

### 3. DEMAND ESTIMATION

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

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

Appendix E presents much of the source material for the population estimates. A variation of the approach defined above was used to estimate traffic in parks. This change in approach was necessary since the majority of park traffic consists of transients; most enter the EPZ from locations outside. Our primary source of population data, the 2000 Census, is not adequate for estimating some transient groups directly.

As a result, we relied on empirical observation of the number of vehicles that can physically be accommodated within park areas. This technique is valid since discussions with public officials confirmed that, with few exceptions, people at the park have access to either a private vehicle or a bus. Thus, the number of people evacuating from the park area will be primarily reflected in the number of evacuating private vehicles.

Estimates of population in parks can be based on estimates of per-vehicle person occupancy. Thus, for the park area, we estimate the number of evacuating vehicles based on parking capacity, then multiply by the per-vehicle person occupancy.

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

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

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

Furthermore, the number of vehicles at a location depends on time of day. For example, motel parking lots may be full at dawn and empty at noon. Similarly, parking lots at area parks, which are full at noon, may be almost empty at dawn. It is clearly wrong to estimate counts of vehicles by simply adding up the capacities of different types of parking facilities, without considering such factors.

Analysis of the population characteristics of the Indian Point Energy Center (IPEC) EPZ indicates the need to identify three distinct groups:

- Permanent residents - people who are year round residents of the EPZ.
- Transients - people who reside outside of the EPZ who enter the area for a specific purpose (shopping, recreation) and then leave the area.
- Employees - people who reside outside of the EPZ and commute to business within the EPZ on a daily basis.

Estimates of the population and number of evacuating vehicles for each of the population groups will be presented for each Emergency Response Planning Area (ERPA) and by polar coordinate representation (population rose). The IPEC EPZ has been subdivided into 51 ERPAs. These areas are shown in Figure 3-1.

### Permanent Residents

The primary source for estimating permanent population is the latest U.S. Census data. Comparing census information, it is possible to estimate the rate of population change over time and to project the year 2000 resident population to a 2003 base year. Table 3-2 presents these estimates.

Table 3-2 shows that the EPZ population has increased about 2.5 percent over the last 3 years. The annual growth rate for each county was estimated using the 1990 and 2000 census results. The growth rates were used to project population grown over the most recent 3-year period,

We designed the telephone survey (Appendix F) to estimate the average number of people who may be expected to occupy each evacuating vehicle. The survey revealed the average household size and the expected number of evacuating vehicles per household. The results are shown on Table 3-1.

<b>Table 3-1. Vehicle Occupancy Rates</b>			
<b>County</b>	<b>Household Size</b>	<b>Evacuating Vehicles Per Household<sup>1</sup></b>	<b>Persons per Evacuating Vehicle</b>
Orange	2.84	1.26	2.24
Putnam	3.10	1.27	2.44
Rockland	3.36	1.25	2.68
Westchester	2.84	1.24	2.28

---

<sup>1</sup> Compare the telephone survey results with Institute for Environmental Studies, University of Toronto, THE MISSISSAUGA EVACUATION FINAL REPORT, June 1981. The report indicates that 75,500 households evacuated the area using 93,400 vehicles, yielding 1.24 evacuating vehicles per household. (Page 5-10).

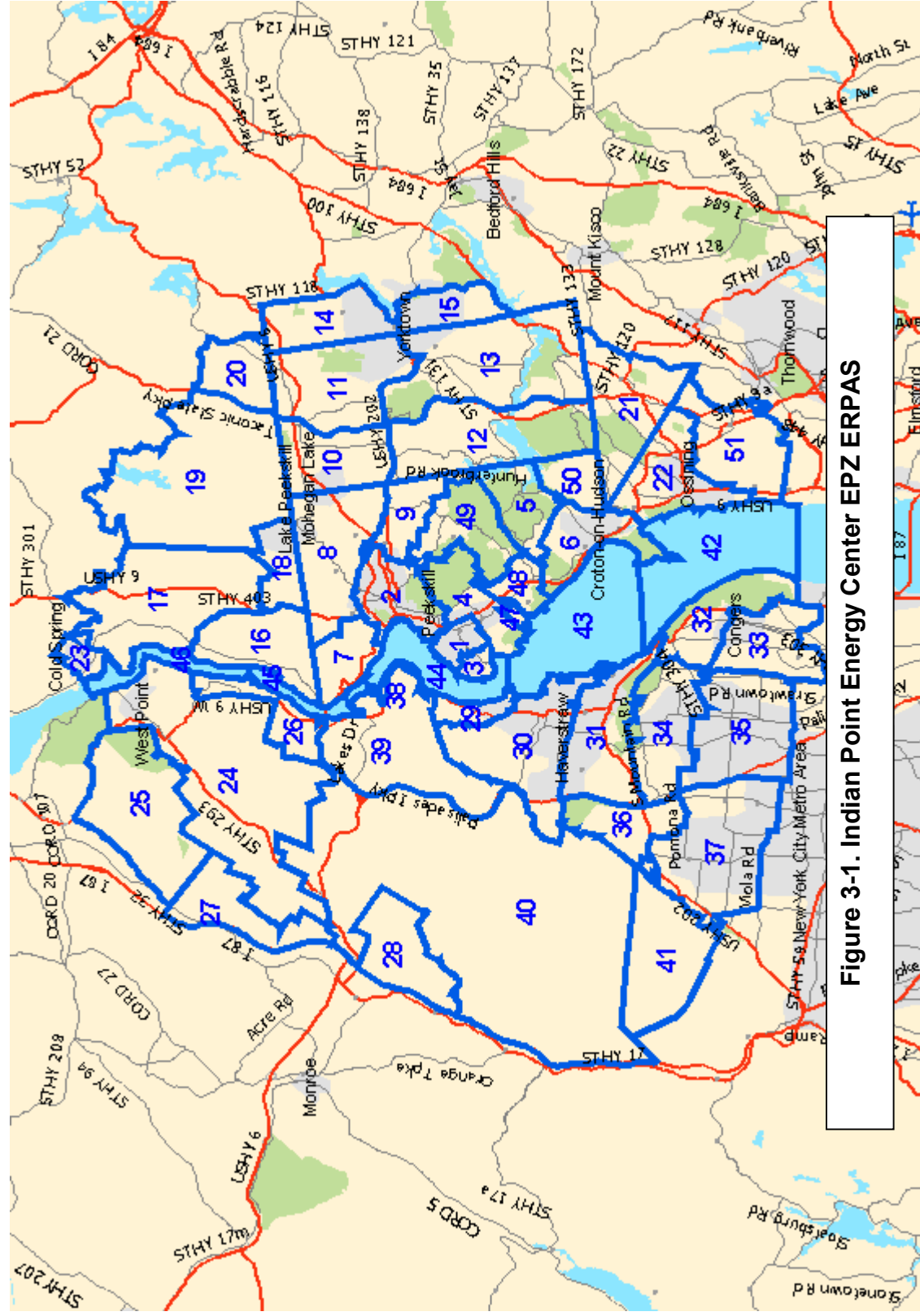


Table 3-2. EPZ Permanent Resident Population Growth					
ERPA	Population		ERPA	Population	
	2000	2003		2000	2003
1	2,171	2,206	27	2,200	2,270
2	22,459	22,826	28	52	54
3	1,273	1,294	29	1,143	1,170
4	3,534	3,592	30	12,968	13,271
5	957	973	31	31,314	33,267
6	7,589	7,713	32	4,973	5,089
7	185	188	33	10,616	10,864
8	11,156	11,338	34	7,428	7,602
9	4,486	4,559	35	23,681	24,235
10	8,021	8,152	36	2,601	2,662
11	18,086	18,382	37	23,220	23,763
12	3,102	3,153	38	60	61
13	7,124	7,240	39	19	20
14	2,688	2,732	40	561	579
15	1,284	1,305	41	174	178
16	532	553	42	-	-
17	1,927	2,005	43	-	-
18	3,533	3,675	44	-	-
19	6,851	7,127	45	-	-
20	4,110	4,275	46	-	-
21	4,785	4,863	47	332	337
22	29,454	29,936	48	3,483	3,540
23	2,523	2,625	49	2,820	2,866
24	7,134	7,360	50	471	479
25	932	962	51	8,277	8,412
26	5,353	5,523	TOTAL	297,642	305,276

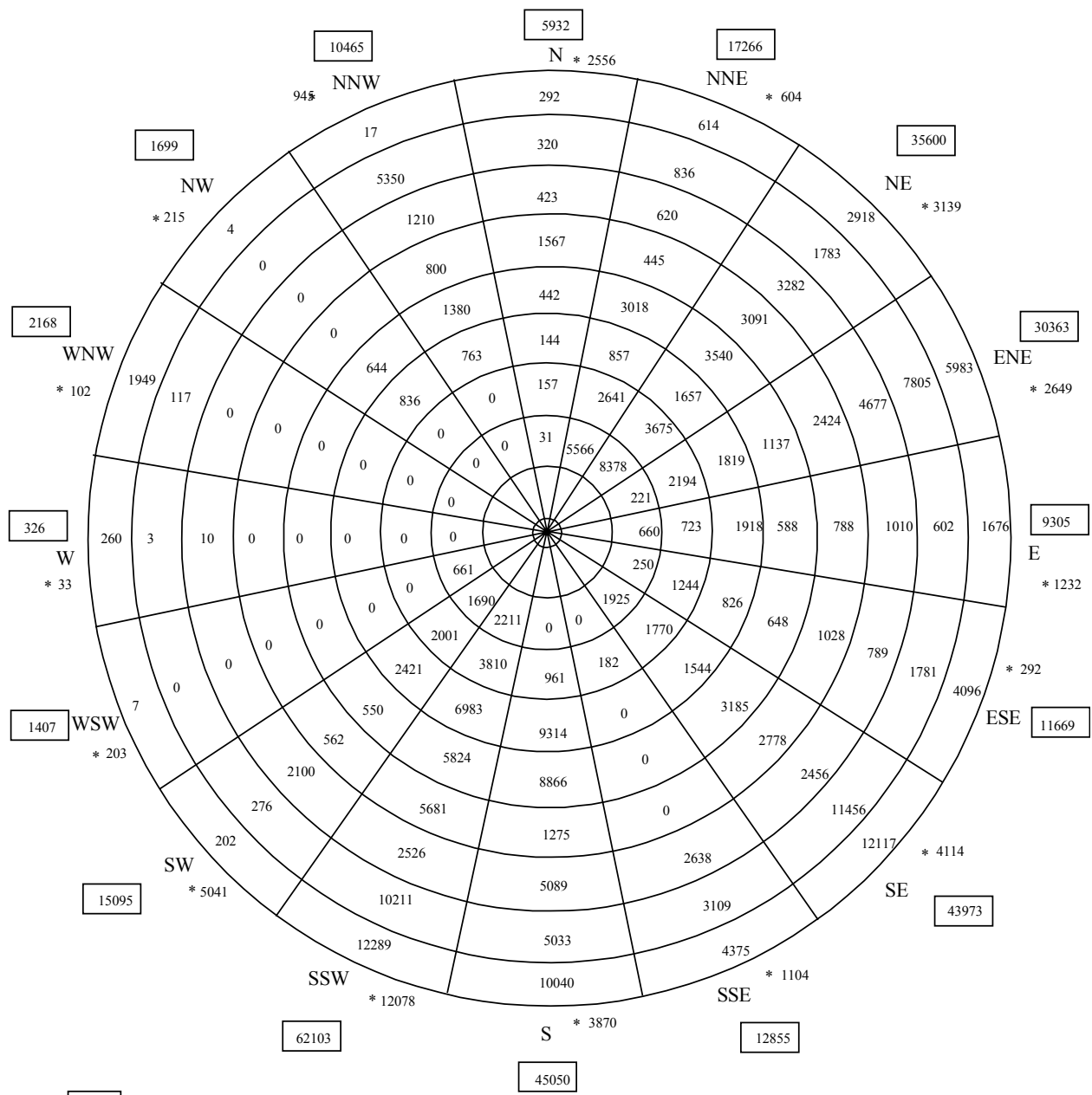
Permanent resident population and vehicle estimates for 2003 are presented in Table 3-3. Figures 3-2 and 3-3 present the permanent resident population and permanent resident vehicle estimates by sector and distance from the Indian Point Energy Center. This “rose” was constructed using GIS software.

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

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

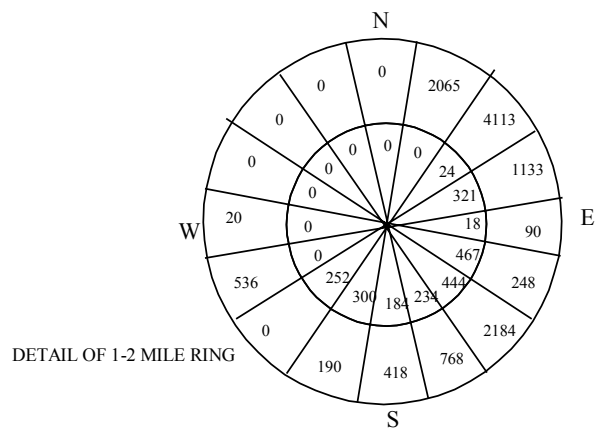
On this basis, the permanent resident population would be reduced by 5 percent in the summer and by a lesser amount in the off-season. This five percent reduction translates into about 6,200 vehicles. Given the uncertainty in this estimate, we elected to apply no reductions in permanent resident population for the summer scenarios to account for residents who may be out of the area.

<b>Table 3-3. Permanent Resident Population and Vehicles by ERPA</b>					
<b>ERPA</b>	<b>Persons</b>	<b>Vehicles</b>	<b>ERPA</b>	<b>Persons</b>	<b>Vehicles</b>
<b>1</b>	2,206	968	<b>27</b>	2,270	1,013
<b>2</b>	22,826	10,020	<b>28</b>	54	24
<b>3</b>	1,294	568	<b>29</b>	1,170	437
<b>4</b>	3,592	1,575	<b>30</b>	13,271	4,952
<b>5</b>	973	427	<b>31</b>	33,267	12,413
<b>6</b>	7,713	3,383	<b>32</b>	5,089	1,899
<b>7</b>	188	82	<b>33</b>	10,864	4,054
<b>8</b>	11,338	4,973	<b>34</b>	7,602	2,837
<b>9</b>	4,559	2,000	<b>35</b>	24,235	9,043
<b>10</b>	8,152	3,575	<b>36</b>	2,662	993
<b>11</b>	18,382	8,062	<b>37</b>	23,763	8,867
<b>12</b>	3,153	1,383	<b>38</b>	61	23
<b>13</b>	7,240	3,175	<b>39</b>	20	7
<b>14</b>	2,732	1,198	<b>40</b>	579	216
<b>15</b>	1,305	572	<b>41</b>	178	66
<b>16</b>	553	227	<b>42</b>	-	-
<b>17</b>	2,005	822	<b>43</b>	-	-
<b>18</b>	3,675	1,506	<b>44</b>	-	-
<b>19</b>	7,127	2,921	<b>45</b>	-	-
<b>20</b>	4,275	1,752	<b>46</b>	-	-
<b>21</b>	4,863	2,133	<b>47</b>	337	148
<b>22</b>	29,936	13,130	<b>48</b>	3,540	1,553
<b>23</b>	2,625	1,076	<b>49</b>	2,866	1,257
<b>24</b>	7,360	1,399	<b>50</b>	479	210
<b>25</b>	962	429	<b>51</b>	8,412	3,689
<b>26</b>	5,523	2,466	<b>TOTAL</b>	<b>305,276</b>	<b>123,523</b>

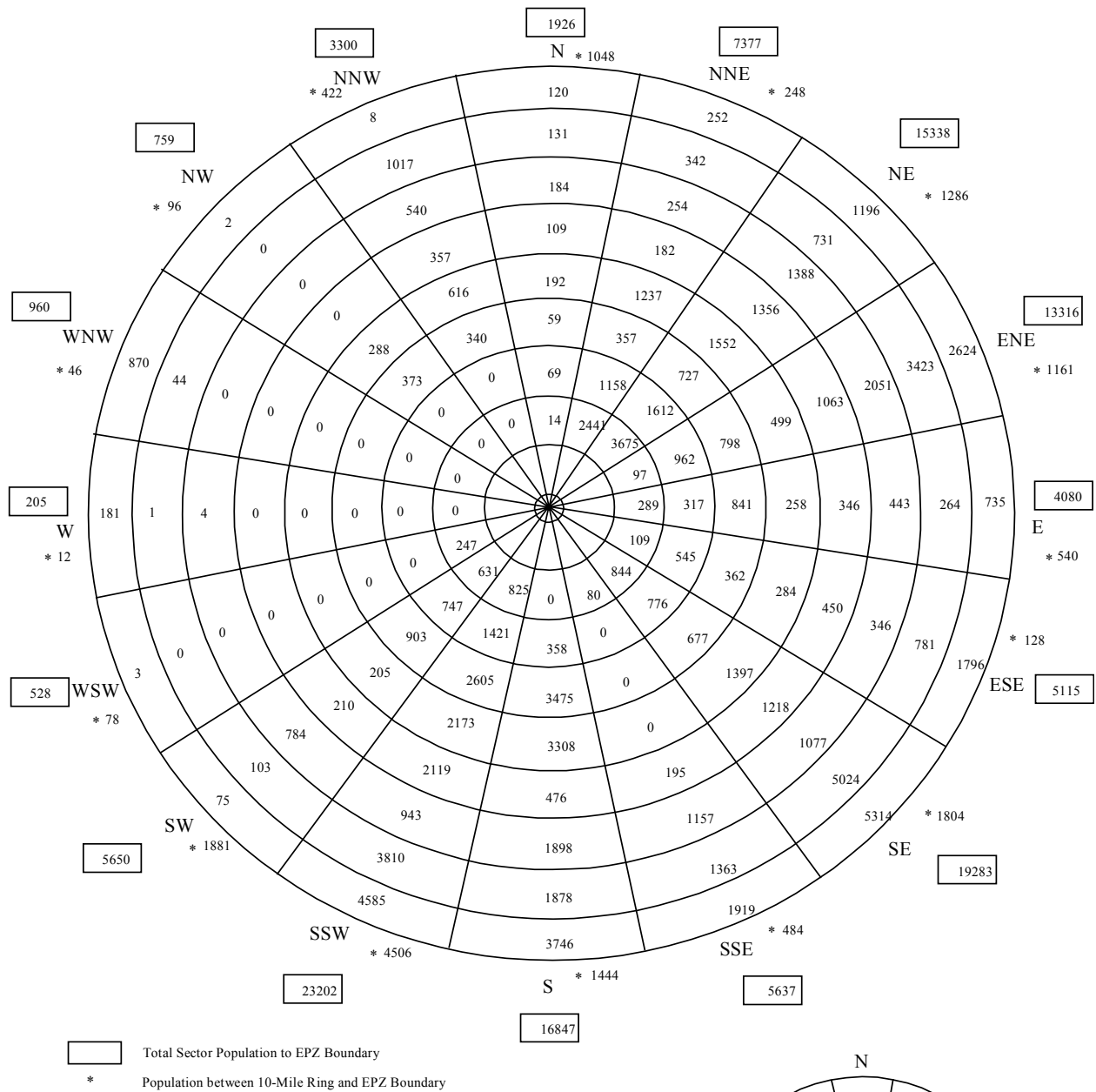


Total Sector Population to EPZ Boundary  
 \* Population between 10-Mile Ring and EPZ Boundary

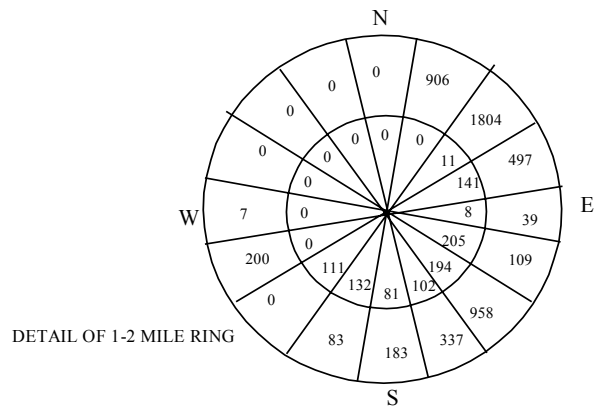
Permanent Resident Population			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-1	2244	0-1	2244
1-2	11765	0-2	14009
2-3	21775	0-3	35784
3-4	19176	0-4	54960
4-5	29082	0-5	84042
5-6	29822	0-6	113864
6-7	20884	0-7	134748
7-8	26830	0-8	161578
8-9	48682	0-9	210260
9-10	56839	0-10	267099
10-EPZ	38177	0-EPZ	305276



**Figure 3-2. Permanent Residents by Sector**



Permanent Resident Vehicles			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-1	985	0-1	985
1-2	5123	0-2	6108
2-3	9252	0-3	15360
3-4	7965	0-4	23325
4-5	11517	0-5	34842
5-6	12009	0-6	46851
6-7	8081	0-7	54932
7-8	11069	0-8	66001
8-9	18912	0-9	84913
9-10	23426	0-10	108339
10-EPZ	15184	0-EPZ	123523



**Figure 3-3. Permanent Resident Vehicles by Sector**



## Transient Population

Transient population groups are defined as those people who enter the EPZ for a specific purpose (shopping, recreation) and who leave on the same day or who stay overnight at camping facilities or hotels and motels. The Indian Point EPZ has a number of areas that attract transients in significant number, including:

- Jefferson Valley Mall, Palisades Center Mall<sup>2</sup>, Woodbury Commons – Shopping, recreation
- Cortlandt Town Center - Shopping
- Franklin D. Roosevelt State Park - Recreation for day-trippers
- Harriman State Park and Croton Point Park – Camping, fishing, hiking, etc.

Because the great majority of people utilizing these facilities travel in private vehicles, it is possible to estimate the transient population by first obtaining an estimate of the parking capacity of each facility and then applying a per vehicle occupancy factor to arrive at the population estimate. Care must be taken to avoid double-counting vehicles belonging to permanent residents who use the facilities. The following are estimates of transient population of each of these groups:

### Jefferson Valley Mall

The Jefferson Valley Mall, in Yorktown Heights, is a large retail shopping facility, with approximately 554,600 square feet of retail space. Data obtained shows that during its peak season (the Christmas holiday), an average of 10,500 shoppers may shop at the mall on a daily basis. With a daily average of 630 employees, and 2,888 parking spaces available, approximately 2,258 parking spaces would remain available to shoppers. Using a vehicular occupancy for transient vehicles of 2.4 persons/vehicle, the population estimate for this facility is 5,419 with an additional 400 persons that may arrive by bus. A total of 5,819 shoppers could be at the mall at any given time.

### Palisades Center Mall

The Palisades Center Mall, in West Nyack, is just south of the EPZ. Since it attracts a large number of transients, evacuees from the mall would be part of the “shadow evacuation”. This mall has approximately 1.85 million square feet of retail space and 8,400 parking spaces. With approximately 1,600 employees at the mall at any given time, during midday, this leaves 6,800 parking spaces available for shoppers and entertainment patrons. Approximately 40 percent of the shoppers are from Rockland County, 10 percent from Orange County, 15 percent from New Jersey, and 35 percent from Westchester County. Double-counting EPZ residents must be avoided.

---

<sup>2</sup> The Palisades Center Mall and Woodbury Commons are outside of the EPZ. However, due to their proximity to the EPZ and their substantial ability to draw transients into the area, we consider them explicitly.

### Woodbury Common Premium Outlets

The Woodbury Common Premium Outlets, in Central Valley, is another large shopping facility just to the west of the EPZ. It has more than 220 shops and serves numerous shoppers, many whom arrive by bus from Manhattan. We estimate a total of 5,900 vehicles may be present at any one time.

### Cortlandt Town Center

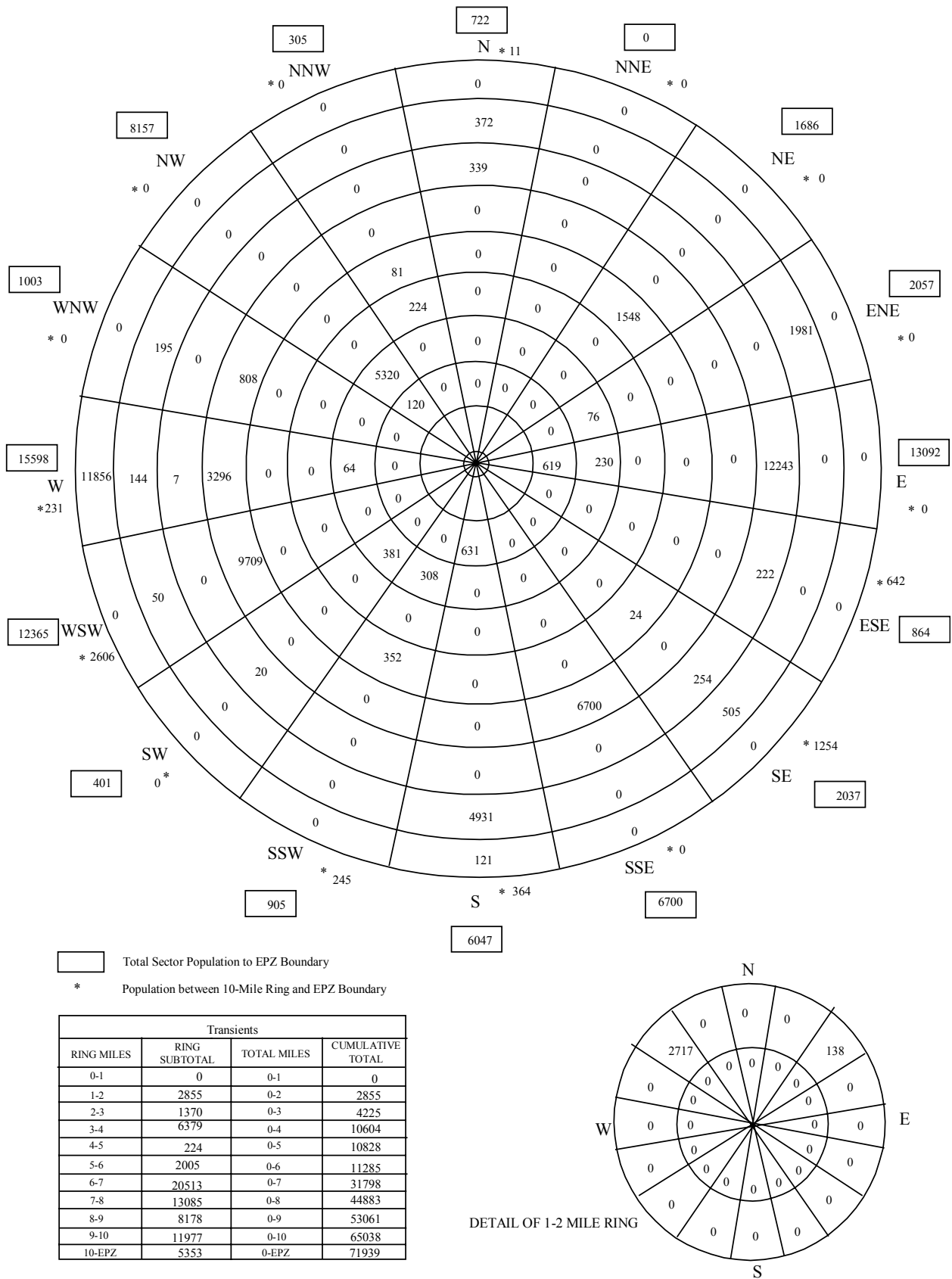
The Cortlandt Town Center is a large strip mall located on Route 6, approximately five minutes west of the Jefferson Valley Mall. The Center features an A & P Supermarket, a Home Depot and a Wal-Mart, each having approximately 300 employees. This mall is approximately 500,000 square feet, which is comparable in size to the Jefferson Valley Mall. We estimate a total of 4,550 shoppers could be at the mall at any given time.

### State and County Parks

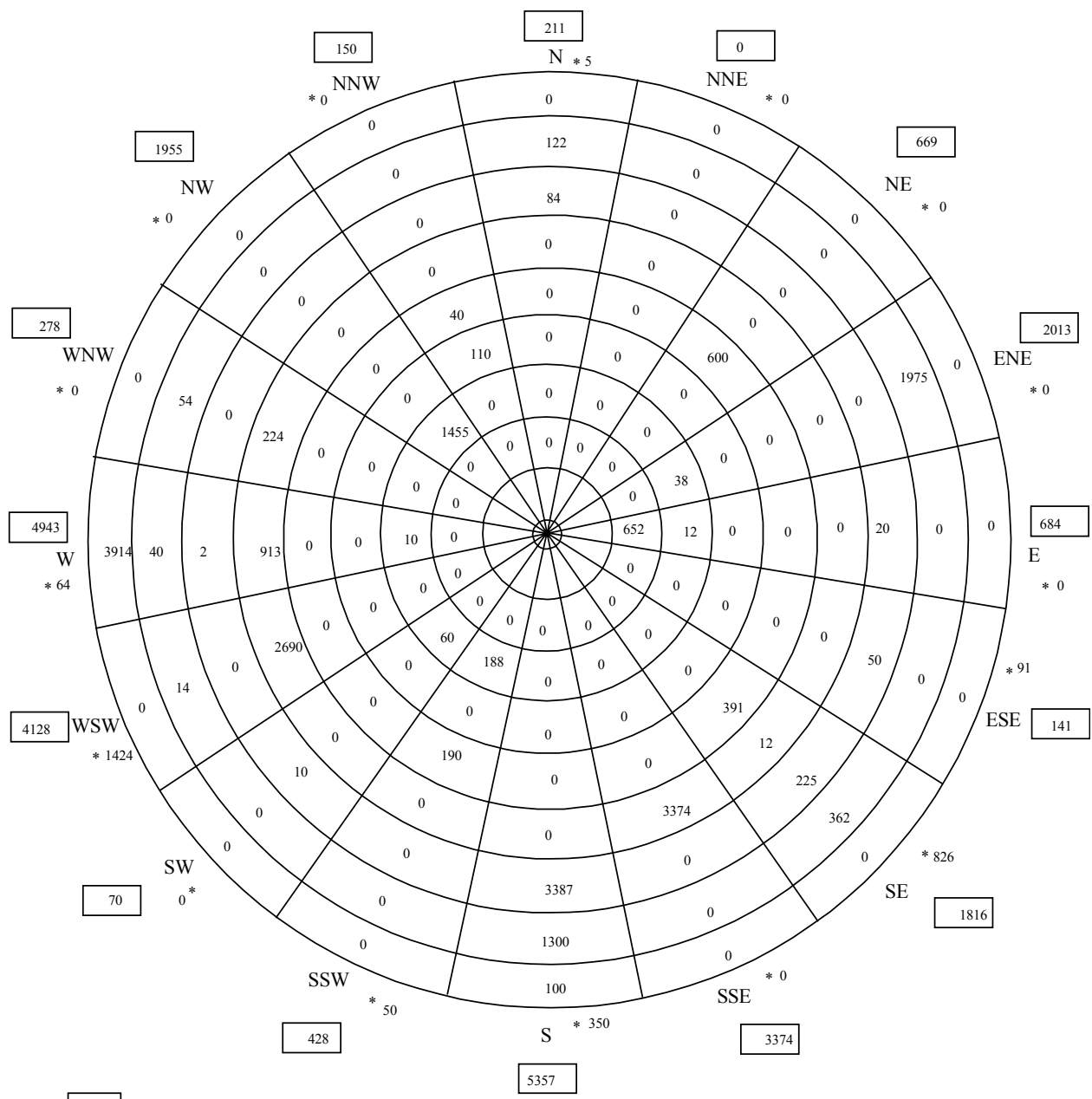
A number of sources of information regarding population estimates for the parks in the EPZ were utilized. Contacts were made with the Palisades Interstate Park Commission and county park managers. These data yield a peak period attendance of approximately 68,887 people. Tables 3-4 and 3-5 present transient population and vehicle estimates by ERPA, respectively. Figures 3-4 and 3-5 present the transient population and vehicle estimates by sector.

Table 3-4. Transient Population by ERPA							
ERPA	Hotels	Daytime State Parks & Camps: EPZ Residents	Daytime State Parks & Camps: Non-EPZ Residents	Overnight State Parks & Camps	Shoppers EPZ Residents	Shoppers Non-EPZ Residents	Non-EPZ Resident ERPA Totals
1	0	0	0	0	0	0	0
2	138	0	0	0	0	0	138
3	0	0	0	0	0	0	0
4	0	1,250	1,250	0	0	0	1,250
5	0	0	0	0	0	0	0
6	24	3,300	6,700	0	0	0	6,724
7	0	0	0	0	0	0	0
8	0	0	0	0	3,003	1,548	0
9	76	0	0	0	0	0	76
10	0	0	0	0	0	0	1,548
11	0	0	0	0	3,845	1,981	1,981
12	0	0	0	222	0	0	222
13	783	3,772	11,318	0	0	0	12,101
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	262	0	0	262
17	0	0	0	80	0	0	80
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	639	0	0	120	0	0	759
23	11	0	0	0	0	0	11
24	292	0	0	0	0	0	292
25	0	0	0	0	0	0	0
26	383	0	0	0	0	0	383
27	0	0	0	0	0	0	0
28	0	0	0	0	2,092	11,856	11,856
29	0	0	0	0	0	0	0
30	308	0	0	445	0	0	753
31	20	350	350	0	0	0	370
32	108	2,475	5,025	0	0	0	5,133
33	40	0	0	0	0	0	40
34	0	0	0	0	0	0	0
35	0	0	0	485	0	0	485
36	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0
39	120	2,678	8,037	0	0	0	8,157
40	0	2,482	14,068	2,995	0	0	17,063
41	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0
49	230	0	0	0	0	0	230
50	0	129	771	0	0	0	771
51	1,254	0	0	0	0	0	1,254
Totals	4,426	16,436	47,519	4,609	8,940	15,385	71,939

Table 3-5. Transient Vehicles by ERPA							
ERPA	Hotels	Daytime State Parks & Camps: EPZ Residents	Daytime State Parks & Camps: Non-EPZ Residents	Overnight State Parks & Camps	Shoppers EPZ Residents	Shoppers Non-EPZ Residents	Non-EPZ Resident ERPA Total Vehicles
1	0	0	0	0	0	0	0
2	69	0	0	0	0	0	69
3	0	0	0	0	0	0	0
4	0	436	436	0	0	0	436
5	0	0	0	0	0	0	0
6	12	1,443	2,931	0	0	0	2,943
7	0	0	0	0	0	0	0
8	0	0	0	0	1,164	600	0
9	38	0	0	0	0	0	38
10	0	0	0	0	0	0	600
11	0	0	0	0	1,489	767	767
12	0	0	0	50	0	0	50
13	111	1,097	3,290	0	0	0	3,401
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	46	0	0	46
17	0	0	0	25	0	0	25
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	566	0	0	21	0	0	587
23	5	0	0	0	0	0	5
24	97	0	0	0	0	0	97
25	0	0	0	0	0	0	0
26	188	0	0	0	0	0	188
27	0	0	0	0	0	0	0
28	0	0	0	0	1,040	5,891	5,891
29	0	0	0	0	0	0	0
30	154	0	0	70	0	0	224
31	10	95	95	0	0	0	105
32	54	511	1,039	0	0	0	1,093
33	60	0	0	0	0	0	60
34	0	0	0	0	0	0	0
35	0	0	0	300	0	0	300
36	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0
39	30	1,157	3,472	0	0	0	3,502
40	0	722	4,094	596	0	0	4,690
41	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0
49	12	0	0	0	0	0	12
50	0	129	262	0	0	0	262
51	826	0	0	0	0	0	826
Totals	2,232	5,590	15,619	1,108	3,693	7,258	26,217

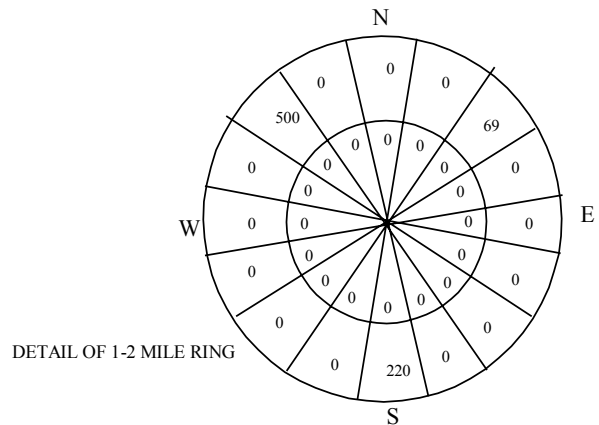


**Figure 3-4. Transient Population by Sector**



Total Sector Population to EPZ Boundary  
 \* Population between 10-Mile Ring and EPZ Boundary

Transient Vehicles			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-1	0	0-1	0
1-2	789	0-2	789
2-3	652	0-3	1441
3-4	1763	0-4	3204
4-5	110	0-5	3314
5-6	1221	0-6	3935
6-7	7213	0-7	11148
7-8	3778	0-8	14926
8-9	3867	0-9	18793
9-10	4014	0-10	22807
10-EPZ	2810	0-EPZ	26217



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

## Employees

Employees who work within the EPZ fall into two categories:

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

Those of the first category have already been counted as part of the permanent resident population. To avoid double counting, we focus on those employees who will evacuate along with the permanent resident population.

The major areas of employment within the Indian Point EPZ are:

- Indian Point Energy Center – in Buchanan
- VA Hudson Valley Healthcare System – in Montrose
- Jefferson Valley Mall and IBM/Watson Research Center – in Yorktown Heights
- Cortlandt Town Center – in Cortlandt
- Pace University – campuses in Briarcliff Manor and Pleasantville
- United States Military Academy – in West Point

To represent the number of persons that work in the EPZ but live outside the EPZ, 1990 New York State journey-to-work data<sup>3</sup> was used. The data defines the number of persons working in a specified location (municipality) by their place of residence (origin municipality). The data indicates that, on average, 46 percent of workers in any municipality come from outside the EPZ. This figure agrees with data obtained by the KLD survey of employers. The total number of jobs in any municipality was determined from NYS Department of Labor statistics for the year 2000. Thus in each ERPA, the number of jobs held by people who enter the EPZ on a daily basis was obtained by multiplying this percentage by the total number of employees.

A factor of 1.07 persons per employee vehicle obtained from the 2000 Census, was used to determine the number of evacuating employee vehicles for Rockland, Orange and Westchester Counties; a factor of 1.05 persons per employee vehicle obtained from the 2000 Census was used in Putnam County.

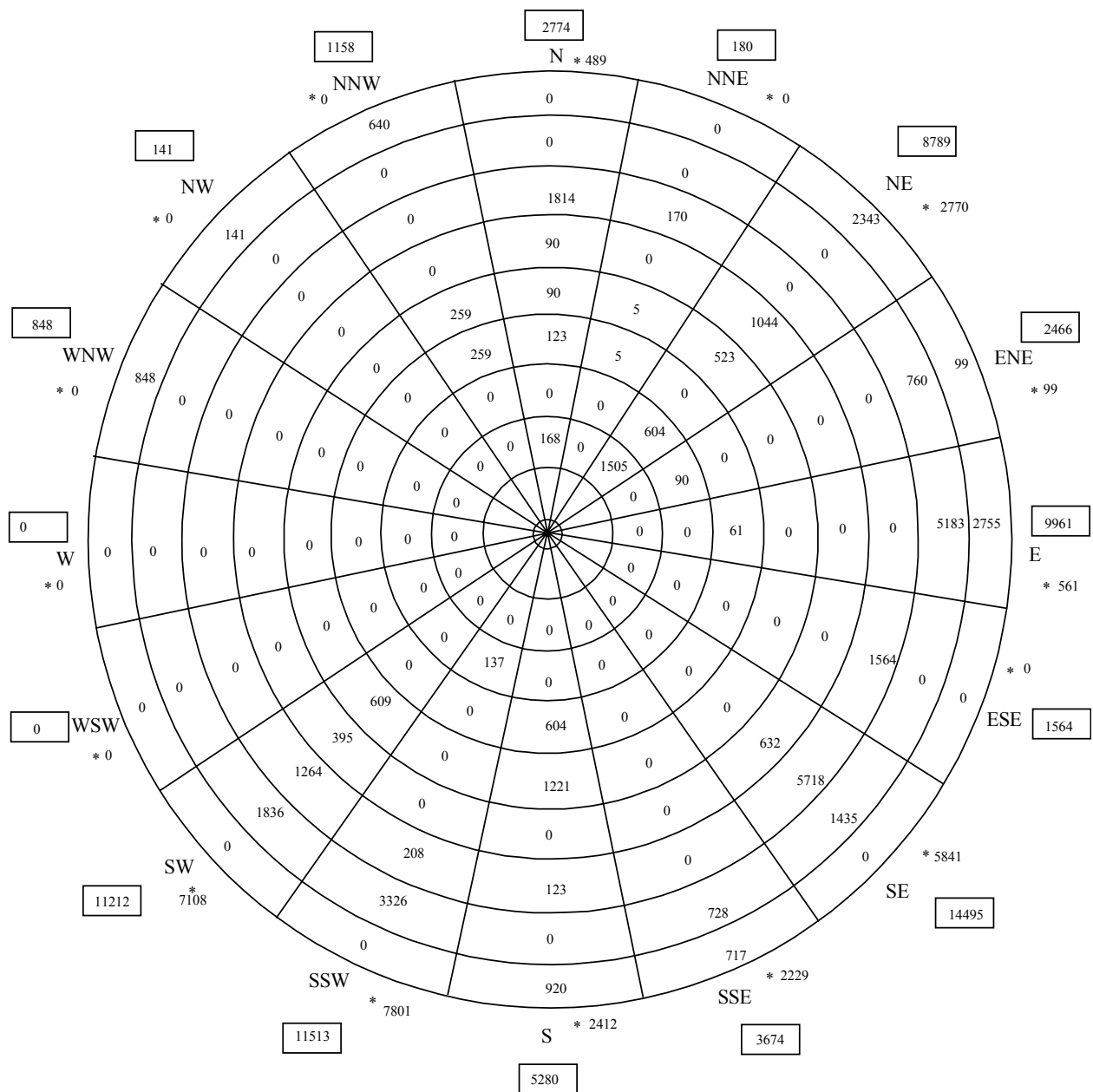
Table 3-6 presents non-EPZ Resident employee and vehicle estimates by ERPA. Figures 3-6 and 3-7 present these data by sector.

---

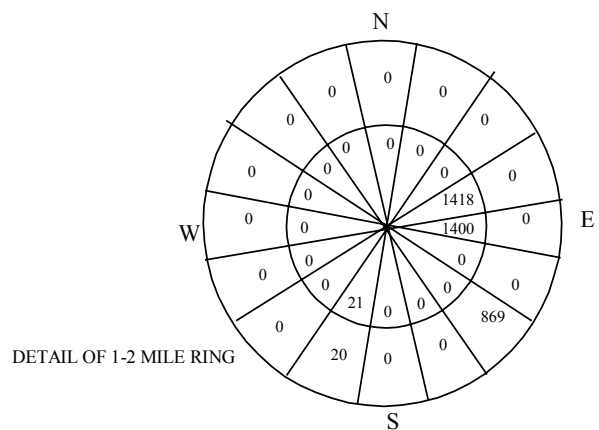
<sup>3</sup> Journey to Work data based on 2000 Census information was not available at this time.

<b>Table 3-6. Non-EPZ Resident Employee Population by ERPA</b>					
<b>ERPA</b>	<b>Persons</b>	<b>Vehicles</b>	<b>ERPA</b>	<b>Persons</b>	<b>Vehicles</b>
1	979	915	27	35	33
2	2,739	2,560	28	0	0
3	39	37	29	0	0
4	949	887	30	151	142
5	0	0	31	2,662	2,488
6	689	644	32	234	219
7	185	173	33	2,147	2,007
8	659	616	34	342	320
9	153	143	35	8,543	7,985
10	1,709	1,598	36	1,380	1,290
11	830	776	37	10,993	10,274
12	1,983	1,854	38	0	0
13	5,655	5,286	39	0	0
14	102	96	40	426	399
15	3,006	2,810	41	0	0
16	335	320	42	0	0
17	0	0	43	0	0
18	10	10	44	0	0
19	188	180	45	0	0
20	5,070	4,829	46	0	0
21	5,856	5,473	47	0	0
22	3,524	3,294	48	231	216
23	533	508	49	6	6
24	1,980	1,851	50	116	109
25	834	780	51	8,219	7,682
26	565	529	Total	74,057	69,339

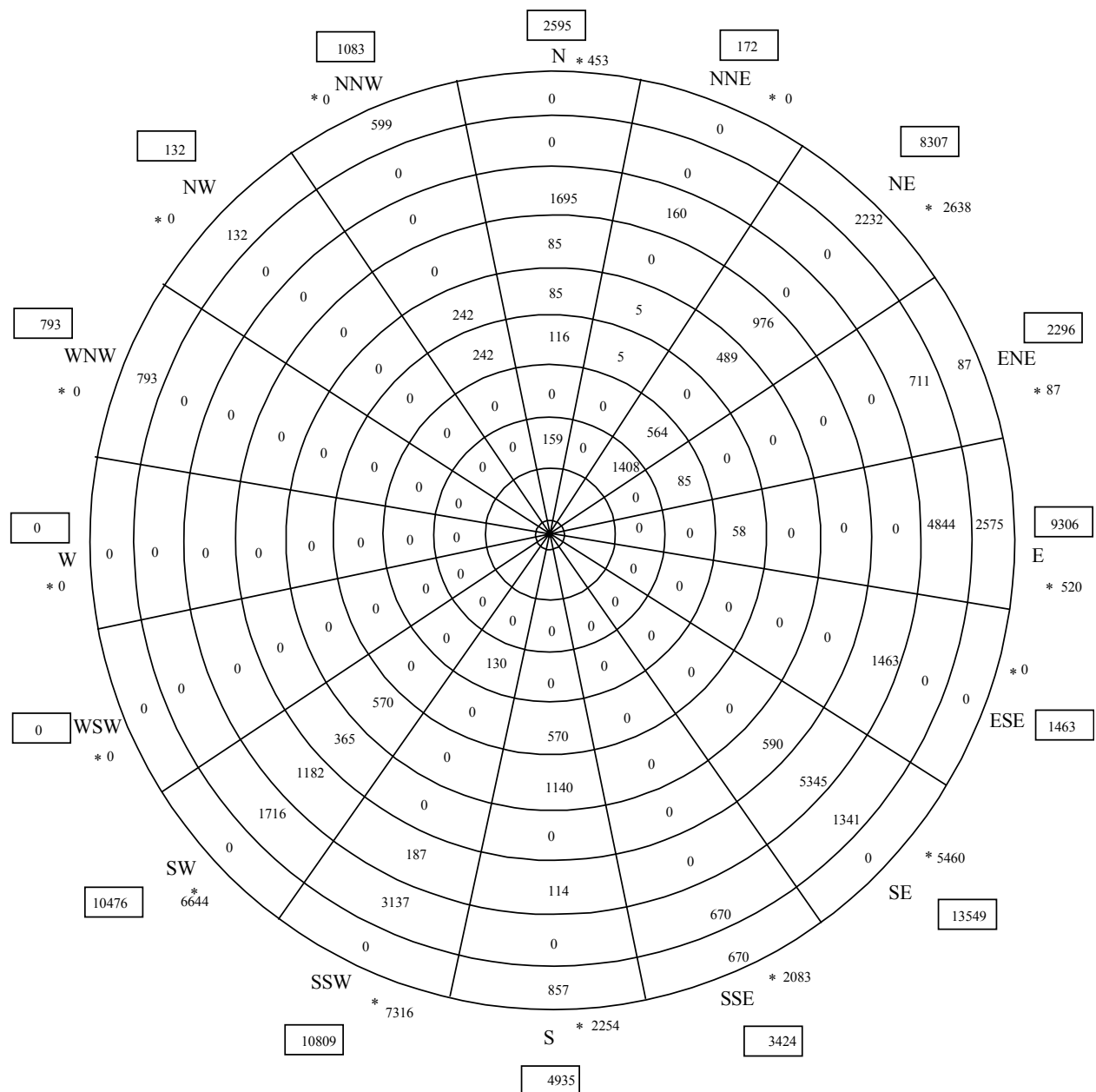




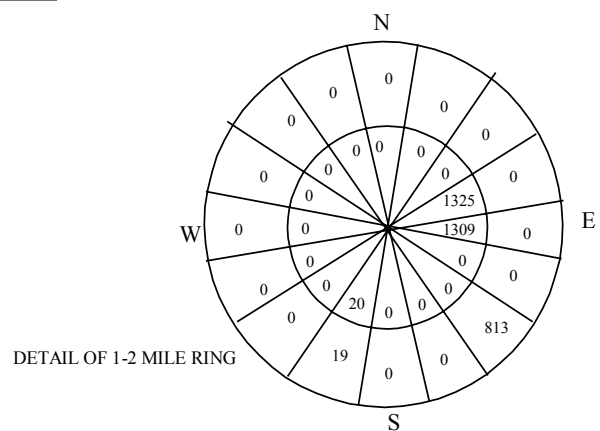
Employees			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-1	2839	0-1	2839
1-2	889	0-2	3728
2-3	1674	0-3	5402
3-4	832	0-4	6234
4-5	1052	0-5	7286
5-6	2708	0-6	9994
6-7	2161	0-7	12155
7-8	10862	0-8	23017
8-9	13267	0-9	36284
9-10	8464	0-10	44748
10-EPZ	29309	0-EPZ	74057



**Figure 3-6. Employee Population by Sector**



Employee Vehicles			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-1	2654	0-1	2654
1-2	832	0-2	3486
2-3	1567	0-3	5053
3-4	780	0-4	5833
4-5	991	0-5	6824
5-6	2530	0-6	9354
6-7	2017	0-7	11371
7-8	10148	0-8	21519
8-9	12420	0-9	33939
9-10	7945	0-10	41884
10-EPZ	27455	0-EPZ	69339



**Figure 3-7. Employee Vehicles by Sector**

### Medical Facilities

The existing plans for Rockland, Orange, Putnam and Westchester Counties present estimates of the populations of medical facilities such as hospitals, nursing and retirement homes and other health-related facilities. The number and type of evacuating vehicles that need to be provided depends on the patients' state of health. Buses can transport up to 40 people; vans, up to 12 people; ambulances, up to 2 people (patients).

### Total Demand in Addition to Permanent Population

There will be vehicles traveling through the EPZ (external-external trips) at the time of the accident. After the Advisory to Evacuate is announced, these through travelers will also evacuate. These through vehicles are assumed to travel on interstate routes and on the major north and southbound limited access highways in the area, which are the primary routes through the EPZ. It is assumed that this traffic will continue to enter the EPZ during the first 90 minutes following the Advisory to Evacuate. We estimate approximately 24,000 vehicles enter the EPZ as external-external trips during this period.