been analyzed for various geographic areas, as discussed below.

A. Emergency Planning Zone, Sectors, Segments, and Subareas

Emergency Planning Zone

As shown in Figure 2, the plume exposure pathway EPZ is defined by an irregularly shaped boundary 10 miles or further from JAF/NMP. The perimeter of the EPZ follows physical and/or political boundaries as much as practical to facilitate recognition of the boundary by the public. The EPZ encompasses, where reasonable, entire political subdivisions to minimize the segregation that would occur if a true 10-mile radius boundary were used to define the EPZ. Figure 2 shows both the actual 10-mile radius EPZ and the approximate 10-mile radius EPZ (included in the Oswego County REPP and used in calculating the evacuation travel time estimates), superimposed on a reduced composite New York State Department of Transportation planimetric map of the region. The map shows major political boundaries, transportation networks, and topographical features.

Sectors

The EPZ was subdivided into areas with approximate two-, five-, and 10-mile radii from JAF/NMP, as specified in Appendix 4 of NUREG-0654. The two-, five-, and 10-mile radii areas were further subdivided into approximate 90° quadrants with north-south and east-west axes. The areas defined by both the radii and quadrants are called Sectors.

Sectors are comprised of smaller units called Emergency Response Planning Areas (ERPAs), which also generally follow political and/or physical boundaries. An ERPA is the fundamental planning area identified in the Oswego County REPP. Each ERPA, as a unit, would follow a specific protective response action in the event of an incident at JAF/NMP. ERPAs, in turn, are further subdivided into traffic zones, which represent population clusters in particular geographic areas following specified evacuation routes out of the EPZ. (For a more detailed discussion of the traffic zones, see Section III.A and Appendix C of this report.)

The Sectors, therefore, approximate the divisions specified in NUREG-0654 without dividing densely populated political subdivisions. Each Sector is comprised of one or more ERPAs. The Sectors are defined as follows:

Sectors A, B, C, and D - Four approximately 90° quadrants comprised of ERPAs generally within a two-mile radius.

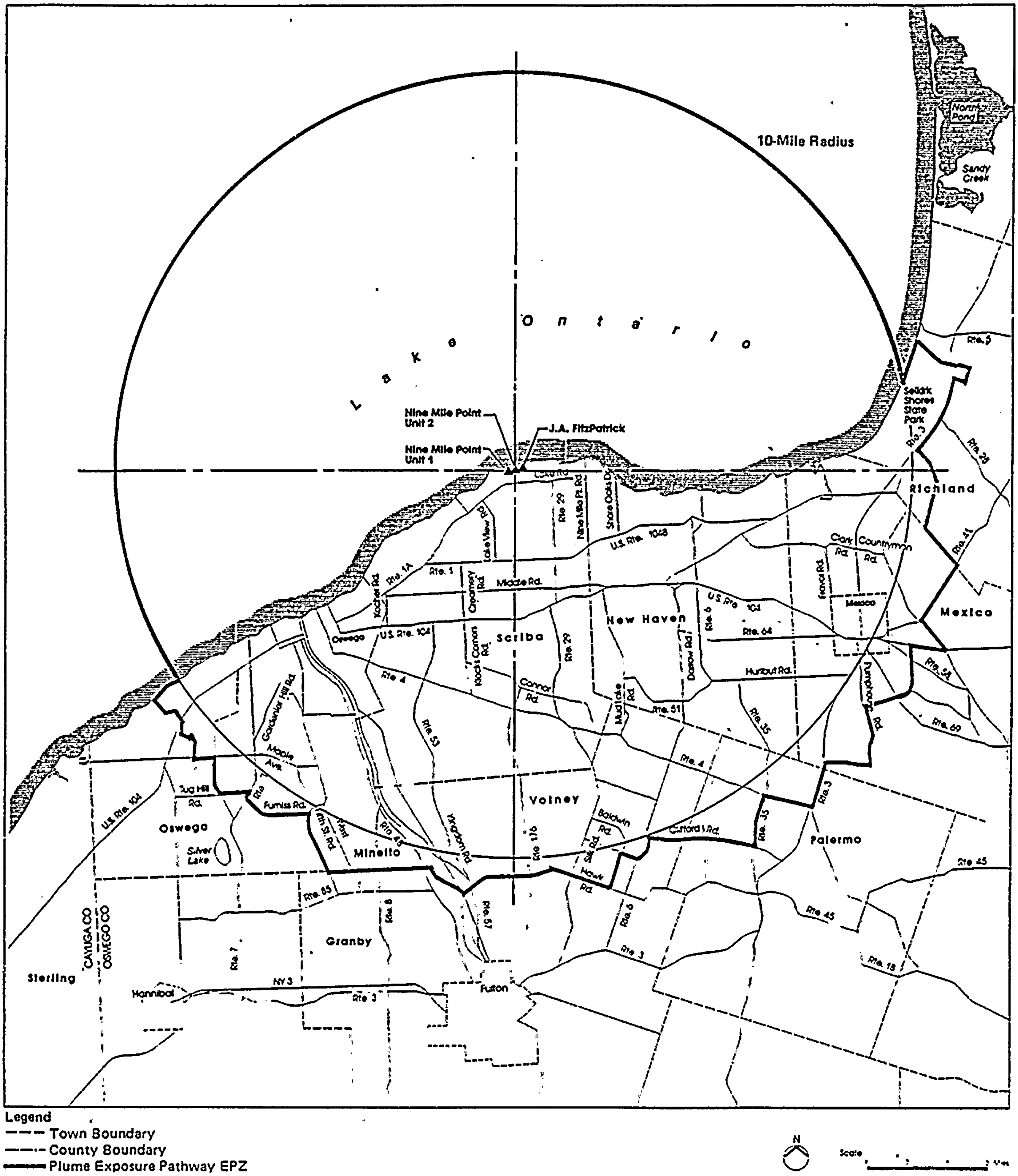


Fig. 2 10-Mile Radius and Actual EPZ Boundaries

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

Sectors E, F, G, and H - Four approximately 90° quadrants comprised of ERPAs generally within a five-mile radius.

Sectors I, J, K, and L - Four approximately 90° quadrants comprised of ERPAs within the 10-mile EPZ.

Sector M - A 360° Sector encompassing the entire 10-mile EPZ.

The Sectors and their component ERPAs are listed in Table 1 and illustrated in Figures 3 through 15. Descriptions of the ERPA boundaries are presented in Appendix A of this report.

Segments and Subareas

Appendix 4 of NUREG-0654 specifies that all population and evacuation time estimate analyses be presented by Sector, as described above. However, as specified in Section J.10.b of NUREG-0654, population estimates have also been prepared for a different geographic breakdown of the area -- comprised of Segments and Subareas. The Segments are radial areas of 22½$^\circ$ each, with the center line of the northern Segment being true north from the Nine Mile Point Unit 2 reactor building. The 16 radial Segments intersect with three concentric rings lying from 0 to 2 miles, 2 to 5 miles, and 5 to 10 miles from the Unit 2 reactor building, to form 48 Subareas within the 10-mile radius area. It is noted that the Segment and Subarea boundaries are not irregularly shaped because they follow polar coordinate specifications.

The plume exposure pathway EPZ is irregular and generally further than 10 miles from JAF/NMP. The outermost Subarea boundaries are defined by a true 10-mile radius. Therefore, a portion of land exists between the outermost Subareas and the plume EPZ. The population in this area is thus included in Sector estimates, but not included in Subarea estimates.

The following is a description of the methodology and sources used to derive permanent resident, transient, and special facilities population estimates for the various geographic areas discussed above. Estimates of the three population categories are presented in this report as baseline estimates in order to provide the largest possible figure for each category. The estimates, therefore, are not additive for determination of the total population at any given point in time because the data may represent various times of day for each of the subgroups. For example, the largest estimate for the special facilities population represents a weekday when school is in session. The permanent resident population, on the other hand, is at its largest at nighttime when most people are at home and businesses and schools are closed. However, to calculate evacuation travel times, the baseline estimates presented herein were adjusted for each population category to coincide with the specific, time-based scenario under study. (The scenarios are discussed further in Section IV.A of this report.)

B. Permanent Resident Population

Permanent residents, as defined in Appendix 4 of NUREG-0654, are those persons who reside in the EPZ, including schoolchildren but excluding persons residing in institutions identified as special facilities in the Oswego County

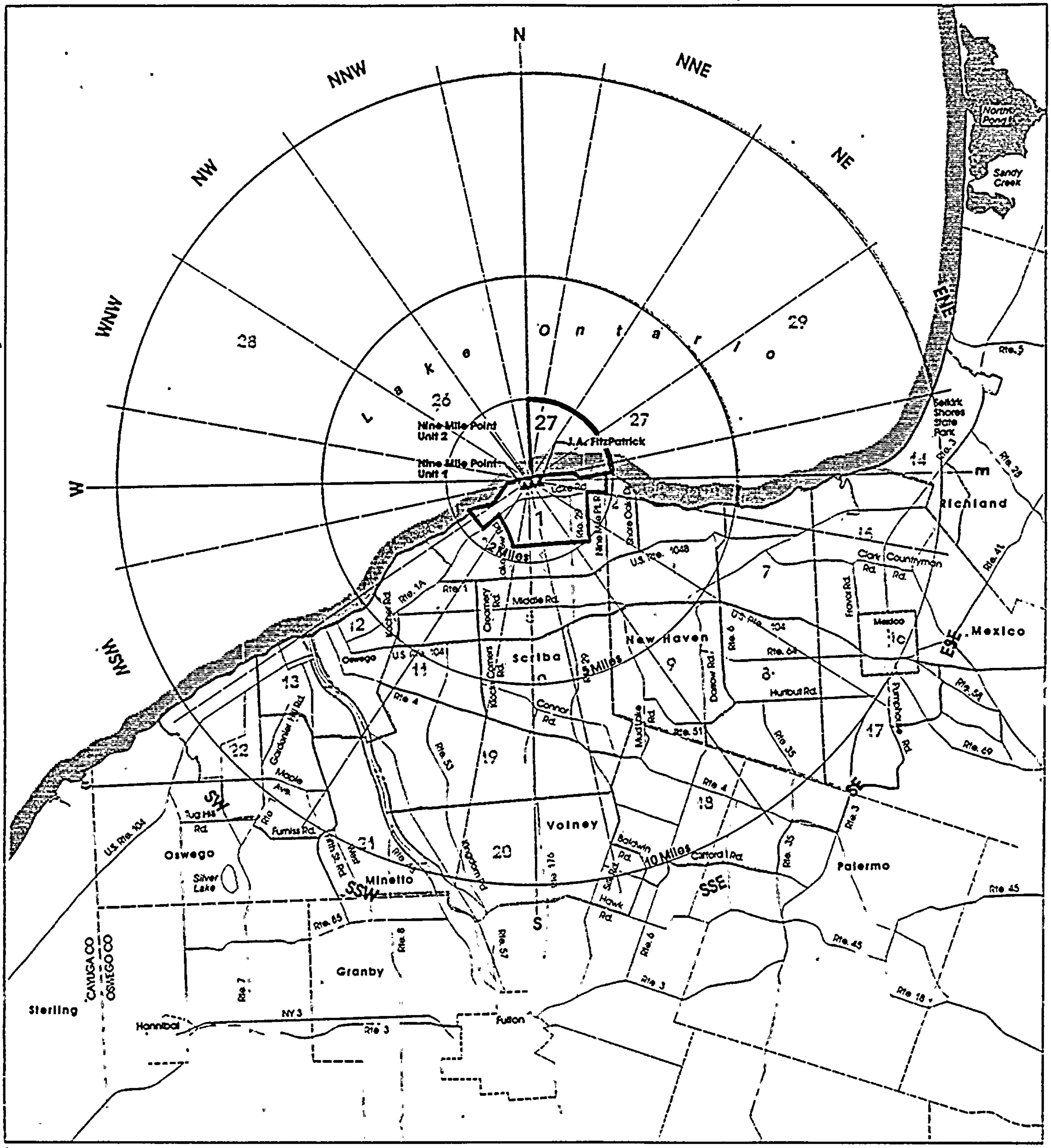
TABLE 1

RELATIONSHIP BETWEEN SECTORS

AND EMERGENCY RESPONSE PLANNING AREAS

Figure Number	Sector*	Approximate Radius	Quadrant	Emergency Response Planning Areas
3	A	2 mile	NE	1,27
4	B	2 mile	SE	1,2
5	C	2 mile	SW	1,3,26
6	D	2 mile	NW	1,26
7	E	5 mile	NE	1,27
8	F	5 mile	SE	1,2,4,5,9,10,27
9	G	5 mile	SW	1,3,5,6,10,11,26
10	H	5 mile	NW	1,26
11	I	10 mile	NE	1,27,29
12	J	10 mile	SE	1,2,4,5,7-10,14-20,27,29
13	K	10 mile	SW	1,3,5,6,10-13,19-25,26,28
14	L	10 mile	NW	1,26,28
15	M	10 mile	All	1-29

*The land portions of each Sector were included in the evacuation travel time estimate analysis. ERPAs 23-25 are located on the Oswego River; ERPAs 26-29 are located on Lake Ontario. Evacuation of Sectors 23-29 is discussed in Section III.E of this report.



Legend
—— Emergency Response Planning Area (ERPA)
ERPA Number
—— ERPA Included in this Sector

2 Miles

Fig. 3 Sector A—90 Degrees NE
2-Mile Radius

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

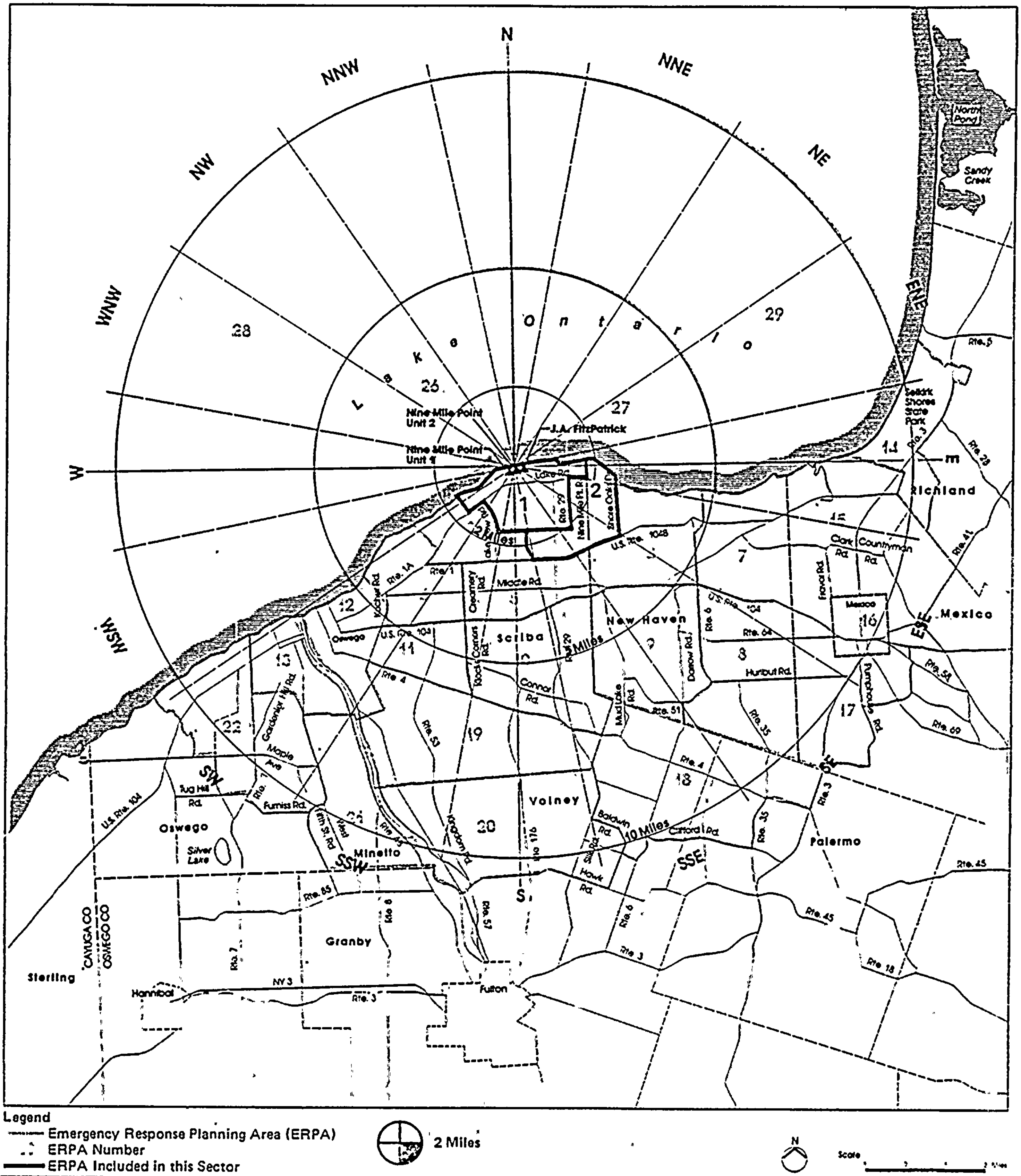


Fig. 4 Sector B—90 Degrees SE
2-Mile Radius

**J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations**

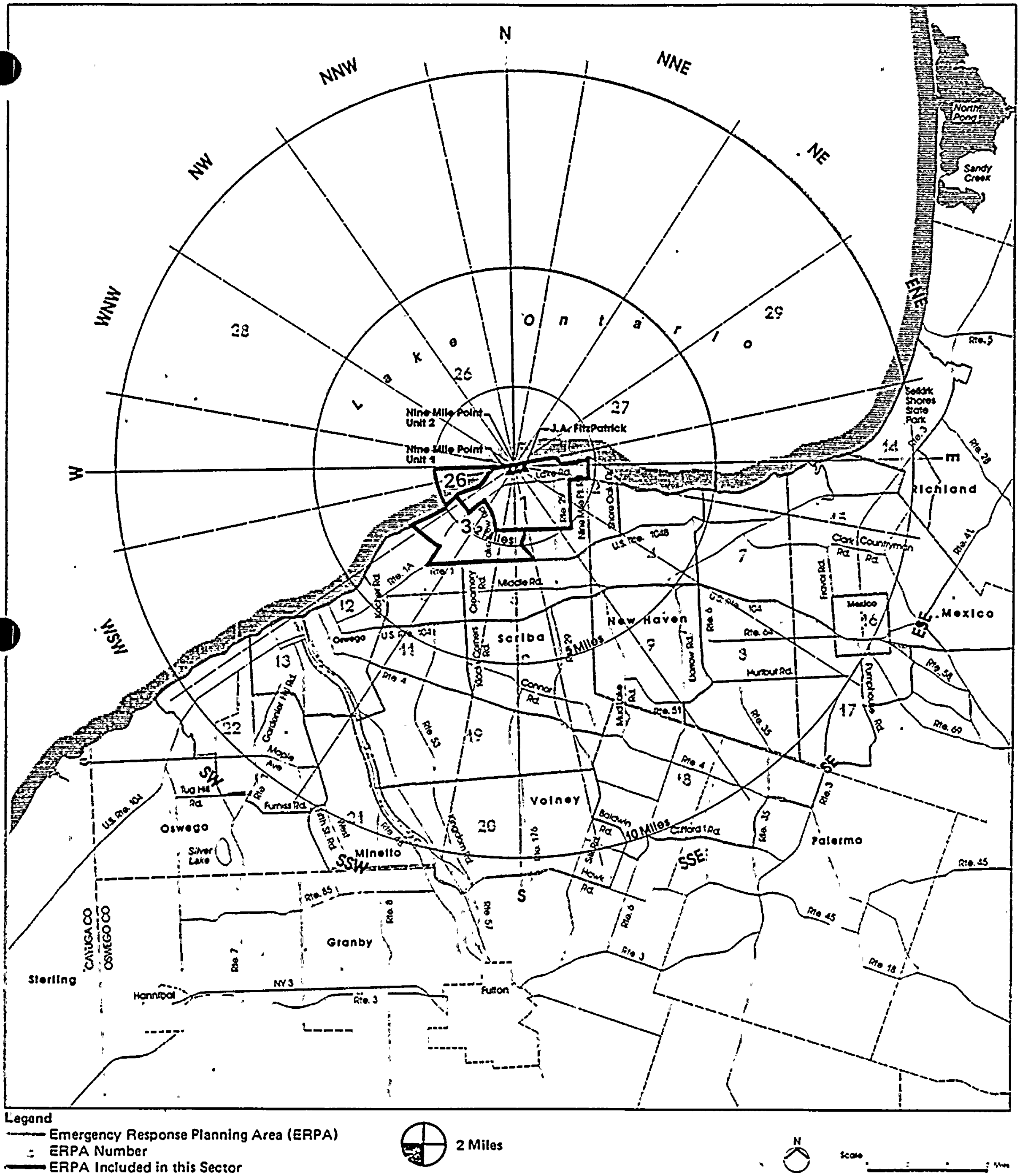
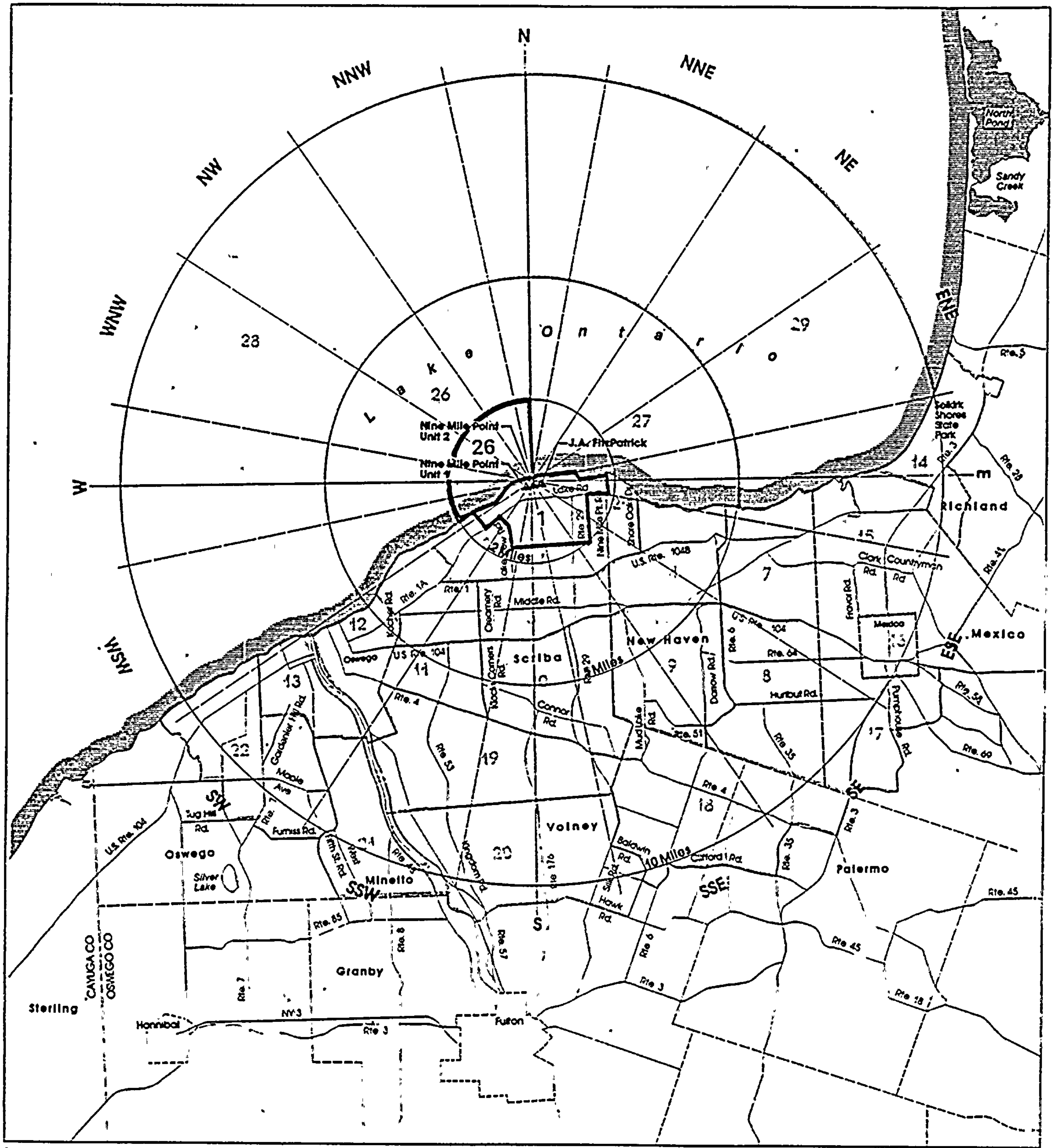


Fig. 5 Sector C—90 Degrees SW
2-Mile Radius

**J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations**



Legend

- Emergency Response Planning Area (ERPA)
- ERPA Number
- ERPA Included in this Sector

2 Miles

Fig. 6 Sector D—90 Degrees NW 2-Mile Radius

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

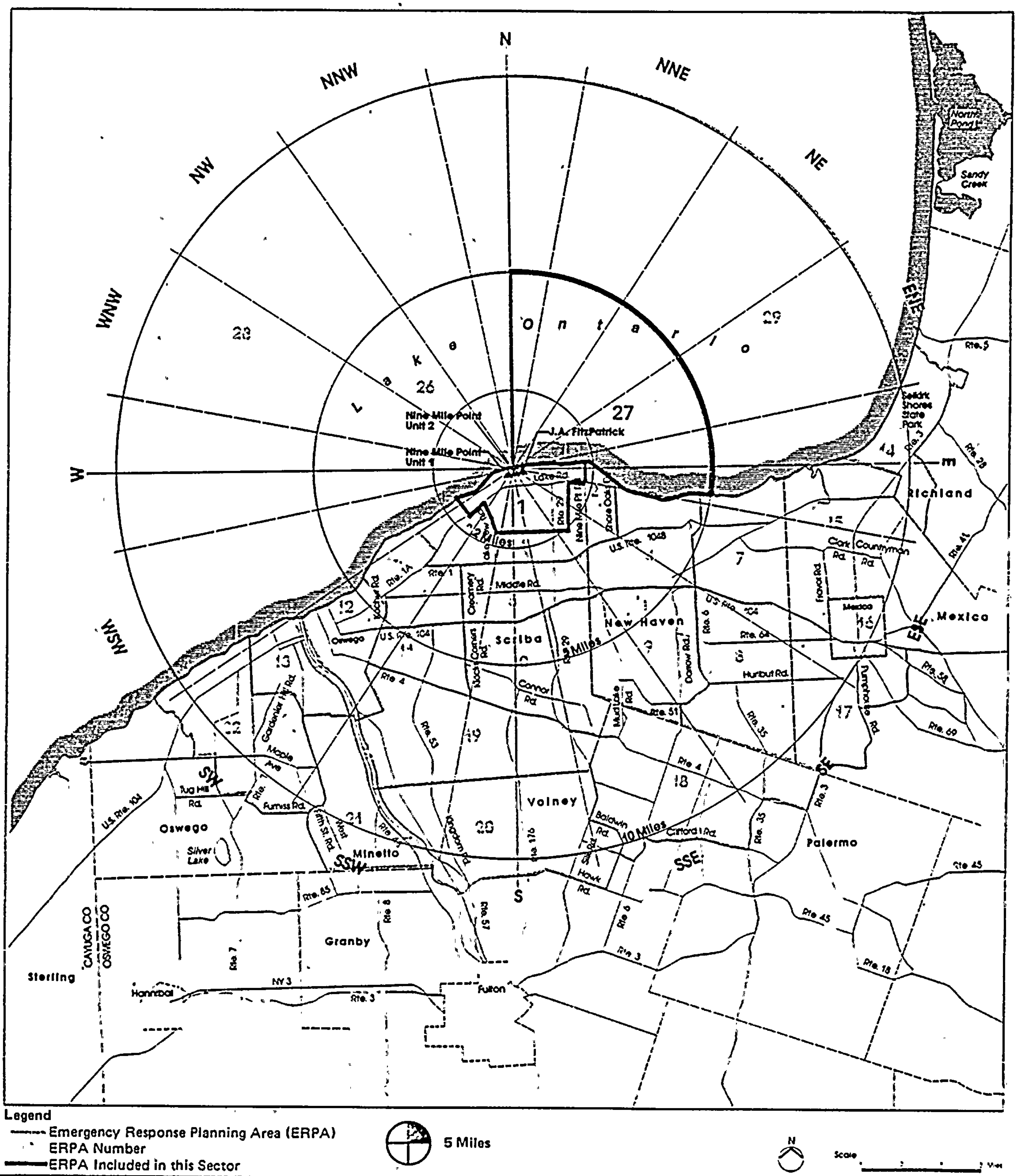


Fig. 7 Sector E—90 Degrees NE 5-Mile Radius

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

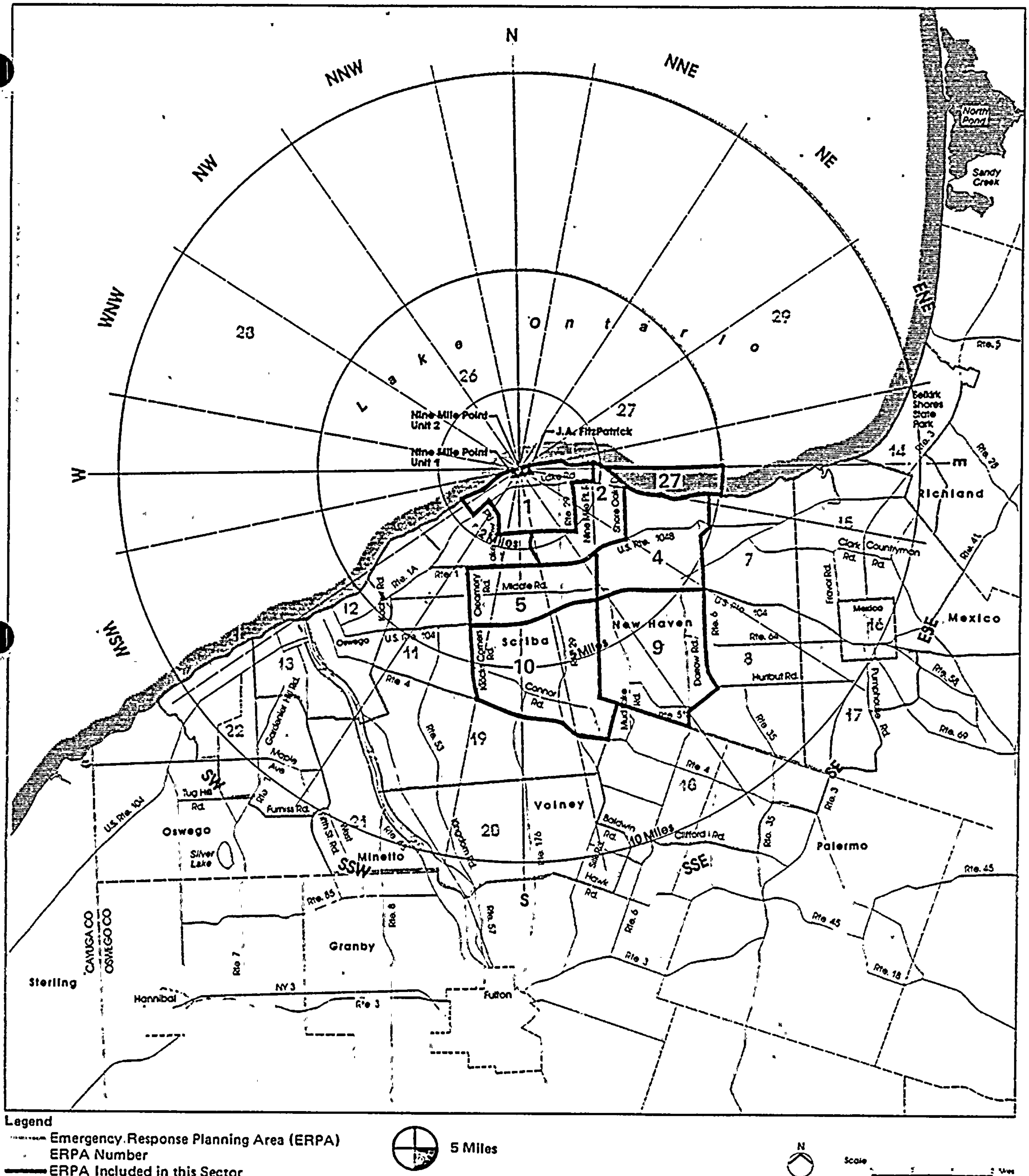
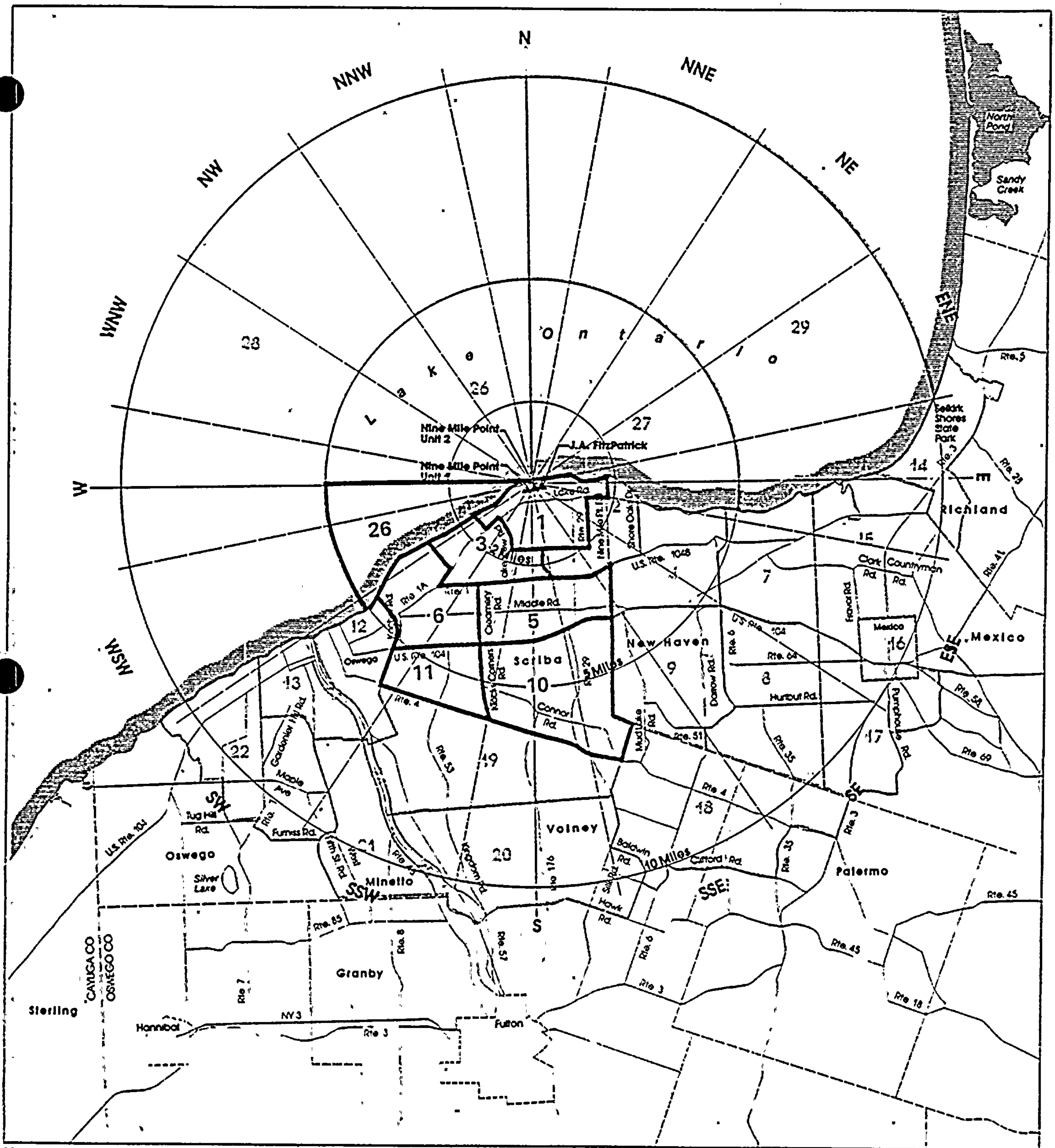


Fig. 8 Sector F—90 Degrees SE
5-Mile Radius

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations



Legend
—— Emergency Response Planning Area (ERPA)
ERPA Number
—— ERPA Included in this Sector

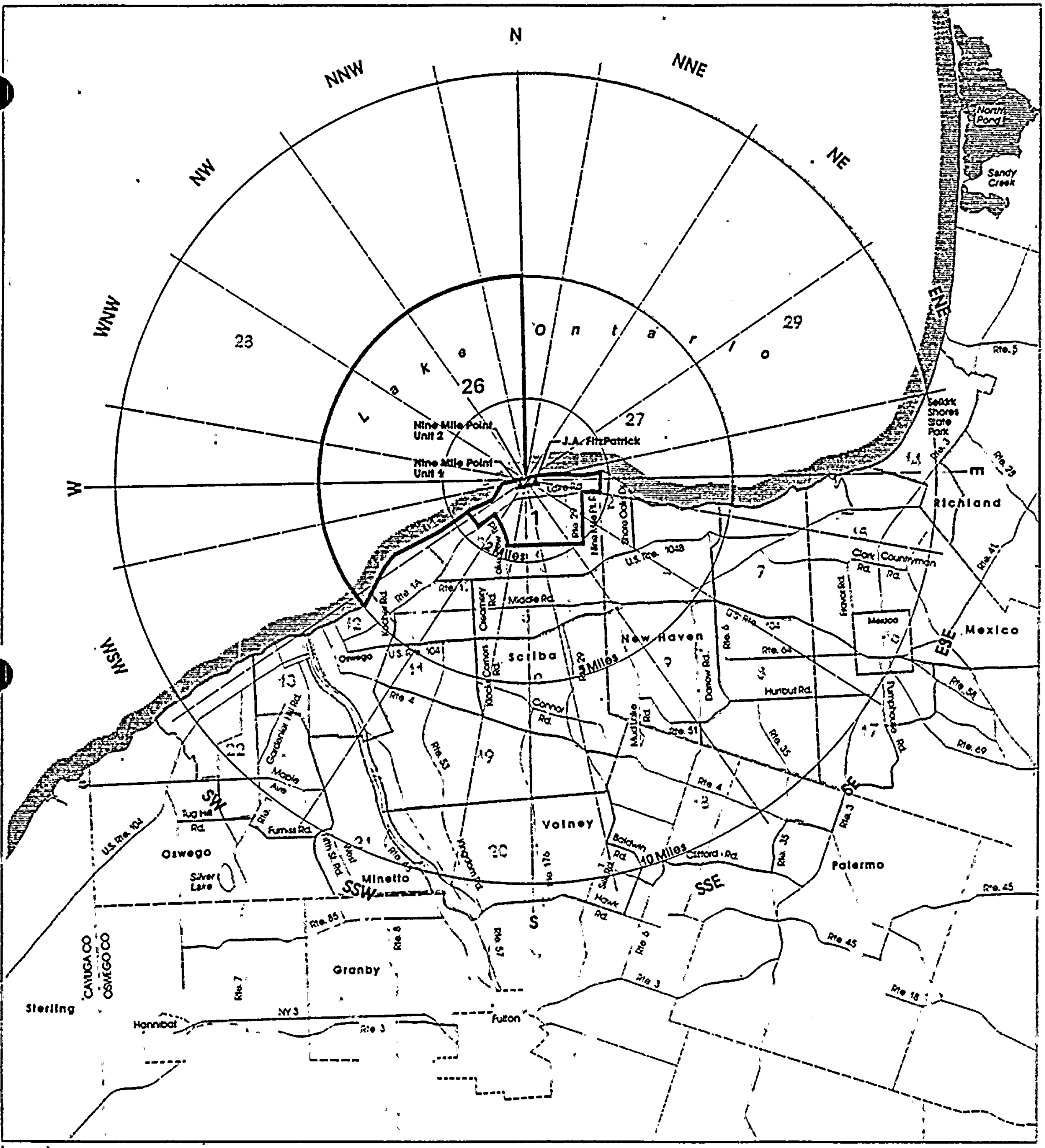
5 Miles

N

Scale

Fig. 9 Sector G—90 Degrees SW
5-Mile Radius

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

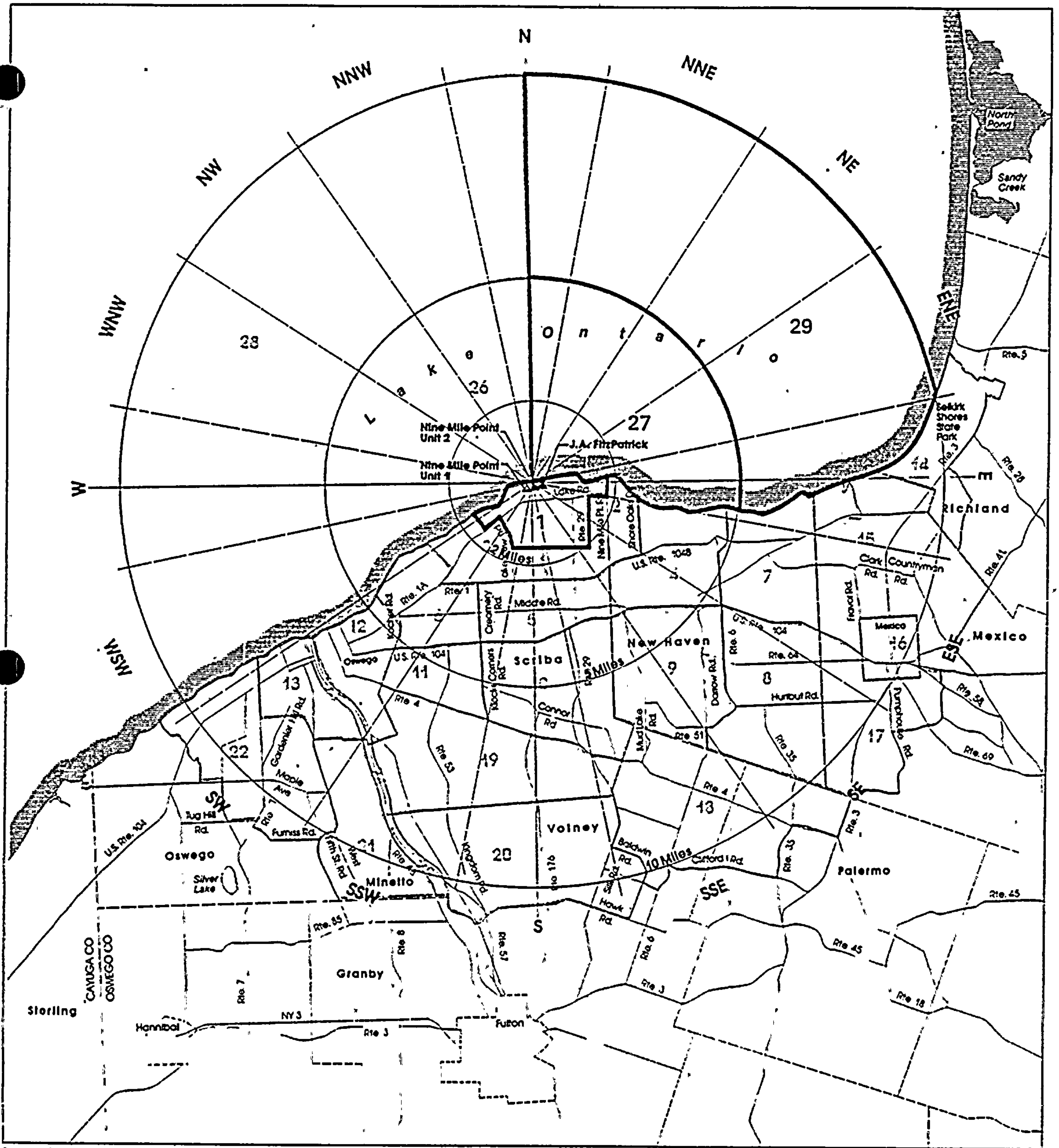


Legend
Emergency Response Planning Area (ERPA)
ERPA Number
ERPA Included in this Sector

5 Miles

Fig. 10 Sector H—90 Degrees NW 5-Mile Radius

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations



Legend
Emergency Response Planning Area (ERPA)
ERPA Number
ERPA Included in this Sector

10 Miles

N

Scale

Fig. 11 Sector I—90 Degrees NE
10-Mile Radius

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

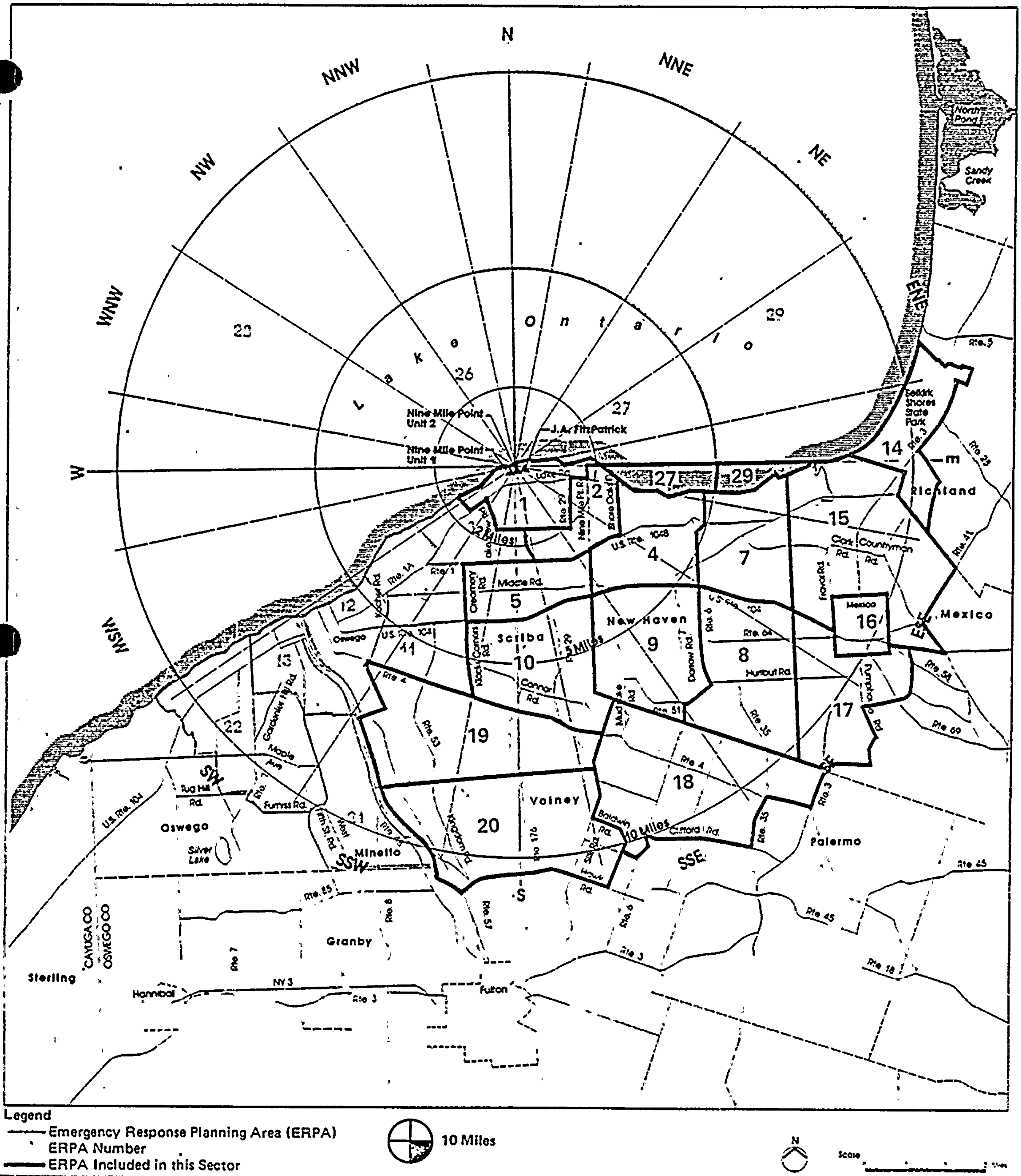
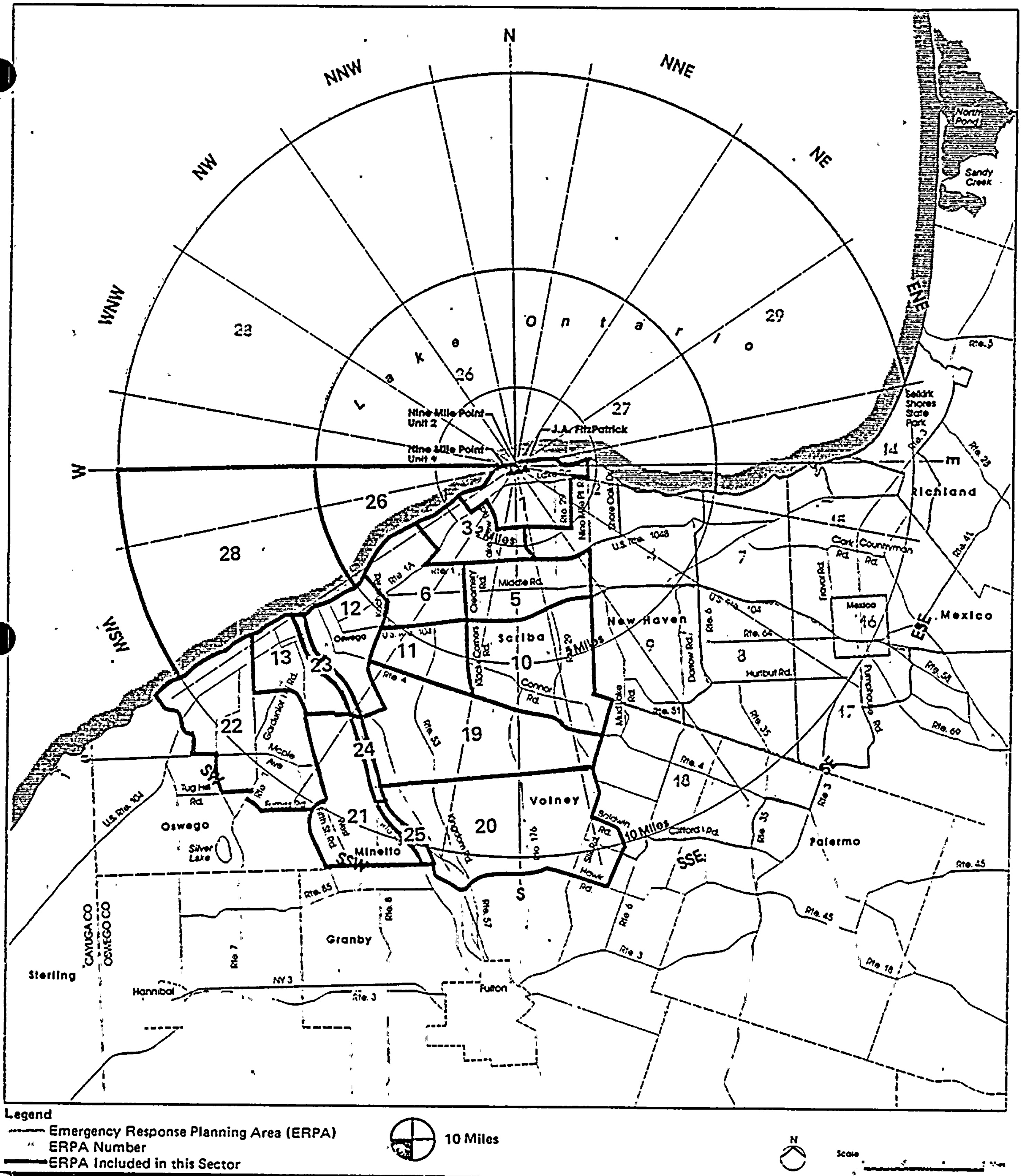


Fig. 12 Sector J—90 Degrees SE
10-Mile Radius

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

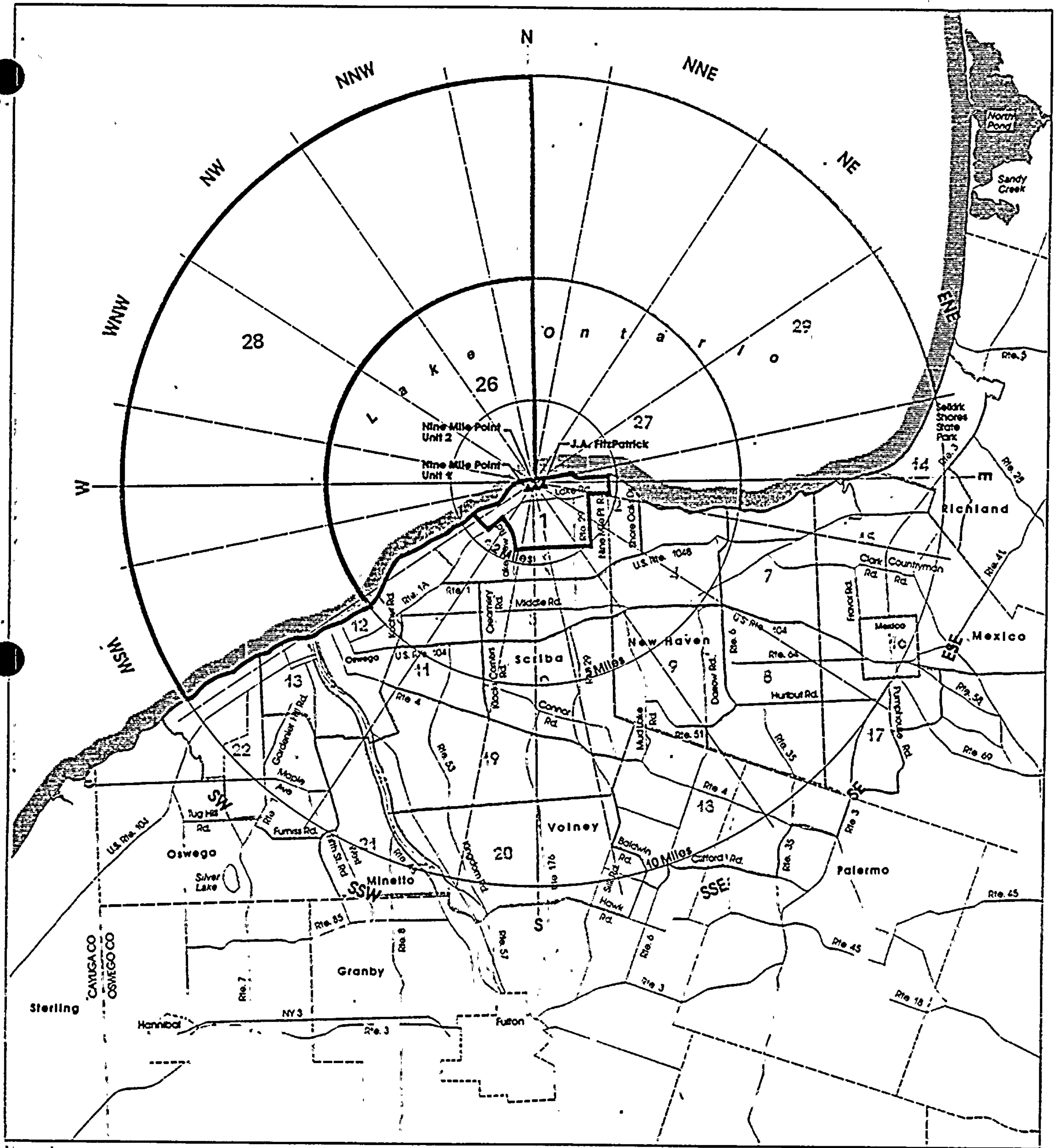


Legend
Emergency Response Planning Area (ERPA)
ERPA Number
ERPA Included in this Sector

10 Miles

Fig. 13 Sector K—90 Degrees SW
10-Mile Radius

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations



Legend
Emergency Response Planning Area (ERPA)
ERPA Number
ERPA Included in this Sector

10 Miles

N

Scale

Fig. 14 Sector L—90 Degrees NW 10-Mile Radius

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

REPP and Section II.D of this report. This definition of permanent residents differs from the U.S. Census definition, which includes persons living in institutions as part of the permanent resident population. Therefore, two separate estimates of the permanent resident population (including and excluding the population living in institutions) are provided in this report.

The 1980 Census data was used to determine the 1980 permanent resident population in the EPZ. Census information is now available in block-level detail for Oswego County. The Census block and tract boundaries were superimposed on a map delineating the traffic zone and ERPA boundaries. A correlation table was prepared that indicates which Census blocks are included in each traffic zone. For the vast majority of cases, individual Census blocks are entirely located within a particular traffic zone. Where blocks are located in more than one traffic zone, the proportion in each zone was determined by house counts made from the New York State Department of Transportation planimetric maps (scale 1:24,000). This disaggregate approach results in a fairly precise determination of population location.

The population data presented in this report is for the year 1984. Growth factors were applied to the 1980 Census population data to estimate the current permanent resident population in the EPZ. These growth factors were calculated by first estimating the 1980-1984 rates of change in household counts in the EPZ on a Census tract level. A 1984 estimate of household size for each tract was then applied to the number of households to determine the 1984 population in each tract. The household size variable accounted for factors such as marriage patterns, divorces, increased longevity of the elderly, housing availability, and birth rates. In all, 11 different growth factors were calculated for the portion of Oswego County in the EPZ by dividing 1984 Census tract population by 1980 Census tract population. These growth factors* were then applied to 1980 population data (for appropriate Census blocks within a given tract) to estimate 1984 permanent resident population on a block level basis.

In all cases, population estimates were developed at the traffic zone level by adding data for individual Census blocks. Traffic zone estimates were then added to provide ERPA estimates; similarly, ERPA estimates were summed to produce Sector estimates of population. The estimates for the 1984 permanent resident population are summarized by Sector in Table 2. Appendix A (Table A-1) presents 1984 permanent resident population summarized by ERPA.

Estimates of the permanent resident population with and without automobiles have also been prepared, as specified in NUREG-0654. The breakdown of the permanent resident population into persons with and without automobiles was required as input to the evacuation travel time estimate analysis, and was calculated in the following manner.

---

*The growth factors were derived from data provided by Donnelley Marketing Information Services, Inc. The individual Donnelley growth factors were averaged and compared to a county-wide growth rate developed by the State of New York and were found to be very similar.

TABLE 2

1984 PERMANENT RESIDENT POPULATION ESTIMATES

BY 90° SECTOR

Sector	1984 Permanent Resident Population	1984 Permanent Resident Population* (Excluding Institutions)	1984 Permanent Resident Population With Autos (Excluding Institutions)	1984 Permanent Resident Population Without Autos (Excluding Institutions)	Number of Autos
2 Mile Radius:					
A	137	137	134	3	48
B	645	645	631	14	193
C	493	493	484	9	152
D	137	137	134	3	48
5 Mile Radius:					
E	137	137	134	3	48
F	3,248	3,231	3,139	92	1,005
G	4,324	4,324	4,186	138	1,410
H	137	137	134	3	48
10 Mile Radius:					
I	137	137	134	3	48
J	11,562	11,545	11,159	386	3,480
K	35,908	31,315	26,815	4,500	11,046
L	137	137	134	3	48
360° EPZ:					
M	43,349	38,739	33,913	4,826	14,635

*Data includes schoolchildren.

The 1980 Census provides block-level data on the average household size and on the number of households with no automobiles and those with one or more automobiles. The total number of households in each block was determined by dividing the total population by the appropriate household size factor. The resulting number of households in each block was then subdivided into households with automobiles and households without automobiles. Household size factors were then re-applied to calculate the population with and without automobiles.

The 1980 Census data on household size was thus used as the auto occupancy factor, and varied from Census block to block. By dividing the number of persons with an automobile by the auto occupancy factor, the number of automobiles used by people evacuating from their homes was determined. Implicit in this calculation is the assumption that families owning automobiles would use only one vehicle during an evacuation from their homes.

The estimated permanent resident population with and without automobiles, and the number of automobiles are also summarized by Sector in Table 2. The transit-dependent population -- those persons without automobiles -- would be evacuated by buses and other emergency vehicles, as described later in this report (see Section III.C).

C. Transient Population

The transient population includes employees not residing within the EPZ, people staying at hotels and motels in the EPZ, and visitors to parks and recreational areas within the EPZ boundary. The estimates of transient population are summarized by Sector in Table 3.

For the categories included in this population subgroup, data was obtained from published statistics and by contacting major employers (those having 50 or more employees), hotel and motel proprietors, and park and camp administrators.

Estimates of total employment for the City of Oswego and the Towns of Oswego, Minetto, Volney and Scriba were derived from place-of-work data presented in "Oswego-Fulton Area Transportation Study, Economic Activity Forecast" (Leon Gold, Planning and Research Bureau, New York State Department of Transportation, May 1971). For the Towns of Palermo, Richland, New Haven, and Mexico, employment estimates were based on employment-by-place-of-residence data from the "Oswego County Preliminary Land Use Plan" (Oswego County Planning Board, August 1976).

The estimates of employees were developed in a multi-step process which was primarily based on the referenced historical data for employment in the County. The first step in this analysis was to determine the growth in employment in the towns within the EPZ between 1968 and 1984. This was done by examining Census data and published estimates of annual employment growth in the County. The percentage increased in employment for the 1968 to 1984 period was then applied to 1968 figures for employment by town (place-of-work), in order to estimate 1984 place-of-work totals.

TABLE 3

1984 TRANSIENT POPULATION ESTIMATES

BY 90° SECTOR

Sector	1984 Transient Population
2 Mile Radius:	
A	784
B	834
C	784
D	784
5 Mile Radius:	
E	784
F	1,146
G	1,517
H	784
10 Mile Radius:	
I	784
J	7,218
K	12,004
L	784
360° EPZ:	
M	17,326

The final 1984 totals for employment by town were adjusted in two ways before allocation by traffic zone. First, the number of employees at special facilities such as schools, colleges, hospitals, and health care facilities were subtracted from the overall town totals because employment data was specifically obtained from these facilities and the facilities' exact locations are known. The second adjustment was made to the towns only partially included in the EPZ. Since only parts of these towns are in the EPZ, the percentage of their total employment which is actually in the EPZ was estimated.

The adjusted employment totals by town were allocated to each traffic zone in two steps. First, the employees in the major companies in the area (generally, more than 50 employees) were allocated to their respective traffic zones. The remaining employees in the town were then allocated to traffic zones based on estimates of the number of businesses in each zone. Special facility employees were then added back in to the appropriate traffic zone totals.

It was assumed for the purpose of the travel time estimate analysis that 100 percent of the employees working in the EPZ commute by automobile. This conservative assumption placed the maximum number of vehicles on the evacuation routes when determining the evacuation travel time estimates. An assumed automobile occupancy factor of 1.1 was applied to the 1984 employment estimates to derive the number of vehicles used by employees to evacuate.

In like manner, available data on hotel/motel occupancy figures, collected by telephone interviews, were allocated to Sectors according to the establishments' locations in the EPZ. An automobile occupancy factor of two persons per automobile was used to determine the number of patrons' vehicles.

Data on attendance for the major park and recreational areas in the EPZ was obtained from Selkirk Shores State Park officials and campground administrators contacted by the Oswego County Office of Emergency Preparedness. The numbers of vehicles used by parks' visitors were determined by applying an assumed automobile occupancy factor of 4 persons per vehicle to the attendance figures. Data on specific parks and campgrounds in the EPZ is presented in Appendix B of this report.

D. Special Facilities Population

Special facility residents include persons in hospitals and other health care facilities; nursing homes; schools (including public and private, day care, nursery, elementary, middle, and high); colleges; residential facilities (such as group homes, convents, and monasteries); and correctional facilities. Special facilities located in the EPZ and pertinent data about them are listed in Appendix B of this report. Residents of the college, nursing homes, and other residential facilities constitute the institutional population which was subtracted from the permanent resident population to determine the permanent resident population excluding institutions, as requested in NUREG-0654 and described earlier.

All population and vehicle data for special facilities were obtained through visits, telephone, and/or letter contact with the individual

facilities. The Oswego County Office of Emergency Preparedness contacted each of these facilities to obtain up-to-date information used in this report. Any special transportation, such as buses, wheelchair vehicles, and ambulances, required to evacuate the special facilities' populations was considered in calculating the evacuation travel time estimates.

Special facility populations for the Sectors are presented in Table 4.

E. Population by Segment and Subarea

Population estimates by $22\frac{1}{2}^{\circ}$ Segments and Subareas are presented and listed for the permanent resident population (including and excluding institutional population, with and without automobiles); for the transient; and for the special facilities populations in Tables 5 through 10 and on Figures 16 through 21.

The sources and methodology used to determine the populations by Segment and Subarea are the same as those used in calculating Sector estimates. However, data was aggregated according to the specified polar coordinate system rather than by ERPA. The estimates made for Subareas were summed to provide estimates for the $22\frac{1}{2}^{\circ}$ Segments out to the actual 10-mile radius boundary. As discussed earlier in Section II.A, a strip of land exists between the outermost Subareas and the plume exposure pathway EPZ boundary. People located in this land area will be included in Sector totals, but not included in Segment totals. Thus, totals by Segment are generally less than or equal to totals by Sector because of the population residing in the area between the actual 10-mile radius and the approximate 10-mile EPZ boundary.

TABLE 4

1984 SPECIAL FACILITIES POPULATION ESTIMATES

BY 90° SECTOR

Sector	1984 Special Facilities Population
2 Mile Radius:	
A	0
B	0
C	0
D	0
5 Mile Radius:	
E	0
F	326
G	0
H	0
10 Mile Radius:	
I	0
J	3,133
K	12,169
L	0
360° EPZ:	
M	15,302

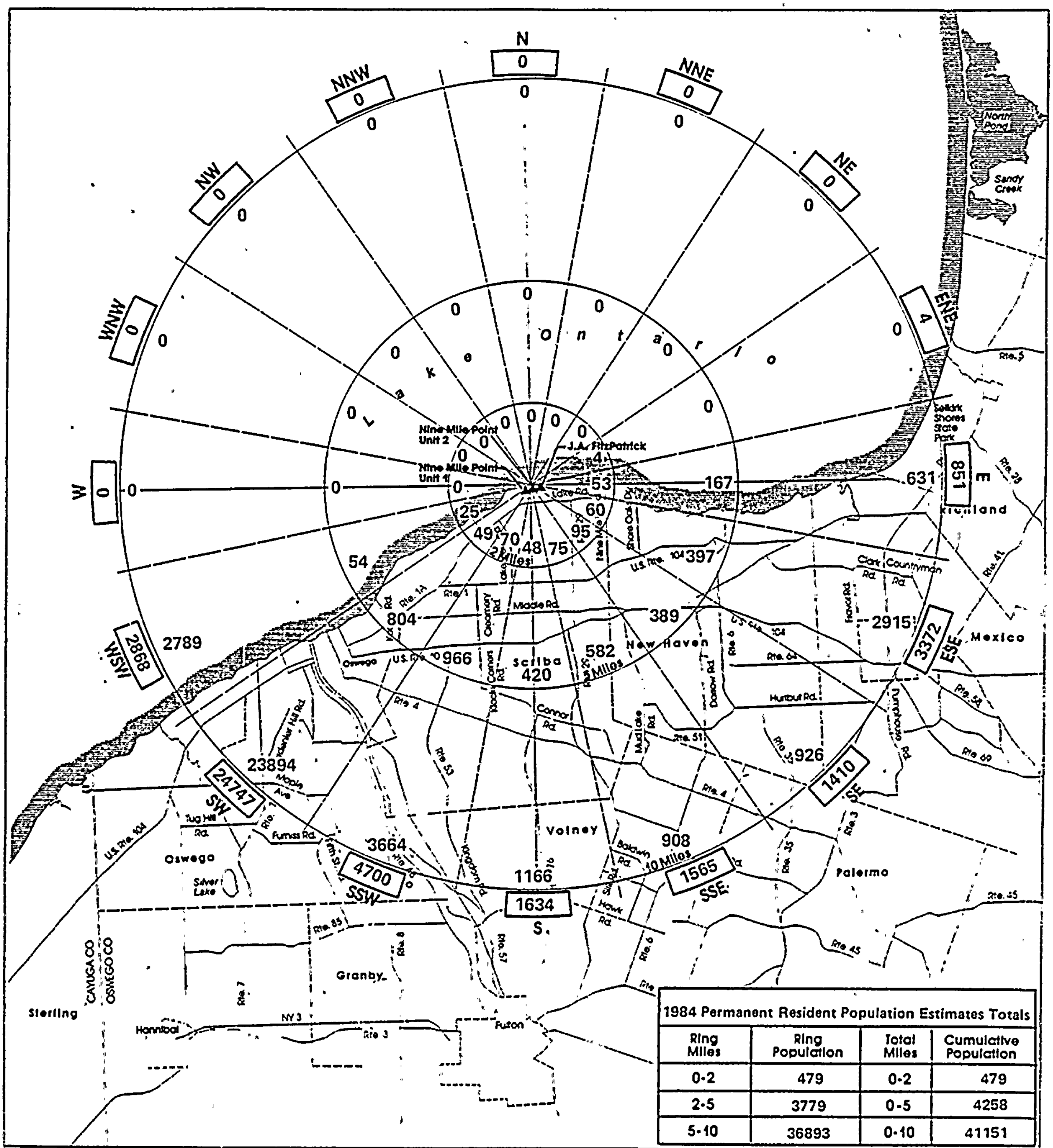
TABLE 5

1984 PERMANENT RESIDENT POPULATION ESTIMATES

BY SEGMENT

	RING, MILES				
	0 - 2	2 - 5	0 - 5	5 - 10	0 - 10
SEGMENT	Subarea Population	Subarea Population	Cumulative Subarea Population	Subarea Population	Cumulative Segment Population
N	0	0	0	0	0
NNE	0	0	0	0	0
NE	0	0	0	0	0
ENE	4	0	4	0	4
E	53	167	220	631	851
ESE	60	397	457	2,915	3,372
SE	95	389	484	926	1,410
SSE	75	582	657	908	1,565
S	48	420	468	1,166	1,634
SSW	70	966	1,036	3,664	4,700
SW	49	804	853	23,894	24,747
WSW	25	54	79	2 789	2,868
W	0	0	0	0	0
WNW	0	0	0	0	0
NW	0	0	0	0	0
NNW	0	0	0	0	0
Ring Population	479	3,779	4,258	36,893	41,151

(Also see Figure 16)



1984 Permanent Resident Population Estimates Totals			
Ring Miles	Ring Population	Total Miles	Cumulative Population
0-2	479	0-2	479
2-5	3779	0-5	4258
5-10	36893	0-10	41151

Legend
- - - Town Boundary
-·-·- County Boundary
1634 Total Segment Population 0 to 10 Miles

Fig. 16 1984 Permanent Resident Population Estimates, by Segment

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

TABLE 6

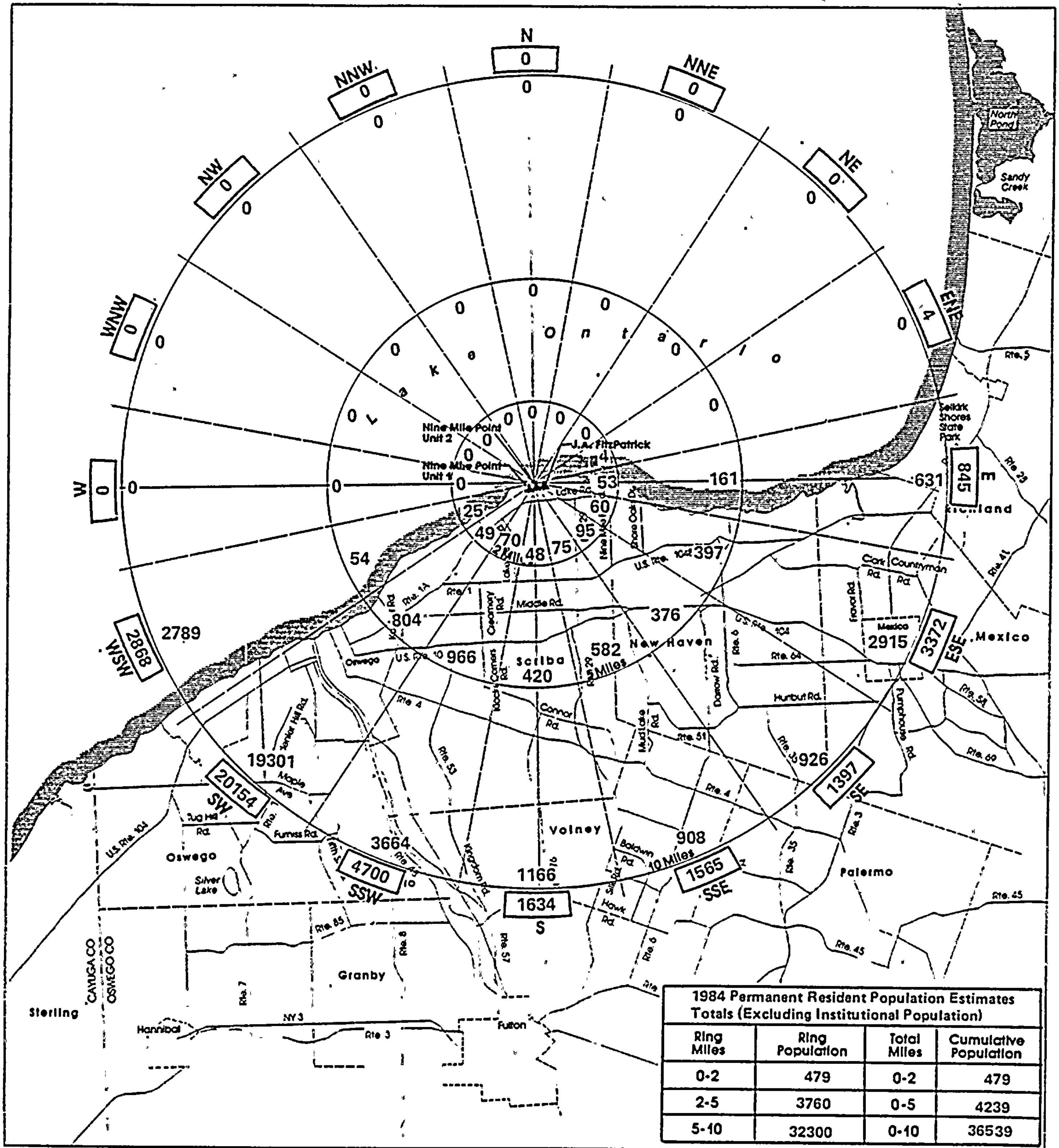
1984 PERMANENT RESIDENT POPULATION ESTIMATES

(EXCLUDING INSTITUTIONAL POPULATION)

BY SEGMENT

	RING, MILES				
	0 - 2	2 - 5	0 - 5	5 - 10	0 - 10
SEGMENT	Subarea Population	Subarea Population	Cumulative Subarea Population	Subarea Population	Cumulative Segment Population
N	0	0	0	0	0
NNE	0	0	0	0	0
NE	0	0	0	0	0
ENE	4	0	4	0	4
E	53	161	214	631	845
ESE	60	397	457	2,915	3,372
SE	95	376	471	926	1,397
SSE	75	582	657	908	1,565
S	48	420	468	1,166	1,634
SSW	70	966	1,036	3,664	4,700
SW	49	804	853	19,301	20,154
WSW	25	54	79	2,789	2,868
W	0	0	0	0	0
WNW	0	0	0	0	0
NW	0	0	0	0	0
NNW	0	0	0	0	0
Ring Population	479	3,760	4,239	32.300	36,539

(Also see Figure 17)



Ring Miles	Ring Population	Total Miles	Cumulative Population
0-2	479	0-2	479
2-5	3760	0-5	4239
5-10	32300	0-10	36539

1984 Permanent Resident Population Estimates Totals (Excluding Institutional Population)

Legend
- — — Town Boundary
- —·—·— County Boundary

1634 Total Segment Population 0 to 10 Miles

Fig. 17 1984 Permanent Resident Population Estimates (excluding Institutional Population), by Segment

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

TABLE 7

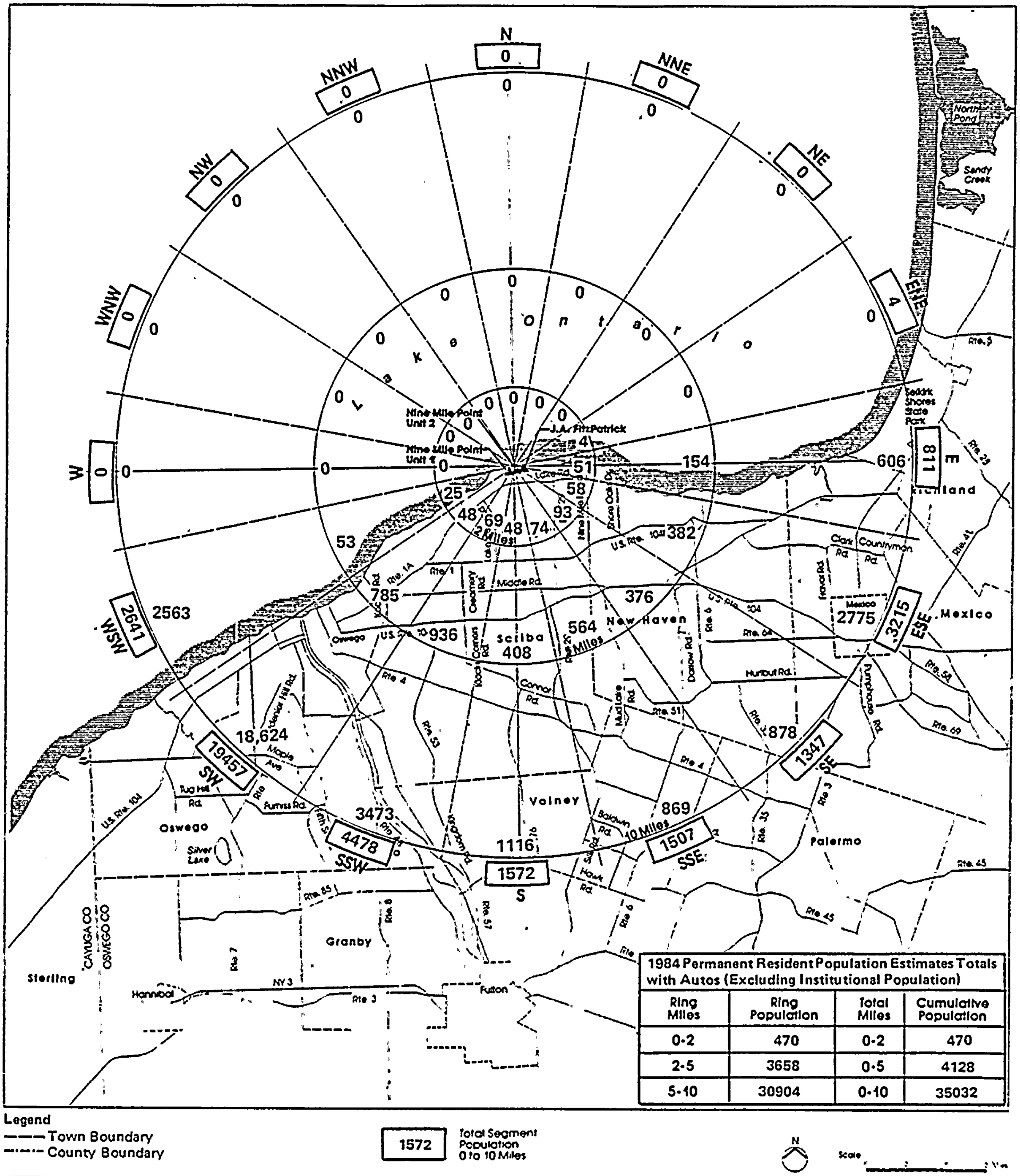
1984 PERMANENT RESIDENT POPULATION ESTIMATES

(EXCLUDING INSTITUTIONAL POPULATION)

WITH AUTOS, BY SEGMENT

	RING, MILES				
	0 - 2	2 - 5	0 - 5	5 - 10	0 - 10
SEGMENT	Subarea Population	Subarea Population	Cumulative Subarea Population	Subarea Population	Cumulative Segment Population
N	0	0	0	0	0
NNE	0	0	0	0	0
NE	0	0	0	0	0
ENE	4	0	4	0	4
E	51	154	205	606	811
ESE	58	382	440	2,775	3,215
SE	93	376	469	878	1,347
SSE	74	564	638	869	1,507
S	48	408	456	1,116	1,572
SSW	69	936	1,005	3,473	4,478
SW	48	785	833	18,624	19,457
WSW	25	53	78	2,563	2,641
W	0	0	0	0	0
WNW	0	0	0	0	0
NW	0	0	0	0	0
NNW	0	0	0	0	0
Ring Population	470	3,658	4,128	30,904	35,032

(Also see Figure 18)



1984 Permanent Resident Population Estimates Totals with Autos (Excluding Institutional Population)			
Ring Miles	Ring Population	Total Miles	Cumulative Population
0-2	470	0-2	470
2-5	3658	0-5	4128
5-10	30904	0-10	35032

Fig. 18 1984 Permanent Resident Population Estimates (excluding Institutional Population) with Autos, by Segment

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

TABLE 8

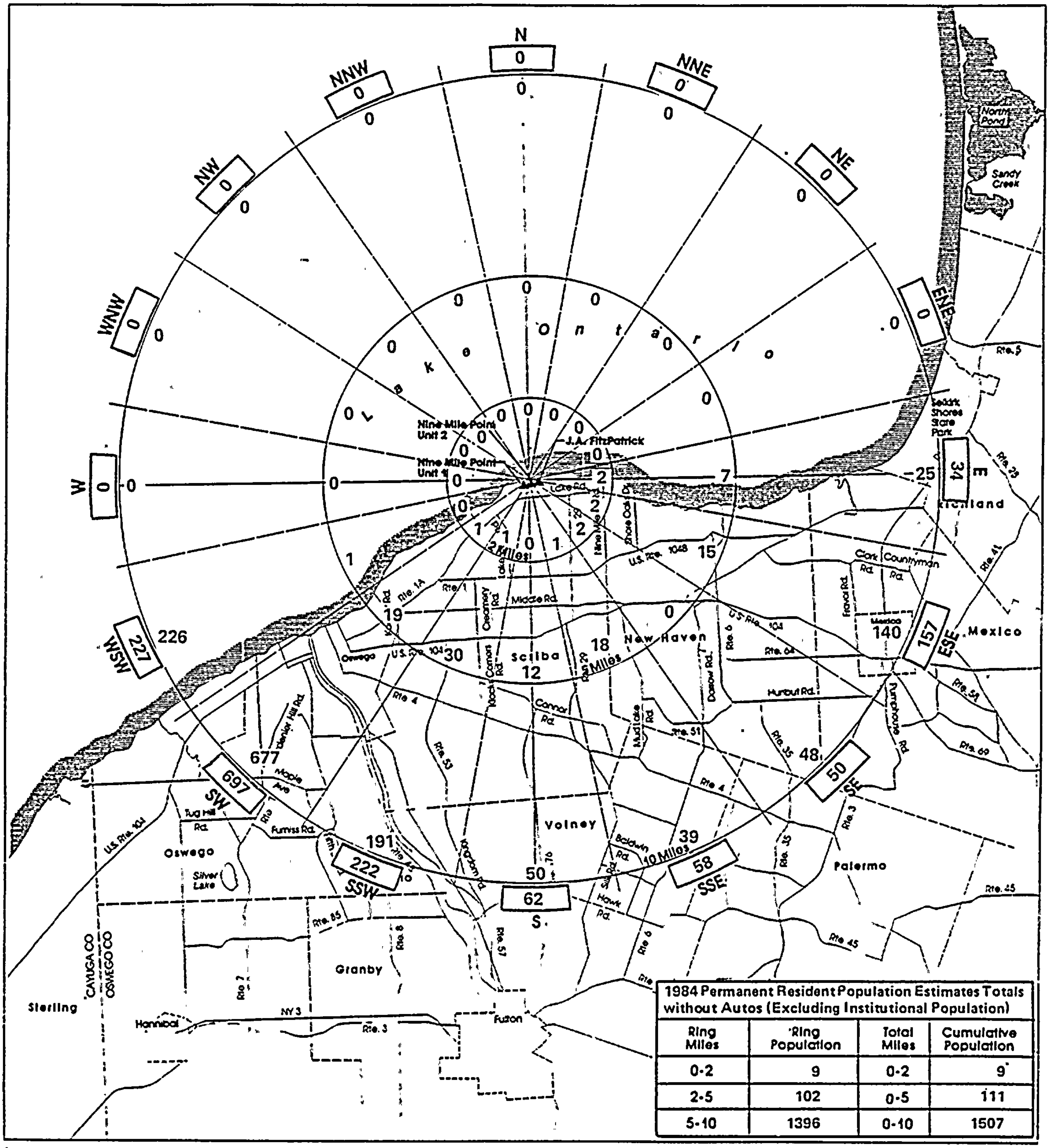
1984 PERMANENT RESIDENT POPULATION ESTIMATES

(EXCLUDING INSTITUTIONAL POPULATION)

WITHOUT AUTOS, BY SEGMENT

	RING, MILES				
	0 - 2	2 - 5	0 - 5	5 - 10	0 - 10
SEGMENT	Subarea Population	Subarea Population	Cumulative Subarea Population	Subarea Population	Cumulative Segment Population
N	0	0	0	0	0
NNE	0	0	0	0	0
NE	0	0	0	0	0
ENE	0	0	0	0	0
E	2	7	9	25	34
ESE	2	15	17	140	157
SE	2	0	2	48	50
SSE	1	18	19	39	58
S	0	12	12	50	62
SSW	1	30	31	191	222
SW	1	19	20	677	697
WSW	0	1	1	226	227
W	0	0	0	0	0
WNW	0	0	0	0	0
NW	0	0	0	0	0
NNW	0	0	0	0	0
Ring Population	9	102	111	1,396	1,507

(Also see Figure 19)



1984 Permanent Resident Population Estimates Totals without Autos (Excluding Institutional Population)			
Ring Miles	Ring Population	Total Miles	Cumulative Population
0-2	9	0-2	9
2-5	102	0-5	111
5-10	1396	0-10	1507

Legend
---- Town Boundary
-·-·- County Boundary

| 62 | Total Segment Population 0 to 10 Miles |

Fig. 19 1984 Permanent Resident Population Estimates (excluding Institutional Population) without Autos, by Segment

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

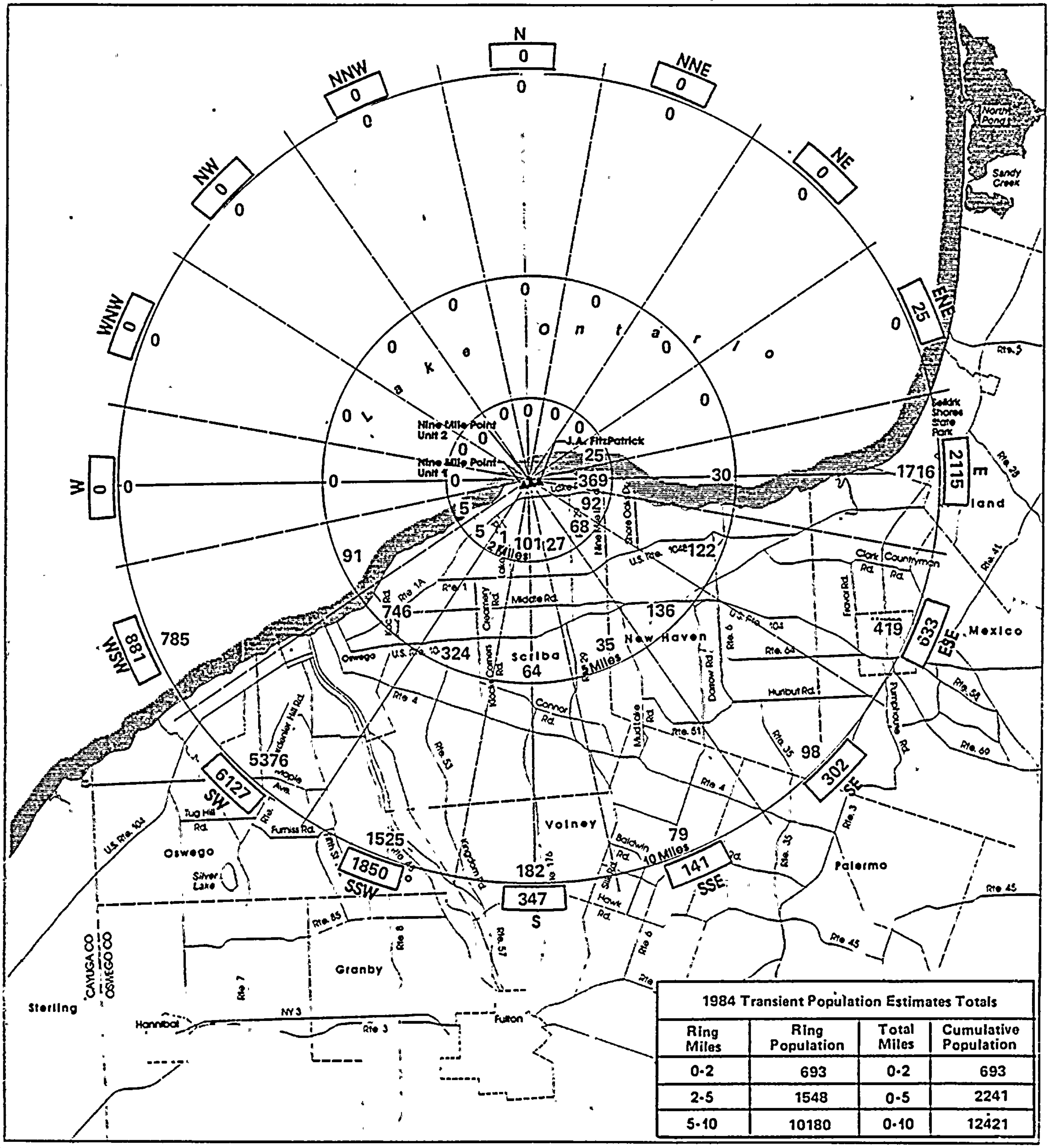
TABLE 9

1984 TRANSIENT POPULATION ESTIMATES

BY SEGMENT

	RING, MILES				
	0 - 2	2 - 5	0 - 5	5 - 10	0 - 10
SEGMENT	Subarea Population	Subarea Population	Cumulative Subarea Population	Subarea Population	Cumulative Segment Population
N	0	0	0	0	0
NNE	0	0	0	0	0
NE	0	0	0	0	0
ENE	25	0	25	0	25
E	369	30	399	1,716	2,115
ESE	92	122	214	419	633
SE	68	136	204	98	302
SSE	27	35	62	79	141
S	101	64	165	182	347
SSW	1	324	325	1,525	1,850
SW	5	746	751	5,376	6,127
WSW	5	91	96	785	881
W	0	0	0	0	0
WNW	0	0	0	0	0
NW	0	0	0	0	0
NNW	0	0	0	0	0
Ring Population	693	1,548	2,241	10,180	12,421

(Also see Figure 20)



1984 Transient Population Estimates Totals			
Ring Miles	Ring Population	Total Miles	Cumulative Population
0-2	693	0-2	693
2-5	1548	0-5	2241
5-10	10180	0-10	12421

Legend
---- Town Boundary
-·-·- County Boundary

347	Total Segment Population 0 to 10 Miles

Fig. 20 1984 Transient Population Estimates, by Segment

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

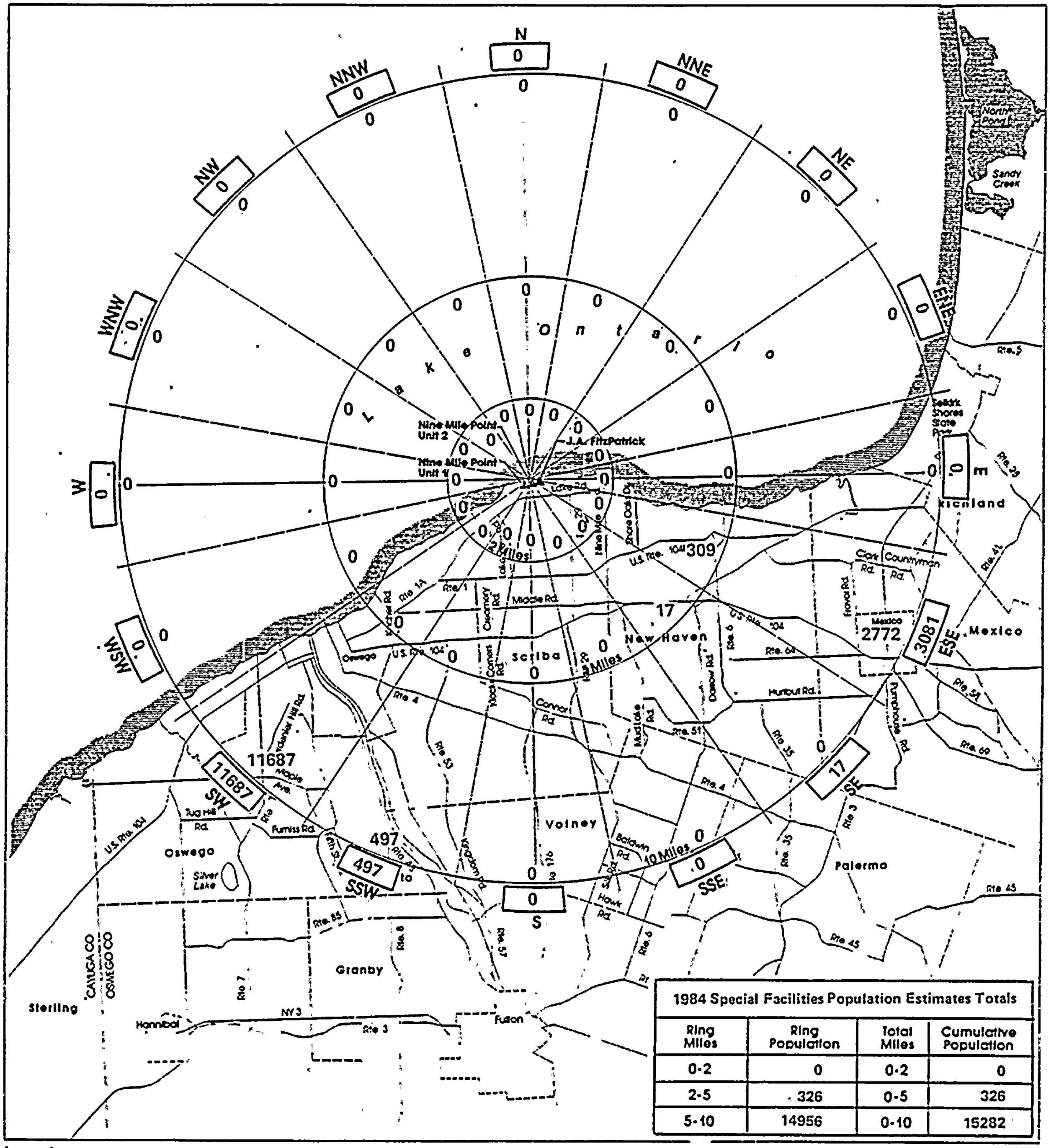
TABLE 10

1984 SPECIAL FACILITIES POPULATION ESTIMATES

BY SEGMENT

SEGMENT	RING, MILES 0 - 2 Subarea Population	2 - 5 Subarea Population	0 - 5 Cumulative Subarea Population	5 - 10 Subarea Population	0 - 10 Cumulative Segment Population
N	0	0	0	0	0
NNE	0	0	0	0	0
NE	0	0	0	0	0
ENE	0	0	0	0	0
E	0	0	0	0	0
ESE	0	309	309	2,772	3,081
SE	0	17	17	0	17
SSE	0	0	0	0	0
S	0	0	0	0	0
SSW	0	0	0	497	497
SW	0	0	0	11,687	11,687
WSW	0	0	0	0	0
W	0	0	0	0	0
WNW	0	0	0	0	0
NW	0	0	0	0	0
NNW	0	0	0	0	0
Ring Population	0	326	326	14,956	15,282

(Also see Figure 21)



1984 Special Facilities Population Estimates Totals

Ring Miles	Ring Population	Total Miles	Cumulative Population
0-2	0	0-2	0
2-5	326	0-5	326
5-10	14956	0-10	15282

Legend
- – – Town Boundary
- –·–·· County Boundary

497 Total Segment Population 0 to 10 Miles

Fig. 21 1984 Special Facilities Population Estimates, by Segment

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

III. TRANSPORTATION FACILITIES

III. TRANSPORTATION FACILITIES

The evacuation travel times described in this report are a function of the evacuating population size, the travel distance, roadway capacities, weather conditions, available emergency manpower, and the number of vehicles. Section II of this report discussed the various evacuating populations; the following is a discussion of the other factors affecting evacuation travel time.

The transportation facilities available to accomplish an evacuation of the EPZ consist of roadways, privately-owned vehicles, buses and vans, emergency vehicles (e.g., ambulances), boats and aircraft. The following is a discussion of the role of these transportation facilities in a JAF/NMP area evacuation and their respective functions in the estimates of the evacuation travel times.

A. Evacuation Roadway Network

Primary evacuation routes were identified for all portions of the EPZ. Each ERPA within the EPZ was disaggregated into one or more traffic zones along recognizable geographic and/or political boundaries. Each traffic zone, which represents a population cluster in a specific geographic area that loads onto a given roadway, was then assigned a primary evacuation route for each mode of travel emanating from that zone. Traffic zone boundaries were developed to minimize the amount of cross traffic required to access a zone's associated primary evacuation route. The evacuation routes and traffic zones are included in the Oswego County REPP and are described in Appendix C of this report.

Evacuation routes for a given traffic zone were chosen to move traffic radially away from JAF/NMP in accordance with NUREG-0654 criteria. Care was taken to select routes likely to be both familiar to and regularly used by drivers in the zone. Limited access facilities such as I-81 are not in the EPZ, and hence were not included as primary evacuation routes.

In developing the evacuation routes, it was assumed that traffic would operate in a normal two-way pattern, with the exception of any one-way streets. This operational strategy would not only permit emergency vehicles and buses to enter the evacuating area, but would also minimize the possibility of a total blockage of a route because of an incident such as an automobile accident. If an accident did occur, traffic could be diverted around that point in the opposing travel lanes. Backup evacuation routes were determined for portions of the primary evacuation network likely to become extremely congested and are included in the Oswego County REPP. A more detailed discussion of these bottleneck locations appears in Section IV.J. Critical Locations.

The selected primary evacuation routes, as well as many others, were traveled to assess their adequacy for evacuation purposes. The data gathered for each route during the field reconnaissance were used to determine the evacuation capacity of each roadway, and included the number of lanes, lane width, shoulder width, location and (if applicable) timing of traffic controls, and posted speed limit. The Oswego County Department of Public

Works was contacted to identify highways in the EPZ that were modified (e.g., widened, new facilities, etc.) since the last evacuation time study was prepared in May 1982.

These roadway inventory data were used to disaggregate the evacuation network into over 150 individual links. A link represents a roadway segment where the physical and operating characteristics are similar, or a portion of a route between other intersecting primary evacuation routes. Figure 22 shows the links in the JAF/NMP evacuation roadway network. The map does not show all the local streets necessary to access the evacuation routes. Each link in the network is numbered for reference, and corresponds to the link characteristic data shown in Appendix D. The information shown in this table includes, for each link, the evacuation route name, the number of lanes in the outbound direction, the free flow travel speed, the link length, and the upper and lower bound evacuation capacities under normal and adverse weather conditions, respectively. The procedures used to calculate the evacuation capacities are discussed below.

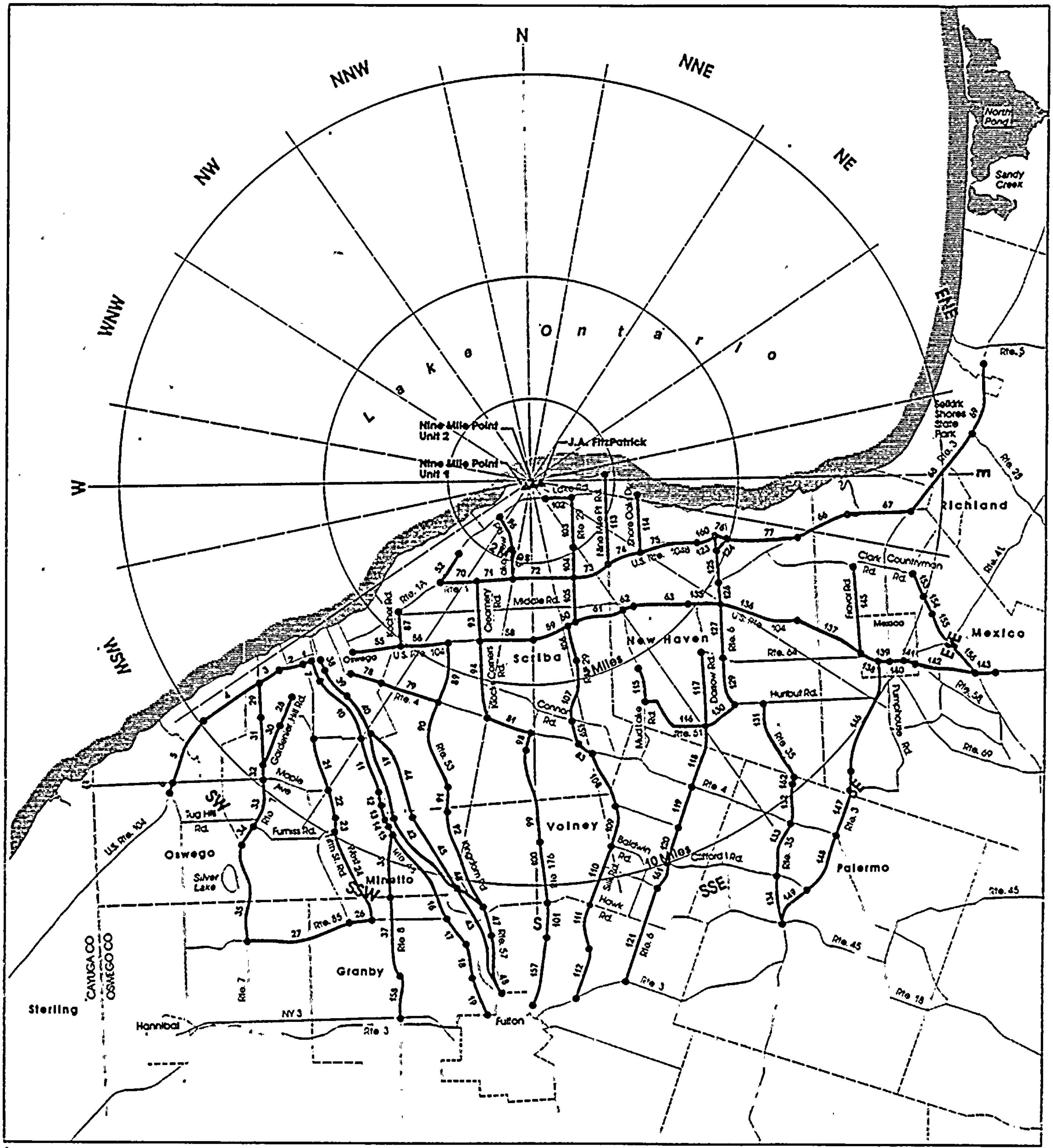
1. Evacuation Capacity Analysis

An important variable in the determination of evacuation travel times is the capacity of roadways in the network to accommodate evacuating vehicles. NUREG-0654 stipulates that normal and adverse weather conditions be addressed in terms of their effects on travel times and capacity. For this reason, it was necessary to develop a procedure to estimate "evacuation capacities" which would represent the number of vehicles serviced per unit of time by each segment of the network under flow conditions likely to occur during an evacuation, for both normal and adverse weather conditions.

Because of the large and sudden demand placed on a roadway system during an evacuation, it was assumed that traffic would be congested, speeds would be low, flow would be unstable, and there would be stoppages of momentary duration. It was assumed that these operating conditions would prevail for the duration of the evacuation, with the exception of the very beginning and end of the egress phase, when volumes would be somewhat lower. The traffic flow conditions indicated above correspond to Level of Service E as described in the Highway Capacity Manual*. Level of Service is a qualitative measure of the effect of a number of factors on traffic flow, including speed, travel time, traffic interruptions, freedom to manuever, safety, driving comfort and convenience, and operating costs.

For Level of Service E flow conditions, standard procedures (as outlined in the Highway Capacity Manual) were followed to calculate the service volume of a roadway under these conditions. This service volume, which is called "evacuation capacity" in the context of this report, was calculated for each link in the network at Level of Service E to represent the upper-bound capability of the roadways to accommodate traffic under normal weather conditions.

*Highway Research Board, Special Report 87; 1965.



Legend
---- Town Boundary
---- County Boundary
Evacuation Routes
117 Link Number

Fig. 22 Evacuation Route Links

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

At the time of an incident at JAF/NMP, events may occur even under fair weather conditions which would reduce the capability of roadways to accommodate evacuating traffic. For example, some traffic control officers designated to monitor traffic checkpoints may be unable to fulfill their assignments. Traffic throughput, therefore, would not be maximized at these locations. To represent this condition, service volumes were calculated at Level of Service D, as suggested by the New York State Department of Transportation. In general, this calculation accounted for a 20 to 40 percent reduction in evacuation capacity, depending on the roadway type, for multi-lane and two-lane facilities, respectively. Therefore, evacuation travel times were calculated as a range of values under normal weather conditions, with lower-bound travel times determined using Level of Service E capacities and upper-bound travel times calculated with Level of Service D capacities.

Under adverse weather conditions, such as snow, fog, heavy rain, or ice, the ability of roadways to carry traffic is further reduced. Two factors account for this reduction: a decreased quality and amount of physical space on the roadway surface (e.g., snow on shoulders) and a more cautious attitude on the part of the driver (resulting in increased headways). Adverse weather conditions were not considered to be during a heavy snowstorm in the Oswego area (when evacuation would not be the recommended response option), but rather after the heavy snowstorm had ended and roadway pavements were adequately cleared for travel. Level of Service D capacities were reduced further by 20 percent to account for these factors and to estimate adverse weather evacuation capacities.

As a first step in the determination of capacity, base evacuation capacities were calculated for each link in the network at the levels of service mentioned above. The base evacuation capacities were then modified by factors which take into account the impact on traffic operations of existing roadway widths and shoulder areas. Other standard capacity-inhibiting factors (such as passing sight distance, percent trucks, and type of terrain) were considered less significant because of the slow and congested traffic conditions expected during the evacuation. All applicable modification factors were abstracted from the <u>Highway Capacity Manual</u>.

The roads and highways in the evacuation area were categorized into two basic groupings for purposes of capacity computations:

- o Two-lane, two-way roadways, and
- o Four-lane highways.

Appendix E details the specific methodology used to calculate evacuation capacities for these roadway types.

B. <u>Privately-Owned Vehicles</u>

It was assumed for the purpose of computing evacuation travel time estimates that families owning automobiles would evacuate from their homes in one car. A percentage of multi-car families might utilize their additional vehicles in an evacuation; the impact of these additional automobiles would be to increase the evacuation travel time estimates roughly proportionally to the percent increase in the number of cars used to evacuate along the critical

evacuation routes. It is noted that multi-car families were assumed to use more than one vehicle when the evacuation trips originated from several locations (e.g., a mother departing from home and a husband departing from work). The number of families with zero, one, or several cars was determined from the 1980 Census, and adjusted to the year 1984 as described earlier in Section II for each traffic zone in the EPZ.

C. Buses and Vans

Buses and vans would be used to evacuate the ambulatory population who would not have their own means of transportation available at the time of an incident. This ambulatory population includes schoolchildren, residents of special facilities, transients without autos, and the general public without autos. The available vehicles in the JAF/NMP area to evacuate these people consist of public, private, and school-district-owned buses and vans. The priorities associated with the deployment of buses and vans depend on whether school is in session at the time of an evacuation. The criteria used to determine bus assignments are fully discussed in Section IV.F. Components of the Evacuation Travel Time. The following is a discussion of the general role of these vehicles in the Oswego County REPP and travel time estimate analysis.

Emergency bus routes were established throughout the EPZ in such a way that most people in densely populated areas (such as the city of Oswego) would be within ½ mile of a bus stop, and no one in the rural areas would be more than 1 mile from a bus stop. Routes would generally be operated so that pickups occur in the direction which would take the bus away from the nuclear power plants. Bus routes are established primarily on main streets. Subdivisions and developments would be entered and side roads would be used only when necessary to provide the coverage discussed above. Each route was field-checked to determine its length, location of existing transit stops, adequacy of stops and coverage, locations of major concentrations of potential users, street names and signing, tight turns, narrow or congested streets, one-way streets, low clearance bridges, low weight limit bridges, and other operating restrictions. In all, 74 individual bus routes were established within the EPZ, not including assignments at specific facilities such as schools, nursing homes, or hospitals. Buses and vans were assigned to routes based on the anticipated number of people to be evacuated and the physical characteristics of the roadways to be traversed. For example, vans were assigned to routes serving the sparsely populated areas along the Lake Ontario shoreline because of the low number of transit-dependent people living there and the operating restrictions caused by the narrow, dead-end roadways.

Based on the number of transit-dependent people in each traffic zone (as described earlier in Section II.B. Permanent Resident Population), the required number of buses for each traffic zone was determined. The public, private, and school district bus operators in the area were contacted by the Oswego County Office of Emergency Preparedness to determine the number of vehicles each company could provide. The bus companies were then assigned service areas based on several factors: local preferences (as requested by the Oswego and Mexico school districts); bus garage location(s); and the number and type of available vehicles. Where possible, service areas were defined to be contiguous with traffic zone and ERPA boundaries to clearly identify responsibilities during a staged or partial evacuation. The

following list specifies the bus companies identified in the Oswego County REPP and the current vehicle inventory of each company:

- City School District of Oswego (58 buses and vans with a total passenger capacity of 3,297).
- Golden Sun Bus Service (26 buses with a total passenger capacity of 1,560)
- Centro of Oswego, Inc. (9 buses with a total passenger capacity of 595)
- Centro of Syracuse, Inc. (174 buses and vans with a total passenger capacity of 8,064)
- Mexico Academy and Central Schools (42 buses and vans with a total passenger capacity of 2,282)
- Oswego County BOCES (29 buses and vans with a total passenger capacity of 391).

Approximately 10 percent of all bus fleets were assumed to be unavailable for evacuation due to maintenance, breakdowns, etc. In addition, only 50 percent of Centro of Syracuse, Inc.'s buses were used in the estimation of evacuation time because the company would continue to provide limited service in the city of Syracuse in the event of a JAF/NMP EPZ evacuation.

D. Emergency Vehicles

Emergency vehicles such as ambulances and wheelchair-equipped buses and vans would be used to evacuate non-ambulatory residents from special facilities, and members of the general population requiring and requesting such transport. Each special facility was contacted to identify the number of residents requiring wheelchair or stretcher transportation (see Appendix B). In addition, the Oswego County Office of Emergency Preparedness compiled a list of non-institutionalized mobility-impaired people that was included in the assignment of emergency vehicles and assessment of evacuation travel times.

The Oswego County Office of Emergency Preparedness also contacted the various ambulance corporations and fire departments in the County to ascertain the availability of emergency vehicles. In addition, the Emergency Medical Service Coordinator for the area was contacted to determine the number of ambulances available through the mutual-aid pact. In all, 21 ambulances are available in Oswego County from nine different providers. The mutual-aid pact adds an additional 106 ambulances to the fleet. For the purpose of estimating evacuation travel times, it was assumed that 50 percent of the ambulances would not be available because of other commitments. Wheelchair-equipped buses and vans generally are provided by the same bus companies discussed earlier; the availability of these vehicles is therefore subject to the same assumptions mentioned in Section III.C. Buses and Vans.

Table 11 presents total vehicle estimates for the EPZ by Sector. Table 12 and Figure 23 contain the same data presented by Segment and Subarea. It is noted that these total vehicle estimates include all vehicles belonging to multi-car families.

E. Boats

Water traffic within the EPZ on Lake Ontario (ERPAs 26-29) and on the Oswego River (ERPAs 23-25) would be cleared primarily by the local law enforcement agencies as specified in the Oswego County REPP. The United States Coast Guard could also be called upon at the time of an incident. The Oswego County REPP provides for the clearing of boats from the lake and river as an initial precautionary option to be implemented prior to a general evacuation.

F. Airplanes

There are no commercial airports within the JAF/NMP EPZ. Just outside the EPZ, there is a county airport in Volney, south of JAF/NMP.

TABLE 11

1984 TOTAL VEHICLE ESTIMATES

BY 90° SECTOR

Sector	1984 Total Vehicles
2 Mile Radius:	
A	67
B	333
C	241
D	67
5 Mile Radius:	
E	67
F	1,772
G	2,165
H	67
10 Mile Radius:	
I	67
J	6,460
K	18,281
L	67
360° EPZ:	
M	22,592

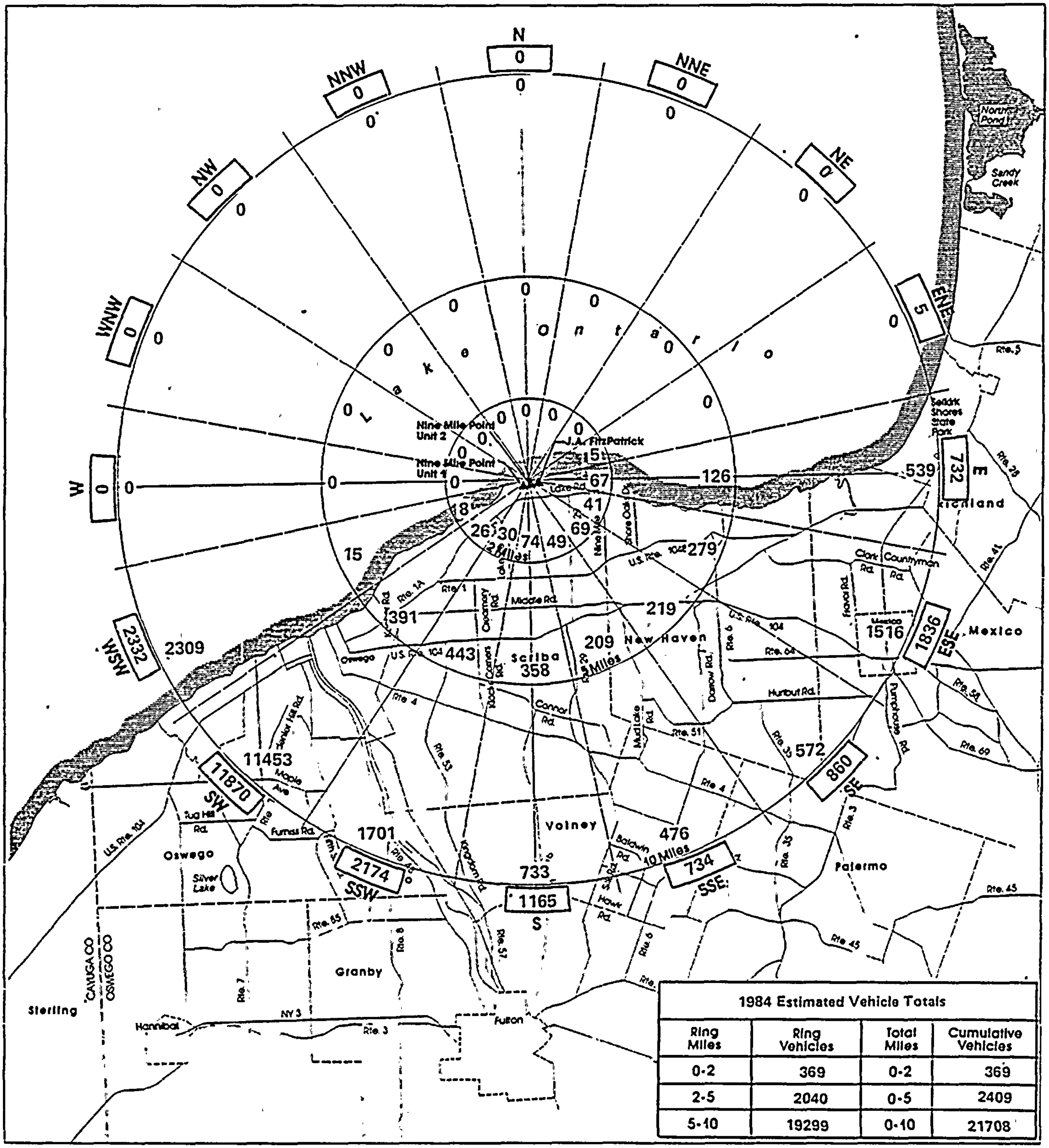
TABLE 12

1984 TOTAL VEHICLE ESTIMATES

BY SEGMENT

	RING, MILES				
	0 - 2	2 - 5	0 - 5	5 - 10	0 - 10
SEGMENT	Subarea Vehicles	Subarea Vehicles	Cumulative Subarea Vehicles	Subarea Vehicles	Cumulative Segment Vehicles
N	0	0	0	0	0
NNE	0	0	0	0	0
NE	0	0	0	0	0
ENE	5	0	5	0	5
E	67	126	193	539	732
ESE	41	279	320	1,516	1,836
SE	69	219	288	572	860
SSE	49	209	258	476	734
S	74	358	432	733	1,165
SSW	30	443	473	1,701	2,174
SW	26	391	417	11,453	11,870
WSW	8	15	23	2,309	2,332
W	0	0	0	0	0
WNW	0	0	0	0	0
NW	0	0	0	0	0
NNW	0	0	0	0	0
Ring Vehicles	369	2,040	2,409	19,299	21,708

(Also see Figure 23)



1984 Estimated Vehicle Totals			
Ring Miles	Ring Vehicles	Total Miles	Cumulative Vehicles
0-2	369	0-2	369
2-5	2040	0-5	2409
5-10	19299	0-10	21708

Legend
- - - Town Boundary
-·-·- County Boundary

1165 Total Segment Vehicles 0 to 10 Miles

N

Scale

Fig. 23 1984 Total Vehicle Estimates, by Segment

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

IV. ANALYSIS OF EVACUATION TRAVEL TIMES

IV. ANALYSIS OF EVACUATION TRAVEL TIMES

A. Scenarios

Evacuation travel time estimates are prepared to serve as a guide for local emergency coordinators in refining their emergency response plans, and as an aid to local officials in selecting protective actions during an emergency. Evacuation travel time estimates were prepared by ERPA for six distinct time-based scenarios and two distinct weather conditions for inclusion in the Oswego County REPP; these estimates assumed a simultaneous evacuation of the entire EPZ. The six scenarios included in the emergency preparedness plan are listed below in order of increasing evacuation travel time:

- Nighttime
- Weekend/Holiday winter, daytime
- Weekend/Holiday summer, daytime
- Evening
- Weekday, school not in session
- Weekday, school in session.

These time-based scenarios were chosen and analyzed for the emergency preparedness plan because they cover all significantly different patterns of population distribution and transportation availability. Hence, the decision maker is provided with an effective tool for deciding the travel time required to simultaneously evacuate the entire EPZ under varying weather conditions and at different times of the day. These evacuation travel times are shown by ERPA in Appendix F.

Because these evacuation travel times assume a simultaneous evacuation of the entire EPZ, they do not provide specific information for an evacuation of a sub-portion of the EPZ. The travel time estimates presented in this section of the report are for the specific 90° Sectors required in NUREG-0654, as well as for the entire EPZ (Sector M). In this report, travel time estimates are provided for the scenarios on both ends of the range of travel times; i.e., the nighttime scenario and the weekday, school-in-session scenario. These two scenarios are also the most frequent in terms of the number of hours they occur during the year. By knowing the shortest and longest evacuation travel times for a given Sector, the decision maker can extrapolate between these endpoints to estimate travel times by Sector for the other four scenarios, if necessary. The nighttime and weekday, school-in-session scenarios are described below. A detailed description of the other four scenarios is included in Appendix A of the Oswego County REPP.

<u>Nighttime Scenario</u> - The baseline scenario is nighttime, when most people in the general population are in their residences, institutions have minimal staff on duty, and relatively few businesses are functioning. This scenario is considered to be representative of the resident population distribution. Nighttime differences among days of the week and seasons are not regarded as large enough to warrant a separate designation.

<u>Weekday, School-in-Session Scenario</u> - Weekdays are characterized by "normal" activity patterns. Most households have at least one member at work.

Institutions are usually at their maximum staffing levels; businesses are usually open and active; and children are in school. This scenario, as opposed to a weekday, school-not-in-session scenario, most significantly affects bus transportation needs and usage, and reception/congregate care procedures because of the greater potential need to reunite families who have been evacuated by different means.

B. Weather Conditions

NUREG-0654 stipulates that two weather conditions -- normal and adverse -- be considered in the evacuation travel time analysis. Therefore, both the nighttime and school-in-session scenarios were analyzed assuming the following weather conditions:

- For normal weather, clear sky and dry roadway pavement;
- For adverse weather, reduced visibility (e.g., due to fog or heavy rain) and/or a slippery roadway surface (e.g., due to plowed snow or ice).

The effects of these weather conditions on the roadway capacities, and hence the evacuation travel time estimates, have been discussed earlier in Section III.A.1. Evacuation Capacity Analysis.

C. Trip Generation

For each traffic zone included in a given 90° Sector, the number of evacuation trips generated by that zone was estimated by trip type. The number of trips varied significantly by scenario. For example, for the weekday school-in-session scenario, large numbers of evacuation trips were attributable to transient employees working in the EPZ. However, for the nighttime scenario, this same trip type (employees) was much less significant because most businesses would be closed.

The number of trips from a given traffic zone was based on population and vehicle occupancy data. For example, if a zone has a nursing home with 120 ambulatory and 15 wheelchair-bound residents, and if the facility owns one 10-passenger wheelchair van, then five vehicle trips would be generated by the nursing home (three buses provided by a bus company with 40 passengers each, one facility-owned van, and one other 5-passenger wheelchair van provided by a bus company).

Vehicle trips generated by each zone were then converted to passenger car equivalents (PCEs) for traffic assignment purposes. Buses were weighted as the equivalent of two cars, since their primary impact would be one of increased roadway space during a slow, congested evacuation condition.

D. Traffic Assignment

The assignment of the evacuation vehicles generated by each traffic zone over the designated evacuation routes was performed by a computer model developed specifically for evacuation planning studies. The model loaded the network and computed the travel and delay times for all zones being analyzed

in any given Sector. A static traffic assignment procedure which assumed instantaneous loading of the evacuation network and concurrent vehicular demand on all roadway segments was incorporated in the computer model. Obviously, this procedure is not an exact simulation of vehicle movement during an evacuation or any other travel situation. However, the static traffic assignment results were compared to those obtained from a complex, state-of-the-art dynamic traffic simulation model for a sample number of routes in the heavily populated Indian Point EPZ (located in parts of Westchester, Rockland, Orange, and Putnam Counties in the State of New York), and were found to be very similar. A detailed description of the static traffic assignment algorithm, and the results of the comparison between the static and dynamic assignments, is presented in Appendix G.

E. Notification Time

The JAF/NMP EPZ is served by a siren notification system that meets the minimum acceptable design objectives specified in Appendix 3 of NUREG-0654. The siren system is designed to notify 100% of the population within 5 miles of the site within 15 minutes. Many sirens are also located in the 5-mile to 10-mile radius. Tonealert radios are provided to private residences within the EPZ located in areas out of the sirens' range. In addition, all schools, special facilities, and major industries in the EPZ have been provided with tonealert radios. The Oswego County REPP contains backup notification procedures such as route alert in the event of a siren/tonealert system malfunction.

F. Components of the Evacuation Travel Time

The estimates of evacuation travel time include the following components:

Public Preparation Time - Twenty minutes are assumed to be required for the public to prepare for evacuation after official notification to leave their homes.

Terminal Time - The terminal time for vehicles departing from home represents the time to drive via local feeder streets in a traffic zone to the first link of the predesignated primary evacuation route. The terminal time for buses and special vehicles is defined as the time to travel from the first pickup point to the first link of the ultimate evacuation route, and is comprised of both traveling time between, and loading time at, pickup points.

Roadway Travel Time - The roadway travel time is the amount of time required for all vehicles to traverse the entire length of their evacuation route to the edge of the evacuated area. This time depends on both normal operating speeds on the road and on delays due to congestion (where the vehicle volumes approach or exceed the capacity of the roadway at a particular location). Hence, the roadway travel time is the amount of time beginning when the first vehicle enters the evacuation route, assuming normal operating speeds, until the last vehicle leaves the Sector, taking account of reduced speeds attributable to congestion and including delay time.

Round Trip Time - For vehicles required to make multiple trips from the evacuating area, round trip time represents the time to travel beyond the EPZ

to a predesignated host facility or reception center, return to the evacuating area for a second assignment, leave the EPZ, and load and unload passengers at terminal points. This round trip time is particularly important for the school-in-session scenario because all schoolchildren would be evacuated first by buses to the New York State Fairgrounds in Syracuse. Some buses would then return to the EPZ for the remaining transit-dependent ambulatory general population. In addition, wheelchair-bound residents at several nursing homes in the City of Oswego would be required to wait for wheelchair-equipped vehicles to complete initial assignments during a school-in-session evacuation.

When school is in session, there are not enough buses available to evacuate all transit-dependent individuals (i.e., schoolchildren, resident population and transients without automobiles, and special facility residents) in one trip. This determination is based on a worst-case assumption of a simultaneous full-EPZ evacuation when schools are open. The Oswego County REPP contains procedures intended to minimize the likelihood of such an occurrence, such as go-home plans and sheltering options. However, for planning purposes, the following steps were followed in the calculation of evacuation travel time estimates (including round-trip time) for a school-in-session scenario:

1. School districts use their full-sized buses to evacuate schools in their districts as a first priority.

2. All elementary schools, middle schools, private schools, nursery schools, and day care centers are evacuated with district-owned or contracted vehicles.

3. Golden Sun Bus Company evacuates schools in Minetto and the City of Oswego because enough district-owned vehicles are not available.

4. Mexico HS, Oswego HS, and the State University are evacuated entirely with Centro of Syracuse buses. Centro also evacuates all ambulatory residents of special facilities.

5. BOCES self-evacuates with its own vehicles and vehicles at the facility belonging to other school districts.

6. School district-owned vans are used to run general population bus routes in the first wave of evacuation in ERPAs near JAF/NMP. With the exception of one bus route in Mexico, full-size district-owned buses are used for the general public only after all schoolchildren have been evacuated.

7. Centro of Oswego vehicles are also used to run general population bus routes in the first wave of evacuation.

8. Enough vans and other buses exist to evacuate all ERPAs in the five-mile radius (ERPAs 1-11) on the first evacuation wave.

9. All remaining ERPAs (ERPAs 12-22) must wait to evacuate on the second wave after schoolchildren have been evacuated. These remaining ERPAs are all at least 5 miles from the site.

G. Evacuation Travel Time Estimates

The results of the evacuation travel time analysis described in this report are presented by Sector in Tables 13, 14, 15, and 16 for the nighttime normal weather, nighttime adverse weather, school-in-session normal weather, and school-in-session adverse weather scenarios, respectively. The travel time estimates are presented for the following population subgroups (as defined earlier):

- Permanent resident population with automobiles;
- Permanent resident population without automobiles;
- Transient population; and
- Special facilities population.

The evacuation travel time estimates calculated for the JAF/NMP EPZ are in accord with the implementation procedures in the REPP. The implementation procedures include provisions such as predesignated evacuation routes for all ERPAs, prioritized traffic control locations, and bus routes with pickup points for the public. Thus, the evacuation travel time estimates are based on these and other operational strategies indicated in the Oswego County REPP.

As mentioned earlier, travel times were calculated as a range under normal weather conditions. When deciding which end of the range to use to estimate evacuation travel time, a decision maker would consider factors including the degree of mobilization, the degree of public cooperation, and the exent of capacity restrictions on key highway links.

Lower-bound evacuation travel times (shorter times) can be anticipated when:

(a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns and highway construction do not occur;

(b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;

(c) An informed and cooperative public follow directions as instructed. (In other words, the public has been sufficiently educated as to their responsibility in an evacuation, and has been given adequate notice of the possibility they may have to evacuate.)

Upper-bound evacuation travel times (longer times) for normal weather conditions are representative of a situation where:

(a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;

Table 13

EVACUATION TRAVEL TIME ESTIMATES BY SECTOR
NIGHTTIME SCENARIO
NORMAL WEATHER

Sector	Quadrant	Resident Population: With Autos From – To	Resident Population: Without Autos From – To	Special Facilities From – To	Transients From – To
2-Mile Radius					
A	NE	0:30 – 0:40	0:40 – 0:50	–	0:40 – 0:50
B	SE	0:30 – 0:40	0:40 – 0:50	–	0:40 – 0:50
C	SW	0:30 – 0:40	0:50 – 1:00	–	0:40 – 0:50
D	NW	0:30 – 0:40	0:40 – 0:50	–	0:40 – 0:50
5-Mile Radius					
E	NE	0:40 – 0:50	1:00 – 1:10	–	0:50 – 1:00
F	SE	0:40 – 0:50	1:10 – 1:20	1:10 – 1:20	0:50 – 1:00
G	SW	0:50 – 1:00	1:20 – 1:30	–	0:50 – 1:00
H	NW	0:40 – 0:50	1:00 – 1:10	–	0:50 – 1:00
10-Mile Radius					
I	NE	1:00 – 1:10	1:20 – 1:30	–	1:10 – 1:20
J	SE	1:10 – 2:10	1:30 – 2:40	1:30 – 1:40	1:20 – 2:20
K	SW	2:20 – 3:50	2:50 – 4:10	2:50 – 4:00	2:20 – 3:50
L	NW	1:00 – 1:10	1:20 – 1:30	–	1:10 – 1:20
360° EPZ					
M	All	2:20 – 3:50	2:50 – 4:10	2:50 – 4:00	2:20 – 3:50

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
- (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
- (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
- (c) An informed and cooperative public follow directions as instructed.

Upper bound evacuation travel times (longer times) are representative of a situation where:
- (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
- (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
- (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
- (a) resident population (with and without automobiles);
- (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
- (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicates that there is no special facility in the given Sector.

Table 14

EVACUATION TRAVEL TIME ESTIMATES BY SECTOR
NIGHTTIME SCENARIO
ADVERSE WEATHER

Sector	Quadrant	Resident Population		Special Facilities	Transients
		With Autos	Without Autos		
2-Mile Radius					
A	NE	0:50	1:00	–	1:00
B	SE	0:50	1:00	–	1:00
C	SW	0:50	1:10	–	1:00
D	NW	0:50	1:00	–	1:00
5-Mile Radius					
E	NE	1:00	1:20	–	1:10
F	SE	1:00	1:30	1:30	1:10
G	SW	1:50	2:10	–	1:50
H	NW	1:00	1:20	–	1:10
10-Mile Radius					
I	NE	1:20	1:40	–	1:30
J	SE	2:30	3:00	2:20	2:40
K	SW	4:40	5:00	4:50	4:40
L	NW	1:20	1:40	–	1:30
360^{o} EPZ					
M	All	4:40	5:00	4:50	4:40

Notes:

(1) The evacuation travel time estimates presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel times are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:

(a) resident population (with and without automobiles);

(b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);

(c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicate that there is no special faciliaty in the given Sector.

Table 15

EVACUATION TRAVEL TIME ESTIMATES BY SECTOR
SCHOOL-IN-SESSION SCENARIO
NORMAL WEATHER

		Resident Population		Special Facilities	Transients
		With Autos	Without Autos		
Sector	Quadrant	From – To	From – To	From – To	From – To
2-Mile Radius					
A	NE	0:30 – 0:40	0:40 – 0:50	–	0:30 – 0:40
B	SE	0:40 – 1:40	0:50 – 1:50	–	0:40 – 1:40
C	SW	0:30 – 0:40	0:50 – 1:00	–	0:30 – 0:40
D	NW	0:30 – 0:40	0:40 – 0:50	–	0:30 – 0:40
5-Mile Radius					
E	NE	0:40 – 0:50	1:00 – 1:10	–	0:40 – 0:50
F	SE	0:50 – 1:50	1:20 – 2:10	1:10 – 1:20	0:50 – 1:50
G	SW	0:50 – 2:00	1:20 – 2:10	–	0:50 – 2:00
H	NW	0:40 – 0:50	1:00 – 1:10	–	0:40 – 0:50
10-Mile Radius					
I	NE	1:00 – 1:10	1:20 – 1:30	–	1:00 – 1:10
J	SE	1:10 – 2:20	3:50 – 5:40	1:30 – 2:30	1:10 – 2:20
K	SW	4:40 – 7:50	6:40 – 9:00	5:00 – 8:00	4:40 – 7:50
L	NW	1:00 – 1:10	1:20 – 1:30	–	1:00 – 1:10
360° EPZ					
M	All	4:40 – 7:50	6:40 – 9:00	5:00 – 8:00	4:40 – 7:50

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
  (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
  (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
  (c) An informed and cooperative public follow directions as instructed.

  Upper bound evacuation travel times (longer times) are representative of a situation where:
  (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
  (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
  (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
  (a) resident population (with and without automobiles);
  (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
  (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicates that there is no special facility in the given Sector.

Table 16

EVACUATION TRAVEL TIME ESTIMATES BY SECTOR
SCHOOL-IN-SESSION SCENARIO
ADVERSE WEATHER

Sector	Quadrant	Resident Population: With Autos	Resident Population: Without Autos	Special Facilities	Transients
2-Mile Radius					
A	NE	0:50	1:00	–	0:50
B	SE	1:50	2:00	–	1:50
C	SW	0:50	1:10	–	0:50
D	NW	0:50	1:00	–	0:50
5-Mile Radius					
E	NE	1:00	1:20	–	1:00
F	SE	2:10	2:20	1:30	2:10
G	SW	2:20	2:30	–	2:20
H	NW	1:00	1:20	–	1:00
10-Mile Radius					
I	NE	1:20	1:40	–	1:20
J	SE	2:50	6:30	2:40	2:50
K	SW	9:40.	10:40	9:50	9:40
L	NW	1:20	1:40	–	1:20
360° EPZ					
M	All	9:40	10:40	9:50	9:40

Notes:

(1) The evacuation travel time estimates presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel times are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:

(a) resident population (with and without automobiles);

(b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);

(c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicate that there is no special faciliaty in the given Sector.

(b) A low state of operational readiness results from minimal mobilization of the emergency workforce;

(c) A low degree of cooperation from the public occurs. (In other words, the public is believed to be unsure as to what is expected of them.)

The evacuation travel times represent the time for the last vehicle in a Sector to clear the Sector boundary.

H. Confirmation Time

Confirmation of evacuation will be provided, to the extent possible, by law enforcement and other emergency workers concurrent with their patrolling of the EPZ during evacuation.

I. Distribution of the Evacuated Population by Time

The time required to evacuate the last individual from a Sector is an important piece of information for an emergency planner and decision maker. Obviously, everyone else will already have been evacuated when the last person leaves; thus, it is also important to obtain an estimate of the percent of the population evacuated as a function of time.

An output of the model used to estimate travel times was a prediction of the temporal distribution of the population as they leave the evacuating area. To produce this output, an approximation was made of the total population evacuated by Sector for each scenario by applying average vehicle occupancy rates to the number of vehicle trips generated by each traffic zone within the Sector. When a traffic zone had evacuated entirely at a given point in time, the estimated population for that zone was added to the Sector population already evacuated at that time; the resulting total was then divided by the total Sector population to determine the percent of the total population evacuated as a function of time.

Typical population distribution curves for the entire 10-mile EPZ (Sector M) are presented in Figures 24 through 27 for the nighttime and school-in-session scenarios under normal and adverse weather conditions. Inspection of these curves indicates that significant portions of the total population would be evacuated well before the last person leaves the EPZ.

J. Critical Locations

The Oswego County REPP calls for the stationing of traffic control personnel at key locations throughout the evacuation network. The REPP also identifies backup evacuation routes for roadway segments likely to become very congested. One of the factors which determined where to place the personnel and where to specify backup routes was based on an output from the computer assignment model that identified critical bottleneck links along each route in the network. These critical links represent the locations of potential maximum delays for evacuees traversing that route. Figures 28 and 29 indicate the critical links for the nighttime and school-in-session scenarios, respectively. Both figures are a composite representation of the critical links identified for an evacuation of all 13 sectors described earlier in this report.

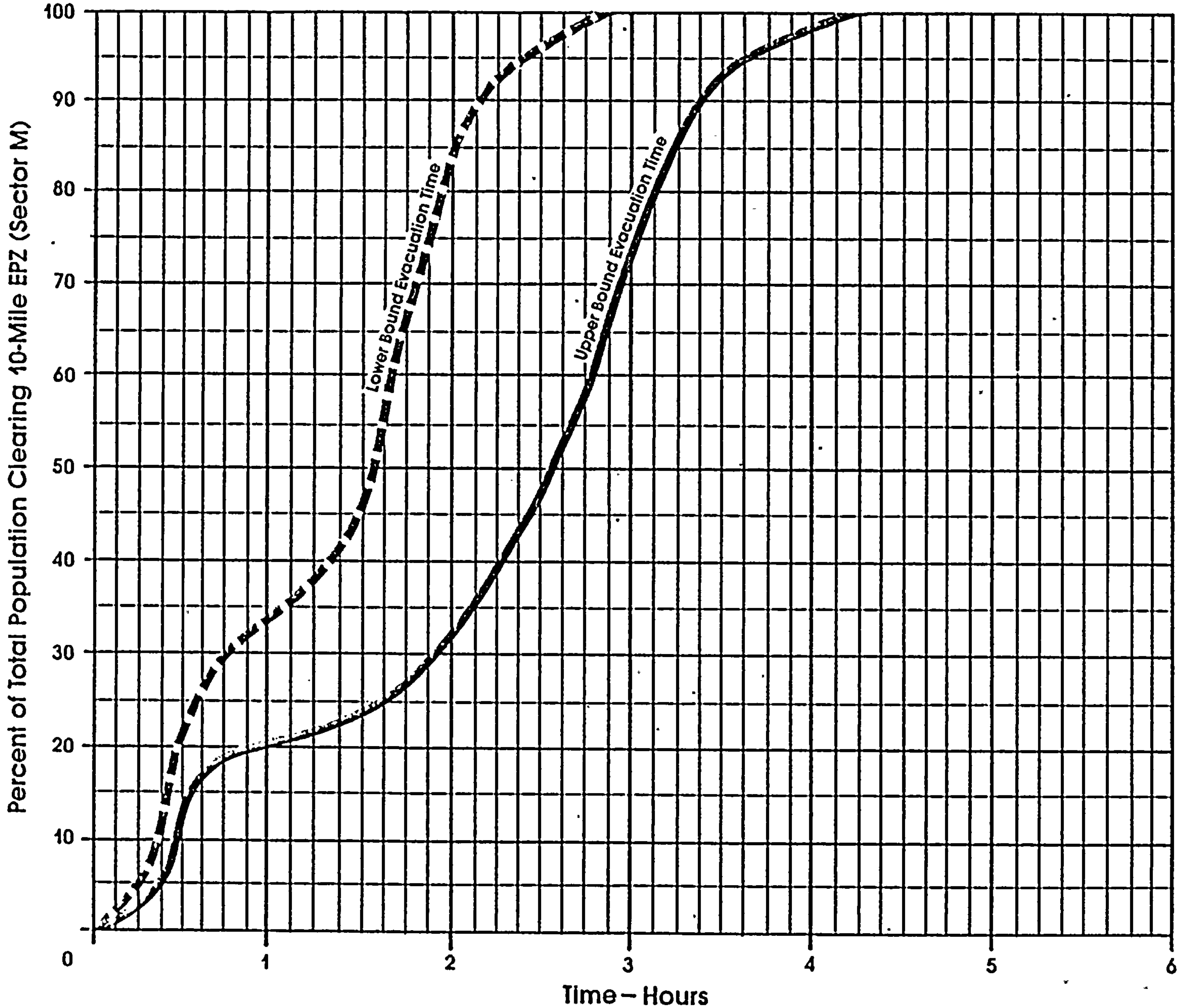


Fig. 24 Population Clearing 10-Mile EPZ Under Nighttime Scenario, Normal Weather

Parsons Brinckerhoff

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

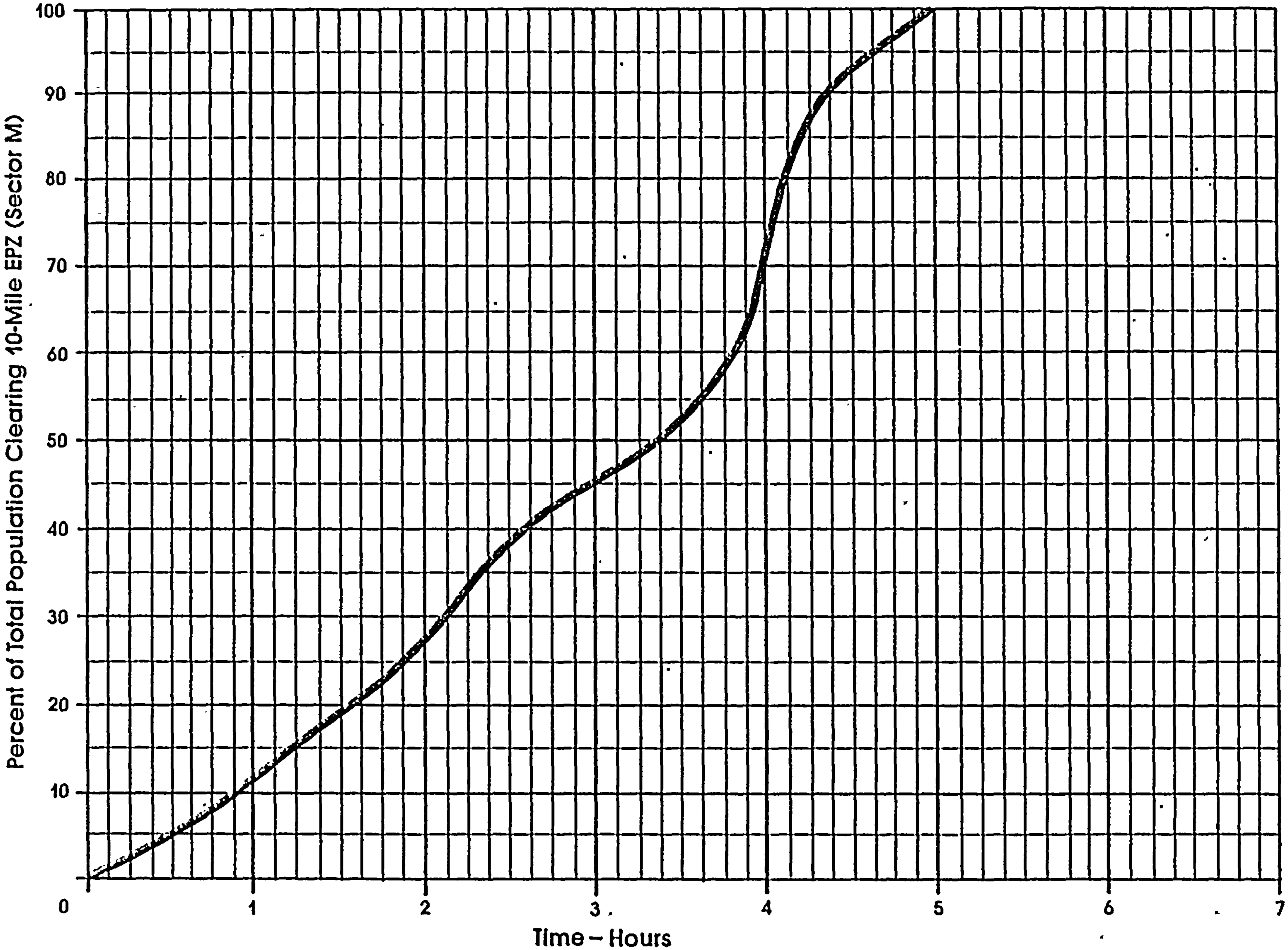


Fig. 25 Population Clearing 10-Mile EPZ Under Nighttime Scenario, Adverse Weather

Parsons Brinckerhoff

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

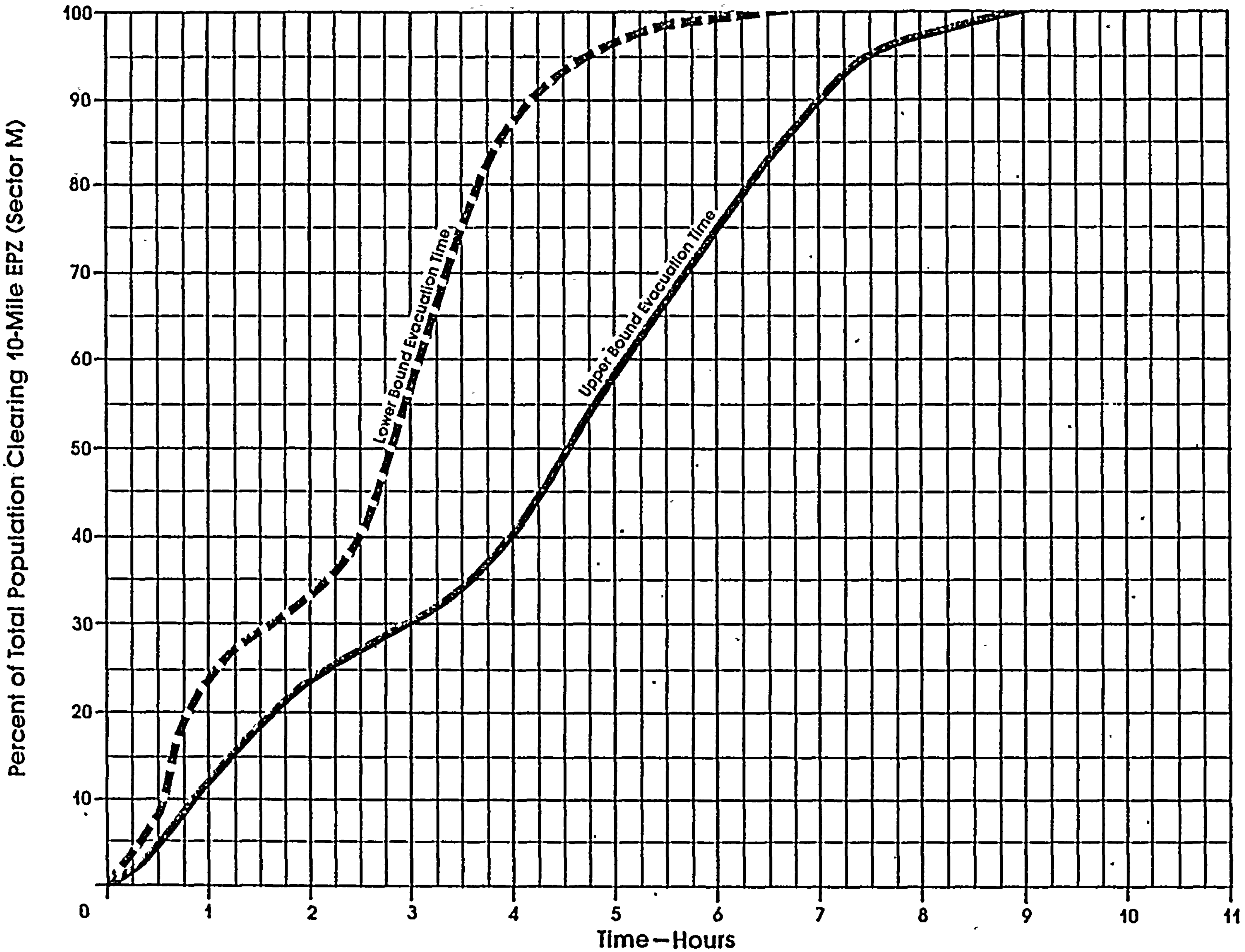


Fig. 26 Population Clearing 10-Mile EPZ Under School-in-Session Scenario, Normal Weather

Parsons Brinckerhoff

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

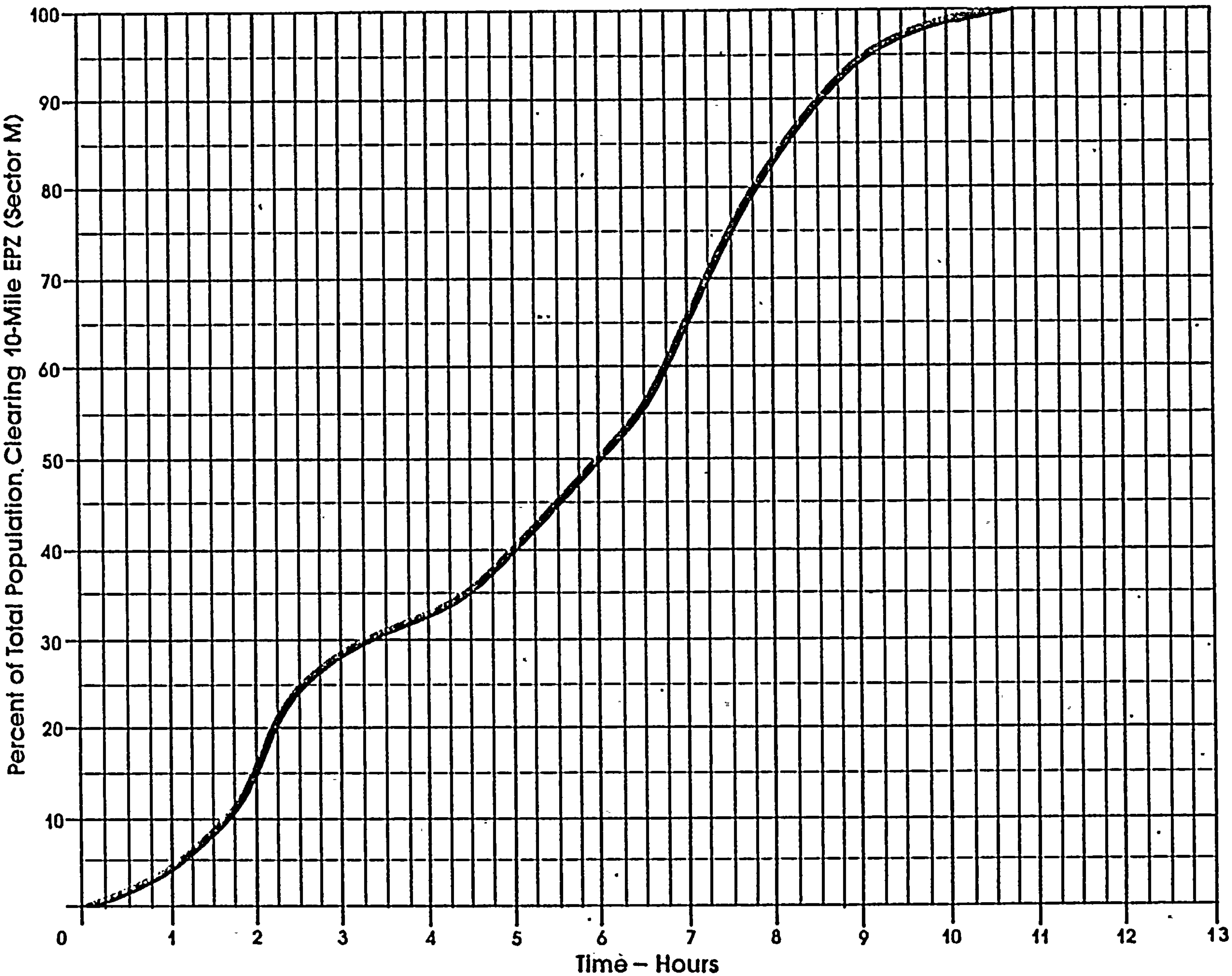


Fig. 27 Population Clearing 10-Mile EPZ Under School-in-Session Scenario, Adverse Weather

Parsons Brinckerhoff

J.A. FitzPatrick/
Nine Mile Point
Nuclear Power Stations

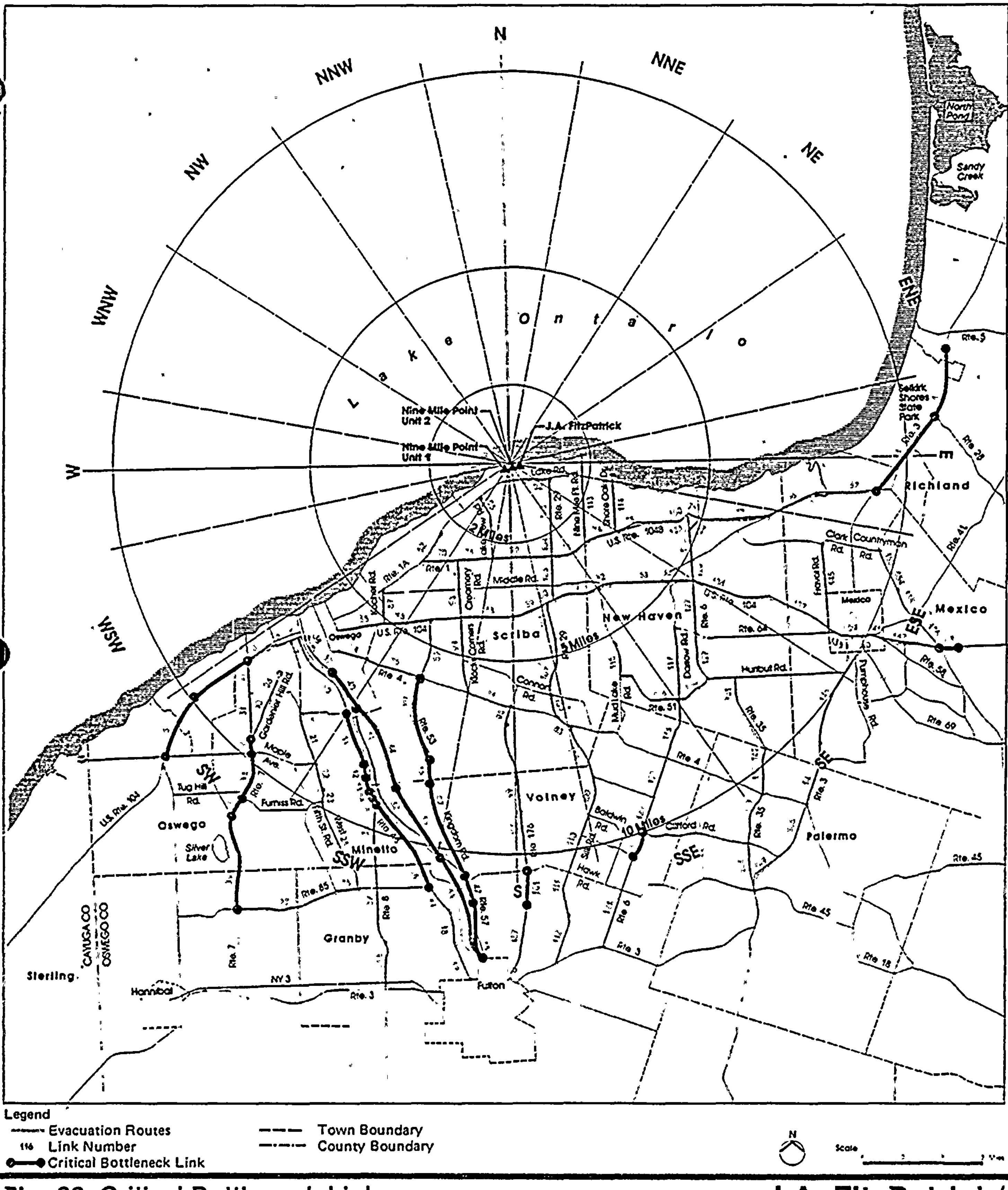
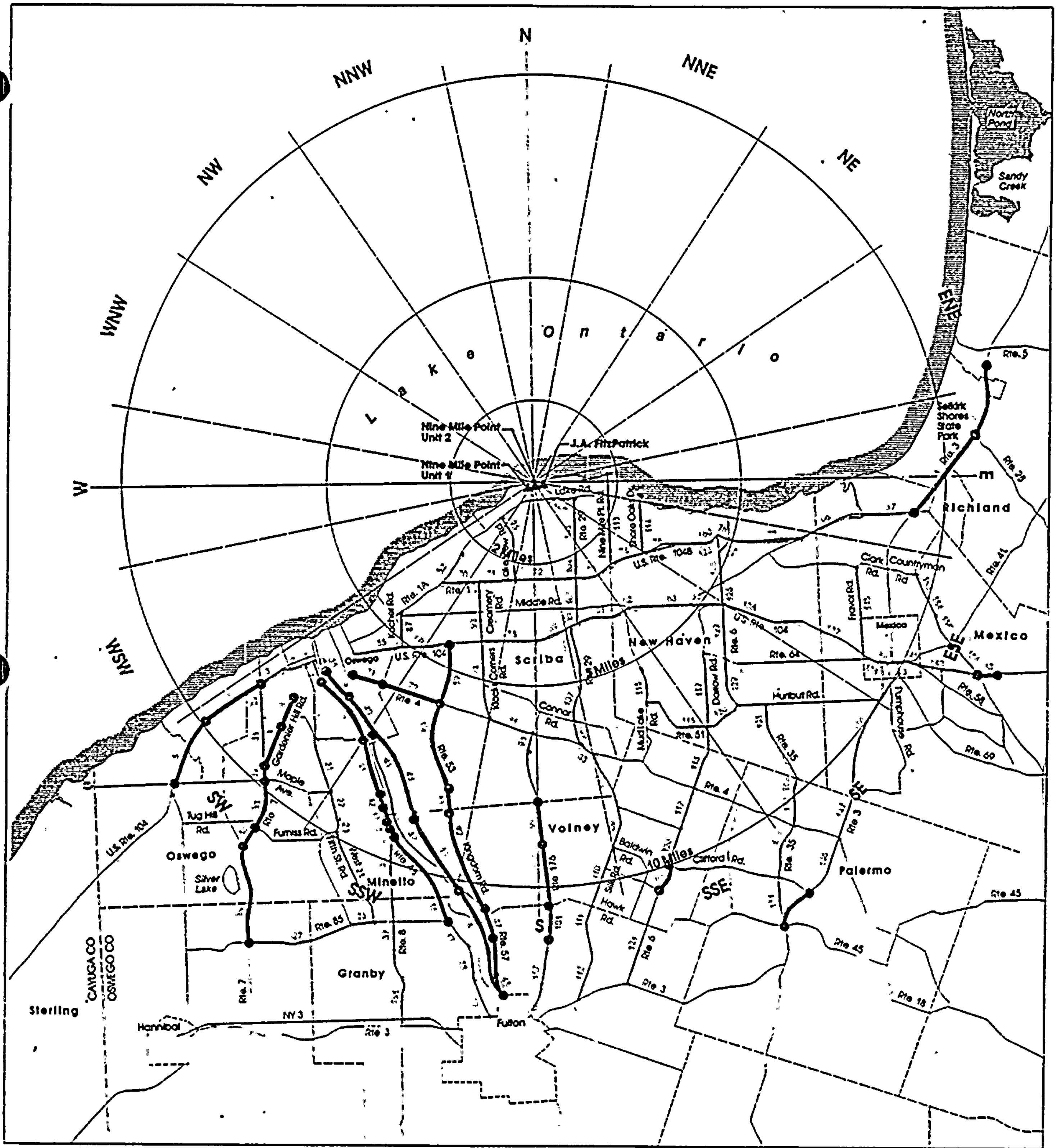


Fig. 28 Critical Bottleneck Links, Nighttime Scenario

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations



Legend

- Evacuation Routes
- 119 Link Number
- Critical Bottleneck Link
- Town Boundary
- County Boundary

N

Scale — Miles

Fig. 29 Critical Bottleneck Links, School-in-Session Scenario

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

K. Temporary Construction Workforce Effect on Evacuation Travel Time

The evacuation travel time analysis described earlier for the school-in-session scenario was modified, in a separate analysis, to include the Nine Mile Point Unit 2 temporary construction workforce of approximately 6,000 people. In some cases, temporary construction workforce members relocated their families to the nearby area for the duration of the project. As such, the inclusion of both workers and their families into the analysis was necessary. The school-in-session scenario was selected because it represents a worst-case condition. The largest shift of construction workers would be on-site, and their families would be at home, in school, or at work.

This section summarizes the methodology that was used to determine the impact of the workforce on evacuation travel time estimates. An employee (and mailing address) listing of construction personnel for the new plant was compiled by the Niagara Mohawk Power Corporation. From this employee address listing, it was determined that (for the purpose of estimating evacuation times) there are four categories of people associated with the temporary construction of Nine Mile Point Unit 2. These are as follows:

1. People whose addresses indicate that they now live in the EPZ, but were assumed to have moved from out of the EPZ to a location within the 10-mile radius (e.g., residents in motels and trailer parks).

2. People whose addresses indicate that they live beyond the EPZ but within reasonable driving distance. These workers were assumed to enter and leave the EPZ daily.

3. People whose addresses indicate that they now live beyond a reasonable driving distance (e.g., mailing addresses in other states). These people were assumed to have temporarily relocated in the EPZ.

4. People who have maintained permanent residence within the EPZ and work at the site.

These categories of construction-related people were counted from the employee mailing address listing and, where appropriate, assigned to geographic areas of concentration by their zip code. ERPAs 2, 7, 12, 13, 16, and 21 were found to be the primary EPZ locations hosting workers and families associated with the temporary plant construction. These people were then included in a separate analysis to determine their impact upon the evacuation time estimates.

The results of this special scenario indicated that as much as 3 hours would be added onto the school-in-session scenario evacuation travel time for ERPA 1. This result assumes that construction workers and the general public would simultaneously be instructed to evacuate. To the extent that workers are given a "head start", this time could be reduced. However, in general, the average impact to the evacuation travel time estimates would be to

increase these times by an hour. The ERPAs primarily affected by this new bulk of evacuating population would be those surrounding the plant area and sharing evacuation routes with the construction workforce. The temporary workforce was assigned to evacuate on four different routes leaving the site, as described in Appendix C for traffic zone 1B. These routes were selected based on several factors:

1. observed discharge patterns, gate locations, parking lot configurations, and parking lot clearing times on the site;

2. avoidance of heavily congested routes serving the City of Oswego and its environs;

3. general radial dispersion.

It is noted that the overall (i.e., longest) evacuation travel times were not significantly affected by the temporary workforce because different routes were utilized. Tables F-15 and F-16 in Appendix F provide evacuation travel time estimates by ERPA for the workforce scenario, under both normal and adverse weather conditions. These tables may be compared to Tables F-3 and F-4, respectively, to assess the increase in travel time assuming significant construction activity on-site.

L. Comparison to Earlier Evacuation Time Estimates

The evacuation travel time estimates prepared for this report were compared to the time estimates included in the earlier May 1982 study. For the nighttime scenario, the current total (i.e., longest) evacuation travel times (for sector M) are nearly identical to those previously calculated for the various population groups. Although the total travel time did not change significantly in the updated study for the nighttime scenario, variations were noted for individual ERPAs within the EPZ. These variations are attributable to the precise block-level population data available from the 1980 Census and used in the current report. The block-level data permits a much more accurate analysis of where people live within the EPZ.

In addition, the revised time estimate tables specifically include 20 minutes for public preparation time that was not included in the earlier study. If the original time estimates are increased by this 20 minute period to be consistent with the revised time estimates, it is noted that the revised evacuation times are slightly lower than the earlier estimates for many ERPAs. This finding is explained by the fact that the total permanent resident population in the EPZ analyzed in the current study is approximately 5400 people lower than the total included in the May 1982 analysis. The earlier analysis was based on 1976 Census projections of 1980 population; the revised study is based on actual 1980 Census data, which is more current and accurate.

Both evacuation time studies were based on the provisions of the Oswego County REPP in effect at the time of the analysis. The latest version of the REPP contains numerous changes in evacuation procedures that are reflected in the updated time estimates. In terms of evacuation time, the most significant change was made to the bus operations procedure. The current REPP provides for all available buses to first transport schoolchildren to the New York

State Fairgrounds in Syracuse, and then return to the EPZ for the transit-dependent general public. Earlier versions of the REPP designated facilities in Jefferson County as school reception centers, in addition to the New York State Fairgrounds. The modified REPP bus procedure is less complicated and more efficient in terms of bus utilization and operations. Hence, evacuation travel times for the resident population without autos are shorter for many ERPAs in the current study. The travel time savings to residents without autos may range from five minutes to nearly three hours under the revised Oswego County REPP procedures for a school in session scenario.

V. RECOMMENDED ACTIONS

V. RECOMMENDED ACTIONS

The evacuation travel time estimates presented in this report are based upon the conditions and actions described in the Oswego County Radiological Emergency Preparedness Plans and Procedures developed for the JAF/NMP EPZ. Such items include designation of primary evacuation routes; prioritized traffic and access control points along primary evacuation routes and at the EPZ boundary; specific bus routes and passenger pickup points for the evacuation of transit-dependent people; coordination of transportation resources for the evacuation of special facilities' populations; provision of a siren and tonealert notification system; and the various other factors discussed in this report.

In addition, the evacuation travel time estimates are based on current data regarding vehicle inventories in the area, updated population estimates for special facilities, and the latest (1980) U.S. Census data.

These parameters have been used as input to the time estimate analysis. Thus, the travel time estimates presuppose some degree of mobilization and activation of emergency workers and systems. At the time of an actual incident, evacuation travel times will approach lower bound estimates if the emergency workforce is fully mobilized and adequately trained in their duties and responsibilities.

The evacuation travel times included herein assume that residents without autos in certain ERPAs must wait for vehicles to return from initial assignments during a school-in-session evacuation. In the case of a full-EPZ evacuation, this assumption is valid because all available resources would be utilized simultaneously. However, in the event of a 10-mile 90° Sector evacuation, it would be possible to "borrow" vehicles designated for the adjacent non-evacuating Sector, thereby eliminating the need for buses to make two trips. If such a procedure were followed, the evacuation travel time for affected ERPAs between 5 and 10 miles from JAF/NMP could be reduced by approximately one to three hours for a school-in-session scenario.

Evacuation travel times for densely populated areas near and in the City of Oswego are longer than times for sparsely populated towns. During an actual incident, emergency response personnel would be monitoring traffic flow on all routes leaving the EPZ. If certain routes were determined to be cleared of traffic while others serving the city's locale were clogged, law enforcement personnel could divert vehicles to predesignated backup routes, and thus reduce total travel time.

APPENDIX A

EMERGENCY RESPONSE PLANNING AREAS:
DEFINITION OF BOUNDARIES AND
1984 PERMANENT RESIDENT POPULATION ESTIMATES

APPENDIX A

EMERGENCY RESPONSE PLANNING AREAS:

DEFINITION OF BOUNDARIES AND

1984 PERMANENT RESIDENT POPULATION ESTIMATES

The plume exposure pathway Emergency Planning Zone (EPZ) for the site has been subdivided into 29 discrete Emergency Response Planning Areas (ERPAs) as shown in Figure A-1. Estimates of 1984 permanent resident population by ERPA are included in Table A-1. The boundaries of the various ERPAs are described below:

ERPA 1 Northeastern area of the Town of Scriba, bounded by (E to W) Lake Road, Parkhurst Road southward, Miner Road, Lake View Road, Lake Road (County Route 1A), and Bayshore Road northwestward to the lake shore (large sign for Bayshore Grove at intersection of Bayshore Road with Lake Road).

ERPA 2 Northwestern corner of the Town of New Haven, N of North Road (County Route 1), W of Shore Oaks Drive, and including the seasonal community of Shore Oaks along the lake shore; and the northeastern part of the town of Scriba, N of North Road (County Route 1), E of creek which runs north-south from Miner Road to North Road, and bounded on the N by (E to W) Lake Road, Parkhurst Road southward and Miner Road.

ERPA 3 North-central part of the Town of Scriba, N of North Road (County Route 1); W of creek which runs north-south from Miner Road to North Road; bounded on the N by (E to W) Miner Road, Lake View Road, Lake Road (County Route 1A), and Bayshore Road northwestward to the lake shore (large sign for Bayshore Grove at intersection of Bayshore Road with Lake Road); and bounded on the W by Lake Road (County Route 1A) and the northwestward-running road entering and just E of the Alcan plant to the lake shore.

ERPA 4 Northwest portion of the town of New Haven, N of U.S. Route 104; bounded on the E by (N to S) Demster Beach Drive, County Route 6A southwestward, and County Route 6; and bounded on the NW by the outer edge of the seasonal community of Shore Oaks, Shore Oaks Drive southward, and North Road (County Route 1) westward.

ERPA 5 East-central portion of the Town of Scriba, S of North Road (County Route 1), N of U.S. Route 104, and E of Creamery Road.

ERPA 6 West-central portion of the Town of Scriba, N of U.S. Route 104, W of Creamery Road; and bounded on the N by (E to W) North Road (County Route 1), Lake Road (County Route 1A) northeastward, and the northwestward-running road entering and just E of the Alcan plant to the lake shore.

ERPA 7 Northeastern portion of the Town of New Haven, N of U.S. Route 104 and bounded on the W by (N to S) Demster Beach Drive, County Route 6A southwestward, and County Route 6.

ERPA 8 Southeastern portion of the Town of New Haven, S of U.S. Route 104, and E of County Route 6.

ERPA 9 Southwestern portion of the Town of New Haven, S of U.S. Route 104, and W of County Route 6.

ERPA 10 Southeast-central portion of the Town of Scriba, S of U.S. Route 104, N of County Route 4 (Hall Road), and E of Klocks Corners Road.

ERPA 11 West-central portion of the Town of Scriba, S of U.S. Route 104, N of County Route 4 (Hall Road), and W of Klocks Corners Road.

ERPA 12 The City of Oswego E of the Oswego River.

ERPA 13 The City of Oswego W of the Oswego River.

ERPA 14 Western portion of the Town of Richland, including, and bounded on the N by, Selkirk Shores State Park; and bounded on the E by (N to S) the eastern border of Selkirk Shores State Park, State Route 3, Manwaring Road, and the old railroad grade from Manwaring Road about 0.3 miles SE of its intersection with South Daysville Road to Sherman Road (the town line) near its intersection with Gibbs Road.

ERPA 15 Northwestern portion of the Town of Mexico, excluding the Village of Mexico, N of U.S. Route 104, and W of Spath Road (County Route 41) and Smithers Road.

ERPA 16 The Village of Mexico.

ERPA 17 Southwestern portion of the Town of Mexico, excluding the Village of Mexico, S of U.S. Route 104; and bounded on the E by (N to S) Emery Road, Standpipe Road (County Route 58), Stone Road, a line across the Little Salmon River from Stone Road where it turns southeastward to the intersection of Route 69 and Larson Road, Larson Road westward, Pumphouse Road, Pople Ridge Road westward, and State Route 3.

ERPA 18 Northwestern portion of the Town of Palermo, bounded by (NE to SW) State Route 3, County Route 4 westward, County Route 35 southward, and Clifford Road westward; and the northeastern portion of the town of Volney, bounded by (SE to NW) Clifford Road, County Route 6 (North Volney Road) southward, Mount Pleasant - Palermo Road (County Route 45) westward, Baldwin Road northward and westward, and Silk Road northward.

ERPA 19 Southern portion of the Town of Scriba, S of County Route 4 (Hall Road), and E of the E bank of the Oswego River.

ERPA 20 Northwestern portion of the Town of Volney, W of Silk Road and Baldwin Road; E of the E bank of the Oswego River; and bounded on the S by (E to W) Hawk Road, Rowlee Road, Distin Road, a short section of County Route 57 northward, and Black Creek.

ERPA 21 The Town of Minetto; and the southeastern corner of the Town of Oswego, S of Furniss Road and E of Ridge Road.

ERPA 22 Northeastern portion of the Town of Oswego, bounded on the S by (E to W) Furniss Road, County Route 7 northeastward, and Tug Hill Road; and bounded on the W by (S to N) Bunker Hill Road, Maple Avenue (County Route 20) westward, Snake Creek, and a NW-running line across Snake Swamp from Snake Creek to the lake shore, approximately halfway between Camp Hollis and Saint Mary's Chapel.

ERPA 23 Oswego River within the Oswego City limits.

ERPA 24 Oswego River S of the Oswego City limit and N of Lock number 5 near the village of Minetto.

ERPA 25 Oswego River S of Lock number 5 near the village of Minetto and N of the Minetto Town line.

ERPA 26 Portion of Lake Ontario within 5 miles and west of the plants.

ERPA 27 Portion of Lake Ontario within 5 miles and east of the plants.

ERPA 28 Portion of Lake Ontario between 5 and 10 miles from and west of the plants.

ERPA 29 Portion of Lake Ontario between 5 and 10 miles from and east of the plants.

TABLE A-1

1984 PERMANENT RESIDENT POPULATION ESTIMATES

EMERGENCY RESPONSE PLANNING AREAS

EMERGENCY RESPONSE PLANNING AREA	1984 PERMANENT RESIDENT POPULATION ESTIMATES
1	137
2	508
3	356
4	620
5	411
6	880
7	818
8	573
9	455
10	1,117
11	1,423
12	9,145
13	11,238
14	122
15	1,028
16	1,692
17	577
18	1,048
19	1,003
20	1,553
21	2,157
22	6,488
TOTAL	43,349

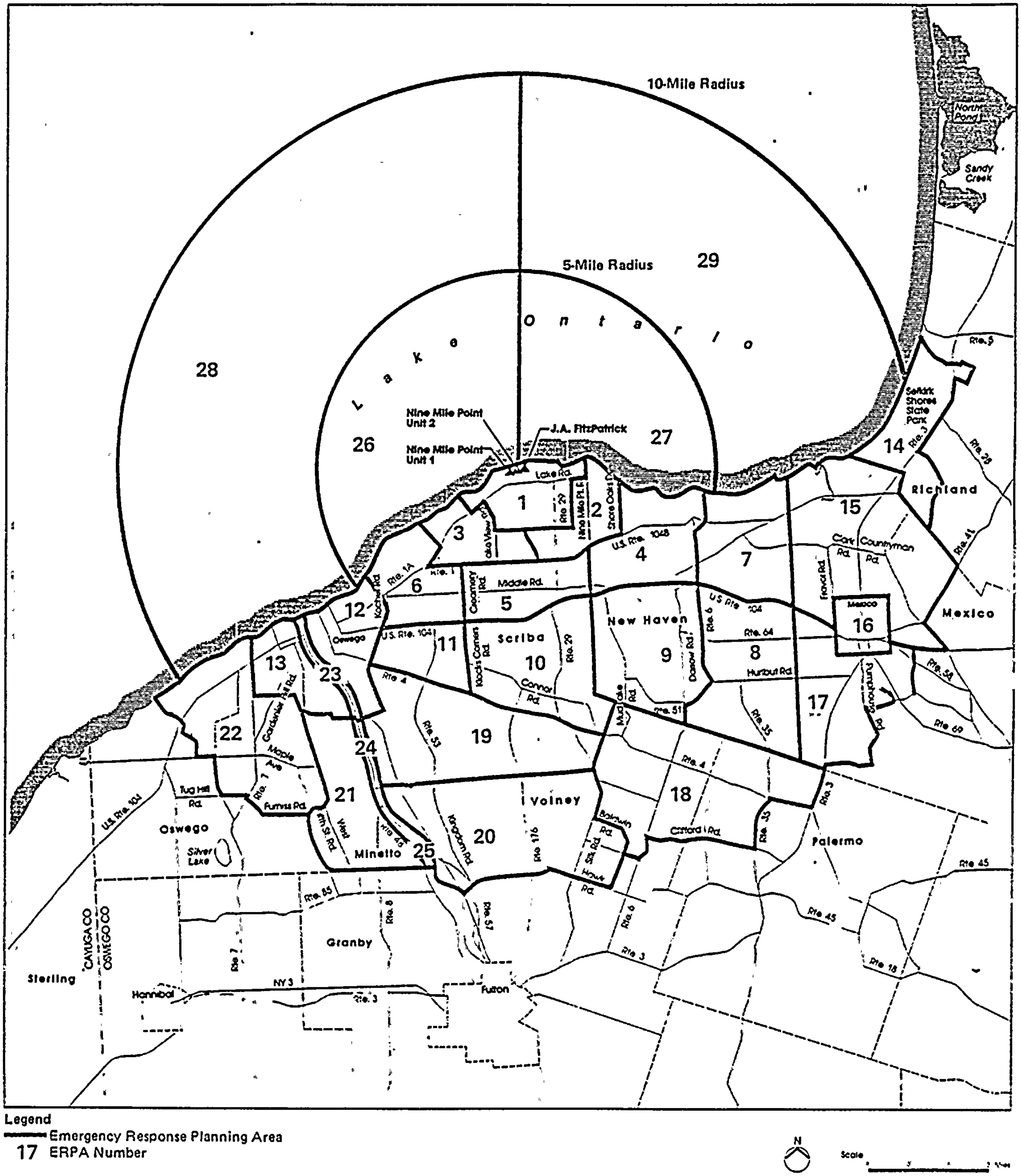


Fig. A-1 Emergency Response Planning Areas

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

APPENDIX B

LISTING OF SPECIAL FACILITIES IN THE EMERGENCY PLANNING ZONE

SCHOOLS

Facility/Address	Approximate Distance/ Direction From Site	Student Enrollment	Staff Faculty/Administrative/Other
City School District of Oswego:			
Fitzhugh Park ES East Tenth & Bridge Streets Oswego, New York 13126	6.0 SW	509	36/1/25
Kingsford Park ES West Fifth & Niagara Streets Oswego, New York 13126	7.5 SW	483	31/1/25
Minetto ES Granby Road Minetto, New York 13126	10.0 SSW	477	35/1/25
Charles E. Riley ES East Eighth & Bunner Streets Oswego, New York 13126	6.65 SW	604	33/1/26
Frederick Leighton ES One Buccaneer Boulevard Oswego, New York 13126	7.5 SW	370	32/1/12
Oswego Middle School Mark Fitzgibbons Drive Oswego, New York 13126	7.5 SW	870	55/2/27

Note: Includes elementary, middle, and high schools, both public and private facilities.
HS-High School
ES-Elementary School

SCHOOLS
(Continued)

Facility/Address	Approximate Distance/ Direction From Site	Student Enrollment	Staff Faculty/Administrative/Other
City School District of Oswego (Cont'd):			
Oswego High School 2 Buccaneer Boulevard Oswego, New York 13126	7.5 SW	1,625	160 (8AM-2:30PM) 10 (2:30PM-11PM) 2 (11PM-7AM)
Mexico Academy & Central School District:			
New Haven ES Route 104 New Haven, New York 13121	5.0 SE	309	17/1/5
Mexico ES Academy Street Mexico, New York 13114	9.5 ESE	385	31/2/7
Mexico Middle School Route 104 Mexico, New York 13114	8.5 ESE	844	52/2/11
Mexico High School Main Street Mexico, New York 13114	9.5 ESE	827	63/3/15

Note: Includes elementary, middle, and high schools, both public and private facilities.
HS-High School
ES-Elementary School

SCHOOLS
(Continued)

Facility/Address	Approximate Distance/ Direction From Site	Student Enrollment	Staff Faculty/Administrative/Other
Mexico Academy & Central School District (Cont'd):			
Palermo ES County Route 45 Fulton, New York 13069	Outside EPZ	271	7/1/7 plus 10 part-time
BOCES:			
County Route 64 Mexico, New York 13114	8.8 SE	Handicapped program- 100 (8 wheelchair, 92 ambulatory) Occupational program- 1,195 (split each session- 8:50AM-11:15AM, 11:50AM- 2:30PM)	106/21/81
Private Schools:			
St. Paul's Academy 115 East Fifth Street Oswego, New York 13126	6.5 SW	200	14/1/19
St. Mary's School 74 West Sixth Street Oswego, New York 13126	7.2 SW	163	18/2/6

Note: Includes elementary, middle, and high schools, both public and private facilities.
HS-High School
ES-Elementary School

SCHOOLS
(Continued)

Facility/Address	Approximate Distance/ Direction From Site	Student Enrollment	Staff Faculty/Administrative/Other
Private Schools (Cont'd):			
Bishop Cunningham HS East River Road Oswego, New York 13126	6.5 SW	154	23/2/9
SUNY Campus School (Sweatman Hall) College at Oswego Oswego, New York 13126	8.0 SW	45 mentally handicapped adults	3/0/2
Oswego Community Christian School Riverfront Building 120 E. First Street Oswego, New York 13126	7.5 SW	50	4/2/0

Note: Includes elementary, middle, and high schools, both public and private facilities.
ES-Elementary School
HS-High School

NURSERY SCHOOLS/DAY CARE CENTERS

Facility/Address	Approximate Distance/ Direction From Site	Student Enrollment	Staff Faculty/Administrative/Other
Children's Center 7 New Street Oswego, New York 13126	8.5 WSW	35	8/3/-
Children's Center East 10th & Mitchell Streets Oswego, New York 13126	6.3 SW	30	8/2/-
Minetto Pre-School Program Methodist Church West River & Granby Roads Minetto, New York 13115	9.5 SW	20	4/1/-
Oswego Cooperative Nursery School 74 West 6th Street Oswego, New York 13126	6.5 WSW	16 (T, Th) 19 (M, W, F) 18 (PM)	2/1/1
Mother Goose Nursery School Wilcox Bldg./Presbyterian Church Mexico, New York 13114	10.25 ESE	35	2
Headstart of Oswego Trinity Methodist Church East 4th & Utica Streets Oswego, New York 13126	6.5 WSW	18	2/-/1-2
Mexico Childcare Class BOCES Occupational Office Mexico, New York 13114	9.0 SE	18 (AM) 17 (PM)	1

COLLEGES

Facility/Address	Approximate Distance/ Direction From Site	Session	Commuting Students/Faculty/Staff	Residential Students
		Spring and Fall Semesters		
State University of New York at Oswego Oswego, New York 13126	8.5 WSW	9AM-1PM	1765/394/1067	4,104
		4:30PM-10PM	492/195/98	
		after 10PM	-/-/10	
		Summer Pre-Session		
		9AM-1PM	685/33/862	
		4:30PM-10PM	195/10/49	
		after 10PM	-/-/4	
		Regular Session		
		9AM-1PM	1477/74/862	
		4:30PM-10PM	492/25/49	
		after 10PM	-/-/4	
		Post Session		
		9AM-1PM	492/25/862	
		4:30PM-10PM	98/5/49	
		after 10PM	-/-/4	
		January		35

NURSING HOMES

Facility/Address	Approximate Distance/ Direction From Plant	Maximum Capacity	Average Number	Patients/Residents Ambulatory	Patients/Residents Non-Ambulatory	Staff by Shift Day	Staff by Shift Evening	Staff by Shift Night
Valehaven Home for Adults East 2nd Street and Corner of Oneida Street Oswego, New York 13126	7.0 SW	34	34	34	0	5 (1 on call)	1	1
St. Luke's Health Related Facility East River Road Oswego, New York 13126	7.1 SW	120	118	102	18 (W=12, S=6)	42 (10 on Sat./Sun)	19	10
Pontiac Nursing Home East River Road Oswego, New York 13126	7.0 SW	80	80	15	65 (W=45, S=20)	36	17	7
Harrwood Nursing Home Sunrise Terrace Oswego, New York 13126	8.3 SW	120	118	43	77 (W=61, S=16)	50	25	10
Hillcrest Nursing Home 132 Ellen Street Oswego, New York 13126	7.8 SW	120	120	43	77 (W=62, S=15)	52	19	9
Ladies Home 43 East Utica Street Oswego, New York 13126	7.0 SW	17	15	15	0	13	7	5
Spencer Rest Home Route 104 (7 miles east of Oswego) New Haven, New York	4.6 SE	17	17	17	0	Weekdays: 4 Weekends: 2	4 2	4 2

Note: Includes health-related facilities, skilled nursing facilities, and rest homes.

W=Wheelchair
S=Stretcher

HOSPITALS AND OTHER HEALTH CARE FACILITIES

Facility/Address	Approximate Distance/ Direction From Plant	Maximum Capacity	Average Number	Number of Patients: Ambulatory	Number of Patients: Non-Ambulatory	Staff by Shift: Day	Staff by Shift: Evening	Staff by Shift: Night
Oswego Hospital 110 Sixth Street Oswego, New York 13126	7.4 SW	172 (includes 38 bed extended care unit)	160	82	78 (all stretcher)	240 112	Weekdays: 61 Weekends: 56	29 28
Alvin L. Krakau Mental Health Center 74 Bunner Street Oswego, New York 13126	6.5 WSW	32	23	23	0	90*	12-14	6-9

*Figure varies as some go to satellite clinics.

CORRECTIONAL FACILITIES/ POLICE LOCKUPS

Facility/Address	Approximate Distance/ Direction From Site	Maximum Capacity	Average Number	Staff Guards/Civilians
Oswego County Jail RD 4, Box 5 State Route 57 Oswego, New York 13126	7.5 SW	96	70	8/2

PARKS AND CAMPGROUNDS

Name/Location	Approximate Distance/ Direction From Site	Attendance Weekend/Holiday Summer Peak	Summer Average	Winter Peak	Winter Average
Selkirk Shores State Park** (Includes Selkirk Beach)	10.0 ENE	3,000	2,500	150	100
Ontario Bible Conference	1.5 E	272	272	--	--
Chedmardo Beach and Campsite	9.5 E	1,000	1,000	--	--
Bears Sleepy Hollow Park	10.5 ENE	124	--	124	--
Flat Rock Campsite	7.8 E	484	400	69	--
Mexico Point Beach*	8.0 E	--	--	--	--
Dowydale Beach*	6.0 E	--	--	--	--
Demster Beach*	5.3 E	--	--	--	--
Shore Oaks Camps*	2.6 E	--	--	--	--
Ramona Beach*	9.0 E	--	--	--	--
State Boat Launch*	3.6 E	--	--	--	--

Note: *These local facilities generally are attended by relatively few people who have their own means of transportation available.

**Figures are for attendance on one day of the weekend and include beach and camping areas.

APPENDIX C

TRAFFIC ZONES:
DEFINITION OF BOUNDARIES
AND EVACUATION ROUTES
LISTED BY TOWN

APPENDIX C

TRAFFIC ZONES: DEFINITION OF BOUNDARIES AND EVACUATION ROUTES

LISTED BY TOWN

Town of Scriba

Zone 1A: The portion of ERPA 1 east of Sunset Bay Creek.

Route: Nine Mile Point Road to Route 1 east (North Road) to N.Y. 104B east to N.Y. 3 north.

Zone 1B: The portion of ERPA 1 west of Sunset Bay Creek and east of Penn Central Railroad tracks (including J.A. FitzPatrick and Nine Mile Point Units 1 and 2).

Route: Lake Road (Route 1A) to Route 29 south to Route 1 east (North Road) to N.Y. 104B east to N.Y. 3 north.

Route:* Lake Road (Route 1A) east to Route 29 south to Route 4 east to Silk Road south.

Route:* Lake Road (Route 1A) west to Lake View Road south to Route 1 west (North Road) to Creamery Road south to Klocks Corners Road to Route 4 east to N.Y. 176 south.

Route:* Lake Road (Route 1A) west to Lake View Road south to Route 1 east (North Road) to Route 29 south to Route 4 east to Silk Road south.

Zone 1C: The portion of ERPA 1 west of Penn Central Railroad track.

Route: Lake View Road south to Route 1 west (North Road) to Creamery Road south to Klocks Corners Road to Route 4 east to N.Y. 176 south.

Zone 2C: The portion of ERPA 2 in the Town of Scriba.

Route: Route 29 south to Route 1 east (North Road) to N.Y. 104B east to N.Y. 3 north.

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*Note: Three additional evacuation routes are provided for Traffic Zone 1B to expedite the movement of the temporary construction workforce located on-site. These additional routes also service other Traffic Zones in the EPZ. The three additional routes are required for an evacuation of JAF/NMP only if the temporary workforce is active at the time. A discussion of the effect of the temporary workforce on evacuation travel time is included in Section IV.K of the report.

Town of Scriba (Continued)

Zone 3A: The portion of ERPA 3 east of creek between Bayshore Grove Road and Cliff Road.

Route: Lake View Road south to Route 1 west (North Road) to Creamery Road south to Klocks Corners Road to Route 4 east to N.Y. 176 south.

Zone 3B: The portion of ERPA 3 west of creek between Bayshore Grove Road and Cliff Road.

Route: Lake Road (Route 1A) west to Route 1 east (North Road) to Creamery Road south to Klocks Corners Road to Route 4 east to N.Y. 176 south.

Zone 5A: The portion of ERPA 5 east of Duke Road.

Route: Route 29 south to U.S. 104 west to Route 29 south to Route 4 east to Silk Road south.

Zone 5B: The portion of ERPA 5 west of Duke Road.

Route: Creamery Road south to Klocks Corners Road to Route 4 east to N.Y. 176 south.

Zone 6A: The portion of ERPA 6 east of creek which runs from Lake Ontario to U.S. 104 and is located between County Route 53 and Klocks Corners Road.

Route: Route 1 east (North Road) to Creamery Road south to Klocks Corners Road to Route 4 east to N.Y. 176 south.

Zone 6B: The portion of ERPA 6 west of creek which runs from Lake Ontario to U.S. 104 and is located between County Route 53 and Klocks Corners Road.

Route: Kocher Road south to U.S. 104 east to Route 53 south to Kingdom Road to Route 57 south.

Zone 10A: The portion of ERPA 10 east of creek, east of Niagara Mohawk power lines and east of Duke Road.

Route: Route 29 south to Route 4 east to Silk Road south.

Zone 10B: The portion of ERPA 10 west of Duke Road, west of Niagara Mohawk power lines, and west of creek.

Route: Klocks Corners Road to Route 4 east to N.Y. 176 south.

Zone 11A: All of ERPA 11.

Route: Route 53 south to Kingdom Road to Route 57 south.

Town of Scriba (Continued)

Zone 19A: The portion of ERPA 19 east of Paddy Lake Road.

Route: Silk Road south.

Zone 19B: The portion of ERPA 19 west of Paddy Lake Road and east of Dutch Ridge Road and Black Creek.

Route: N.Y. 176 south.

Zone 19C: The portion of ERPA 19 west of Dutch Ridge Road and Black Creek, and east of Penn Central Railroad tracks.

Route: Route 53 south to Kingdom Road to Route 57 south.

Zone 19D: The portion of ERPA 19 west of Penn Central Railroad tracks.

Route: Route 57 south.

Town of New Haven

Zone 2A: The portion of ERPA 2 east of Sunset Bay Creek.

Route: Shore Oaks Drive to Route 1 east (North Road) to N.Y. 104B east to N.Y. 3 north.

Zone 2B: The portion of ERPA 2 west of Sunset Bay Creek in the Town of New Haven.

Route: Nine Mile Point Road to Route 1 east (North Road) to N.Y. 104B east to N.Y. 3 north.

Zone 4A: The portion of ERPA 4 north of Route 1 (North Road).

Route: Route 1 east (North Road) to N.Y. 104B east to N.Y. 3 north.

Zone 4B: The portion of ERPA 4 south of Route 1 (North Road) and east of Mack Road and Catfish Creek.

Route: Route 6 south.

Zone 4C: The portion of ERPA 4 south of Route 1 (North Road) and west of Mack Road and Catfish Creek.

Route: U.S. 104 east to Route 6 south.

Zone 7A: The portion of ERPA 7 north of Route 1 (North Road), east of Larkin Road and north of N.Y. 104B.

Route: Route 1 east (North Road) to N.Y. 104B east to N.Y. 3 north.

Town of New Haven (Continued)

Zone 7B: The portion of ERPA 7 south of N.Y. 104B and east of East Branch of Catfish Creek.

Route: U.S. 104 east.

Zone 7C: The portion of ERPA 7 south of Route 1 (North Road), west of Larkin Road, south of N.Y. 104B, and west of East Branch of Catfish Creek.

Route: Route 6A south to Route 6 south.

Zone 8A: The portion of ERPA 8 north of Stone Road (Country Home Road) and east of East Branch of Catfish Creek (east of Kirby Road).

Route: U.S. 104 east.

Zone 8B: The portion of ERPA 8 south of Stone Road (Country Home Road) and east of Catfish Creek and Kirby Road.

Route: Route 35 south.

Zone 8C: The portion of ERPA 8 west of East Branch of Catfish Creek, west of Kirby Road and west of Catfish Creek.

Route: Route 6 south.

Zone 9A: The portion of ERPA 9 east of Mud Lake Road (Route 51), south of Lilly Marsh Road, and east of creek between Lilly Pond and Route 51.

Route: Darrow Road south to Route 6 south.

Zone 9B: The portion of ERPA 9 west of creek between Lilly Pond and Route 51, north of Lilly Marsh Road, and west of Mud Lake Road.

Route: Route 51 east to Route 6 south.

Town of Richland

Zone 14A: All of ERPA 14.

Route: N.Y. 3 north.

Town of Mexico

Zone 15A: The portion of ERPA 15 north of Gibbs Road, north of Smith Road, west of Fort Leazier Road, and north of Countryman Road, Clark Road and Potter Road.

Route: N.Y. 3 north.

Town of Mexico (Continued)

Zone 15B: The portion of ERPA 15 south of Gibbs Road, east of Fort Leazier Road, south of Countryman Road, and east of N.Y. 3.

Route: Fort Leazier Road south to Dewey Road to Newcomb Road to Smithers Road to U.S. 104 east.

Zone 15C: The portion of ERPA 15 south of Potter Road and Clark Road, and west of N.Y. 3.

Route: Fravor Road south to U.S. 104 east.

Zone 17A: The portion of ERPA 17 east of Little Salmon River.

Route: U.S. 104 east.

Zone 17B: The portion of ERPA 17 west of Little Salmon River.

Route: N.Y. 3 south.

Village of Mexico

Zone 16A: The portion of ERPA 16 north of U.S. 104.

Route: U.S. 104 east.

Zone 16B: The portion of ERPA 16 south of U.S. 104.

Route: N.Y. 3 south.

Town of Palermo

Zone 18A: The portion of ERPA 18 in the Town of Palermo.

Route: Route 35 south.

Town of Volney

Zone 18B: The portion of ERPA 18 in the Town of Volney.

Route: Route 6 south.

Zone 20A: The portion of ERPA 20 east of N.Y. 176.

Route: Silk Road south.

Zone 20B: The portion of ERPA 20 west of N.Y. 176 and east of Black Creek.

Route: N.Y. 176 south.

Town of Volney (Continued)

Zone 20C: The portion of ERPA 20 west of Black Creek and east of Penn Central Railroad tracks.

Route: Route 53 south to Kingdom Road to Route 57 south.

Zone 20D: The portion of ERPA 20 west of Penn Central Railroad tracks.

Route: N.Y. 481 south.

Town of Minetto

Zone 21A: The portion of ERPA 21 north of Route 25 and east of Erie Lackawanna Railroad tracks.

Route: N.Y. 48 south.

Zone 21B: The portion of ERPA 21 south of Route 25 and east of West Fifth Street Road.

Route: Route 8 south.

Zone 21D: The portion of ERPA 21 west of Erie Lackawanna Railroad tracks and north of Route 25.

Route: Route 25 south to West Fifth Street Road south to Route 85 west.

Town of Oswego

Zone 21C: The portion of ERPA 21 in the Town of Oswego.

Route: West 5th Street Road south to Route 85 west.

Zone 22A: The portion of ERPA 22 east of Penn Central Railroad tracks.

Route: Route 25 south to West Fifth Street Road south to Route 85 west.

Zone 22B: The portion of ERPA 22 west of Penn Central Railroad tracks, east of Bunker Hill Road, south of Thompson Road, east of Thompson Road and south of U.S. 104.

Route: Route 7 south.

Zone 22C: The portion of ERPA 22 north of U.S. 104, west of Thompson Road, north of Thompson Road, and west of Bunker Hill Road.

Route: U.S. 104 west.

Town of Oswego (Continued)

Zone 12A: The portion of ERPA 12 north of U.S. 104 and east of East 13th Street.

Route: U.S. Route 104 east to Route 53 south to Kingdom Road to Route 57 south.

Zone 12B: The portion of ERPA 12 west of East 13th Street, south of U.S. 104, north of Route 4 and east of East 9th Street.

Route: Route 4 east to Route 53 to south Kingdom Road to Route 57 south.

Zone 12C: The portion of ERPA 12 west of East 9th Street and south of Route 4.

Route: N.Y. 481 south.

Zone 13A: The portion of ERPA 13 south of U.S. 104 and east of West Fifth Street Road.

Route: N.Y. 48 south.

Zone 13B: The portion of ERPA 13 south of U.S. 104, west of West Fifth Street Road, and east of Hillside Avenue.

Route: Gardenier Hill Road south to Route 7 south.

Zone 13C: The portion of ERPA 13 north of U.S. 104 and west of Hillside Avenue.

Route: U.S. 104 west.

APPENDIX D

ROADWAY LINK CHARACTERISTICS

ROADWAY LINK CHARACTERISTICS

Link Number	Link Description: Mainline	From	To	Link Length (Miles)	Speed Limit (Mph)	Number of Lanes Outbound	Capacity (PCE/Hour): Normal Weather	Adverse Weather
1	US 104	West 1 St	West 5 St	0.27	30	2	3520	1970
2	US 104	West 5 St	Hillside Ave	0.60	30	2	3520	1970
3	US 104	Hillside Ave	Johnson Rd	0.67	30	2	3880	2650
4	US 104	Johnson Rd	Cemente Rd	1.73	45	1	1550	720
5	US 104	Cemente Rd	Rte 20	1.67	55	1	1550	720
6	US 104	Rte 20	NY 104A	0.33	55	1	1550	720
7	West 1 St	US 104	Erie St	0.47	30	2	3440	1930
10	NY 48	Erie St	City Limit	2.00	30	1	1200	560
11	NY 48	City Limit	Ridgeway	1.53	55	1	1200	560
12	NY 48	Ridgeway	Snell Rd	0.40	40	1	1200	560
13	NY 48	Snell Rd	Power Plant	0.40	40	1	1200	560
14	NY 48	Power Plant	Rte 25	0.27	35	1	1200	560
15	NY 48	Rte 25	Rte 8	0.23	15	1	1410	650
16	NY 48	Rte 8	Rte 85	2.58	40	1	1410	650
17	NY 48	Rte 85	Robby Rd	0.80	55	1	1410	650
18	NY 48	Robby Rd	Honey Hill	0.93	45	1	1410	650
19	NY 48	Honey Hill	Fulton Limits	1.13	40	1	1410	650
21	West 5 St	Rathburn Rd	Rte 20	1.47	40	1	1200	560
22	West 5 St	Rte 20	Rte 25	0.80	50	1	1410	650
23	West 5 St	Rte 25	Furniss Rd	0.40	50	1	1410	650
24	West 5 St	Furniss Rd	Rte 85	2.60	50	1	1410	650
26	Rte 85	West 5 St	Ridge Rd	0.69	45	1	1140	530
27	Rte 85	Ridge Rd	Rte 7	2.59	45	1	1140	530
28	Liberty St	Ellen St	Hillside Ave	0.93	30	1	1410	650
29	Rte 7	US 104	Byer Rd	1.00	40	1	1410	650
30	Gard Hi Rd	Hillside Ave	Rte 7	1.00	45	1	1410	650
31	Rte 7	Byer Rd	Gard. Hi. Rd	1.13	40	1	1360	630
32	Rte 7	Gard. Hi. Rd	Rte 20	0.53	40	1	1360	630
33	Rte 7	Rte 20	Furniss Rd	1.67	35	1	1360	630
34	Rte 7	Furniss Rd	Bunker Hill	0.67	40	1	1360	630
35	Rte 7	Bunker Hill	Rte 85	2.60	35	1	1360	630
36	Rte 8	NY 48	Town Line	1.59	55	1	1260	590
37	Rte 8	Town Line	Honey Hill	2.00	55	1	1260	590
38	NY 481	US 104	E. Utica St	0.31	30	2	3560	1990
39	NY 481	E. Utica St	Dam Lock 6	0.88	40	2	3280	2240
40	NY 481	Dam Lock 6	Rte 57	1.19	55	1	1600	740
41	Rte 57	NY 481	Rte 45	2.25	45	1	1360	630
42	Rte 57	Rte 45	NY 481	2.31	45	1	1360	630
43	NY 481	Rte 57	Fulton Limits	2.81	55	1	1360	630
44	NY 481	Rte 57	Rte 45	2.31	55	1	1600	740
45	NY 481	Rte 45	Rte 57	2.06	45	1	1600	740
46	Rte 57	NY 481	Kingdom Rd	0.88	40	1	1600	740
47	Rte 57	Kingdom Rd	Howard Rd	0.69	55	1	1360	630
48	Rte 57	Howard Rd	Fulton Limits	1.56	35	1	1360	630
52	Lake Rd	Walker Rd	Rte 1	0.98	55	1	1140	530
55	US 104	East 12 St	Kocher Rd	1.19	55	1	1600	740
56	US 104	Kocher Rd	Rte 53	1.13	45	1	1490	690

ROADWAY LINK CHARACTERISTICS
(Continued)

Link Number	Link Description: Mainline	From	To	Link Length (Miles)	Speed Limit (Mph)	Number of Lanes Outbound	Capacity (PCE/Hour): Normal Weather	Adverse Weather
58	US 104	Klocks Corner	Rte 51A	1.38	55	1	1490	690
59	US 104	Rte 51A	Rte 29	0.94	55	1	1490	690
60	US 104	Rte 29	Rte 29	0.15	55	1	1490	690
61	US 104	Rte 29	Rte 51	1.25	55	1	1490	690
62	US 104	Rte 51	Middle Rd	0.38	55	1	1490	690
63	US 104	Middle Rd	NY 104B	1.31	55	1	1490	690
66	NY 104B	Rte 1	Rte 16	1.50	55	1	1600	740
67	NY 104B	Rte 16	NY 3	1.40	55	1	1600	740
68	NY 3	NY 104B	Rte 28	2.50	55	1	1300	600
69	NY 3	Rte 28	NY 13	1.75	55	1	1490	690
70	Rte 1	Lake Rd	Creamery Rd	0.94	55	1	1140	530
71	Rte 1	Creamery Rd	Lake View Rd	0.88	55	1	1140	530
72	Rte 1	Lake View Rd	Rte 29	1.50	55	1	1140	530
73	Rte 1	Rte 29	Nine Mile	0.94	55	1	1140	530
74	Rte 1	Nine Mile	Shore Oaks Dr	0.75	45	1	1140	530
75	Rte 1	Shore Oaks Dr	Catfish Dr	1.66	45	1	1140	530
76	Rte 1	Hickory Grove	Rte 6A	0.31	45	1	1230	570
77	Rte 1	Rte 6A	Rte 43	1.75	45	1	1230	570
78	Rte 4	Cherry St	City Line Rd	1.00	45	1	1490	690
79	Rte 4	City Line Rd	Rte 53	1.44	45	1	1490	690
81	Rte 4	Klocks Corner	NY 176	1.09	55	1	1300	600
83	Rte 4	Rte 29	Silk Rd	0.45	45	1	1550	720
87	Kocher Rd	Rte 1	US 104	0.86	45	1	1300	600
89	Rte 53	US 104	Rte 4	1.50	55	1	1230	570
90	Rte 53	Rte 4	Dutch Ridge	2.19	55	1	1230	570
91	Rte 53	Dutch Ridge	Rte 45	0.75	40	1	1230	570
92	Rte 53	Rte 45	Rte 57	2.50	55	1	1230	570
93	Creamery Rd	Rte 1	US 104	1.50	45	1	1060	490
94	Klocks Corner	US 104	Rte 4	2.01	55	1	1300	600
96	Lake View Rd	Lake Rd	Minor Rd	0.94	30	1	1060	490
97	Lake View Rd	Minor Rd	Rte 1	0.75	30	1	1060	490
98	NY 176	Rte 4	Whitmore Rd	0.45	55	1	1300	600
99	NY 176	Whitmore Rd	Rte 45	2.39	55	1	1300	600
100	NY 176	Rte 45	Rowlee Rd	1.75	55	1	1300	600
101	NY 176	Rowlee Rd	Howard Rd	0.88	55	1	1300	600
102	Lake Rd	Fitzpatrick	Rte 29	0.68	55	1	1180	550
103	Rte 29	Lake Rd	Minor Rd	1.19	45	1	1300	600
104	Rte 29	Minor Rd	Rte 1	0.69	45	1	1300	600
105	Rte 29	Rte 1	US 104	1.06	45	1	1300	600
106	Rte 29	US 104	Rte 51A	0.88	45	1	1360	630
107	Rte 29	Rte 51A	O'Conner Rd	2.06	25	1	1360	630
108	Silk Rd	Rte 4	MacDougal Rd	1.44	55	1	1410	650
109	Silk Rd	MacDougal Rd	Baldwin Rd	1.00	35	1	1410	650
110	Silk Rd	Baldwin Rd	Rowlee Rd	1.50	55	1	1410	650

ROADWAY LINK CHARACTERISTICS
(Continued)

Link Number	Link Description: Mainline	From	To	Link Length (Miles)	Speed Limit (Mph)	Number of Lanes Outbound	Capacity (PCE/Hour): Normal Weather	Adverse Weather
111	Silk Rd	Rowlee Rd	Howard Rd	1.13	55	1	1410	650
112	Silk Rd	Howard Rd	NY 3	1.31	55	1	1410	650
113	Nine Mile	Nine Mile Pt	Rte 1	1.88	30	1	1060	490
114	Shore Oaks Dr	Shore Oaks	Rte 1	1.40	30	1	1060	490
115	Rte 51	Rte 51A	Mud Lake Rd	0.88	50	1	1140	530
116	Rte 51	Mud Lake Rd	Rte 6	1.13	50	1	1140	530
117	Darrow Rd	Stone Rd	Rte 6	1.81	40	1	1060	490
118	Rte 6	Rte 51	Rte 4	1.63	55	1	1300	600
119	Rte 6	Rte 4	MacDougal Rd	1.06	55	1	1360	630
120	Rte 6	MacDougal Rd	Clifford Rd	1.00	55	1	1140	530
121	Rte 6	Rte 45	NY 3	2.50	55	1	1230	570
123	Rte 6	Rte 1	Rte 6A	0.38	45	1	1410	650
124	Rte 6A	Rte 1	Rte 6	0.38	45	1	1140	530
125	Rte 6	Rte 6A	NY 104B	0.81	55	1	1360	630
126	Rte 6	NY 104B	US 104	0.50	35	1	1060	490
127	Rte 6	US 104	Stone Rd	1.38	55	1	1200	560
129	Rte 6	Stone Rd	Rte 64	1.25	35	1	1200	560
130	Rte 6	Rte 64	Rte 51	0.94	55	1	1200	560
131	Rte 35	Rte 64	Johnson Rd	2.00	45	1	1300	600
132	Rte 35	Craw Rd	Rte 4	1.06	45	1	1300	600
133	Rte 35	Rte 4	Clifford Rd	1.38	45	1	1230	570
134	Rte 35	Clifford Rd	Rte 45	1.19	45	1	1230	570
135	US 104	NY 104B	Rte 6	0.81	35	1	1490	690
136	US 104	Rte 6	Rte 43	2.06	55	1	1550	720
137	US 104	Rte 43	Fravor Rd	1.44	55	1	1490	690
138	US 104	Fravor Rd	NY 3	0.50	30	1	1490	690
139	US 104	NY 3	NY 3	0.31	30	1	1490	690
140	US 104	NY 3	Rte 41	0.31	30	1	1490	690
141	US 104	Rte 41	Rte 58	0.38	30	1	1410	650
142	US 104	Rte 58	Smither Rd	1.38	55	1	1300	600
143	US 104	Smithers Rd	Fraser Rd	0.56	55	1	1300	600
145	Fravor Rd	Potter Rd	US 104	2.33	30	1	1140	530
146	NY 3	US 104	Hanson	2.88	55	1	1600	740
147	NY 3	Hanson	Rte 4	1.63	55	1	1600	740
148	NY 3	Rte 4	Clifford Rd	1.50	55	1	1600	740
149	NY 3	Clifford Rd	Rte 45	1.06	55	1	1600	740
153	Fort Le. Rd	Countryman	Dewey Dr	0.69	45	1	1140	530
154	Dewey Dr	Fort Le. Rd	Pulaski Rd	0.38	45	1	1140	530
155	Newcomb Rd	Pulaski Rd	Rte 41	0.81	45	1	1140	530
156	Smithers Rd	Rte 41	US 104	0.94	45	1	1140	530
157	NY 176	Howard Rd	Fulton Limits	1.75	55	1	1300	600
158	Rte 8	Honey Hill	NY 3	1.00	55	1	1260	590
159	Rte 29	O'Conner Rd	Rte 4	0.56	45	1	1360	630
160	Rte 1	Catfish Dr	Hickory Grove	0.50	30	1	1140	530
161	Rte 6	Clifford Rd	Rte 45	0.63	35	1	1140	530
162	Rte 35	Johnson Rd	Craw Rd	0.13	25	1	1300	600

APPENDIX E

METHODOLOGY TO CALCULATE EVACUATION CAPACITIES

APPENDIX E

METHODOLOGY TO CALCULATE EVACUATION CAPACITIES

Two-Lane, Two-Way Roadways

Table 10.7 of the Highway Capacity Manual shows the maximum service volume under ideal conditions for passenger cars traveling in both directions on a two-lane highway as 2,000 vehicles per hour (vph). When modified to represent a one-lane outbound flow (as described below), this value represents the upper-bound base evacuation capacity for normal weather conditions for two-lane, two-way roadways.

The base evacuation capacity for this type of roadway for normal weather conditions was further reduced by a factor of 0.58 to obtain the lower-bound base evacuation capacity at Level of Service D. This factor, which is also shown in Table 10.7, represents a restricted average highway speed of 40 miles per hour with no restraint created by limited passing sight distance for traffic flow at Level of Service D.

It was anticipated that during an evacuation, the traffic demand would approximate 90 percent in the direction of outbound movements. In the interest of providing a conservative yet realistic capacity estimate, 80 percent of the capacity was assigned to the outbound flow.

Thus, from the above considerations, the base evacuation capacities at Levels of Service D and E were computed as follows:

LOS_D Base Evacuation Capacity = 2000 x 0.58 x 0.80 = 928 vph
LOS_E Base Evacuation Capacity = 2000 x 1.00 x 0.80 = 1,600 vph

Each segment of the evacuation roadway network has individual characteristics which further reduce that segment's ability to meet the demand volume. From Table 10.8 of the Highway Capacity Manual, values for these effects (referred to herein as the "W" factor) were applied to the base evacuation capacities to derive the segment's actual evacuation capacity. For example, for a segment with two 12-foot-wide travel lanes and no shoulders, the base 928 capacity was multiplied by a factor of W = 0.88 to produce a capacity for the segment of 817 vehicles per hour at Level of Service D. This value was further reduced by a factor of 20 percent to obtain an evacuation capacity of 654 vph for adverse weather estimates.

Thus, from the above derivation, the Level of Service D and E capacities for evacuation traffic were computed as shown below:

Two-Lane, Two-Way Roadways (Normal Weather)
LOS_D Evacuation Capacity = 928 x W
LOS_E Evacuation Capacity = 1,600 x W

where W is the factor from Table 10.8.

Adverse weather capacities were obtained by multiplying Level of Service D capacities by a factor of 0.80.

Four-Lane Highways

Table 10.1 of the Highway Capacity Manual indicates a maximum service volume of 4,000 vehicles per hour as the ideally available capacity for each direction of travel on four-lane highways. This value represents the upper-bound outbound base evacuation capacity at Level of Service E.

The base evacuation capacity at Level of Service E was further modified by a factor of 0.70, which represents a restricted average highway speed of 50 miles per hour, to obtain lower-bound base evacuation capacity at Level of Service D. This factor was also extracted from Table 10.1.

Hence, the base evacuation capacities at Levels of Service D and E were computed as follows:

Four-Lane Undivided Highway

LOS_D Base Evacuation Capacity = 4,000 x 0.7 = 2,800 vph
LOS_E Base Evacuation Capacity = 4,000 x 1.0 = 4,000 vph

The only "W" factor applied to these base capacities was taken from Table 10.2, which recognizes both lane width and lateral clearance impacts on the capacity. This factor also includes a small allowance to compensate for opposing traffic left turns.

Therefore, the calculations for evacuation capacities were:

Four-Lane Highway (Normal Weather)

LOS_D Evacuation Capacity = 2,800 x W
LOS_E Evacuation Capacity = 4,000 x W

where W is the factor from Table 10.2.

Adverse weather capacities were obtained by multiplying Level of Service D capacities by a factor of 0.80.

No other normally applied factor was used to decrement the capacity, because it was assumed that the influence of an emergency evacuation will tend to create a condition of mass usage in a single direction, which will effectively mask other considerations.

TABLE 10.8—COMBINED EFFECT OF LANE WIDTH AND RESTRICTED LATERAL CLEARANCE ON CAPACITY AND SERVICE VOLUMES OF TWO-LANE HIGHWAYS WITH UNINTERRUPTED FLOW

DISTANCE FROM TRAFFIC LANE EDGE TO OBSTRUCTION (FT)	ADJUSTMENT FACTORS W_L AND W_c FOR LATERAL CLEARANCE AND LANE WIDTH[a]															
	OBSTRUCTION ON ONE SIDE ONLY[b]								OBSTRUCTIONS ON BOTH SIDES[b]							
	12-FT LANES		11-FT LANES		10-FT LANES		9-FT LANES		12-FT LANES		11-FT LANES		10-FT LANES		9-FT LANES	
	LEVEL B	LEVEL E[c]	LEVEL B	LEVEL E[c]	LEVEL B	LEVEL E[c]	LEVEL B	LEVEL E[c]	LEVEL B	LEVEL E[c]	LEVEL B	LEVEL E[c]	LEVEL B	LEVEL E[c]	LEVEL B	LEVEL E[c]
6	1.00	1.00	0.86	0.88	0.77	0.81	0.70	0.76	1.00	1.00	0.86	0.88	0.77	0.81	0.70	0.76
4	0.96	0.97	0.83	0.85	0.74	0.79	0.68	0.74	0.92	0.94	0.79	0.83	0.71	0.76	0.65	0.71
2	0.91	0.93	0.78	0.81	0.70	0.75	0.64	0.70	0.81	0.85	0.70	0.75	0.63	0.69	0.57	0.65
0	0.85	0.88	0.73	0.77	0.66	0.71	0.60	0.66	0.70	0.76	0.60	0.67	0.54	0.62	0.49	0.58

[a] Adjustment W_c given for level E, capacity, and W_L for level B; interpolate for others.
[b] Includes allowance for opposing traffic.
[c] Capacity.

This table was extracted from the <u>Highway Capacity Manual</u>

TABLE 10.2—COMBINED EFFECT OF LANE WIDTH AND RESTRICTED LATERAL CLEARANCE ON CAPACITY AND SERVICE VOLUME OF UNDIVIDED MULTILANE HIGHWAYS WITH UNINTERRUPTED FLOW

DISTANCE FROM TRAFFIC LANE EDGE TO OBSTRUCTION (FT)	ADJUSTMENT FACTOR,[a] W, FOR LATERAL CLEARANCE AND LANE WIDTH							
	OBSTRUCTION ON RIGHT SIDE ONLY, OF ONE-DIRECTION TRAVELED WAY (INCLUDES ALLOWANCE FOR OPPOSING TRAFFIC ON LEFT)				OBSTRUCTIONS ON BOTH SIDES OF ONE-DIRECTION TRAVELED WAY[b,c]			
	12-FT LANES	11-FT LANES	10-FT LANES	9-FT LANES	12-FT LANES	11-FT LANES	10-FT LANES	9-FT LANES
(a) 4-LANE UNDIVIDED HIGHWAY, ONE DIRECTION OF TRAVEL								
6	1.00	0.95	0.89	0.77	N.A.	N.A.	N.A.	N.A.
4	0.98	0.94	0.88	0.76	N.A.	N.A.	N.A.	N.A.
2	0.95	0.92	0.86	0.75	0.94	0.91	0.86	N.A.
0	0.88	0.85	0.80	0.70	0.81	0.79	0.74	0.66
(b) 6-LANE UNDIVIDED HIGHWAY, ONE DIRECTION OF TRAVEL								
6	1.00	0.95	0.89	0.77	N.A.	N.A.	N.A.	N.A.
4	0.99	0.94	0.88	0.76	N.A.	N.A.	N.A.	N.A.
2	0.97	0.93	0.86	0.75	0.96	0.92	0.85	N.A.
0	0.94	0.90	0.83	0.72	0.91	0.87	0.81	0.70
(c) DIVIDED HIGHWAYS, ONE DIRECTION OF TRAVEL								
Use adjustment factors from Table 9.2								

[a] Same adjustments for capacity and all levels of service.
[b] Appropriate for use only where normally undivided roadway is temporarily separated into two roadways by obstructions such as centerline barrier, bridge structural elements, piers, and the like, which are closer than would be the opposing traffic.
[c] N.A. = Not applicable; use adjustment for obstruction on right side only. (In these cases, clearance is temporarily greater than the usual separation from opposing traffic, but adjustment for this temporary improvement is not feasible).

This table was extracted from the <u>Highway Capacity Manual</u>

APPENDIX F

EVACUATION TRAVEL TIMES

BY EMERGENCY RESPONSE PLANNING AREAS

APPENDIX F

EVACUATION TRAVEL TIMES

BY EMERGENCY RESPONSE PLANNING AREAS

This Appendix includes evacuation travel time estimates by ERPA for a simultaneous full-EPZ evacuation. Evacuation travel time estimates are presented for the following scenarios, weather conditions, and population groups:

Scenarios

School-in-Session
School-not-in-Session
Weekend/Holiday Summer
Weekend/Holiday Winter
Evening
Nighttime
School-in-Session with Temporary Construction Workforce

Weather Conditions

Normal
Adverse

Population Groups

Resident Population with Autos
Resident Population without Autos
Special Facilities Population
Transient Population

A total of 16 tables are included in this Appendix. Table F-1 is a "summary" table that indicates evacuation travel times for all scenarios under normal weather conditions. Similarly, Table F-2 shows evacuation travel times for all scenarios under adverse weather conditions. Tables F-3 through F-16 each show evacuation travel times for a particular scenario under a particular weather condition.

Table F-3

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
SCHOOL-IN-SESSION SCENARIO
NORMAL WEATHER

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	1:40 – 2:30	1:20 – 2:20	–	1:40 – 2:00
2	1:10 – 2:20	1:20 – 2:30	–	1:10 – 2:20
3	1:40 – 2:30	1:20 – 1:30	–	–
4	1:00 – 2:20	1:30 – 2:50	1:30 – 2:30	1:00 – 2:20
5	1:40 – 2:30	1:20 – 2:20	–	1:40 – 2:20
6	3:50 – 6:10	4:20 – 6:40	–	3:50 – 6:10
7	1:00 – 2:10	1:20 – 2:40	–	1:00 – 2:10
8	0:50 – 2:00	1:10 – 2:20	–	0:50 – 2:00
9	0:50 – 1:50	1:20 – 2:20	–	0:50 – 1:50
10	1:40 – 2:20	1:50 – 2:40	–	1:40 – 2:20
11	3:50 – 6:10	4:10 – 6:30	–	3:50 – 6:10
12	3:50 – 6:20	6:20 – 8:40	4:10 – 6:30	3:50 – 6:20
13	4:40 – 7:50	6:40 – 9:00	4:00 – 5:00	4:40 – 7:50
14	0:40 – 2:10	3:40 – 5:20	–	1:00 – 2:20
15	0:50 – 2:10	3:40 – 5:30	–	0:50 – 2:10
16	0:40 – 2:00	3:50 – 5:30	0:50 – 2:10	0:40 – 3:00
17	0:50 – 1:50	3:40 – 5:30	1:00 – 1:10	0:50 – 1:00
18	0:40 – 1:40	3:40 – 5:20	–	0:40 – 1:40
19	3:50 – 6:10	5:30 – 7:30	–	3:10 – 5:10
20	3:40 – 6:00	5:30 – 7:30	–	3:40 – 6:00
21	2:30 – 4:00	6:20 – 8:40	2:50 – 4:20	2:30 – 4:00
22	4:40 – 7:50	6:20 – 8:50	5:00 – 8:00	4:40 – 7:50
All ERPAs	4:40 – 7:50	6:40 – 9:00	5:00 – 8:00	4:40 – 7:50

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
  (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
  (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
  (c) An informed and cooperative public follow directions as instructed.

  Upper bound evacuation travel times (longer times) are representative of a situation where:
  (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
  (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
  (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
  (a) resident population (with and without automobiles);
  (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
  (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-4

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
SCHOOL-IN-SESSION SCENARIO
ADVERSE WEATHER

ERPA	Resident Population: With Autos	Resident Population: Without Autos	Special Facilities	Transients
1	2:50	2:40	—	2:50
2	2:50	2:50	—	2:50
3	3:00	1:40	—	—
4	2:40	3:10	2:40	2:40
5	2:50	2:40	—	2:50
6	7:40	8:00	—	7:40
7	2:30	3:00	—	2:30
8	2:30	2:40	—	2:30
9	2:10	2:40	—	2:10
10	2:50	3:10	—	2:50
11	7:40	7:50	—	7:40
12	7:40	10:20	7:50	7:40
13	9:40	10:40	6:00	9:40
14	2:30	6:10	—	2:40
15	2:30	6:20	—	2:30
16	2:20	6:30	2:30	2:20
17	2:20	6:20	2:00	1:50
18	2:00	6:10	—	2:00
19	7:30	8:50	—	6:20
20	7:30	8:50	—	7:30
21	5:00	10:20	5:10	5:00
22	9:40	10:30	9:50	9:40
All ERPAs	9:40	10:40	9:50	9:40

Notes:

(1) The evacuation travel time estimates presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel times are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:

(a) resident population (with and without automobiles);

(b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);

(c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicate that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-5

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
SCHOOL-NOT-IN-SESSION SCENARIO
NORMAL WEATHER

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	2:20 – 3:30	1:20 – 2:20	–	2:30 – 3:40
2	2:20 – 3:30	1:20 – 1:30	–	2:20 – 3:30
3	1:40 – 2:30	1:20 – 1:30	–	–
4	2:10 – 3:20	2:40 – 3:50	1:30 – 2:20	2:10 – 3:20
5	1:40 – 2:30	1:20 – 2:20	–	1:40 – 2:20
6	3:50 – 6:20	4:20 – 6:40	–	3:50 – 6:20
7	2:10 – 3:20	1:10 – 2:10	–	2:10 – 3:20
8	0:50 – 1:50	1:10 – 2:00	–	0:50 – 1:50
9	0:50 – 1:50	1:20 – 2:20	–	0:50 – 1:50
10	1:40 – 2:20	1:50 – 2:40	–	1:40 – 2:20
11	3:50 – 6:10	4:10 – 6:30	–	3:50 – 6:10
12	4:00 – 6:20	4:00 – 6:20	3:40 – 5:40	4:00 – 6:20
13	3:40 – 6:10	4:00 – 6:30	3:10 – 4:40	3:40 – 6:10
14	2:00 – 3:10	2:30 – 3:30	–	2:20 – 3:30
15	2:00 – 3:10	1:10 – 2:10	–	2:20 – 3:30
16	0:40 – 1:30	1:20 – 2:20	–	0:40 – 1:30
17	0:40 – 1:30	1:10 – 2:00	–	0:40 – 0:50
18	0:40 – 1:40	1:10 – 1:50	–	0:40 – 1:40
19	3:50 – 6:10	4:00 – 6:30	–	3:10 – 6:10
20	3:40 – 6:10	4:00 – 6:10	–	3:40 – 6:10
21	2:20 – 3:50	2:40 – 4:10	–	2:20 – 3:50
22	3:40 – 6:00	4:00 – 6:20	4:00 – 6:20	3:40 – 6:00
All ERPAs	4:00 – 6:20	4:20 – 6:40	4:00 – 6:20	4:00 – 6:20

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
- (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
- (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
- (c) An informed and cooperative public follow directions as instructed.

Upper bound evacuation travel times (longer times) are representative of a situation where:
- (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
- (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
- (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
- (a) resident population (with and without automobiles);
- (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
- (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-6

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
SCHOOL-NOT-IN-SESSION SCENARIO
ADVERSE WEATHER

	Resident Population			
ERPA	With Autos	Without Autos	Special Facilities	Transients
1	4:10	2:30	–	4:20
2	4:10	1:40	–	4:10
3	3:00	1:40	–	–
4	4:00	4:30	2:40	4:00
5	2:50	2:30	–	2:50
6	7:40	8:10	–	7:40
7	4:00	2:30	–	4:00
8	2:00	2:20	–	2:00
9	2:00	2:40	–	2:00
10	2:50	3:10	–	2:50
11	7:40	7:50	–	7:40
12	7:40	7:50	6:50	7:40
13	7:30	7:50	5:30	7:30
14	3:50	4:00	–	4:10
15	3:50	2:30	–	3:50
16	1:50	2:30	–	1:50
17	1:40	2:10	–	1:00
18	2:00	2:10	–	2:00
19	7:40	7:50	–	6:20
20	7:30	7:30	–	7:30
21	4:30	5:00	–	4:30
22	7:30	7:40	7:40	7:30
All ERPAs	7:40	8:10	7:40	7:40

Notes:

(1) The evacuation travel time estimates presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel times are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:
   (a) resident population (with and without automobiles);
   (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
   (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicate that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-7

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
WEEKEND/HOLIDAY SUMMER SCENARIO
NORMAL WEATHER

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	2:10 – 3:10	1:20 – 1:30	–	2:20 – 3:10
2	2:10 – 3:10	1:20 – 1:30	–	–
3	1:00 – 1:50	1:30 – 2:20	–	–
4	2:00 – 3:00	2:30 – 3:30	1:30 – 1:40	–
5	1:00 – 1:50	1:20 – 2:20	–	0:50 – 1:00
6	2:30 – 3:50	2:50 – 4:20	–	1:00 – 1:50
7	2:00 – 3:00	1:10 – 1:20	–	–
8	0:50 – 1:00	1:00 – 1:10	–	–
9	0:50 – 1:00	1:20 – 1:30	–	–
10	0:50 – 1:50	1:10 – 2:10	–	–
11	2:30 – 3:50	2:40 – 4:00	–	2:30 – 4:00
12	2:30 – 3:50	2:40 – 4:00	2:50 – 4:20	2:30 – 3:50
13	1:50 – 2:50	2:10 – 3:10	2:20 – 3:20	1:50 – 2:50
14	1:50 – 2:50	2:20 – 3:10	–	2:10 – 3:10
15	1:50 – 3:00	1:10 – 1:20	–	2:10 – 3:10
16	0:40 – 0:50	1:10 – 1:20	–	–
17	0:40 – 0:50	1:00 – 1:10	–	–
18	0:40 – 0:50	1:00 – 1:10	–	–
19	2:20 – 3:50	2:40 – 4:00	–	–
20	2:20 – 3:40	2:50 – 4:10	–	–
21	1:40 – 2:20	2:00 – 2:50	–	–
22	1:50 – 2:50	2:10 – 3:00	–	1:50 – 2:50
All ERPAs	2:30 – 3:50	2:50 – 4:20	2:50 – 4:20	2:30 – 4:00

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
- (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
- (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
- (c) An informed and cooperative public follow directions as instructed.

Upper bound evacuation travel times (longer times) are representative of a situation where:
- (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
- (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
- (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
- (a) resident population (with and without automobiles);
- (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
- (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-8

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
WEEKEND/HOLIDAY SUMMER SCENARIO
ADVERSE WEATHER

ERPA	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
1	3:50	2:10	—	4:00
2	3:50	1:40	—	—
3	2:10	2:40	—	—
4	3:40	4:10	2:20	—
5	2:10	2:40	—	1:10
6	4:40	5:00	—	2:10
7	3:40	2:10	—	—
8	1:40	1:20	—	—
9	1:40	2:10	—	—
10	2:10	2:20	—	—
11	4:40	4:50	—	4:30
12	4:40	4:50	5:00	4:40
13	3:30	3:50	3:50	3:30
14	3:30	3:40	—	3:40
15	3:30	2:20	—	3:50
16	1:30	2:20	—	—
17	1:30	1:20	—	—
18	1:30	1:20	—	—
19	4:30	4:40	—	—
20	4:30	5:00	—	—
21	2:50	3:10	—	—
22	3:20	3:40	—	3:20
All ERPAs	4:40	5:00	5:00	4:40

Notes:

(1) The evacuation travel time estimates presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel times are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:

(a) resident population (with and without automobiles);

(b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);

(c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicate that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-9

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
WEEKEND/HOLIDAY WINTER SCENARIO
NORMAL WEATHER

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	1:00 – 1:50	1:20 – 2:10	–	1:00 – 1:10
2	1:00 – 1:10	1:20 – 1:30	–	–
3	1:00 – 1:50	1:30 – 2:20	–	–
4	1:00 – 1:10	1:30 – 1:40	1:30 – 1:40	–
5	1:00 – 1:50	1:20 – 2:20	–	0:50 – 1:00
6	2:20 – 3:40	2:50 – 4:10	–	1:00 – 1:50
7	0:50 – 1:00	1:10 – 1:20	–	–
8	0:40 – 1:00	1:00 – 1:10	–	–
9	0:50 – 1:00	1:20 – 1:30	–	–
10	0:50 – 1:50	1:10 – 2:10	–	–
11	2:20 – 3:40	2:40 – 4:00	–	2:20 – 3:40
12	2:30 – 3:50	2:40 – 4:00	2:50 – 4:10	2:30 – 3:50
13	1:50 – 2:50	2:10 – 3:00	2:20 – 3:20	1:40 – 2:50
14	0:30 – 0:40	1:00 – 1:10	–	0:40 – 0:50
15	0:50 – 1:00	1:10 – 1:20	–	0:50 – 1:00
16	0:40 – 0:50	1:10 – 1:20	–	–
17	0:40 – 0:50	1:00 – 1:10	–	–
18	0:40 – 0:50	1:00 – 1:10	–	–
19	2:20 – 3:40	2:40 – 3:50	–	–
20	2:20 – 3:30	2:50 – 4:10	–	–
21	1:40 – 2:20	2:00 – 2:50	–	–
22	1:50 – 2:40	2:10 – 3:00	2:00 – 3:00	2:00 – 2:40
All ERPAs	2:30 – 3:50	2:50 – 4:10	2:50 – 4:10	2:30 – 3:50

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
- (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
- (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
- (c) An informed and cooperative public follow directions as instructed.

Upper bound evacuation travel times (longer times) are representative of a situation where:
- (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
- (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
- (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
- (a) resident population (with and without automobiles);
- (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
- (c) transients (employees, visitors to parks, resident and dav camps, hotels, and motels).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-10

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
WEEKEND/HOLIDAY WINTER SCENARIO
ADVERSE WEATHER

ERPA	Resident Population With Autos	Resident Population Without Autos	Special Facilities	Transients
1	2:10	2:30	–	1:20
2	1:20	1:40	–	–
3	2:10	2:40	2:20	–
4	1:50	2:20	–	–
5	2:10	2:40	–	1:10
6	4:30	5:00	–	2:10
7	1:40	2:10	–	–
8	1:40	1:20	–	–
9	1:40	2:10	–	–
10	2:10	2:20	–	–
11	4:30	4:40	–	4:30
12	4:30	4:40	5:00	4:30
13	3:20	3:40	3:50	3:20
14	0:50	1:20	–	1:00
15	1:40	2:20	–	1:10
16	1:30	2:20	–	–
17	1:30	1:20	–	–
18	1:30	1:20	–	–
19	4:20	4:30	–	–
20	4:20	5:00	–	–
21	2:50	3:10	–	–
22	3:20	3:30	3:30	3:20
All ERPAs	4:30	5:00	5:00	4:30

Notes:

(1) The evacuation travel time estimates presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel times are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:
- (a) resident population (with and without automobiles);
- (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
- (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicate that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-11

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
EVENING SCENARIO
NORMAL WEATHER

ERPA	Resident Population With Autos From – To	Resident Population Without Autos From – To	Special Facilities From – To	Transients From – To
1	1:10 – 2:10	1:20 – 2:30	–	1:20 – 2:20
2	1:10 – 2:10	1:20 – 2:30	–	–
3	1:00 – 1:50	1:30 – 2:20	–	–
4	1:00 – 1:10	1:30 – 2:40	1:30 – 1:40	–
5	1:00 – 1:50	1:20 – 2:20	–	0:50 – 1:00
6	2:20 – 3:40	2:50 – 4:00	–	1:00 – 1:50
7	0:50 – 2:00	1:10 – 2:20	–	–
8	0:50 – 1:00	1:00 – 1:10	–	–
9	0:50 – 1:00	1:20 – 1:30	–	–
10	0:50 – 1:50	1:20 – 2:10	–	–
11	2:20 – 3:40	2:30 – 3:50	–	2:20 – 3:40
12	2:20 – 3:40	2:30 – 3:50	2:50 – 4:00	2:20 – 3:40
13	2:50 – 4:40	3:10 – 5:00	2:20 – 3:10	2:50 – 4:40
14	0:40 – 2:00	1:10 – 2:20	–	0:50 – 2:10
15	0:50 – 2:00	1:10 – 2:30	–	1:00 – 2:10
16	0:40 – 0:50	1:10 – 1:20	–	–
17	0:40 – 0:50	1:00 – 1:10	–	–
18	0:40 – 0:50	1:00 – 1:10	–	–
19	2:20 – 3:30	2:40 – 3:50	–	–
20	2:10 – 3:30	2:50 – 4:00	–	–
21	1:30 – 2:20	2:00 – 2:40	–	–
22	2:50 – 4:40	3:10 – 4:50	3:00 – 4:50	2:50 – 4:40
All ERPAs	2:50 – 4:40	3:10 – 5:00	3:00 – 4:50	2:50 – 4:40

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
- (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
- (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
- (c) An informed and cooperative public follow directions as instructed.

Upper bound evacuation travel times (longer times) are representative of a situation where:
- (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
- (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
- (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
- (a) resident population (with and without automobiles);
- (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
- (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-12

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
EVENING SCENARIO
ADVERSE WEATHER

ERPA	Resident Population With Autos	Resident Population Without Autos	Special Facilities	Transients
1	2:30	2:50	–	2:40
2	2:30	2:50	–	–
3	2:10	2:40	–	–
4	2:30	3:00	2:20	–
5	2:10	2:40	–	1:10
6	4:20	4:50	–	2:10
7	2:20	2:40	–	–
8	1:40	1:20	–	–
9	1:40	2:10	–	–
10	2:10	2:20	–	–
11	4:20	4:30	–	4:20
12	4:20	4:30	4:50	4:20
13	5:40	6:00	3:40	5:40
14	2:20	2:40	–	2:30
15	2:20	2:50	–	2:30
16	1:30	2:20	–	–
17	1:30	1:20	–	–
18	1:30	1:20	–	–
19	4:20	4:30	–	–
20	4:10	4:50	–	–
21	2:50	3:10	–	–
22	5:40	5:00	5:50	4:40
All ERPAs	5:40	6:00	5:50	5:40

Notes:

(1) The evacuation travel time estimates presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel times are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:
- (a) resident population (with and without automobiles);
- (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
- (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicate that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-13

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
NIGHTTIME SCENARIO
NORMAL WEATHER

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	1:10 – 2:10	1:20 – 2:20	–	1:20 – 2:20
2	1:10 – 2:10	1:20 – 2:20	–	–
3	1:00 – 1:50	1:30 – 2:20	–	–
4	1:00 – 2:10	1:30 – 2:40	1:30 – 1:40	–
5	1:00 – 1:50	1:20 – 2:20	–	0:50 – 1:00
6	2:30 – 3:40	2:50 – 4:00	–	1:00 – 1:50
7	0:50 – 2:00	1:10 – 2:20	–	–
8	0:50 – 1:00	1:00 – 1:10	–	–
9	0:50 – 1:00	1:20 – 1:30	–	–
10	0:50 – 1:50	1:10 – 2:10	–	–
11	2:20 – 3:40	2:30 – 3:50	–	2:20 – 3:40
12	2:20 – 3:40	2:30 – 3:50	2:50 – 4:00	2:20 – 3:40
13	2:20 – 3:50	2:50 – 4:10	2:20 – 3:10	2:20 – 3:50
14	0:40 – 2:00	1:10 – 2:20	–	0:50 – 2:10
15	0:50 – 2:00	1:10 – 2:30	–	1:00 – 2:10
16	0:40 – 0:50	1:10 – 1:20	–	–
17	0:40 – 0:50	1:00 – 1:10	–	–
18	0:40 – 0:50	1:00 – 1:10	–	–
19	2:20 – 3:30	2:40 – 3:50	–	–
20	2:10 – 3:30	2:50 – 4:00	–	–
21	0:40 – 2:20	2:00 – 2:40	–	–
22	2:20 – 3:50	2:40 – 4:10	2:40 – 4:00	2:20 – 3:50
All ERPAs	2:20 – 3:50	2:50 – 4:10	2:50 – 4:00	2:20 – 3:50

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
  (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
  (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
  (c) An informed and cooperative public follow directions as instructed.

  Upper bound evacuation travel times (longer times) are representative of a situation where:
  (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
  (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
  (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
  (a) resident population (with and without automobiles);
  (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
  (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-14

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
NIGHTTIME SCENARIO
ADVERSE WEATHER

ERPA	Resident Population With Autos	Resident Population Without Autos	Special Facilities	Transients
1	2:30	2:40	–	2:40
2	2:30	2:40	–	–
3	2:10	2:40	–	–
4	2:30	3:00	2:20	–
5	2:10	2:40	–	1:10
6	4:20	4:50	–	2:10
7	2:20	2:40	–	–
8	1:40	1:20	–	–
9	1:40	2:10	–	–
10	2:10	2:20	–	–
11	4:20	4:30	–	4:20
12	4:20	4:30	4:50	4:20
13	4:40	5:00	3:40	4:40
14	2:20	2:40	–	2:30
15	2:20	2:50	–	2:30
16	1:30	2:20	–	–
17	1:30	1:20	–	–
18	1:30	1:20	–	–
19	4:20	4:30	–	–
20	4:10	4:40	–	–
21	2:50	3:10	–	–
22	4:40	5:00	4:50	4:40
All ERPAs	4:40	5:00	4:50	4:40

Notes:

(1) The evacuation travel time estimates presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel times are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:

(a) resident population (with and without automobiles);

(b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);

(c) transients (employees, visitors to parks, resident and day camps, hotels, and motels).

(5) Gaps in this Table indicate that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA in a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-15

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
SCHOOL-IN-SESSION SCENARIO WITH TEMPORARY CONSTRUCTION WORKFORCE
NORMAL WEATHER

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	2:30 – 3:50	1:20 – 2:20	–	3:30 – 4:50
2	2:20 – 3:40	2:30 – 3:40	–	2:20 – 3:40
3	2:10 – 3:30	2:40 – 3:50	–	–
4	2:20 – 2:30	2:50 – 4:10	1:30 – 2:30	2:20 – 3:30
5	2:10 – 3:20	2:40 – 3:50	–	2:10 – 3:10
6	4:00 – 6:30	4:30 – 6:50	–	4:00 – 6:30
7	2:20 – 3:30	1:20 – 2:40	–	2:20 – 3:30
8	0:50 – 2:10	1:10 – 2:20	–	0:50 – 2:10
9	0:50 – 1:50	1:20 – 2:20	–	0:50 – 1:50
10	2:10 – 3:20	2:20 – 3:30	–	2:10 – 3:20
11	4:00 – 6:30	4:10 – 6:40	–	4:00 – 6:30
12	4:00 – 6:30	6:30 – 8:50	4:10 – 6:40	4:00 – 6:30
13	4:50 – 8:10	6:50 – 8:40	3:10 – 5:10	4:50 – 8:10
14	2:10 – 3:20	3:40 – 5:20	–	2:30 – 3:40
15	2:10 – 3:30	3:50 – 5:30	–	2:10 – 3:30
16	0:40 – 2:00	3:50 – 5:40	0:50 – 1:00	0:40 – 2:00
17	0:50 – 2:00	3:40 – 5:40	1:00 – 1:10	0:50 – 1:00
18	0:40 – 1:40	3:40 – 5:20	–	0:40 – 1:40
19	4:00 – 6:20	5:40 – 7:40	–	3:20 – 5:30
20	3:50 – 6:20	5:40 – 7:40	–	3:20 – 6:20
21	2:40 – 4:20	6:30 – 9:00	2:50 – 4:30	2:40 – 4:20
22	4:50 – 8:00	6:30 – 9:10	5:10 – 8:20	4:50 – 8:00
All ERPAs	4:50 – 8:10	6:50 – 9:10	5:10 – 8:20	4:50 – 8:10

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
- (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
- (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
- (c) An informed and cooperative public follow directions as instructed.

Upper bound evacuation travel times (longer times) are representative of a situation where:
- (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
- (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
- (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
- (a) resident population (with and without automobiles);
- (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
- (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels, and temporary construction workers and their families).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA is a staged evacuation will not exceed the travel time range indicated in this Table.

Table F-16

EVACUATION TRAVEL TIME ESTIMATES BY ERPA
SCHOOL-IN-SESSION SCENARIO WITH TEMPORARY CONSTRUCTION WORKFORCE
ADVERSE WEATHER

ERPA	Resident Population With Autos	Resident Population Without Autos	Special Facilities	Transients
1	4:30	2:40	–	5:40
2	4:30	4:20	–	4:30
3	4:10	4:30	–	–
4	4:20	4:50	2:40	4:20
5	4:00	4:30	–	4:00
6	7:50	8:20	–	7:50
7	4:10	3:00	–	4:10
8	2:30	2:50	–	2:30
9	2:10	2:40	–	2:10
10	4:00	4:10	–	4:00
11	7:50	8:10	–	7:50
12	8:00	10:40	8:10	8:00
13	10:00	11:00	6:10	10:00
14	4:10	6:10	–	4:20
15	4:10	6:20	–	4:10
16	2:30	6:40	2:40	2:30
17	2:20	6:30	2:10	1:50
18	2:00	6:10	–	2:00
19	7:50	9:10	–	6:40
20	7:40	9:00	–	7:40
21	5:10	10:50	5:20	5:10
22	10:00	10:50	10:10	10:00
All ERPAs	10:00	11:00	10:10	10:00

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel time ranges are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:

(a) resident population (with and without automobiles);

(b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);

(c) transients (employees, visitors to parks, resident and day camps, hotels, and motels, and temporary construction workers and their families).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA is a staged evacuation will not exceed the travel time range indicated in this Table.

APPENDIX G

METHODOLOGY TO ESTIMATE ROADWAY TRAVEL TIMES DURING AN EVACUATION

APPENDIX G

METHODOLOGY TO ESTIMATE ROADWAY TRAVEL TIMES

DURING AN EVACUATION

A. Introduction

This Appendix describes the traffic engineering computer model used to estimate roadway travel times during an evacuation of the JAF/NMP EPZ. The model used in this study has also been applied to the Indian Point (New York), Three Mile Island (Pennsylvania), and Salem/Hope Creek (New Jersey and Delaware) Emergency Planning Zones. To evaluate the computer model used in the aforementioned studies, a separate analysis was conducted using a different model for the purpose of comparing results. The Indian Point EPZ was selected for the comparative study because of the diverse characteristics of its roadway network and population density.

As described later in this Appendix, the comparative study showed that both models provide quite similar estimates of evacuation travel time. Thus, it is concluded that the model used to estimate travel times for the JAF/NMP EPZ can be applied with a high degree of confidence.

The remaining sections of this Appendix discuss the traffic assignment process used for the JAF/NMP EPZ; present the detailed results of the comparative study; and summarize the conclusions drawn from the comparison of traffic models.

B. Static Traffic Assignment Process

1. Inputs

The static traffic assignment process developed to estimate roadway travel times during an evacuation requires three basic types of input. The first type relates to the characteristics of the evacuation roadway network, which is comprised of one-directional links, each having its own attributes. The links are described in terms of their capability to accommodate evacuating traffic (evacuation capacity), length, and free-flow speed (speed limit).

The second type of input required for this assignment process is zonal vehicle trip generation data. The EPZ is disaggregated into traffic zones, and the numbers of trips by each vehicle type (e.g., autos, buses, ambulances) are estimated in terms of passenger car equivalents (PCE's) for each traffic zone. Buses are weighted as the equivalent of two passenger cars in this analysis. In addition, a terminal time for all trip types for each traffic zone is input.

The third input type used in the static assignment process is evacuation path data. Evacuation routes are designated fixed paths extending from the traffic zones to the Sector boundary via specific roadways. Separate paths are developed for each trip type and are expressed in terms of connecting link numbers. Destinations (e.g., reception centers) are defined for each traffic zone and input for the purpose of determining the number of vehicles and

passengers expected at each destination. Average vehicle occupancies are used to estimate the number of passengers arriving in vehicles at the destination.

2. Static Assignment Algorithm

A computer program was written to process the above input data and compute roadway travel times for each trip type by traffic zone. A flow chart of the static traffic assignment computer program is included at the end of this Appendix.

Initially, the program calculates the total vehicular demand volume (in PCE's) on each link in the network by aggregating the vehicle trips generated by each traffic zone along the evacuation path. Implicit in this assignment is the assumption that all vehicles from all zones using a given evacuation route are on each link along the designated route concurrently. The assignment process is thus considered "static," because the spatial movement of vehicles across the network is not explicitly recognized as a function of time.

For each link in the network, three additional computations are performed. First, the free-flow travel time is calculated as the quotient of the link length and the free-flow speed. Second, the total vehicular demand volume is divided by the hourly evacuation capacity (for the appropriate weather condition) of the link to obtain the volume/capacity (V/C) relationship for the link. Finally, the evacuation speed or delay time is computed for each link, depending on whether the V/C ratio is less than or greater than 1.0, respectively. The formula contained in the Federal Highway Administration Traffic Assignment Manual, August 1973, was adopted and modified as follows for use in computing the speed at which evacuees will travel when capacity exceeds demand.

$$\text{Evacuation Speed} = \frac{\text{Free-Flow Speed}}{0.25\left[\frac{\text{Demand}}{\text{Capacity}}\right]^4 + 1} \quad (\text{for demand} < \text{capacity})$$

Following these calculations, the model computes the roadway travel time for each traffic zone's evacuation route (or routes since some buses and special vehicles had separate routes) by scanning the links comprising the evacuation route to determine the maximum V/C ratio along the route.

When the hourly evacuation capacity exceeds the total demand volume (V/C ratio less than 1.0) for all links along the route, the link evacuation speeds are used to compute link travel time, and the travel times for each link along the path are summed to obtain the traffic zone-to-Sector boundary roadway travel time for the route.

When the total demand volume exceeds the hourly evacuation capacity (V/C ratio greater than 1.0) along any link of a traffic zone's evacuation route, the roadway travel time is represented by the maximum link delay time incurred along the route. Link delay time is calculated as the volume/capacity ratio in hours for each link along the route. The link with the maximum V/C ratio is identified as the bottleneck link for the evacuation route for use in

future planning. Other links along the route where the V/C ratio exceeds 1.0 are also identified for planning purposes.

The roadway travel time as determined above is added to the terminal time and the free-flow travel time for each zone trip type to determine the total roadway evacuation travel time. The total roadway evacuation travel time resulting from this analysis represents the time for the last vehicle in the zone to clear the Sector.

3. Outputs

The computer program developed for the static assignment process provides five basic reports which are used in the evacuation planning process. The reports are described below:

a. Summary of link statistics: link number, description, length, free-flow speed and time, vehicular demand volume, evacuation capacity, and volume/capacity ratio.

b. Summary of traffic zone statistics: number of trips, evacuation route, destination, terminal time, free-flow travel time, roadway travel time, total evacuation time, and bottleneck link; for each trip type, sorted in ascending order by total evacuation time.

c. Summary of all bottleneck links and the traffic zones which are routed over them.

d. Summary of all destinations and the estimated number of vehicles (by type) and passengers assigned to each.

e. Distribution of the percent of the total population evacuated as a function of time.

C. Comparison of Static and Dynamic Traffic Assignment Processes

Because of the importance of the assignment process in the overall procedure to estimate evacuation travel times, it was decided to evaluate the static traffic assignment model used in the evacuation planning process. Travel times estimated by the static model were compared with times estimated by a state-of-the-art dynamic traffic assignment model.

The dynamic assignment model used in the comparative analysis is an offspring of the TRANSYT model* presently included in the Federal Highway Administration computer program batteries. The model employs principles of flow continuity and flow dynamics to move traffic on each link in the network towards its ultimate destination. Traffic flow representation changes with time to reflect changes in demand and roadway conditions. Traffic movement on each link in the network is constrained by roadway geometrics, control devices, and other vehicles present on the roadway.

*The dynamic evacuation model, named DYNEV, was provided by KLD Associates, Inc.

Various types of test routes were selected for this comparison and were located in Rockland and Westchester Counties in the Indian Point EPZ in New York State. Input requirements for both models were basically identical with one exception, which relates to the time varying nature of vehicles entering the evacuation network. The static assignment process assumed a concurrent loading of the entire network; the distribution over time of vehicle trips feeding the network was not addressed by the static model. However, because of the time dependent nature of the dynamic simulation model, it was possible to input trip generation data which varied with time at each load point in the network. This time-based distribution curve used in the comparison of assignment processes was provided by the New York State Office of Disaster Preparedness.

Separate comparative analyses and evaluations of the static and dynamic model results were made using Level of Service D and Level of Service E evacuation capacities. Table G-1 presents a comparison of the percent of total vehicles (in PCEs) evacuated for each route by time in the test network. The comparison was made between the static and dynamic assignment results when one or the other reached a time period when the total vehicles traveling the evacuation route had cleared the EPZ boundary. In all cases, the static assignment evacuation reached 100 percent completion either before or at the same time as the dynamic assignment evacuation. The percentages enclosed by parentheses in Table G-1 correspond to static and dynamic evacuation roadway travel times using Level of Service D capacities. Percentages without parentheses correspond to static and dynamic evacuation roadway travel times estimated using Level of Service E capacities.

Examination of Table G-1 shows a 97 percent correlation between the two assignment model results on an aggregate basis for the sample Indian Point roadway network east of the Hudson River in Westchester County. That is, at the time that the static assignment estimated complete evacuation of vehicles beyond the EPZ, the dynamic assignment estimated 97 percent of the vehicles would have cleared the EPZ. On the west side of the Hudson River near Indian Point, where both Levels of Service E and D were analyzed by both models, the two model results were 99 percent and 98 percent, respectively. Overall, for the entire test evacuation network, comparison of the static and dynamic assignment results at Level of Service E indicated a 99 percent correlation. In other words, when the static model estimated the network would be cleared (total vehicle evacuation), the dynamic model estimated 99 percent of the vehicles would have cleared the EPZ boundary. The dynamic assignment results indicated that complete evacuation of all vehicles beyond the EPZ boundary would occur 15 minutes later than the static assignment estimate at Level of Service E.

In addition to the evacuation times generated by each assignment technique, the location of bottlenecks by each methodology was compared. The critical bottleneck links identified by the static model were identified in the dynamic assignment results as well. The dynamic assignment produced the percent of vehicles stopped at each link during the evacuation. This statistic was used as a measure of the congestion level on each link. For the identified bottleneck links, the average percentage of stops as indicated by the dynamic model output was roughly 45 percent higher than on non-critical links, indicating that an increase in congestion was appropriately simulated by the static model on the critical links.

TABLE G-1

COMPARISON OF STATIC AND DYNAMIC ASSIGNMENT RESULTS.

Evacuation Route	Total Vehicles Using Evacuation Route	Traffic Assignment Methodology	Percent of Total Vehicles Evacuated During the Following Time Period* 0:45 1:00	1:45 2:00	2:00 2:15	2:15 2:30	2:30 2:45	2:45 3:00	3:00 3:15	3:15 3:30	3:30 3:45	3:45 4:00	4:15 4:30	4:30 4:45	5:30 5:45	5:45 6:00	6:00 6:15	6:15 6:30	7:15 7:30
East of River (Westchester County)																			
Route 6	4,360	Static	–	–	–	–	–	–	–	–	–	100	–	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	–	84	–	100	–	–	–	–	–
Route 120	5	Static	100	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Dynamic	33	–	–	100	–	–	–	–	–	–	–	–	–	–	–	–	–
Route 9A	8,690	Static	–	–	–	–	–	–	–	100	–	–	–	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	100	–	–	–	–	–	–	–	–	–
Taconic Parkway	5,155	Static	–	–	100	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		Dynamic	–	–	92	–	–	–	100	–	–	–	–	–	–	–	–	–	–
Amawalk Road	2,575	Static	–	–	–	–	–	100	–	–	–	–	–	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	89	–	100	–	–	–	–	–	–	–	–	–
Total East Routes	20,785	Static	–	–	–	–	–	–	–	–	–	100	–	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	–	97	–	100	–	–	–	–	–
West of River (Rockland County)																			
Palisades Parkway	8,655	Static	–	–	–	–	–	–	–	–	100	–	–	–	–	(100)	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	97	100	–	–	–	(97)	–	(100)	–
Route 9W	3,850	Static	–	–	–	–	–	–	–	–	–	–	100	–	–	–	–	(100)	–
		Dynamic	–	–	–	–	–	–	–	–	–	–	99	100	–	–	–	(87)	(100)
Route 303	3,310	Static	–	100	–	–	(100)	–	–	–	–	–	–	–	–	–	–	–	–
		Dynamic	–	98	–	–	(90)	100	(100)	–	–	–	–	–	–	–	–	–	–
Route 45	1,920	Static	–	–	–	100	–	–	–	–	(100)	–	–	–	–	–	–	–	–
		Dynamic	–	–	–	98	–	100	–	–	(100)	–	–	–	–	–	–	–	–
Little Tor Road	3,025	Static	–	–	–	–	–	–	–	–	100	–	–	–	(100)	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	99	100	–	–	(95)	–	(100)	–	–
Route 304	3,655	Static	–	–	–	100	–	–	–	–	–	(100)	–	–	–	–	–	–	–
		Dynamic	–	–	–	99	–	100	–	–	–	(100)	–	–	–	–	–	–	–
Total West Routes	24,415	Static	–	–	–	–	–	–	–	–	–	–	100	–	–	–	–	(100)	–
		Dynamic	–	–	–	–	–	–	–	–	–	–	99	100	–	–	–	(98)	(100)
Total Network Routes	45,200	Static	–	–	–	–	–	–	–	–	–	–	100	–	–	–	–	–	–
		Dynamic	–	–	–	–	–	–	–	–	–	–	99	100	–	–	–	–	–

* Note: Numbers enclosed by parentheses represent the percent of total vehicles along a route evacuated during the time period using Level of Service D capacities.

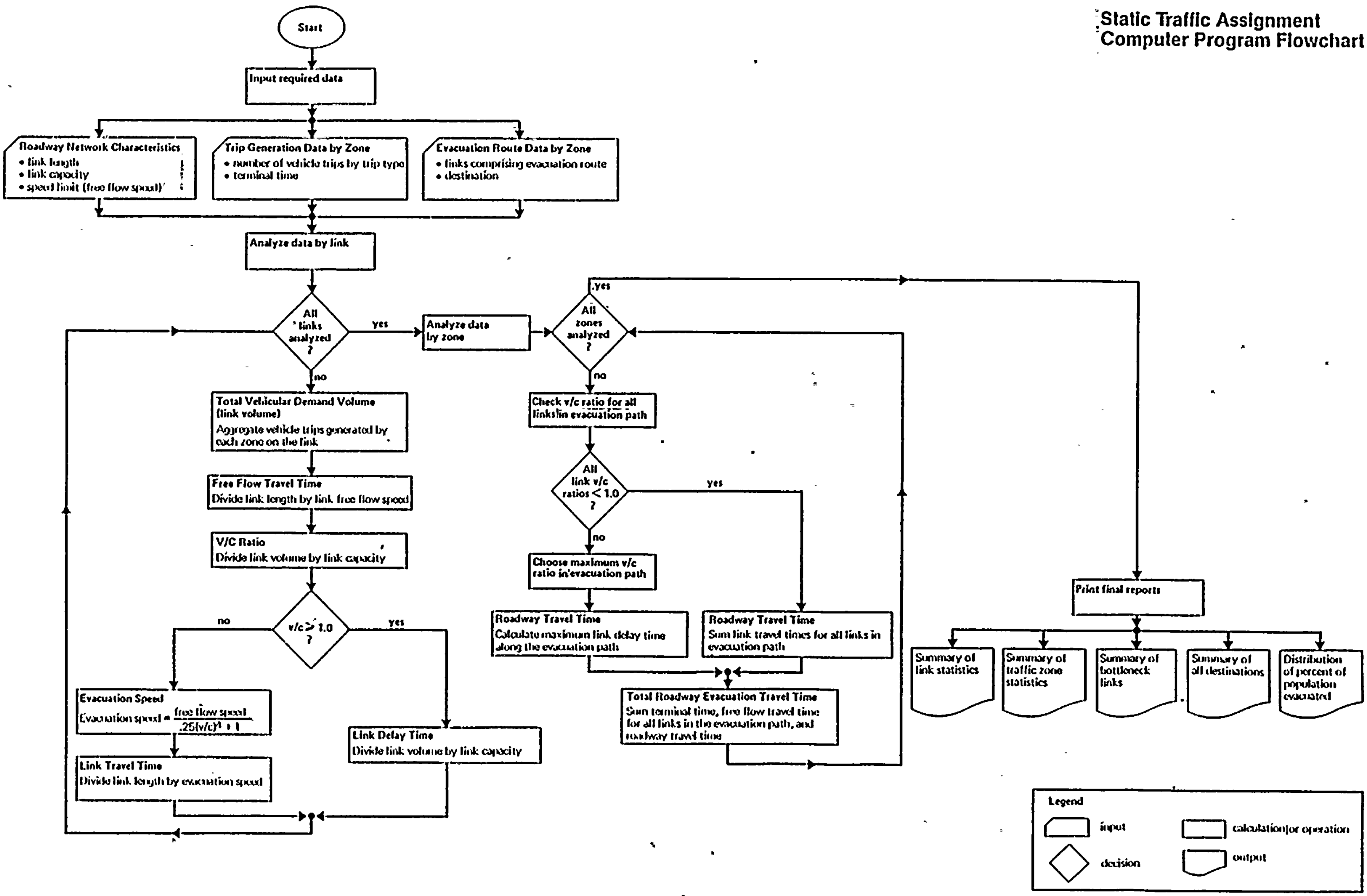
Numbers not enclosed by parentheses represent the percent of total vehicles along a route evacuated during the time period using Level of Service E capacities.

D. Conclusions

The results of the comparative analysis presented in this Appendix indicate that the static traffic assignment model can be applied to highway networks to estimate evacuation roadway travel times with a high degree of confidence.

Under almost identical circumstances, the static assignment model results have proven comparable with those produced by a state-of-the-art, complex dynamic assignment model, which simulates the evacuation process within the framework of time. Roadway travel times were estimated and congested roadways identified with a high degree of correlation using the less complex static assignment methodology. A close correlation between assignment procedures exists for varying roadway types, weather conditions, and loading characteristics. Thus, the use of the static assignment model to estimate evacuation travel times in the JAF/NMP EPZ is appropriate.

Static Traffic Assignment Computer Program Flowchart



APPENDIX H

COMMENTS

Parsons
Brinckerhoff

Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Planners

March 1, 1984

Mr. Pat Volza
Niagara Mohawk Power Corporation
Nine Mile Point Nuclear Station
Lycoming, New York 13093

Re: Evacuation Travel Time Estimates for the James A. FitzPatrick/Nine Mile Point Emergency Planning Zone

Dear Mr. Volza:

We are pleased to submit for your review and comment a draft copy of the subject evacuation time estimate report. The report addresses the requirements of NUREG-0654, Appendix 4 by providing updated population data, vehicle inventories, and evacuation travel times. In addition, the report contains information which can be directly incorporated in the County and State radiological emergency preparedness plans.

Kindly review the report at your earliest convenience. Your written comments will be included in the final report ultimately submitted to FEMA. We would be pleased to attend a meeting in Oswego County to discuss the report, respond to comments/questions, and make modifications, if required.

Please feel free to call if I can answer any questions you may have about the study.

Very truly yours,

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Michael Della Rocca

Michael Della Rocca

MDR/edf

cc: T. Chwalek (NMPC)
N. Avrakotos (NYPA)
G. Brower (Oswego County OEP)
D. Davidoff (REPG)

One Penn Plaza, 250 West 34th Street • New York, New York 10119
212-613-5000 • Cable: Parklap, New York • Telex WU12-5441 • RCA 232 117

OSWEGO COUNTY
OFFICE OF EMERGENCY PREPAREDNESS (315) 598-1191
200 NORTH 2ND STREET FULTON, NEW YORK 13069

GEORGE W. BROWER
DIRECTOR

March 19, 1984

Mr. Michael Della Rocca
Parsons Brinckerhoff Quade & Douglas, Inc.
One Penn Plaza
250 West 34th Street
New York, New York 10119

Dear Mr. ~~Della Rocca~~: Mike

As per our conference call with Pat Volza on Friday, March 16, 1984, the following are comments regarding your Evacuation Travel Time Estimates draft:

1. difference between the maps shown in the report and the ones we've been using ie: the radius should be relabeled to read 10.5 Mile Radius in order to alleviate confusion. Also, the scale appears to be slightly off.

2. columns on Table 2 (p.II-8) should reflect whether or not they're including institutional populations.

3. paragraph beginning "The sources and methodology...," on p. II-15 should be revised to indicate which areas "between the actual 10-mile radius and the approximate 10-mile EPZ boundary" are being discussed. As it stands, it's unclear.

4. Appendix B - Schools - p.4 of 4 the following should be changed:

    a. after SUNY Campus School, parentheses and Sweatman Hall should be added

    b. student enrollment should be "45 mentally handicapped adults"

    c. staff column should read 3/0/2

    d. Oswego Community Christian School has moved to the Riverfront Building
    120 E. First Street
    Oswego, New York 13126

5. Appendix B - Nursing Homes - p. 1 of 1, "Old" in front of Ladies Home should be deleted.

6. Add an explanation as to why the information regarding Indian Point is included.

All in all, it's a fine job as it includes additional information which could prove to be very helpful. If you have questions concerning my comments, or need more information from us, please don't hesitate to call.

Sincerely,

Peg

Margaret L. Helmke
Operations/Training Officer

cc: George W. Brower
Pasquale Volza
James Papile

STATE OF NEW YORK DEPARTMENT OF HEALTH

CORNING TOWER • THE GOVERNOR NELSON A. ROCKEFELLER EMPIRE STATE PLAZA • ALBANY, N.Y. 12237

DAVID AXELROD, M.D.
Commissioner

March 21, 1984

Mr. Michael DellaRocca
Parsons, Brinckerhoff, Quade & Douglas, Inc.
One Penn Plaza
250 West 34th Street
New York, NY 10119

Dear Mike:

I received your draft of "Evacuation Travel Time Estimates for the James A. FitzPatrick/Nine/Mile Point Emergency Planning Zone" and find that your format and contents closely follow the methodology you used to complete the Indian Point time estimates. (Since I did not have a copy of the methodology you primarily used for JAF/NMP, I could not compare the present study with that data.)

The time estimates that are shown in your current study were compared with the time estimates shown in the Oswego County Radiological Emergency Preparedness Plan (OCREPP). As a result of this comparison I found that the time estimates are different for most ERPAs and in some cases they differ by an hour or more. I realize that these time estimates changed because of changes made to the OCREPP and population change but I believe that FEMA may want further explanation and causes of such changes.

In addition, the following comments are submitted for your review and correction, if required.

a. List of parks and camp grounds shown in Appendix B does not agree with the list shown in Attachment 8, Law Enforcement Procedure, OCREPP.

b. All ERPAs With Autos For Resident Population should read 4:50 - 7:50 since that is the longest time shown. (ERPA 13).

I recommend that the introduction in Appendix G include comment as to why the static assignment model used to estimate evacuation travel times for JAF/NMP EPZ is appropriate. I realize that you have included a statement at the end of Appendix B but I believe it should be in the beginning so that when reference is made to Indian Point data it would have been explained why you used that data.

I would like to take you up on your offer to have a meeting in Oswego County. I believe a meeting is necessary to discuss the time estimate changes before they are presented to FEMA for approval. If a meeting is scheduled please schedule after 1 April 1984.

Thank you.

Very truly yours,

James D. Papile
Radiological Emergency
Preparedness Group

cc: N. Avrakotos (NYPA)
G. Brower (Oswego Co. OEP)
P. Volza (NMPC)

Parsons Brinckerhoff

Parsons Brinckerhoff Quade & Douglas, Inc. Engineers • Planners

April 6, 1984

Mr. Pat Volza
Niagara Mohawk Power Corporation
Nine Mile Point Nuclear Station
Lycoming, New York 13093

Re: Incorporating Comments Received on the Draft
Evacuation Time Estimate Report

Dear Mr. Volza:

On March 1, 1984 the draft report entitled "Evacuation Travel Time Estimates for the James A. FitzPatrick/Nine Mile Point Emergency Planning Zone" was submitted to the Niagara Mohawk Power Corporation (NMPC), the Oswego County Office of Emergency Preparedness (OEP), the New York Power Authority (NYPA), and New York State Radiological Emergency Preparedness Group (REPG) for review and comment. In the following month, comments were received from all four agencies suggesting changes to the draft report. OEP and REPG transmitted their comments in letters dated March 19, 1984 and March 21, 1984, respectively. NMPC and NYPA comments were received verbally.

The attached table summarizes the comments received from these reviewing agencies. The table indicates the nature and source of the comments and the change(s) to be made and included in the final report. Kindly review the table for concurrence with the proposed changes, and provide any final suggestions you may have by April 13, 1984. A final report will be issued shortly thereafter.

Thank you for your help and cooperation.

Very truly yours,

PARSON BRINCKERHOFF QUADE & DOUGLAS INC.

Michael Della Rocca

Michael Della Rocca

Enclosure
cc: P. Helmke (OEP)
N. Avrakotos (NYPA)
J. Papile (REPG)
T. Chwalek (NMPC)

One Penn Plaza, 250 West 34th Street • New York, New York 10119
212-613-5000 • Cable: Parklap, New York • Telex WU12-5441 • RCA 232 117

COMMENTS ON THE MARCH 1, 1[illegible] DRAFT REPORT ENTITLED

"EVACUATION TRAVEL TIME ESTIMATES FOR THE JAMES A. FITZPATRICK/NINE MILE POINT EMERGENCY PLANNING ZONE"

NATURE OF COMMENT	SOURCE	CHANGES TO BE MADE TO DRAFT REPORT
1. The maps in the report differ from the maps used in the Oswego County Radiological Emergency Preparedness Plan (REPP) in the location of the 2-, 5-, and 10-mile radii.	OEP and NMPC	Revise Figures 2 through 29 to indicate 2-, 5-, and 10-mile radii from the center of the Unit 2 reactor building.
2. The columns on Table 2 should reflect whether or not they include institutional populations.	OEP	Revise columns to indicate that institutional populations are extluded, and adjust data in Table 2 accordingly, where necessary.
3. The paragraph beginning "The sources and methodology... on page II-15 should be revised to indicate which areas "between the actual 10-mile radius and the approximate 10-mile EPZ boundary" are being discussed. As it stands, it's unclear.	OEP and NMPC	Revise the paragraph as suggested.
4. Appendix B - Schools - p. 4 of 4 the following should be changed: a. after SUNY Campus School, parentheses and Sweatman Hall should be added b. student enrollment should be "45 mentally handicapped adults" c. staff column should read 3/0/2 d. Oswego Community Christian School has moved to the Riverfront Building 120 E. First Street Oswego, New York 13126	OEP	Revise Appendix B - Schools - as indicated

5. Appendix B - Nursing Homes - p. 1 of 1, "Old" in front of Ladies Home should be deleted.	OEP	Revise Appendix B - Nursing Homes - as indicated.
6. Explain why the information about Indian Point is included in the report in Appendix G (i.e., why the static model used to estimate evacuation travel times for the JAF/NMP EPZ is appropriate).	OEP, NYPA and REPG	At the beginning of Appendix G, explain why the test of the traffic computer model using Indian Point data is included in the Oswego report. State the conclusions of the Appendix up front. Delete the roadway map of the evacuation test network (Figure G-1).
7. Explain the reasons for the differences in travel time contained in the last version of the REPP and the revised report.	REPG	In Section IV (Analysis of Evacuation Travel Times), include a discussion of the reasons for the changes in travel time from earlier studies.
8. List of parks and camp grounds shown in Appendix B does not agree with the list shown in Attachment 8, Law Enforcement Procedure, REPP.	REPG	Revised Appendix B - Parks and Campgrounds - as indicated, to be consistent with the REPP.
9. All ERPAs with autos for resident population should read 4:50 - 7:50, since that is the longest time shown in Table F-1 (ERPA 13).	REPG	Revise Table F-1, ERPA 13 to read 4:40 - 7:50.
10. The section of the report discussing bus assignments (beginning on page III-7) should be clarified with regard to bus routes along the shoreline.	OEP	Explain why vans were used for bus routes that begin or terminate along the lake shoreline.
11. The section of the report discussing boats (beginning on page III-10) should mention the clearing of Lake Ontario as a precautionary option.	OEP	Revise the section as indicated.
12. The term "ERPA" is not defined before it appears on page I-3.	NYPA	Reference the REPP definition and indicate the location in the report where the term is defined.
13. Gibson Bus Services will no longer participate in the REPP (as of 4/3/84)	OEP	Modify bus assignments to account for the six vehicles the company was originally anticipated to provide, and update evacuation time estimates if required.

14. The tables indicating evacuation travel time estimates in Appendix F are cumbersome to use because each scenario/weather condition combination is shown on a separate page.	NMPC	Include two "executive summary" tables at the beginning of the appendix that show the time estimates for all scenarios (one table for each weather condition).

STATE OF NEW YORK DEPARTMENT OF HEALTH

CORNING TOWER • THE GOVERNOR NELSON A. ROCKEFELLER EMPIRE STATE PLAZA • ALBANY, N.Y. 12237

DAVID AXELROD, M.D.
Commissioner

April 13, 1984

Mr. Michael Della Rocca
Parsons Brinckerhoff Quade & Douglas, Inc.
One Penn Plaza
250 West 34th Street
New York, NY 10119

Dear Mr. Della Rocca:

I concur with your proposed changes as cited in your April 6, 1984 letter.

Sincerely yours,

James D. Papile
Radiological Emergency
Preparedness Group

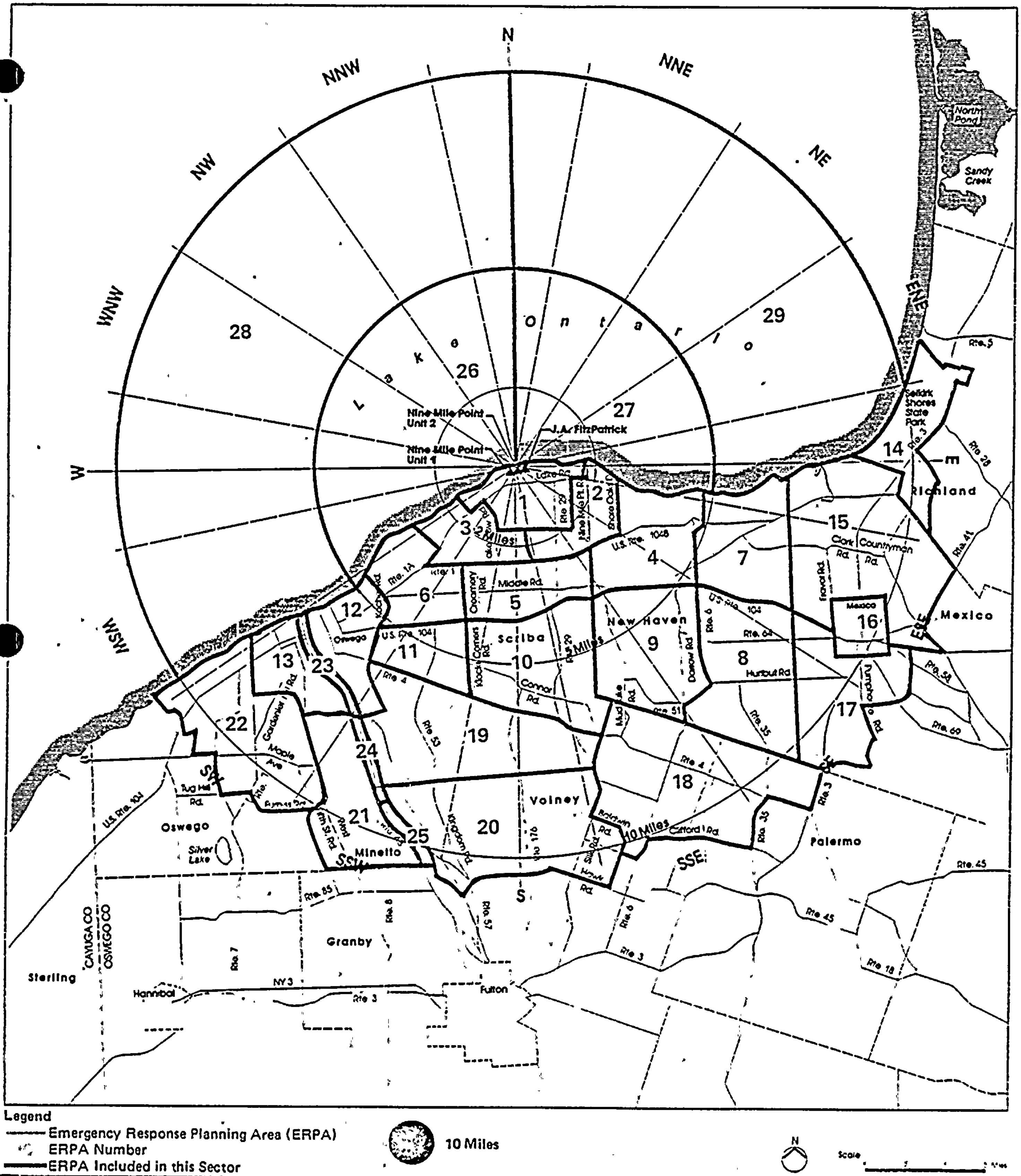


Fig. 15 Sector M—360 Degrees
10-Mile Radius

J.A. FitzPatrick/ Nine Mile Point Nuclear Power Stations

NORMAL WEATHER

SCHOOL-IN-SESSION SCENARIO WITH TEMPORARY CONSTRUCTION WORKFORCE

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	2:30 – 3:50	1:20 – 2:20	–	3:30 – 4:50
2	2:20 – 3:40	2:30 – 3:40	–	2:20 – 3:40
3	2:10 – 3:30	2:40 – 3:50	–	–
4	2:20 – 2:30	2:50 – 4:10	1:30 – 2:30	2:20 – 3:30
5	2:10 – 3:20	2:40 – 3:50	–	2:10 – 3:10
6	4:00 – 6:30	4:30 – 6:50	–	4:00 – 6:30
7	2:20 – 3:30	1:20 – 2:40	–	2:20 – 3:30
8	0:50 – 2:10	1:10 – 2:20	–	0:50 – 2:10
9	0:50 – 1:50	1:20 – 2:20	–	0:50 – 1:50
10	2:10 – 3:20	2:20 – 3:30	–	2:10 – 3:20
11	4:00 – 6:30	4:10 – 6:40	–	4:00 – 6:30
12	4:00 – 6:30	6:30 – 8:50	4:10 – 6:40	4:00 – 6:30
13	4:50 – 8:10	6:50 – 8:40	3:10 – 5:10	4:50 – 8:10
14	2:10 – 3:20	3:40 – 5:20	–	2:30 – 3:40
15	2:10 – 3:30	3:50 – 5:30	–	2:10 – 3:30
16	0:40 – 2:00	3:50 – 5:40	0:50 – 1:00	0:40 – 2:00
17	0:50 – 2:00	3:40 – 5:40	1:00 – 1:10	0:50 – 1:00
18	0:40 – 1:40	3:40 – 5:20	–	0:40 – 1:40
19	4:00 – 6:20	5:40 – 7:40	–	3:20 – 5:30
20	3:50 – 6:20	5:40 – 7:40	–	3:20 – 6:20
21	2:40 – 4:20	6:30 – 9:00	2:50 – 4:30	2:40 – 4:20
22	4:50 – 8:00	6:30 – 9:10	5:10 – 8:20	4:50 – 8:00
All ERPAs	4:50 – 8:10	6:50 – 9:10	5:10 – 8:20	4:50 – 8:10

SCHOOL-IN-SESSION SCENARIO

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	1:40 – 2:30	1:20 – 2:20	–	1:40 – 2:00
2	1:10 – 2:20	1:20 – 2:30	–	1:10 – 2:20
3	1:40 – 2:30	1:20 – 1:30	–	–
4	1:00 – 2:20	1:30 – 2:50	1:30 – 2:30	1:00 – 2:20
5	1:40 – 2:30	1:20 – 2:20	–	1:40 – 2:20
6	3:50 – 6:10	4:20 – 6:40	–	3:50 – 6:10
7	1:00 – 2:10	1:20 – 2:40	–	1:00 – 2:10
8	0:50 – 2:00	1:10 – 2:20	–	0:50 – 2:00
9	0:50 – 1:50	1:20 – 2:20	–	0:50 – 1:50
10	1:40 – 2:20	1:50 – 2:40	–	1:40 – 2:20
11	3:50 – 6:10	4:10 – 6:30	–	3:50 – 6:10
12	3:50 – 6:20	6:20 – 8:40	4:10 – 6:30	3:50 – 6:20
13	4:50 – 7:50	6:40 – 9:00	4:00 – 5:00	4.40 – 7:50
14	0:40 – 2:10	3:40 – 5:20	–	1:00 – 2:20
15	0:50 – 2:10	3:40 – 5:30	–	0:50 – 2:10
16	0:40 – 2:00	3:50 – 5:30	0:50 – 2:10	0:40 – 3:00
17	0:50 – 1:50	3:40 – 5:30	1:00 – 1:10	0:50 – 1:00
18	0:40 – 1:40	3:40 – 5:20	–	0:40 – 1:40
19	3:50 – 6:10	5:30 – 7:30	–	3:10 – 5:10
20	3:40 – 6:00	5:30 – 7:30	–	3:40 – 6:00
21	2:30 – 4:00	6:20 – 8:40	2:50 – 4:20	2:30 – 4:00
22	4:40 – 7:50	6:20 – 8:50	5:00 – 8:00	4:40 – 7:50
All ERPAs	4:40 – 7:50	6:40 – 9:00	5:00 – 8:00	4:40 – 7:50

SCHOOL-NOT-IN-SESSION SCENARIO

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	2:20 – 3:30	1:20 – 2:20	–	2:30 – 3.40
2	2:20 – 3:30	1:20 – 1:30	–	2:20 – 3:30
3	1:40 – 2:30	1:20 – 1:30	–	–
4	2:10 – 3:20	2:40 – 3:50	1:30 – 2:20	2:10 – 3:20
5	1:40 – 2:30	1:20 – 2:20	–	1:40 – 2:20
6	3:50 – 6:20	4:20 – 6:40	–	3:50 – 6:20
7	2:10 – 3:20	1:10 – 2:10	–	2:10 – 3:20
8	0:50 – 1:50	1:10 – 2:00	–	0:50 – 1:50
9	0:50 – 1:50	1:20 – 2:20	–	0:50 – 1:50
10	1:40 – 2:20	1:50 – 2:40	–	1:40 – 2:20
11	3:50 – 6:10	4:10 – 6:30	–	3:50 – 6:10
12	4:00 – 6:20	4:00 – 6:20	3:40 – 5:40	4:00 – 6:20
13	3:40 – 6:10	4:00 – 6:30	3:10 – 4:40	3:40 – 6:10
14	2:00 – 3:10	2:30 – 3:30	–	2:20 – 3:30
15	2:00 – 3:10	1:10 – 2:10	–	2:20 – 3:30
16	0:40 – 1:30	1:20 – 2:20	–	0:40 – 1:30
17	0:40 – 1:30	1:10 – 2:00	–	0:40 – 0:50
18	0:40 – 1:40	1:10 – 1:50	–	0:40 – 1:40
19	3:50 – 6:10	4:00 – 6:30	–	3:10 – 6:10
20	3:40 – 6:10	4:00 – 6:10	–	3:40 – 6:10
21	2:20 – 3:50	2:40 – 4:10	–	2:20 – 3:50
22	3:40 – 6:00	4:00 – 6:20	4:00 – 6:20	3:40 – 6:00
All ERPAs	4:00 – 6:20	4:20 – 6:40	4:00 – 6:20	4:00 – 6:20

WEEKEND/HOLIDAY SUMMER SCENARIO

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	2:10 – 3:10	1:20 – 1:30	–	2:20 – 3:10
2	2:10 – 3:10	1:20 – 1:30	–	–
3	1:00 – 1:50	1:30 – 2:20	–	–
4	2:00 – 3:00	2:30 – 3:30	1:30 – 1:40	–
5	1:00 – 1:50	1:20 – 2:20	–	0:50 – 1:00
6	2:30 – 3:50	2:50 – 4:20	–	1:00 – 1:50
7	2:00 – 3:00	1:10 – 1:20	–	–
8	0:50 – 1:00	1:00 – 1:10	–	–
9	0:50 – 1:00	1:20 – 1:30	–	–
10	0:50 – 1:50	1:10 – 2:10	–	–
11	2:30 – 3:50	2:40 – 4:00	–	2:30 – 4:00
12	2:30 – 3:50	2:40 – 4:00	2:50 – 4:20	2:30 – 3:50
13	1:50 – 2:50	2:10 – 3:10	2:20 – 3:20	1:50 – 2:50
14	1:50 – 2:50	2:20 – 3:10	–	2:10 – 3:10
15	1:50 – 3:00	1:10 – 1:20	–	2:10 – 3:10
16	0:40 – 0:50	1:10 – 1:20	–	–
17	0:40 – 0:50	1:00 – 1:10	–	–
18	0:40 – 0:50	1:00 – 1:10	–	–
19	2:20 – 3:50	2:40 – 4:00	–	–
20	2:20 – 3:40	2:50 – 4:10	–	–
21	1:40 – 2:20	2:00 – 2:50	–	–
22	1:50 – 2:50	2:10 – 3:00	–	1:50 – 2:50
All ERPAs	2:30 – 3:50	2:50 – 4:20	2:50 – 4:20	2:30 – 4:00

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures. Lower bound evacuation travel times (shorter times) can be anticipated when:
- (a) Unexpected long-term capacity restrictions on key highway links owing to incidents such as accidents, vehicle breakdowns, and highway construction, do not occur;
- (b) A high state of operational readiness (traffic control officers mobilized, traffic control devices operational, all buses stationed to begin their initial runs, etc.) is attained;
- (c) An informed and cooperative public follow directions as instructed.

Upper bound evacuation travel times (longer times) are representative of a situation where:
- (a) Capacity restrictions adversely affect traffic flow, but not to the point where a breakdown in traffic flow would result;
- (b) A low state of operational readiness results from minimal mobilization of the emergency workforce;
- (c) A low degree of cooperation from the public occurs.

(2) The evacuation travel time ranges are indicated as hours: minutes, and include 20 minutes of public preparation time.

(3) Normal weather conditions are considered to be clear sky and dry roadway pavement for the above scenario.

(4) The population subgroups indicated in this Table are:
- (a) resident population (with and without automobiles);
- (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
- (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels, and temporary construction workers and their families).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA is a staged evacuation will not exceed the travel time range indicated in this Table.

WEEKEND/HOLIDAY WINTER SCENARIO

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	1:00 – 1:50	1:20 – 2:10	–	1:00 – 1:10
2	1:00 – 1:10	1:20 – 1:30	–	–
3	1:00 – 1:50	1:30 – 2:20	–	–
4	1:00 – 1:10	1:30 – 1:40	1:30 – 1:40	–
5	1:00 – 1:50	1:20 – 2:20	–	0:50 – 1:00
6	2:20 – 3:40	2:50 – 4:10	–	1:00 – 1:50
7	0:50 – 1:00	1:10 – 1:20	–	–
8	0:40 – 1:00	1:00 – 1:10	–	–
9	0:50 – 1:00	1:20 – 1:30	–	–
10	0:50 – 1:50	1:10 – 2:10	–	–
11	2:20 – 3:40	2:40 – 4:00	–	2:20 – 3:40
12	2:30 – 3:50	2:40 – 4:00	2:50 – 4:10	2:30 – 3:50
13	1:50 – 2:50	2:10 – 3:00	2:20 – 3:20	1:40 – 2:50
14	0:30 – 0:40	1:00 – 1:10	–	0:40 – 0:50
15	0:50 – 1:00	1:10 – 1:20	–	0:50 – 1:00
16	0:40 – 0:50	1:10 – 1:20	–	–
17	0:40 – 0:50	1:00 – 1:10	–	–
18	0:40 – 0:50	1:00 – 1:10	–	–
19	2:20 – 3:40	2:40 – 3:50	–	–
20	2:20 – 3:30	2:50 – 4:10	–	–
21	1:40 – 2:20	2:00 – 2:50	–	–
22	1:50 – 2:40	2:10 – 3:00	2:00 – 3:00	2:00 – 2:40
All ERPAs	2:30 – 3:50	2:50 – 4:10	2:50 – 4:10	2:30 – 3:50

EVENING SCENARIO

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	1:10 – 2:10	1:20 – 2:30	–	1:20 – 2:20
2	1:10 – 2:10	1:20 – 2:30	–	–
3	1:00 – 1:50	1:30 – 2:20	–	–
4	1:00 – 1:10	1:30 – 2:40	1:30 – 1:40	–
5	1:00 – 1:50	1:20 – 2:20	–	0:50 – 1:00
6	2:20 – 3:40	2:50 – 4:00	–	1:00 – 1:50
7	0:50 – 2:00	1:10 – 2:20	–	–
8	0:50 – 1:00	1:00 – 1:10	–	–
9	0:50 – 1:00	1:20 – 1:30	–	–
10	0:50 – 1:50	1:20 – 2:10	–	–
11	2:20 – 3:40	2:30 – 3:50	–	2:20 – 3:40
12	2:20 – 3:40	2:30 – 3:50	2:50 – 4:00	2:20 – 3:40
13	2:50 – 4:40	3:10 – 5:00	2:20 – 3:10	2:50 – 4:40
14	0:40 – 2:00	1:10 – 2:20	–	0:50 – 2:10
15	0:50 – 2:00	1:10 – 2:30	–	1:00 – 2:10
16	0:40 – 0:50	1:10 – 1:20	–	–
17	0:40 – 0:50	1:00 – 1:10	–	–
18	0:40 – 0:50	1:00 – 1:10	–	–
19	2:20 – 3:30	2:40 – 3:50	–	–
20	2:10 – 3:30	2:50 – 4:00	–	–
21	1:30 – 2:20	2:00 – 2:40	–	–
22	2:50 – 4:40	3:10 – 4:50	3:00 – 4:50	2:50 – 4:40
All ERPAs	2:50 – 4:40	3:10 – 5:00	3:00 – 4:50	2:50 – 4:40

NIGHTTIME SCENARIO

	Resident Population		Special Facilities	Transients
	With Autos	Without Autos		
ERPA	From – To	From – To	From – To	From – To
1	1:10 – 2:10	1:20 – 2:20	–	1:20 – 2:20
2	1:10 – 2:10	1:20 – 2:20	–	–
3	1:00 – 1:50	1:30 – 2:20	–	–
4	1:00 – 2:10	1:30 – 2:40	1:30 – 1:40	–
5	1:00 – 1:50	1:20 – 2:20	–	0:50 – 1:00
6	2:30 – 3:40	2:50 – 4:00	–	1:00 – 1:50
7	0:50 – 2:00	1:10 – 2:20	–	–
8	0:50 – 1:00	1:00 – 1:10	–	–
9	0:50 – 1:00	1:20 – 1:30	–	–
10	0:50 – 1:50	1:10 – 2:10	–	–
11	2:20 – 3:40	2:30 – 3:50	–	2:20 – 3:40
12	2:20 – 3:40	2:30 – 3:50	2:50 – 4:00	2:20 – 3:40
13	2:20 – 3:50	2:50 – 4:10	2:20 – 3:10	2:20 – 3:50
14	0:40 – 2:00	1:10 – 2:20	–	0:50 – 2:10
15	0:50 – 2:00	1:10 – 2:30	–	1:00 – 2:10
16	0:40 – 0:50	1:10 – 1:20	–	–
17	0:40 – 0:50	1:00 – 1:10	–	–
18	0:40 – 0:50	1:00 – 1:10	–	–
19	2:20 – 3:30	2:40 – 3:50	–	–
20	2:10 – 3:30	2:50 – 4:00	–	–
21	0:40 – 2:20	2:00 – 2:40	–	–
22	2:20 – 3:50	2:40 – 4:10	2:40 – 4:00	2:20 – 3:50
All ERPAs	2:20 – 3:50	2:50 – 4:10	2:50 – 4:00	2:20 – 3:50

Table F-2
EVACUATION TRAVEL TIME ESTIMATES BY ERPA
ADVERSE WEATHER

Table F-2
EVACUATION TRAVEL TIME ESTIMATES BY ERPA
ADVERSE WEATHER

SCHOOL-IN-SESSION SCENARIO WITH TEMPORARY CONSTRUCTION WORKFORCE

	Resident Population			
ERPA	With Autos	Without Autos	Special Facilities	Transients
1	4:30	2:40	–	5:40
2	4:30	4:20	–	4:30
3	4:10	4:30	–	–
4	4:20	4:50	2:40	4:20
5	4:00	4:30	–	4:00
6	7:50	8:20	–	7:50
7	4:10	3:00	–	4:10
8	2:30	2:50	–	2:30
9	2:10	2:40	–	2:10
10	4:00	4:10	–	4:00
11	7:50	8:10	–	7:50
12	8:00	10:40	8:10	8:00
13	10:00	11:00	6:10	10:00
14	4:10	6:10	–	4:20
15	4:10	6:20	–	4:10
16	2:30	6:40	2:40	2:30
17	2:20	6:30	2:10	1:50
18	2:00	6:10	–	2:00
19	7:50	9:10	–	6:40
20	7:40	9:00	–	7:40
21	5:10	10:50	5:20	5:10
22	10:00	10:50	10:10	10:00
All ERPAs	10:00	11:00	10:10	10:00

SCHOOL-IN-SESSION SCENARIO

	Resident Population			
ERPA	With Autos	Without Autos	Special Facilities	Transients
1	2:50	2:40	–	2:50
2	2:50	2:50	–	2:50
3	3:00	1:40	–	–
4	2:40	3:10	2:40	2:40
5	2:50	2:40	–	2:50
6	7:40	8:00	–	7:40
7	2:30	3:00	–	2:30
8	2:30	2:40	–	2:30
9	2:10	2:40	–	2:10
10	2:50	3:10	–	2:50
11	7:40	7:50	–	7:40
12	7:40	10:20	7:50	7:40
13	9:40	10:40	6:00	9:40
14	2:30	6:10	–	2:40
15	2:30	6:20	–	2:30
16	2:20	6:30	2:30	2:20
17	2:20	6:20	2:00	1:50
18	2:00	6:10	–	2:00
19	7:30	8:50	–	6:20
20	7:30	8:50	–	7:30
21	5:00	10:20	5:10	5:00
22	9:40	10:30	9:50	9:40
All ERPAs	9:40	10:40	9:50	9:40

SCHOOL-NOT-IN-SESSION SCENARIO

	Resident Population			
ERPA	With Autos	Without Autos	Special Facilities	Transients
1	4:10	2:30	–	4:20
2	4:10	1:40	–	4:10
3	3:00	1:40	–	–
4	4:00	4:30	2:40	4:00
5	2:50	2:30	–	2:50
6	7:40	8:10	–	7:40
7	4:00	2:30	–	4:00
8	2:00	2:20	–	2:00
9	2:00	2:40	–	2:00
10	2:50	3:10	–	2:50
11	7:40	7:50	–	7:40
12	7:40	7:50	6:50	7:40
13	7:30	7:50	5:30	7:30
14	3:50	4:00	–	4:10
15	3:50	2:30	–	3:50
16	1:50	2:30	–	1:50
17	1:40	2:10	–	1:00
18	2:00	2:10	–	2:00
19	7:40	7:50	–	6:20
20	7:30	7:30	–	7:30
21	4:30	5:00	–	4:30
22	7:30	7:40	7:40	7:30
All ERPAs	7:40	8:10	7:40	7:40

WEEKEND/HOLIDAY SUMMER SCENARIO

	Resident Population			
ERPA	With Autos	Without Autos	Special Facilities	Transients
1	3:50	2:10	–	4:00
2	3:50	1:40	–	–
3	2:10	2:40	–	–
4	3:40	4:10	2:20	–
5	2:10	2:40	–	1:10
6	4:40	5:00	–	2:10
7	3:40	2:10	–	–
8	1:40	1:20	–	–
9	1:40	2:10	–	–
10	2:10	2:20	–	–
11	4:40	4:50	–	4:30
12	4:40	4:50	5:00	4:40
13	3:30	3:50	3:50	3:30
14	3:30	3:40	–	3:40
15	3:30	2:20	–	3:50
16	1:30	2:20	–	–
17	1:30	1:20	–	–
18	1:30	1:20	–	–
19	4:30	4:40	–	–
20	4:30	5:00	–	–
21	2:50	3:10	–	–
22	3:20	3:40	–	3:20
All ERPAs	4:40	5:00	5:00	4:40

Notes:

(1) The evacuation travel time ranges presented in this Table are based on operational strategies indicated in the evacuation implementation procedures.

(2) The evacuation travel time ranges are indicated as hours:minutes, and include 20 minutes of public preparation time.

(3) Adverse weather conditions are considered to be a slippery roadway surface (e.g., due to snow or ice), and/or reduced visibility (e.g., due to fog or heavy rain) for the above scenario.

(4) The population subgroups indicated in this Table are:
   (a) resident population (with and without automobiles);
   (b) special facilities (schools, colleges, nursing homes, hospitals, other health care facilities, residential facilities such as group homes, convents, and monasteries);
   (c) transients (employees, visitors to parks, resident and day camps, hotels, and motels, and temporary construction workers and their families).

(5) Gaps in this Table indicates that there is no special facility or transient population in the given ERPA.

(6) The evacuation travel time ranges presented in this Table assume a simultaneous evacuation of the entire EPZ. The evacuation travel time for any individual ERPA is a staged evacuation will not exceed the travel time range indicated in this Table.

WEEKEND/HOLIDAY WINTER SCENARIO

	Resident Population			
ERPA	With Autos	Without Autos	Special Facilities	Transients
1	2:10	2:30	–	1:20
2	1:20	1:40	–	–
3	2:10	2:40	2:20	–
4	1:50	2:20	–	–
5	2:10	2:40	–	1:10
6	4:30	5:00	–	2:10
7	1:40	2:10	–	–
8	1:40	1:20	–	–
9	1:40	2:10	–	–
10	2:10	2:20	–	–
11	4:30	4:40	–	4:30
12	4:30	4:40	5:00	4:30
13	3:20	3:40	3:50	3:20
14	0:50	1:20	–	1:00
15	1:40	2:20	–	1:10
16	1:30	2:20	–	–
17	1:30	1:20	–	–
18	1:30	1:20	–	–
19	4:20	4:30	–	–
20	4:20	5:00	–	–
21	2:50	3:10	–	–
22	3:20	3:30	3:30	3:20
All ERPAs	4:30	5:00	5:00	4:30

EVENING SCENARIO

	Resident Population			
ERPA	With Autos	Without Autos	Special Facilities	Transients
1	2:30	2:50	–	2:40
2	2:30	2:50	–	–
3	2:10	2:40	–	–
4	2:30	3:00	2:20	–
5	2:10	2:40	–	1:10
6	4:20	4:50	–	2:10
7	2:20	2:40	–	–
8	1:40	1:20	–	–
9	1:40	2:10	–	–
10	2:10	2:20	–	–
11	4:20	4:30	–	4:20
12	4:20	4:30	4:50	4:20
13	5:40	6:00	3:40	5:40
14	2:20	2:40	–	2:30
15	2:20	2:50	–	2:30
16	1:30	2:20	–	–
17	1:30	1:20	–	–
18	1:30	1:20	–	–
19	4:20	4:30	–	–
20	4:10	4:50	–	–
21	2:50	3:10	–	–
22	5:40	5:00	5:50	4:40
All ERPAs	5:40	6:00	5:50	5:40

NIGHTTIME SCENARIO

	Resident Population			
ERPA	With Autos	Without Autos	Special Facilities	Transients
1	2:30	2:40	–	2:40
2	2:30	2:40	–	–
3	2:10	2:40	–	–
4	2:30	3:00	2:20	–
5	2:10	2:40	–	1:10
6	4:20	4:50	–	2:10
7	2:20	2:40	–	–
8	1:40	1:20	–	–
9	1:40	2:10	–	–
10	2:10	2:20	–	–
11	4:20	4:30	–	4:20
12	4:20	4:30	4:50	4:20
13	4:40	5:00	3:40	4:40
14	2:20	2:40	–	2:30
15	2:20	2:50	–	2:30
16	1:30	2:20	–	–
17	1:30	1:20	–	–
18	1:30	1:20	–	–
19	4:20	4:30	–	–
20	4:10	4:40	–	–
21	2:50	3:10	–	–
22	4:40	5:00	4:50	4:40
All ERPAs	4:40	5:00	4:50	4:40

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